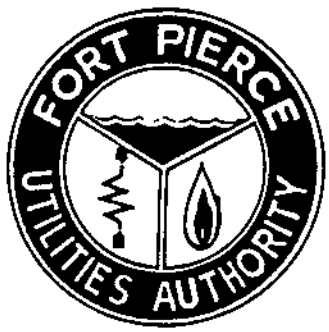
WELL COMPLETION REPORT
for the
LAWNWOOD WELL FIELD EXPANSION AND FLORIDAN AQUIFER BLENDING WELL

Prepared for



Fort Pierce Utilities Authority

Prepared by

CH2M HILL

SEF38101.L1

June 1988

WELL COMPLETION REPORT
FOR THE LAWNWOOD WELL FIELD EXPANSION
AND FLORIDAN AQUIFER BLENDING WELL

Prepared for

FORT PIERCE UTILITIES AUTHORITY

Prepared by

CH2M HILL SOUTHEAST, INC.
800 Fairway Drive, Suite 350
Deerfield Beach, Florida 33441

June 1988

SEF38101.L1

CONTENTS

TABLES

FIGURES

Section 1
INTRODUCTION

1.1 BACKGROUND

In 1988, the Fort Pierce Utilities Authority (FPUA) authorized the design and installation of two shallow aquifer production wells at the Lawnwood Well Field, and one Floridan aquifer blending well at FPUA's water treatment plant (WTP). The wells were designed to provide the City of Fort Pierce with an additional 2.0 mgd of water.

Bids for well drilling services were received from seven prospective contractors. The contract was awarded to Drilling Services Inc. of Fort Pierce, who submitted a bid price of $100,741.50.

1.2 SCOPE

The scope of the contract included professional observation of drilling activities, collection and logging of geological samples, geophysical logging, observation of well construction and development, pumping tests, and well disinfection and capping. Upon completion, this project provided FPUA with two 12-inch-diameter, shallow-aquifer, public water supply wells, each capable of producing at a rate of 350 gallons per minute (gpm); and one 12-inch-diameter, Floridan aquifer public water supply blending well, capable of producing at a rate of 700 gpm.

1.3 SITE LOCATIONS

The two shallow aquifer production wells (S-17 and S-18) are located on the northeast portion of the Lawnwood Well Field, due east of the existing Production Well S-10. The Floridan aquifer blending well (FB-1) is located behind the water treatment plant, just southeast of the existing Production Well W-3. The locations of the FPUA water treatment plant and well fields are shown in Figure 1-1, and the recently installed shallow aquifer production wells and blending well are shown in Figure 1-2.

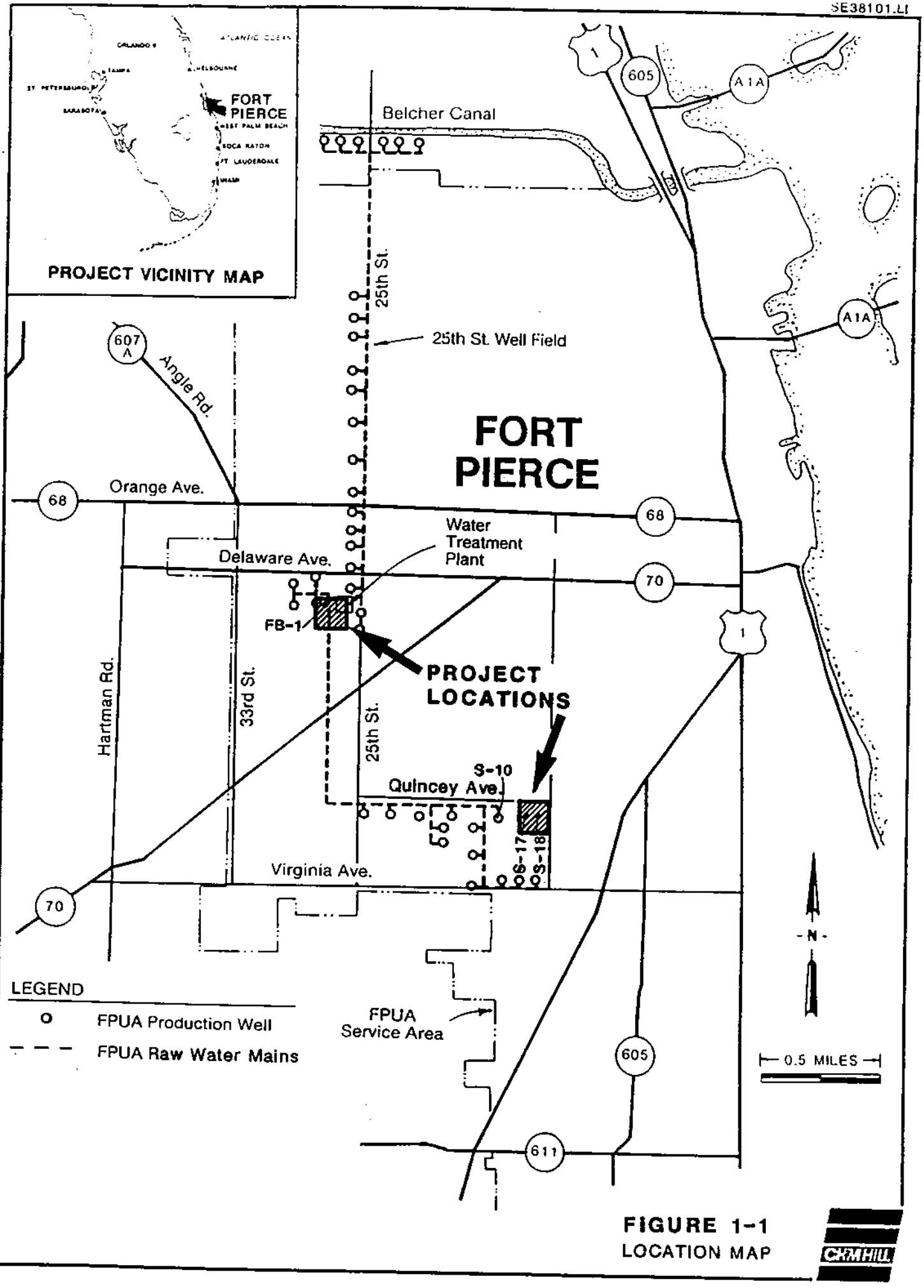
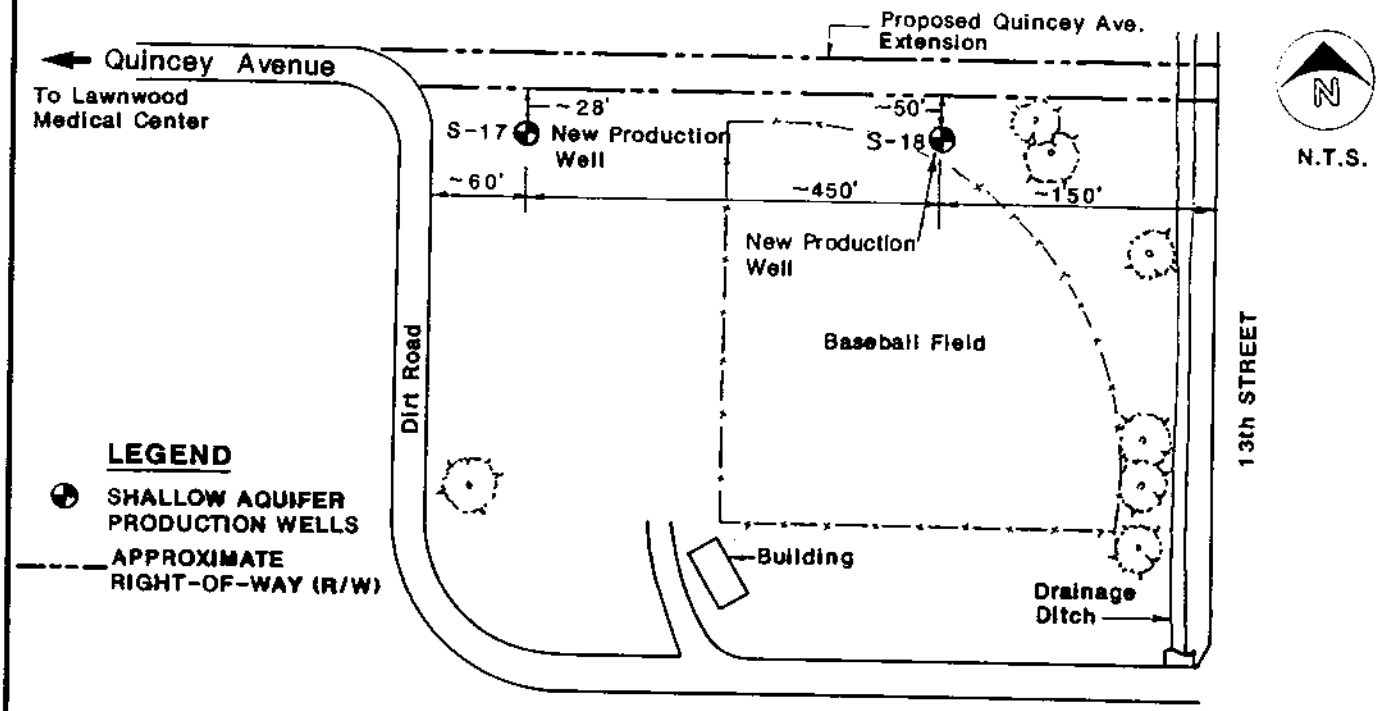
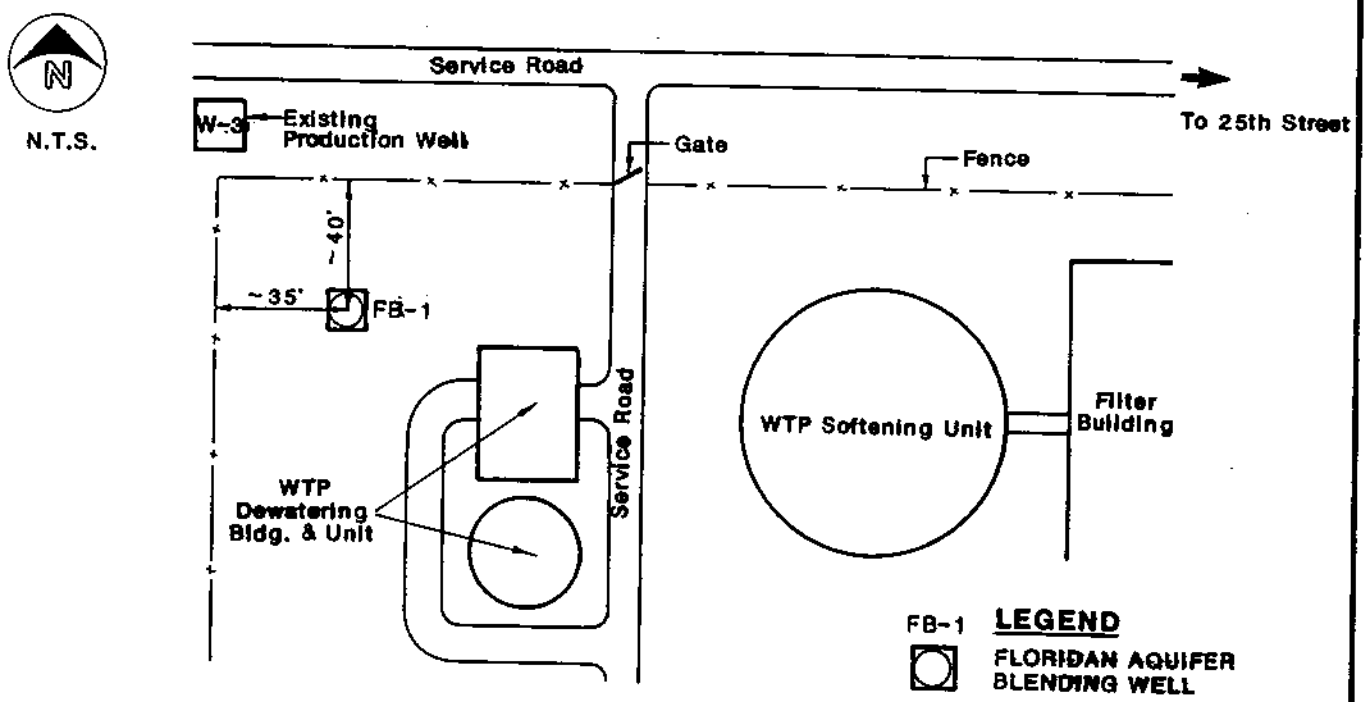


FIGURE 1-1
LOCATION MAP



PROPOSED LAWNWOOD SHALLOW AQUIFER WELL LOCATIONS



PROPOSED FLORIDAN AQUIFER BLENDING WELL LOCATION

FIGURE 1-2
PRODUCTION WELL LOCATIONS

CH2M HILL

Section 2
FIELD INVESTIGATIONS

2.1 GENERAL

Field studies at the two shallow aquifer production well sites, S-17 and S-18, included evaluation of cutting samples and geophysical logs. Data from the sampling and logging procedures were used to determine the subsurface geology and establish intervals for screening. For each selected screen zone, grain size analyses were also performed to ascertain proper screen slot and gravel pack sizes.

The Floridan aquifer blending well (FB-1) was investigated to determine the subsurface geology and production zones. Previous studies of the Floridan aquifer in the surrounding area were compiled, cutting samples were collected, downhole geophysical logging was performed, and water quality data were collected to assess the best producing zone for blending.

2.2 FIELD ANALYSES

To conduct the field investigations, a test boring at each production well was drilled by mud rotary techniques with a Failing 1500, truck-mounted, rotary drilling rig. The 4-inch-diameter borings were drilled to 115 and 120 feet for S-17 and S-18, respectively. During the drilling, cutting samples were collected at 5-foot intervals.

Sieve analysis at S-17 and S-18 was conducted by Fraser Engineering and Testing, Inc., of Fort Pierce. The results indicated that a .035-inch screen slot size and a 6/20 filter pack material would be adequate for both production wells.

Field procedures at FB-1 included the collection of cutting samples at 5-foot intervals to 120 feet, then at 10-foot intervals thereafter. Sieve analysis was not performed since the production zone of the well is located in hard limestone and does not require a screen.

Table 2-1 presents a description of the lithologies and associated formation names for S-17, S-18, and FB-1. Detailed lithologic logs are provided in Appendix A, and Appendix B contains the results of the grain size analyses.

2.3 GEOPHYSICAL LOGGING

After the test borings at S-17 and S-18 were drilled, CH2M HILL ran natural gamma, single point resistivity, and spontaneous potential logs. The natural gamma log was used to

Table 2-1
LITHOLOGIES OF PRODUCTION WELL BORINGS

Depth (ft)	S-17	Formation Name
0-35	Sand; Brown; Medium-fine	SURFICIAL AQUIFER
35-60	Sand; Brown; Medium-fine; shell fragments	
60-110	Sand; Gray; Medium-fine; shell	
110-115	Sandy Clay; Green	HAWTHORN FORMATION
	S-18	
0-30	Sand; Brown; Medium-fine	
30-65	Sand; Brown; Medium-fine; Shell fragments, Trace organic material	
65-114	Sand/Calcarenite; Gray; Medium-fine; Shell fragments, trace organic material	SURFICIAL AQUIFER
114-120	Sandy Clay; Gray-Green	HAWTHORN FORMATION
	FB-1	
0-70	Sand; Brown; Medium-fine	SURFICIAL AQUIFER
70-110	Sand; Gray; Medium-fine; shell fragments, Calcarenite seams	
110-190	Sandy Clay; Green; Soft	HAWTHORN FORMATION
190-290	Clay; Green; Soft to medium stiff	
290-510	Clay; Green; Stiff; Phosphatic limestone nodules	
510-580	Limestone; Pale greenish yellow; Clay seams	
580-730	Hard Limestone; Tan; Interbedded chert	FLORIDAN AQUIFER
730-904	Hard to medium soft limestone; White; Interbedded Chert and clay beds	

identify formation changes within the borehole, while the single point resistivity and spontaneous potential logs served to show changes in porosity. The geophysical logging results and lithologic log data were combined to locate producing zones for screen placement.

To identify lithologies and producing zones within the Floridan aquifer, CH2M HILL conducted geophysical logging at FB-1 before casing strings were installed and after drilling to total depth. In addition to the natural gamma, single point resistivity, and spontaneous potential logs, caliper, fluid resistivity, and fluid velocity logs were also run.

The fluid resistivity log provided data on changes in water quality for each producing interval. The fluid velocity log identified points where formation water entered the well. The log velocities were adjusted for borehole diameter, and the corrected, true flow rates were used to construct a flow profile. This profile provided an indication of depth-related changes in flow within the aquifer, and is shown in Figure 2-1. The fluid resistivity and fluid velocity logs were collectively analyzed to identify water quality with respect to depth.

Copies of all the geophysical logs are contained in Appendix C.

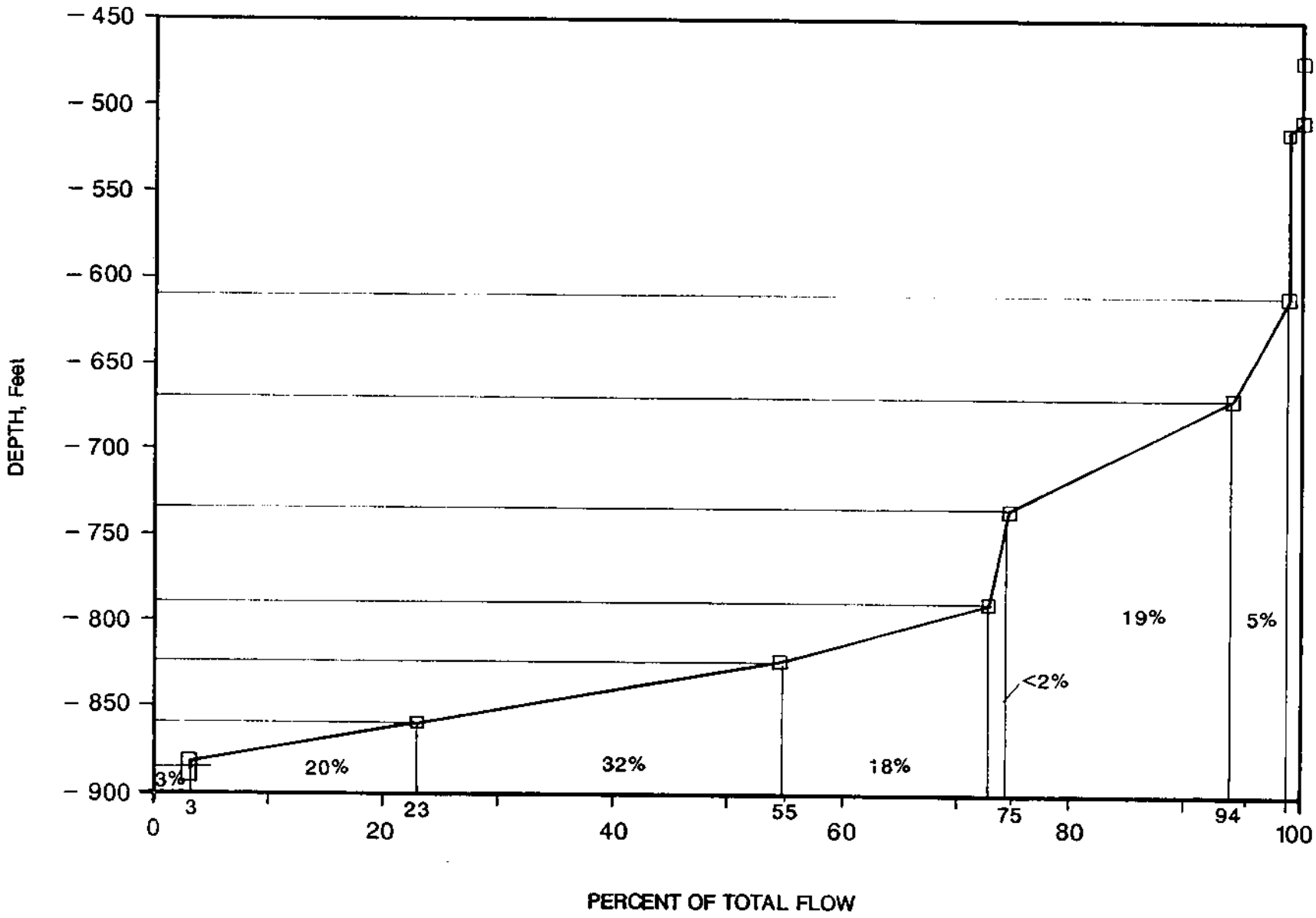


FIGURE 2-1

FB-1 FLOW PROFILE
APRIL 20, 1988

CH2M HILL

Section 3
WELL DETAILS

3.1 WELL DESIGN

CH2M HILL reviewed the information derived from the lithologic logs, cutting samples, and geophysical logging to establish the designs for production wells S-17 and S-18. The screened intervals were determined by geophysical techniques. Sieve analyses were performed on composite samples from each proposed interval. This evaluation of grain size distribution allowed for the proper design of filter material around and above the well screen. The accuracy of the proposed designs was verified by comparing the field investigation results with data from other wells currently in the well field.

The final design of the Floridan aquifer well, FB-1, was determined by cutting samples and geophysical logging. Data from these field studies were used to establish casing and open hole depths. As noted in Section 2, FB-1 was not evaluated by sieve analyses because the hard limestone production zone did not require screening.

The final design specifications of the wells were as follows:

Well Specifications	Interval (feet)
S-17	
Steel 18-inch surface casing	0-60
Steel 12-inch casing	0-60
12-inch wire-wound stainless steel screen (.035-inch slot)	60-85
6/20 gravel pack	Surface-90
Steel 12-inch tail-pipe	85-90
S-18	
Steel 18-inch surface casing	0-55
Steel 12-inch casing	0-55:85-100 (blank)
12-inch wire-wound stainless steel screen (.035-inch slot)	55-85:100-115
6/20 gravel pack	Surface-120
Steel 12-inch tail-pipe	115-120
FB-1	
Steel 18-inch casing	0-118
Steel 12-inch casing	0-508
Open hole, 12-inch nominal	508-904

Well design details for S-17, S-18, and FB-1 are shown in Figures 3-1, 3-2, and 3-3, respectively.

3.2 WELL CONSTRUCTION

All wells were constructed in accordance with specifications and applicable standards.

After the test borings were drilled and sampled, a Midway 1500 drill rig was used to advance the borings for well installation. On S-17 and S-18, filter material was then tremied around and above the screen to the surface.

The drilling contractor grouted the surface casings of the two shallow aquifer wells (S-17 and S-18) and the 18-inch surface casing of FB-1. Pressure-grouting was used to ensure that grout was forced from the bottom of the inner casing to the surface under constant pressure.

Dowell/Schlumberger, Inc., was contracted to pressure-grout the 12-inch-diameter, 508 feet of steel casing for FB-1. The grouting procedure required 419 cubic feet (355 sacks) of cement slurry at 15.6 pounds per gallon.

3.3 WELL DEVELOPMENT AND DISINFECTION

The two shallow aquifer wells were developed by an alternating sequence of jetting water and blowing compressed air at different screen depths. This procedure continued until the discharge water was clear and free of suspended sediment. Development times for S-17 and S-18 were 29 hours and 30 hours, respectively. The Floridan aquifer well, FB-1, was developed during the 7.5-hour specific drawdown test by using a high-capacity turbine pump.

The shallow aquifer production wells were disinfected during development by 5-pound doses of hypochlorite calcium (HTH). Disinfection of FB-1 involved adding 4 pounds of HTH and 3,000 gallons of water.

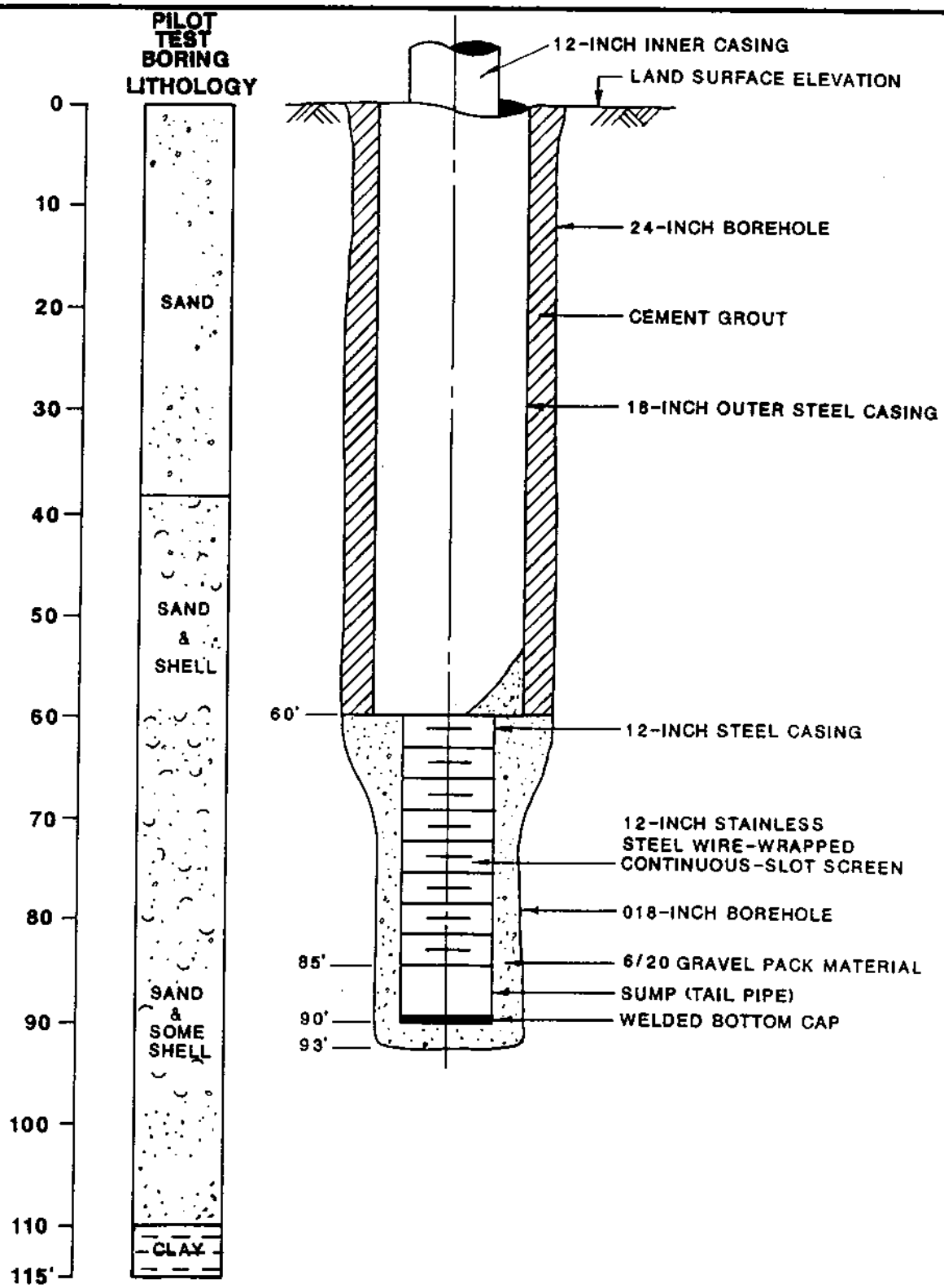


FIGURE 3-1
SHALLOW AQUIFER WELL CONSTRUCTION DETAILS FOR S-17

CH2MHILL

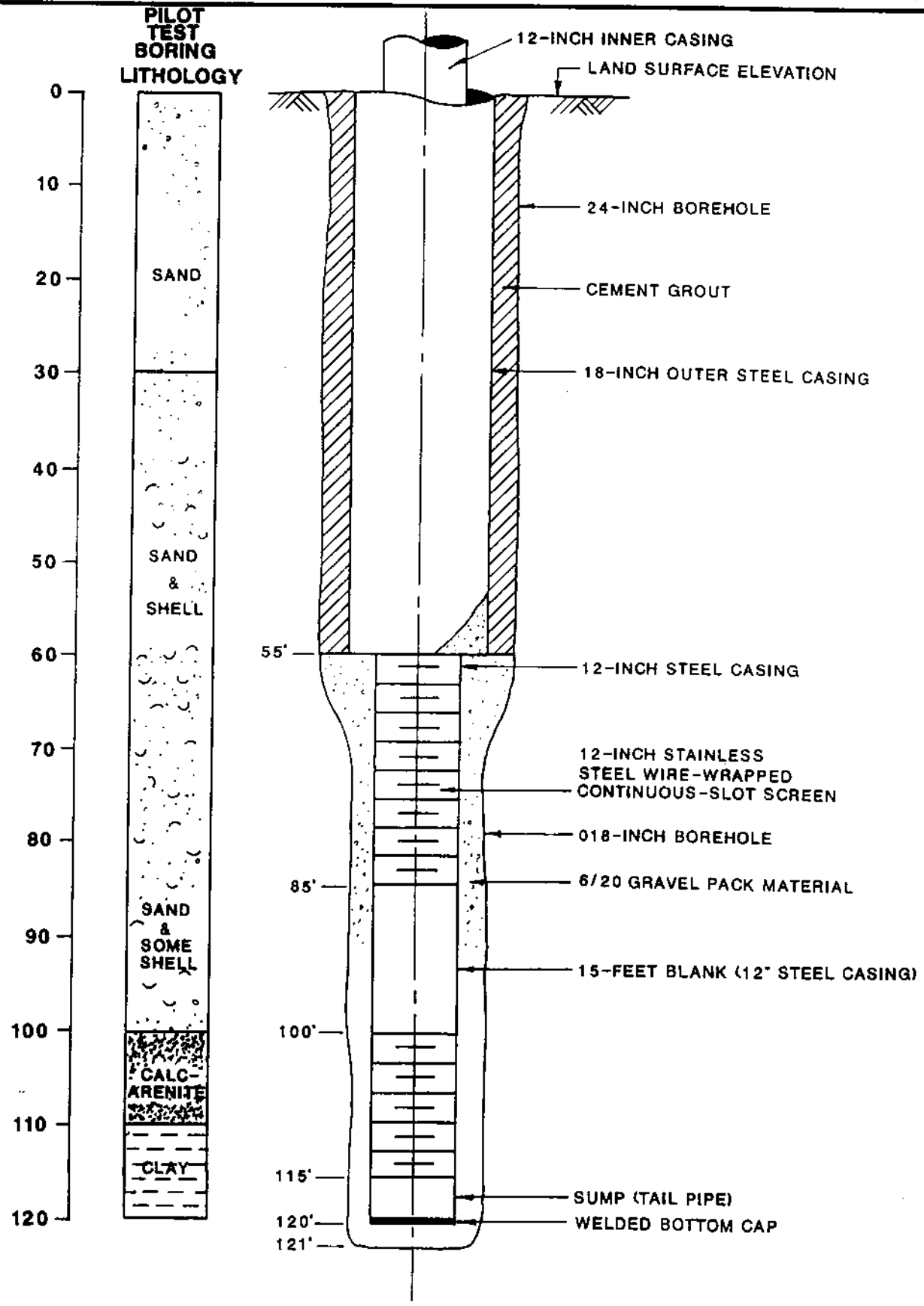


FIGURE 3-2
SHALLOW AQUIFER WELL CONSTRUCTION DETAILS FOR S-18

CH2MHILL

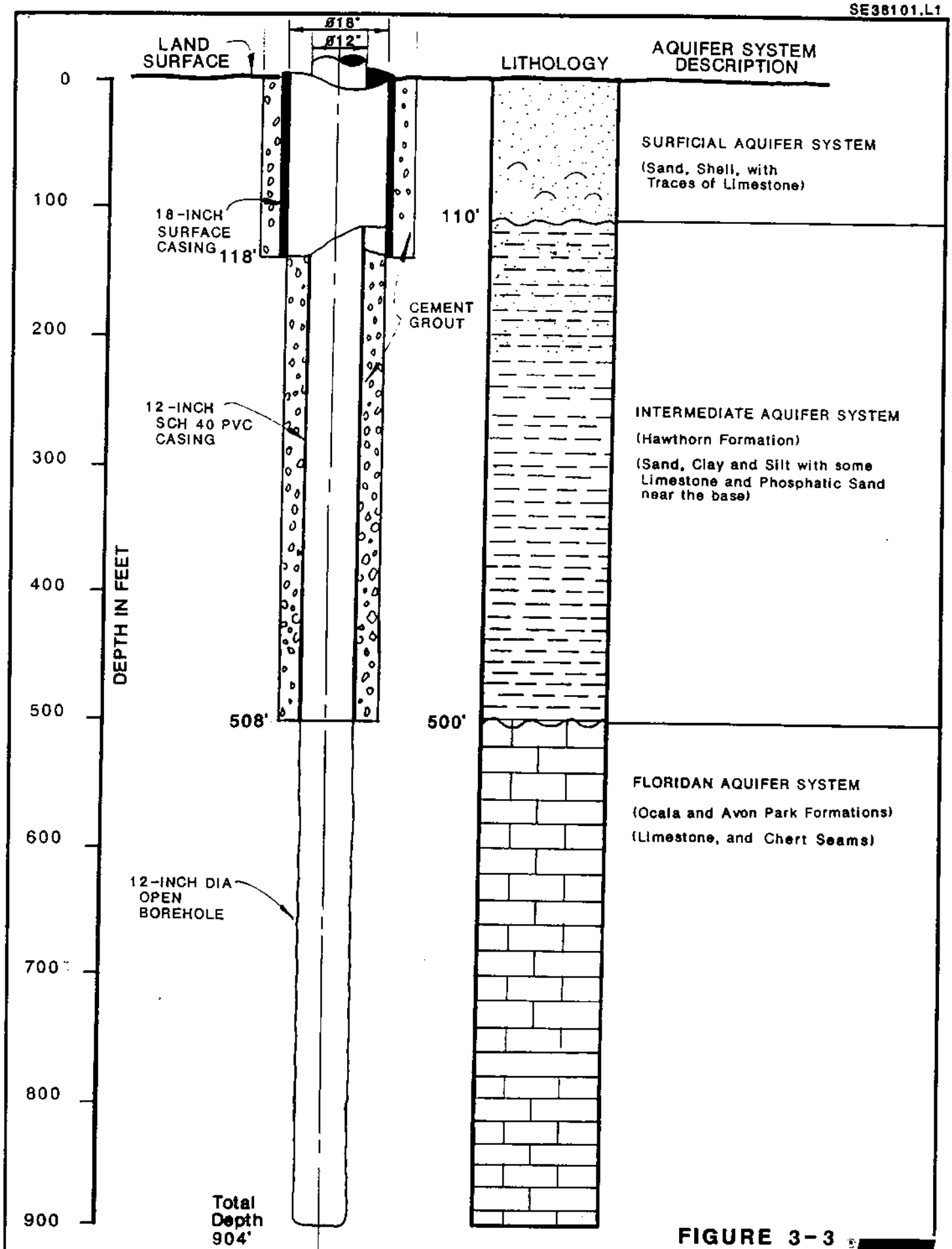


FIGURE 3-3
WELL CONSTRUCTION DETAILS
FLORIDAN AQUIFER BLENDING
WELL (FB-1)

CH2MHILL

Section 4
TEST DATA

A 24-hour aquifer performance test (APT) was conducted on S-17 at an average pumping rate of 351 gpm. Water levels were measured during the test from S-18 and a nearby irrigation well (LV-1). At the end of 24 hours, a drawdown of 2.22 feet was measured in LV-1. Water levels from S-18 showed no response, probably because of the distance from S-17 (approximately 475 feet) and the close proximity to the point of discharge. A straight-line distance drawdown calculation was used to analyze the drawdown data in LV-1, and a straight-line recovery calculation was used to evaluate information from S-17. The results indicated an average transmissivity of 66,500 gpd/foot. Appendix D presents the raw data collected during the APT.

A Step Drawdown Test (SDT) was performed on S-17, S-18, and FB-1. The SDT for S-17 was conducted during the 24-hour APT and indicated an average specific capacity of 14 gpm/foot. The average specific capacity of S-18 as determined by the SDT was 20 gpm/foot.

The SDT performed on FB-1 began at approximately 50 percent capacity with drawdown measurements collected every 3 minutes for 1 hour. Thereafter, each step increased by 30 minutes, for a total time of 7.5 hours. The results for each step indicated specific capacities of 700 gpm/foot, 227 gpm/foot, 141 gpm/foot, and 71 gpm/foot.

The results of the SDTs are summarized in Table 4-1, and the raw data are presented in Appendix D.

Well loss (head loss attributable to well inefficiency) resulting from friction was insignificant in the three wells and does not affect the specific capacity values.

Flow rates during all tests were measured with a manometer tube attached to a 6-inch pipe with a 4-inch orifice plate.

Table 4-1
SPECIFIC DRAWDOWN TEST RESULTS

Well No.	Date	Static Level (ft)	Pumping Rate (gpm)	Pumping Drawdown (ft)	Time (min)	Specific Capacity (gpm/ft)
S-17	3/17/88	19.96	351	24.82	1440	14.0
S-18	3/21/88	17.25	200	10.00	60	20.0
			300	14.80	60	20.2
			350	17.20	60	20.4
			400	19.70	60	20.30
			500	24.20	60	20.24
			613	32.00	60	19.2
FB-1	4/25/88	13.00	350	~~.50~~ 14.34	60	~~700.0~~ 24.3
	6 PSI	13.86	500	~~2.20~~ 16.06	90	~~227.0~~ 31.1
			650	~~4.60~~ 18.46	120	~~141.0~~ 35.2
			750	~~10.50~~ 24.36	150	~~71.0~~ 30.7
			1000	~~15.00~~ 28.86	30	~~66.0~~ 34.6

13.86

18.46 -

24.36 -

28.86.

Section 5
WATER QUALITY

Water quality samples were collected from Well S-18 on March 21, 1988, before and after the SDT. The samples were analyzed for total chlorides, sulfate, TDS, and conductivity. On April 25, 1988, water quality samples were collected from S-17 and S-18 and analyzed for the parameters previously tested for S-18. The second round of sampling and analyses for S-18 were performed to verify the results of the first tests.

FB-1 was sampled for water quality before and after the SDT performed on April 25, 1988. The samples were analyzed for chloride concentrations and conductivity. The laboratory results were verified by a second round of water quality samples collected on April 27, 1988, and analyzed for the same parameters.

Table 5-1 summarizes the water quality sampling and results. Complete water quality data for water samples taken during the SDT are included in Appendix D.

Table 5-1
WATER QUALITY SUMMARY

Well No.	Date	Chloride (ppm)	Sulfate (ppm)	TDS (ppm)	Conductivity (µmhos/cm)
S-17	4/25/88	45	11	440	560
S-18 (start)	3/21/88	71	0	408	560
S-18 (end)	3/21/88	70	0	410	560
FB-1 (step 1)	4/25/88	315	120	890	630
FB-1 (step 2)	4/25/88	314	136	900	630
FB-1 (step 3)	4/25/88	316	110	900	630
FB-1 (step 4)	4/25/88	317	144	900	630
FB-1 (step 5)	4/25/88	356	130	910	640
FB-1	4/27/88	319	80	900	640

Appendix A
LITHOLOGIC LOGS

PILOT HOLE GEOLOGIC DATA
WELL NO. S-17
APRIL 17, 1988

Depth Interval (feet)	Description
0-5	Medium-fine sand; dark brown; trace organics
5-10	Medium sand; gray; trace organics
10-15	Medium sand; brown; iron stain, with trace organics
15-20	Medium sand; light brown-tan; trace organics
20-25	Fine-medium sand; light brown-tan; iron stain
25-30	Fine-medium sand; gray-tan; trace organics
30-35	Fine-medium snad; gray-tan; trace iron stain, organics
35-40	Fine-medium sand; medium dark gray; 10% shell with limestone nodules
40-45	Fine-medium sand; medium dark gray; trace clayey silt layers, 50% shell
45-50	Fine sand; medium-dark gray; 30% shell
50-55	Fine sand; medium dark gray; 50% shell
55-60	Fine-medium sand; medium dark gray; 70% shell
60-65	Medium-fine sand, gray-tan; 90% shell
65-70	Medium-fine sand; gray; 10% fines, 90% shell
70-75	Medium-fine sand; gray, 10% fines, 90% shell
75-80	Medium-fine sand; gray; 10% fines, 90% shell
80-85	Medium-fine sand; dark gray; 20% fines, 80% shell
85-90	Fine sand; dark gray; 60% fine sod, 40% shell, trace organics
90-95	Fine sand; brown-dark gray; 60% fine sod; 20% shell
95-100	Fine sand; brown-dark gray; 60% fine sod, 20% shell
100-105	Fine sand; dark gray; 60% fine sod, 30% shell
105-110	Fine sand; dark gray; 60% fine sand, 20% shell, trace organics
110-115	Fine sand with interbedded clay; green gray; 50% shell

PILOT HOLE GEOLOGIC DATA
WELL NO. S-18
FEBRUARY 18, 1988

Depth Interval (feet)	Description
0-5	Medium-fine sand; dark brown; with trace shell, organics
5-10	Medium sand; light brown; trace organics, iron stain
10-15	Medium sand; dark brown; trace organics, iron stain
15-20	Medium-fine sand; light brown; trace organics, iron stain
20-25	Fine-medium sand; light brown; trace organics, trace iron
25-30	Fine-medium sand; light brown; trace iron
30-35	Fine-medium sand; tan-gray; 10% fine sand, 20% shell, trace organics
35-40	Medium sand; tan-gray; 15% fine sand, 25% shell, trace organics
40-45	Fine-medium sand; tan; 15% fine sand, 25% shell, trace organics
45-50	Fine-medium sand; tanish-gray; 15% fine sand, 50% shell
50-55	Fine-medium sand; grayish-tan; 20% fine sand, 30% shell
55-60	Fine-medium sand; grayish-tan; 20% fine sand, 75% shell
60-65	Fine-medium sand; tan; 95% shell
65-70	Fine-medium sand; grayish-tan; 95% shell
70-75	Fine-medium sand; gray; 95% shell
75-80	Fine sand; dark gray; 10% fine sand, 90% shell
80-85	Fine sand; gray; 20% fine sand, 60% shell, interbedded calcarenite
85-90	Fine sand; gray; 10% fine sand, 40% shell
90-95	Silty clay; gray-green; 20% shell
95-100	Clayey silty sand; gray; 30% shell
100-105	Limestone (calcarenite); gray; 5% fine sand
105-110	Limestone (calcarenite); gray; 15% fine sand
110-115	Sandy limestone (calcarenite); 10% shell
115-120	Clay; green; 10% shell

CUTTINGS GEOLOGIC DATA
WELL NO. FB-1
4/11/88 to 4/19/88

Depth Interval (feet)	Description
0-5d	Fine sand; brown; trace organics
5-10	Silty fine sand; light brown; trace organics
10-15	Silty fine sand; tan-brown; trace organics
15-20	Silty fine sand; brown
20-25	Silty fine-medium sand; brown
25-30	Silty fine-medium sand; brown
30-35	Silty fine-medium sand; brown
35-40	Silty fine-medium sand; brown
40-45	Silty fine-medium sand; brown
45-50	Silty fine-medium sand; tan; 10% shell
50-55	Silty fine sand; tan-gray; 30% shell
55-60	Silty fine sand; tan-gray; 85% shell
60-65	Silty fine sand; light gray; 85% shell
65-70	Silty fine sand; light gray; 85% shell
70-75	Silty fine sand; light gray; 75% shell
75-80	Silty fine sand; light gray; 60% shell
80-85	Silty fine sand; gray; 45% shell
85-90	Silty fine sand; gray; 40% shell, trace organics
90-95	Silty fine sand; gray; 45% shell, trace organics
95-10	Silty fine sand; gray; 35% shell, trace organics
100-105	Silty fine sand; gray; 35% shell, trace organics
105-110	Silty fine sand; light green; 10% shell, clay seams
110-115	Silty clay; green-gray; trace organics
115-120	Medium sandy clay; dark gray-green; limestone fragments
120-130	Medium-fine sandy clay; dark gray-green; limestone fragments
130-140	Clay; gray-green; stiff
140-150	Clay; green; soft
150-220	As above
220-230	Clay; green; stiff
230-420	As above
420-430	Clay; green; with interbedded chert, very stiff
430-490	Clay; green; very stiff
490-510	Limestone; light gray-green; interbedded clay and chert
510-640	Limestone; light green; clay seams and interbedded chert
640-680	Limestone; tan; clay seams
680-730	Cemented limestone; tan; very hard
730-904	Cemented limestone; white; interbedded clay

Appendix B
GRAIN SIZE ANALYSIS

FRASER ENGINEERING AND TESTING, INC.
3504 INDUSTRIAL 33rd STREET FORT PIERCE, FLORIDA 33450
FORT PIERCE: (305) 461-7508
VERO BEACH: (305) 567-6167
STUART: (305) 283-7711

Report
of
SIEVE ANALYSIS

Client CH2M Hill **Date** February 19, 1988

Contractor -

Site Lawnwood Wellfield Expansion
Boring #S-17, 55' - 85'
6 Samples Mixed

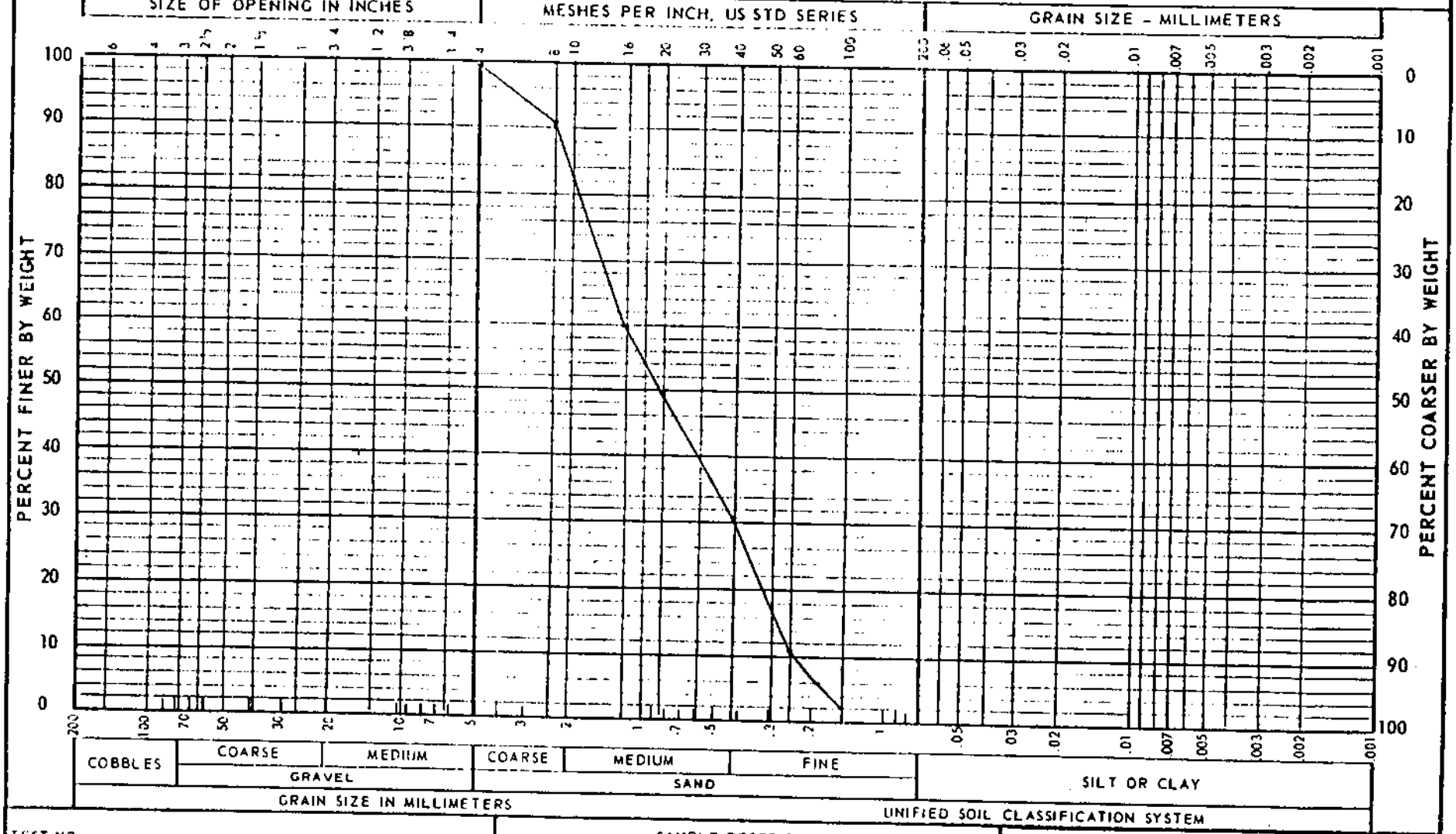
Soil Description Sand, medium and fine, with shell fragments.

SIEVE SIZE	PERCENT PASSING
No. 4	99.98
No. 8	91.2
No. 16	59.3
No. 20	49.7
No. 40	31.0
No. 60	10.9
No. 80	5.9
No. 100	2.1

Respectfully submitted,

ALEXANDER H. FRASER, P. E.

MECHANICAL ANALYSIS GRAPH OF GRANULAR MATERIALS



TEST NO.

SAMPLE NO. S-17

SAMPLE LOCATION S-17

SAMPLE ELEVATION 55-85

SAMPLE DESCRIPTION

Sand, medium and fine with shell fragments

FRASER ENGINEERING AND TESTING

DRAWN BY DA | CHECKED BY | DATE 2-19

FORM 526 (HT)

FRASER ENGINEERING AND TESTING, INC.
3504 INDUSTRIAL 33rd STREET FORT PIERCE, FLORIDA 33450
FORT PIERCE: (305) 461-7508
VERO BEACH: (305) 567-6167
STUART: (305) 283-7711

Report
of

SIEVE ANALYSIS

Client CH2M Hill

Date February 19, 1988

Contractor -

Site Lawnwood Wellfield Expansion
Boring #S-18, 100' - 115'
3 Samples Mixed

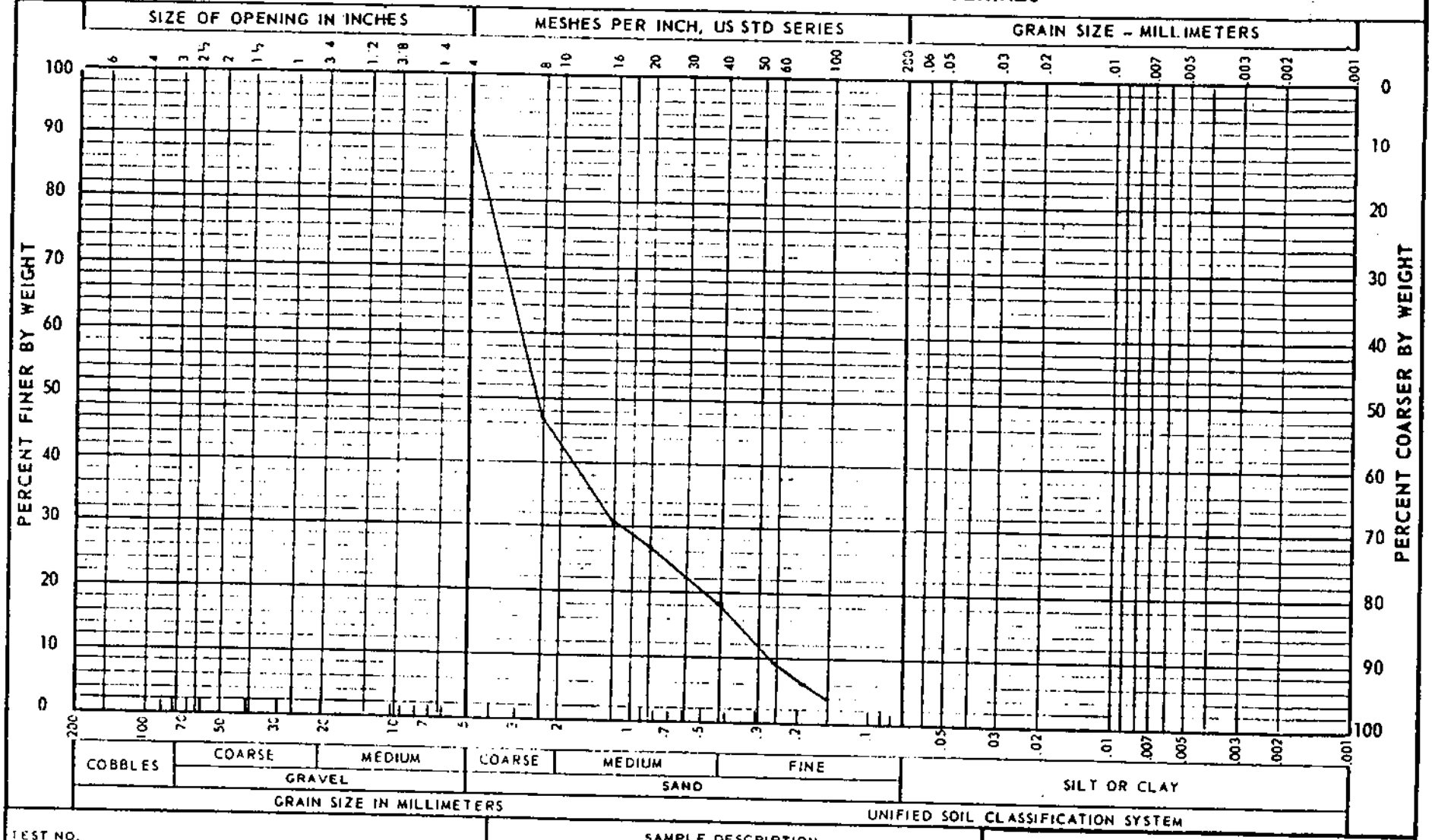
Soil Description Cemented sand and shells, shell fragments and sand.

SIEVE SIZE	PERCENT PASSING
No. 4	91.5
No. 8	46.7
No. 16	31.5
No. 20	27.5
No. 40	18.7
No. 60	9.9
No. 80	6.4
No. 100	4.6

Respectfully submitted,

ALEXANDER H. FRASER, P. E.

MECHANICAL ANALYSIS GRAPH OF GRANULAR MATERIALS



TEST NO.

SAMPLE NO.

SAMPLE LOCATION S-18

SAMPLE ELEVATION 100' - 115

SAMPLE DESCRIPTION

Cemented sand and shells, shell fragments and sand

FRASER ENGINEERING AND TESTING

DRAWN BY PA | CHECKED BY | DATE 2-19

FORM 526 (H1)

Appendix C
GEOPHYSICAL LOGS

Appendix D
PUMPING TEST DATA
AND
WATER QUALITY RESULTS

PUMPING TEST REPORT

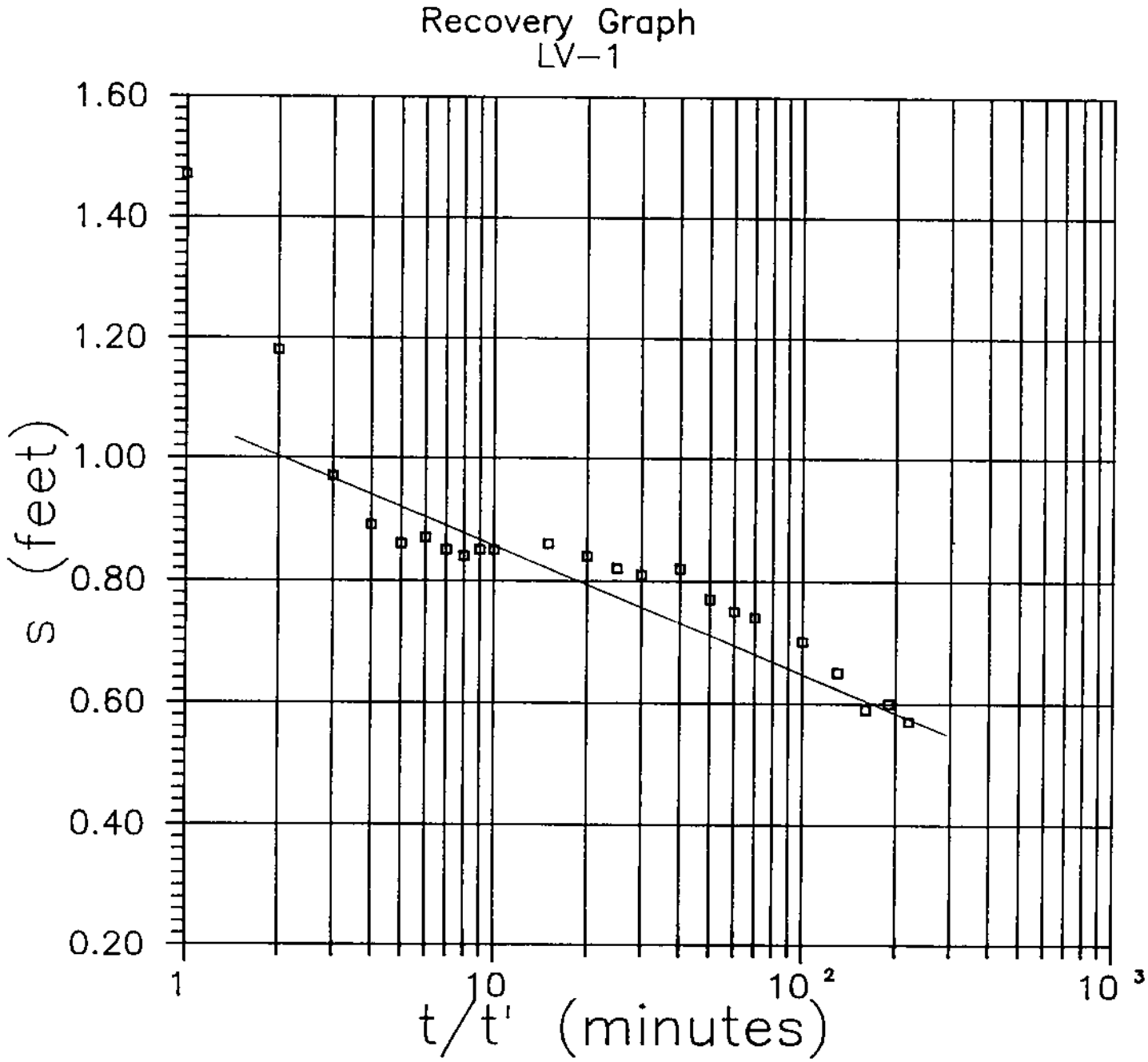
WELL NUMBER: LV-1(OBSERVATION WELL)
TYPE OF DATA: RECOVERY
PUMPED WELL NO.: S-17
WELL RADIUS: 0.5 ft.
PUMPING RATE: 351 gpm
START TIME & DATE: 09:53 17-MAR-88
METHOD OF MEASUREMENT: M-SCOPE
DISTANCE FROM PUMPED WELL: 110 ft.

MEASUREMENTS BY:
T.SHARP
P.KWIATKOWSKI
D.VANNOTE

INITIAL DEPTH TO WATER (PUMPING): 37.22 ft.

TIME	TIME SINCE PUMP STOPPED (MINUTES)	PUMPING RATE (GPM)	DEPTH TO WATER LEVEL (FEET)	RECOVERY (FEET)	REMARKS
09:53	0.000	351.00	37.22	17.26	LV-1 pumping at 250-350
	0.250		23.85	3.89	gpm- turned off at 09:53
	0.500		23.16	3.20	
	0.050		22.38	2.42	
	0.750		22.25	2.29	
	1.000		22.27	2.31	
	1.500		22.33	2.37	
	2.000		22.31	2.35	
	2.500		22.30	2.34	
	3.000		22.28	2.32	
	3.500		22.29	2.33	NO ANALYSIS
	4.000		22.28	2.32	
	4.500		22.27	2.31	
	5.000		22.19	2.23	
	6.000		22.15	2.19	
	7.000		22.13	2.17	
	8.000		22.13	2.17	
	9.000		22.11	2.15	
	10.000		22.10	2.14	
	15.000		22.10	2.14	
10:13	20.000		22.10	2.14	turned off S-17 at 10:13
	21.000	351.00	21.43	1.47	
	22.000		21.14	1.18	
	23.000		20.93	0.97	
	24.000		20.85	0.89	
	25.000		20.82	0.86	
	26.000		20.83	0.87	
	27.000		20.81	0.85	
	28.000		20.80	0.84	
	29.000		20.81	0.85	
	30.000		20.81	0.85	
	35.000		20.82	0.86	
	40.000		20.80	0.84	
	45.000		20.78	0.82	
	50.000		20.77	0.81	
10:53	60.000		20.78	0.82	

		70.000		20.73	0.77	
		80.000		20.71	0.75	
		90.000		20.70	0.74	
		120.000		20.66	0.70	
		150.000		20.61	0.65	
		180.000		20.55	0.59	
		210.000		20.56	0.60	
	13:53	240.000		20.53	0.57	



Transmissivity (T)=$\frac{264Q}{\Delta s}$

Storativity (S)=$\frac{.3Tto}{r^2}$

Q=351 gpm
r=110 ft.
Δs=1.47S
to=.07

T=62,823 gpd/ft
S=.11

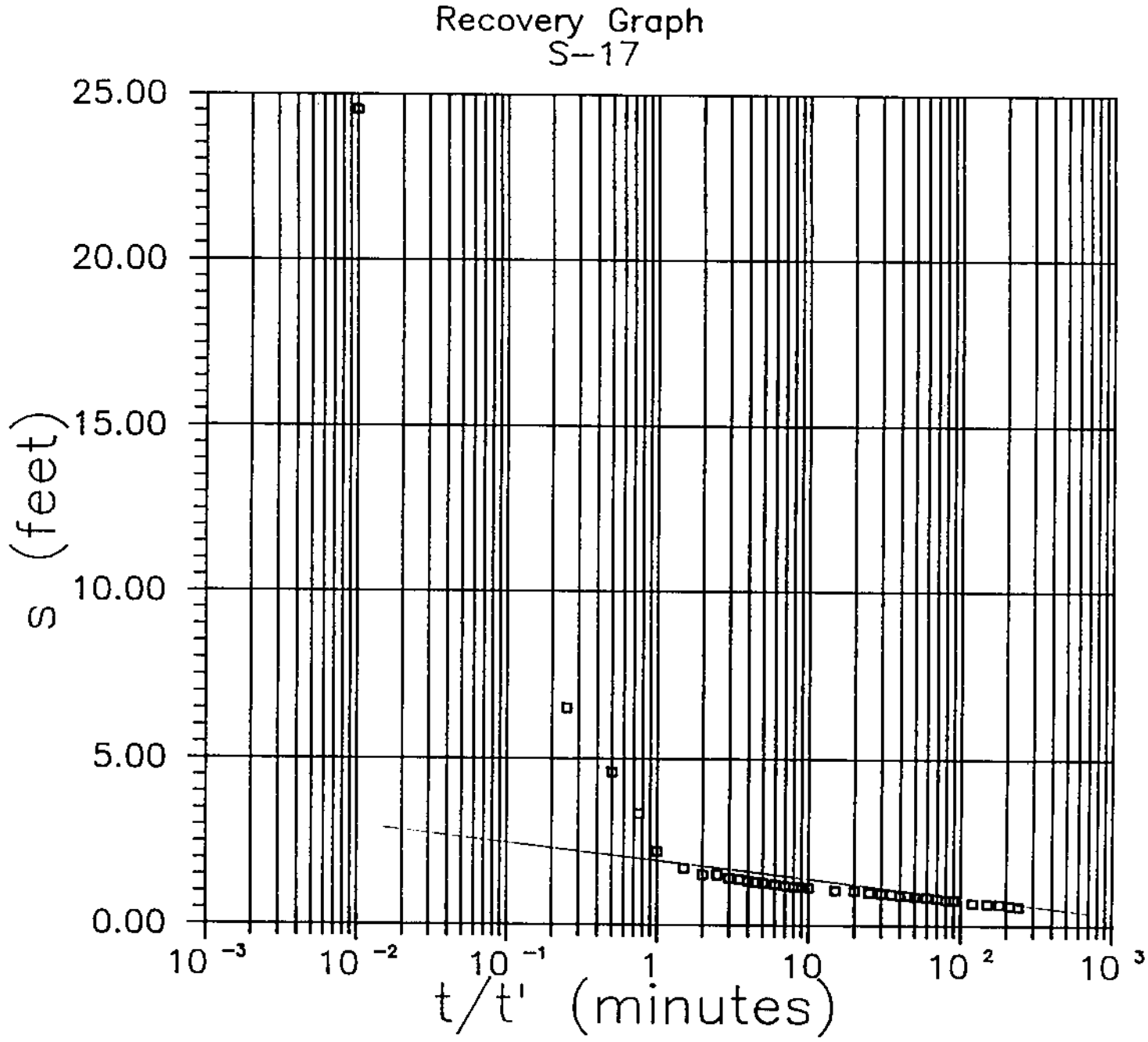
PUMPING TEST REPORT

WELL NUMBER: S-17(PUMPING WELL)
TYPE OF DATA: RECOVERY
PUMPED WELL NO.: S-17
WELL RADIUS: 0.5 ft.
PUMPING RATE: 351 gpm
START TIME & DATE: 10:13 17-MAR-88
METHOD OF MEASUREMENT: M-SCOPE
DISTANCE FROM PUMPED WELL : N/A

MEASUREMENTS BY:
T.SHARP
P.KWIATKOWSKI
D.VANNOTE

INITIAL DEPTH TO WATER (PUMPING): 44.62 ft.

TIME	TIME SINCE PUMP STOPPED (MINUTES)	PUMPING RATE (GPM)	DEPTH TO WATER LEVEL (FEET)	RECOVERY (FEET)	REMARKS
10:13	0.000	351.00	44.62	24.53	
	0.250		26.60	6.51	
	0.500		24.69	4.60	
	0.750		23.44	3.35	
	1.000		22.31	2.22	
	1.500		21.81	1.72	
	2.000		21.61	1.52	
	2.500		21.61	1.52	
	3.000		21.51	1.42	
	3.500		21.47	1.38	
	4.000		21.43	1.34	
	4.500		21.39	1.30	
	5.000		21.37	1.28	
	6.000		21.32	1.23	
	7.000		21.29	1.20	
	8.000		21.26	1.17	
	9.000		21.25	1.16	
	10.000		21.23	1.14	
	15.000		21.15	1.06	
	20.000		21.13	1.04	
	25.000		21.08	0.99	
	30.000		21.05	0.96	
	35.000		21.04	0.95	
	40.000		21.00	0.91	
	45.000		21.00	0.91	
	50.000		20.96	0.87	
	60.000		20.94	0.85	
	70.000		20.91	0.82	
	80.000		20.87	0.78	
	90.000		20.87	0.78	
	120.00		20.77	0.68	
	150.00		20.75	0.66	
	180.00		20.74	0.65	
	210.00		20.70	0.61	
14:13	240.00		20.68	0.59	



Transmissivity (T)=$\frac{264Q}{\Delta s}$

Q=351 gpm
r=110 ft.
Δs=1.48 ft.

T=62,611 gpd/ft

PUMPING TEST REPORT

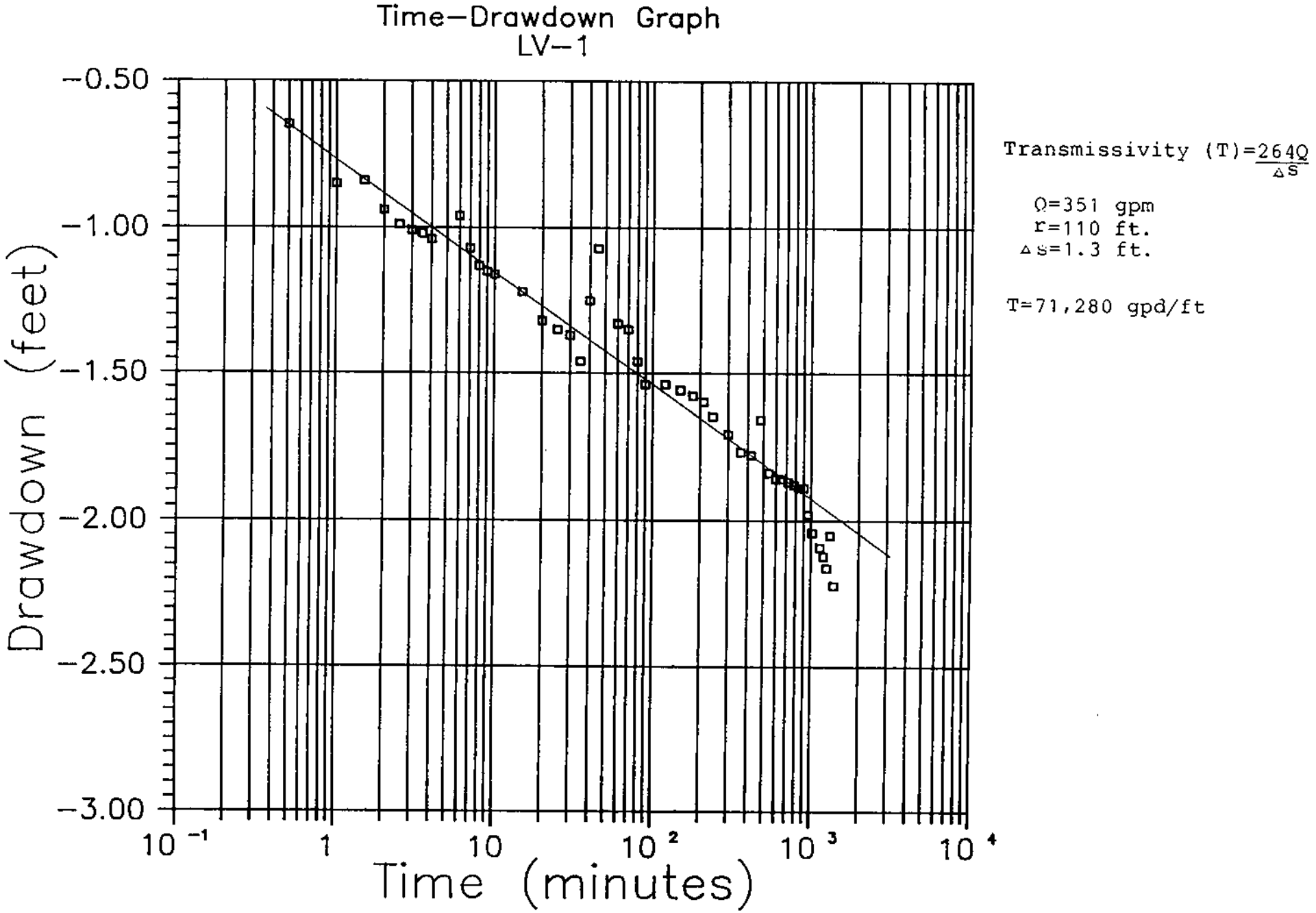
WELL NUMBER: LV-1(OBSERVATION WELL)
TYPE OF DATA: DRAWDOWN
PUMPED WELL NO.: S-17
WELL RADIUS: 0.5 ft.
PUMPING RATE: 351 gpm
START TIME & DATE: 09:31 17-MAR-88
METHOD OF MEASUREMENT: M-SCOPE
DISTANCE FROM PUMPED WELL: 110 ft.

MEASUREMENTS BY:
T.SHARP
P.KWIATKOWSKI
D.VANNOTE

INITIAL DEPTH TO WATER (STATIC): 19.96 ft.

TIME	TIME SINCE PUMP STARTED (MINUTES)	PUMPING RATE (GPM)	DEPTH TO WATER LEVEL (FEET)	DRAWDOWN (FEET)	REMARKS
09:31	0.00	351.00	19.96	0.00	LV-1 pressure gauge 64
	0.50		20.61	0.65	psi
	1.00		20.81	0.85	
	1.50		20.80	0.84	
	2.00		20.90	0.94	
	2.50		20.95	0.99	
	3.00		20.97	1.01	
	3.50		20.98	1.02	
	4.00		21.00	1.04	
	4.50				
	5.00				water alongside casing gave false reading
	6.00		20.92	0.96	
	7.00		21.03	1.07	
	8.00		21.09	1.13	
	9.00		21.11	1.15	
	10.00		21.12	1.16	S-17= DTW-42.86 ft. 0951
	15.00		21.18	1.22	
	20.00		21.28	1.32	
	25.00		21.31	1.35	
	30.00		21.33	1.37	S-17= DTW-43.19 ft. 1011
	37.00		21.42	1.46	
	40.00		21.21	1.25	
	45.00		21.03	1.07	
	50.00				no measurement
	60.00		21.29	1.33	
	70.00		21.31	1.35	S-17= DTW-40.72 ft. 1054
	80.00		21.42	1.46	S-17= DTW-42.91 ft. 1056
	90.00		21.50	1.54	
	120.00		21.50	1.54	S-17= DTW-43.47 ft. 1145
	150.00		21.52	1.56	
	180.00		21.54	1.58	
	210.00		21.56	1.60	
	240.00		21.61	1.65	
	300.00		21.67	1.71	
	360.00		21.73	1.77	
	420.00		21.74	1.78	S-17= DTW-43.93 ft. 1643
	480.00		21.62	1.66	
	540.00		21.80	1.94	

	600.00		21.82	1.86	
	660.00		21.82	1.86	
	720.00		21.83	1.87	
	780.00		21.84	1.88	
	840.00		21.85	1.89	
	900.00		21.85	1.89	second irrigation well on
	960.00		21.94	1.98	
	1020.00		22.00	2.04	
	1080.00				missed reading
	1140.00		22.05	2.09	
	1200.00		22.08	2.12	
	1260.00		22.12	2.16	S-17= DTW-44.55 ft. 0645
	1320.00		22.01	2.05	second irrig. well off
23:27	1396.00		22.18	2.22	S-17= DTW-44.78 ft. 0855



Transmissivity (T)=$\frac{264Q}{\Delta s}$

Q=351 gpm
r=110 ft.
Δs=1.3 ft.

T=71,280 gpd/ft

PERMIT NO.:56-00085-W APPLICATION NO.:09157-F
APPLICANT'S NAME: Doug VanNote/CH2M-Hill
PROJECT NAME: FPUA/Lawnwood Wellfield S-18
PROJECT LOCATION: SECT.: 16 TWNSHP.:34-37 RNG.:40E and 41E
WEATHER CONDITIONS: Clear
TEST OPERATOR: DSI TEST DATE: 3/21/88
PUMP CHARACTERISTICS: DIAMETER:4 INCHES
FLOW METER TYPE: 6-INCH DISCHARGE PIPE: 4-INCH ORIFICE
STATIC WATER LEVEL: -17.25FT. FT FROM TOP OF CASING: -17.25FT.

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	WATER QUALITY DATA PPM	micromhos/cm
200	0	0.00	CL:71 SO4:0 TDS:408	COND.:560
	5	9.50		
	10	9.80		
	15	9.80		
	20	9.90		
	25	9.90		
	30	10.00		
	35	10.00		
	40	10.00		
	45	10.00		
	50	10.00		
	55	10.00		
	60	10.00		
300	0	14.00		
	5	14.50		
	10	14.80		
	15	14.80		
	20	14.80		
	25	14.80		
	30	14.80		

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	WATER QUALITY DATA
300	35	14.80	
	40	14.90	
	45	14.90	
	50	15.00	
	55	15.00	
	60	15.00	
350	0	16.50	
	5	16.50	
	10	16.50	
	15	16.50	
	20	17.00	
	25	17.00	
	30	17.00	
	35	17.00	
	40	17.00	
	45	17.10	
	50	17.10	
	55	17.20	
	60	17.20	
400	0	18.50	
	5	18.50	
	10	18.50	
	15	18.50	
	20	18.50	
	25	18.50	
	30	19.00	

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	WATER QUALITY DATA
	40	19.00	
	45	19.50	
	50	19.50	
	55	19.70	
	60	19.70	
500	5	21.50	
	10	21.50	
	15	21.50	
	20	21.50	
	25	21.50	
	30	21.50	
	35	22.00	
	40	22.00	
	45	24.00	
	50	24.70	
	55	24.70	
	60	24.70	
613	0	28.00	
	5	30.00	
	10	30.00	
	15	31.00	
	20	31.00	
	25	31.00	
	30	31.00	
	35	31.00	
	40	31.00	

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	WATER QUALITY DATA
613	45	32.00	
	50	32.00	
	55	32.00	
	60	32.00	CL:70 SO4:0 TDS:410 COND.:560

April 25, 1988 water quality data for S-17 and S-18:

S-17
CL:45ppm SO4:11ppm TDS:440ppm COND.:560 micromhos/cm

S-18
CL:72ppm SO4:0ppm TDS:410ppm COND.:560 micromhos/cm

ASSUMPTIONS:

1) This test was performed under rainless conditions
2) The static water table of S-18 is 17.25 ft.
3) Top of casing is approx. 2 ft. above land surface
4) Drawdowns were measured to the nearest 0.1 ft.
5) Measurements were taken at five minute intervals

PERMIT NO.:56-00085-W APPLICATION NO.:09157-F
APPLICANT'S NAME: Doug VanNote/CH2M-Hill
PROJECT NAME: FPUA/Floridan Aquifer Blending Well
PROJECT LOCATION: SECT.: 8 TWNSHP.:34-37 RNG.:40 and 41E
WEATHER CONDITIONS: Clear
TEST OPERATOR: DSI TEST DATE: 4/25/88
PUMP CHARACTERISTICS: DIAMETER:4-INCHES
FLOW METER TYPE: 6-INCH DISCHARGE PIPE; 4-INCH ORIFICE
STATIC WATER LEVEL: Flowing FT FROM TOP OF CASING: APPROX. 13

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	CHLORIDE Conc. (PPM)	CONDUCTIVITY (MICROMHOS/CM)
350	0	0.00	315	630
	3	0.30		
	6	0.30		
	9	0.40		
	12	0.40		
	15	0.46		
	18	0.48		
	21	0.50		
	24	0.52		
	27	0.54		
	30	0.54		
	33	0.53		
	36	0.50		
	39	0.50		
	42	0.50		
	45	0.50		
	48	0.50		
	51	0.50		
	54	0.50		
	57	0.50		
	60	0.50		

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	CHLORIDE Conc. (PPM)	CONDUCTIVITY (MICROMHOS/CM)
500	0	2.00	314	630
	3	2.00		
	6	2.10		
	9	2.10		
	12	2.10		
	15	2.10		
	18	2.10		
	21	2.10		
	24	2.10		
	27	2.10		
	30	2.10		
	33	2.10		
	36	2.20		
	39	2.20		
	42	2.20		
	45	2.20		
	48	2.20		
	51	2.20		
	54	2.20		
	57	2.20		
	60	2.20		
	63	2.20		
	66	2.20		
	69	2.20		
	72	2.20		
	75	2.20		

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	CHLORIDE Conc. (PPM)	CONDUCTIVITY (MICROMHOS/CM)
500	78	2.20		
	81	2.20		
	84	2.20		
	87	2.20		
	90	2.20		
650	0	4.40	316	630
	3	4.40		
	6	4.40		
	9	4.40		
	12	4.50		
	15	4.50		
	18	4.50		
	21	4.60		
	24	4.60		
	27	4.60		
	30	4.60		
	33	4.60		
	36	4.60		
	39	4.60		
	42	4.60		
	45	4.60		
	48	4.60		
	51	4.60		
	54	4.60		
	57	4.60		
	60	4.60		

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	CHLORIDE Conc. (PPM)	CONDUCTIVITY (MICROMHOS/CM)
650	63	4.60		
	66	4.60		
	69	4.60		
	72	4.60		
	75	4.60		
	78	4.60		
	81	4.60		
	84	4.60		
	87	4.60		
	90	4.60		
	93	4.60		
	96	4.60		
	99	4.60		
	102	4.60		
	105	4.60		
	108	4.60		
	111	4.60		
	114	4.60		
	117	4.60		
	120	4.60		
750	0	10.20	317	630
	3	10.20		
	6	10.20		
	9	10.30		
	12	10.30		

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	CHLORIDE Conc. (PPM)	CONDUCTIVITY (MICROMHOS/CM)
750	15	10.40		
	18	10.40		
	21	10.40		
	24	10.40		
	27	10.40		
	30	10.40		
	33	10.40		
	36	10.40		
	39	10.50		
	42	10.50		
	45	10.50		
	48	10.50		
	51	10.50		
	54	10.50		
	57	10.50		
	60	10.50		
	63	10.50		
	66	10.50		
	69	10.50		
	72	10.50		
	75	10.50		
	78	10.50		
	81	10.50		
	84	10.50		
	87	10.50		
	90	10.50		

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	CHLORIDE Conc. (PPM)	CONDUCTIVITY (MICROMHOS/CM)
750	93	10.50		
	96	10.50		
	99	10.50		
	102	10.50		
	105	10.50		
	108	10.50		
	111	10.50		
	114	10.50		
	117	10.50		
	120	10.50		
	123	10.50		
	126	10.50		
	129	10.50		
	132	10.50		
	135	10.50		
	138	10.50		
	141	10.50		
	144	10.50		
	147	10.50		
	150	10.50		
1000	0	14.50	317	630
	3	15.00		
	6	15.00		
	9	15.00		
	12	15.00		
	15	15.00		

DISCHARGE RATE (GPM)	TIME (MIN)	DRAWDOWN (FT)	CHLORIDE Conc. (PPM)	CONDUCTIVITY (MICROMHOS/CM)
1000	18	15.00		
	21	15.00		
	24	15.00		
	27	15.00		
	30	15.00	356	640

ASSUMPTIONS:

1) FB-1 is a flowing well
2) Top of casing is 2 ft. above land surface
3) Drawdowns were measured to the nearest 0.1 ft.
4) Measurements were taken at three minute intervals
5) This test was performed under rainless conditions