MILES GRANT CONSUMPTIVE USE

AND

IMPACT ON ADJACENT USERS

October 1979

79-40

GEE & JENSON ENGINEERS · ARCHITECTS · PLANNERS, INC.

2019 OKEECHOBEE BLVD. WEST PALM BEACH, FLORIDA

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TABLE OF CONTENTS

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APPENDICES

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MILES GRANT CONSUMPTIVE USE

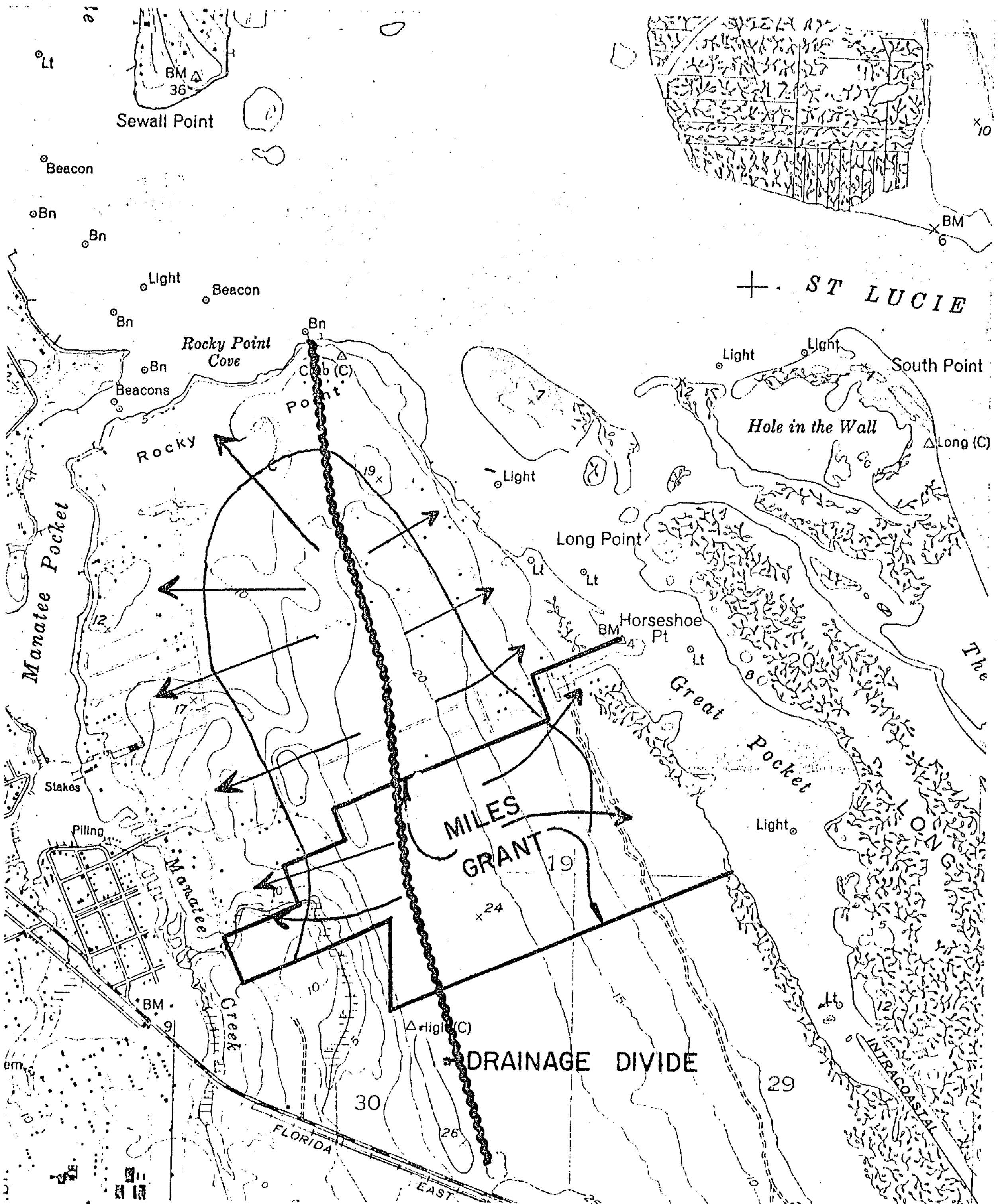
AND

IMPACT ON ADJACENT USERS

I. Introduction

The Miles Grant Development is a coordinated development of recreational and residential areas of approximately 303 acres located in Martin County, Florida. The site is located due east of the town of Port Salerno and five miles southeast of Stuart, Florida (Fig. 1). Its south boundary is Cove Road and the eastern boundary is the Intracoastal waterway. Miles Grant is part of Hanson Grant, Township 38 South, Range 42 East.

Miles Grant Water and Sewer Company supplies potable water to the development. Six supply wells withdraw water from the surficial aquifer. The golf course is irrigated from Golf Course Lake which is designed to receive treated sewage effluent. Irrigation around the clubhouse and dwelling units is supplied from shallow 2-inch wells. Water Use Permit No. 43-00086-W, issued on November 17, 1977 to the Miles Grant Water and Sewer Company for a ten year period by the South Florida Water Management District (SFWMD) is for public water supply. The allocation for water withdrawal is 95.2 MGY (0.261 MGD) on an average day basis and 0.469 MGD on a maximum day basis.



DIRECTION OF
GROUND WATER
MOVEMENT

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.
WEST PALM BEACH, FLORIDA

MILES GRANT
GROUND WATER FLOW PATTERN

DESIGNED	DRAWN	CHECKED	JOB NO.	DRAWING NO.
	R.M.		79-40	
DATE	SCALE	APPROVED	FILE NO.	SHEET OF
OCT. '79	None			

IV. Hydrogeologic Monitoring Programs Required By The Special Conditions Of The Consumptive Use Permit

Impact of groundwater withdrawals on adjacent domestic or irrigation supply wells is a primary concern when developing municipal, agricultural or industrial water supplies. Impacts with respect to quantity and quality must be evaluated as part of the South Florida Water Management District's (SFWMD) Consumptive Use Permit Application. Miles Grant was issued a 10-year Consumptive Use Permit (No. 43-00086-W) on November 17, 1977. This permit provides an annual allocation of 95.2 million gallons to be withdrawn from the surficial aquifer underlying Miles Grant. As part of this permit, 14 special conditions were given. Special conditions are designed to provide a means of safely managing the state's water resources and to protect the supplies of both the user and adjacent users. Special conditions specifically designed as a water management tool for the Miles Grant service area are as follows:

1. Total installed capacity shall not exceed 900 GPM from six wells.
   0.469
2. Maximum day withdrawal shall not exceed 469 MGD.
3. Permittee shall submit to the district copies of "monthly operating reports" as submitted to the Florida Department of Environmental Regulation (DER). These reports shall contain:

a. Daily withdrawals. b. Analysis for chloride ion concentration in raw water determined as often as required by DER, but no fewer than once per month.

Monthly operating reports shall be submitted on a monthly basis following the month of record. Permittee shall begin submitting reports in the month following the month of permit issuance.

4. In the event of a declared water shortage, water withdrawal reductions may be ordered by the District in proportion to the maximum day withdrawal specified in the staff report.

5. If the maximum day withdrawal in this report is exceeded the permit shall be subject to review and possible revocation.

6. Permittee shall implement a "Saltwater Intrusion Monitoring and Management (SWIMM) Program" within one year of date of permit issuance. A preliminary proposal shall be submitted to staff for approval within six months of permit issuance. The purpose of the plan shall be to monitor the location of the saltwater interface and alert the district of any increase in chloride concentrations in monitoring wells. Plan shall cover monitoring well lo depths, construction, screens, method of ch

analysis, frequency of data collection, and a management scheme for operating water supply wells at particular chloride levels in monitoring wells. Plan shall contain a provision that the district shall be notified of any significant increase in chloride concentration within any monitoring well immediately.

7. Permittee shall monitor water table elevations in USGS Well No. M1004 on a daily basis. Results of monitoring shall be submitted to the district on a yearly basis after the date of permit issuance. The district shall be notified of any significant decline in water table immediately.

8. Permittee shall undertake a study in order to determine the magnitude of the potential problems associated with spraying sewage effluent within a public water supply wellfield and the discharge of 195,000 GPD of sewage effluent adjacent to a wellfield area. This study shall include:

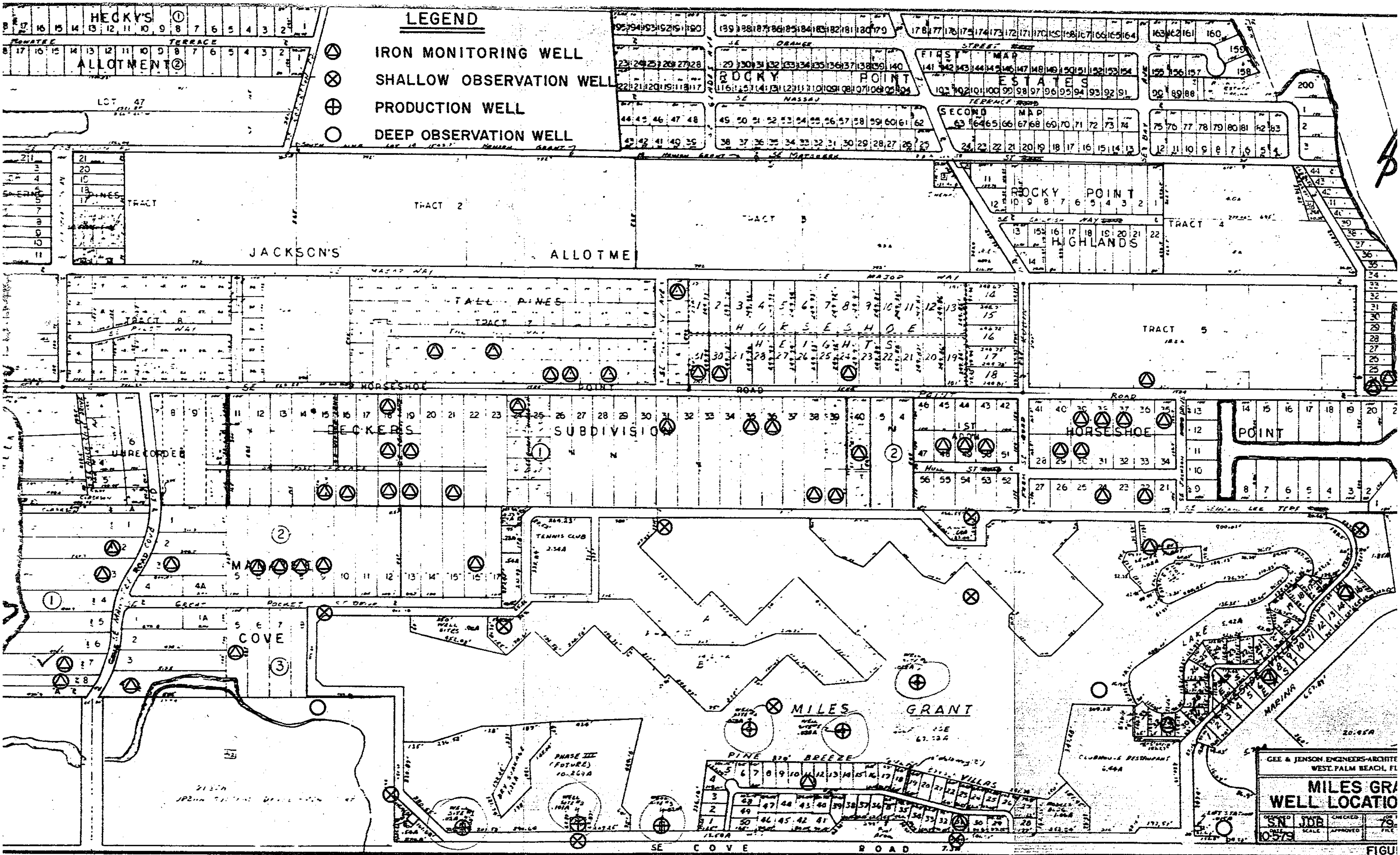
   a. A hydrologic evaluation of the percentage of pumped water which may constitute effluent recharge at the present time and at projected ultimate withdrawal rate.

   b. Monitoring of raw water quality. Results of the study which shall be known as the

"Sewage Effluent Recharge Study (SERS)" shall be submitted within two years of permit issuance and shall contain a plan for ongoing monitoring. A preliminary proposal for this study shall be submitted within six months after the date of permit issuance.

9. The annual allocation specified herein shall be subject to modification should saltwater intrusion or a significant decline in water table occur. The annual allocation specified herein shall also be subject to modification if it is apparent that significant recharge of the wellfield occurs as a consequence of either spray irrigation of the golf course with sewage effluent or wastewater discharge into the irrigation pond.

To satisfy these special conditions, Miles Grant Water and Sewer Company contracted Gee & Jenson Engineers-Architects-Planners, Inc., to design and operate a SWIMM and SERS program to the satisfaction of the SFWMD and for the safety of Miles Grant's potable water supply. To date, five 150 feet deep salinity observation wells, 10 shallow observation wells (15 to 40 feet deep) have been constructed (Fig. 2). Two additional wells are equipped with continuous water level recorders for monitoring groundwater levels. A continuous


LEGEND
IRON MONITORING WELL
SHALLOW OBSERVATION WELL
PRODUCTION WELL
DEEP OBSERVATION WELL
HECKY'S
ALLOTMENT
LOT 47
ROCKY POINT ESTATES
FIRST MAP
SECOND MAP
TRACT 2
TRACT 3
TRACT 4
TRACT 5
JACKSON'S ALLOTMENT
ROCKY POINT HIGHLANDS
TALL PINES
HORSESHOE HEIGHTS
SE HORSESHOE POINT ROAD
DECKERS SUBDIVISION
UNRECORDED
HORSESHOE
POINT
TENNIS CLUB
COVE
MILES GRANT
PINE BREEZE
VILLAS
MARINA
LAKE
SE COVE ROAD
GEE & JENSON ENGINEERS-ARCHITE
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V. Hydrogeologic Data Compiled From the SWIMM and SERS Monitoring Program

Dewatering activities of the Miles Grant Golf Course Lake in 1971, caused salt water to migrate from the Horshoe Point Canal into shallow domestic supply wells between the canal and the lake. To evaluate the extent of intrusion and recovery, a water quality monitoring program of domestic wells was begun and an 8-inch monitor well constructed next to the lake to monitor groundwater levels. Because this dewatering had an adverse impact on water quality in an area outside of Miles Grant's service area, concern over impacts of proposed municipal supply well withdrawals on adjacent well water quality became a primary issue during approval of development plans for Miller Grant.

As part of the SFWMD CUP application, a hydrologic evaluation of the safe yield of Miles Grant's water supply system was prepared by Gee and Jenson Engineers-Architects-Planners, Inc. and approved by the SFWMD. In addition to this hydrologic evaluation, the Martin County Commission requested a program be designed and operated to monitor water levels and water quality in the producing aquifer. Data obtained from this monitoring program would measure the impact of municipal withdrawals on salt water intrusion and dewatering of adjacent domestic wells as a means of determining the safe yield of the Miles Grant well field. The SFWMD incorporated the commission's request for this program into the CUP as special condition No. 6 (listed on page 7). Gee & Jenson worked with the SFWMD to design the SWIMM program which was implemented in May of 1979.

As part of the SWIMM program, monitor wells were designed for use in monitoring groundwater quality in the upper 15 to 30 feet of the surficial aquifer. Monitor water quality in this zone permits monitoring of impact of spraying treated sewage effluent from the golf course lake onto the golf course. This program (SERS) CUP special condition No. 8 is designed to assure this method of wastewater dispoal will not pose a pollution problem to Miles Grant's potable supply wells.

Hydrogeologic data provided by drilling of the 5 salinity observation wells and 10 shallow observation wells shows the surficial aquifer ranges from 130 to over 150 feet thick in the Miles Grant area (Appendix A, Lithology Logs). Fine-grained, unconsolidated silica sand, stained by iron, ranges from land surface to 25 to 45 feet in depth. Thin shell and limestone lenses occur near the base of the sand unit. A grey, calcareous sandstone interlayered with fossiliferous limestone extends from the surficial sand to the top of an olive green silty sand. This silty sand marks the base of the surficial aquifer at depths of 130 feet in the west to greater than 150 feet in the eastern part of the study area. Iron staining of sand grains and hydrogen sulfide staining is prevalent throughout the surficial sand and calcareous sandstone units. No confining sediments were found in the upper 150 feet of sediments, characterizing the surficial aquifer as a water table aquifer. The lithified nature, solution features and thickness of the sandstone-limestone unit indicate a potential transmissivity value higher than the 13,000 gpd/ft estimated for this area. Comparing geologic characteristics of the Miles Grant area with other areas along the Atlantic Coastal Ridge indicates transmissivities in Miles Grant may be in the range of 30,000 to 60,000 gpd/ft. This would significantly alter the projected cone of depression presented before the Martin County Commission on December 12, 1978. Water level records from well M-1004, which is approximately 400 feet from supply well No. 1 supports a transmissivity more in the range of 40,000 gpd/ft. An aquifer test to determine production well cone of depression was conducted on October 3, 1979 (See Section VI. Results of Aquifer Test and Appendix B, Aquifer Test Data).

Conductivity surveys on the 5 salinity observation wells have located the salt/fresh water interface on the eastern part of the property (Appendix C, Salinity Surveys). Wells D-1, D-2 and D-3 are located on a north-south transect 1,200 to 1,500 feet west of the Intracoastal waterway. In each of these wells, the salt/fresh water interface is encountered between 80 and 90 feet below land surface. Potable water is present from the water table down to 80 feet. Below 80 feet, salt concentrations increase rapidly until nearly equalling the Intracoastal waterway concentrations below depths of 115 feet. No significant inward movement of the salt/fresh water interface has been observed during the monitoring period, May through October 1979. Wells D-4 and D-5, 5,400 and 7,000 feet west of the Intracoastal waterway, exhibited potable water the total depth of each well. Monthly monitoring of conductance values in these 5 wells provide an early warning system for movement of the salt/fresh water interface into Miles Grant's supply wells. Supply wells 4, 5 and 6 withdraw water from near the base of the surficial aquifer (126 to 143 feet). Supply well No. 6 is itself a good monitor well for salt water encroachment, being approximately 2,500 feet west of the Intracoastal waterway.

VI. Aquifer Test Evaluation

A hydrogeologic investigation for Miles Grant was conducted on October 3, 1979. The purpose of the study was to aid in the planning and management of the public water supply system.

The primary purpose of the study was to determine the impact of water withdrawals both at the present time and at buildout. The impact is to be evaluated for both salt-water intrusion and adjacent users. The study also gives necessary information to resolve the ongoing dispute between the Breedloves and Miles Grant concerning the deterioration of Mr. Breedlove's water quality as a result of dewatering activities by Miles Grant starting in 1971. The detailed technical evaluation is presented in Appendix B. In summary, an aquifer test was conducted where one well was pumped continuously for seven hours at a rate of 150 gpm. Resulting drawdowns were measured by taking water levels at several observation wells throughout the test. The date from the test was analyzed using several analytical methods to obtain the aquifer parameters. A transmissivity of 54,500 gpd/ft and storage coefficient of 0.16 was found to be representative of the system.

Using these parameters and assuming that supply wells 1 and 4 would be pumped continuously for 100 days with no recharge to the system, (dry season conditions); it was found that the one foot drawdown contour occurs at a radial distance of about 660 feet from each pumping well. At this point, there is no measurable interefence between supply wells. From this information it can be seen that the impact on the northern property boundary is minimal since the one foot drawdown contour is approximately 400 feet from the boundary at its closest point. Impact on adjacent users, event at buildout, will not measurably impact adjacent users. Additionally, aquifer test data shows that withdrawing potable water from the base of the surficial aquifer will have little effect on shallow wells greater than 500' from the production wells.

APPENDIX A

APPENDIX A

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

MILES GRANT

WELL NO. 1

Depth (ft)	Lithology
0- 25	Sand: white to light tan, unconsolidated silica, very fine to medium grained.
25- 40	Sandstone: light grayish brown, well lithified medium to coarse grained, 5% stained reddish brown to black gives salt and pepper appearance to green, subangular to subrounded, with carbonate cement; Shell: with white 20% shell material, primarily Pelecypods (Cardiad sp., Arca sp.) and echinoid fragments (sand dollars).
40- 55	Sandstone: light brown silica (considerable iron stained individual grains, with 10% stained dark reddish brown to dark green to black) well lithified fine to coarse grain, poorly sorted ,calcareous cemented, subangular to subrounded, granular. Shell: white, broken fragments cemented within sandstone, primarily Pelecypod (approximately 40% of sample).
55- 65	Sandstone: as above with only 1% shell, drusy structure.
65- 70	Sandstone: silica light brown, well lithified medium to coarse grained, subrounded, cemented with carbonate, 10% of sand grains stained reddish brown to green to black, moderately sorted, 30% coarse shell debris, primarily Pelecypod (Chione Cancellata) Echinoid fragments, iron staining on some sand grains.
70- 85	Sandstone: light brown silica, fine grained, subrounded, well lithified with carbonate cement, iron stained sand grains as above, large shell fragments (15% of sample) very porous, extensive solution development; grayish sandstone fragments have 30-40% fecal pellets showing orientation of deposition.
85-105	Limestone: light brown to gray 99% fecal pellets in calcite matrix, very well lithified Shell: large fragments of Pelecypod - white Gastropods
105-120	Limestone: gray to white, well lithified, abundant fecal pellets in carbonate matrix, iron stained, sand fine to coarse grained, abundant shell fragments. Shell: 30% of sample, adults, primarily Pelecypods (Ostrea Chione sp., Mercenaria sp.) Gastropods (Bulla sp., Turritella sp.) Echinoid spines.

Depth (ft)	Lithology
120 -130	Well developed calcite crystals (indication of solution and sample porosity).
130 -140	Same as above, 40% large Pelecypod fragments.
140	As above, numerous Oliva sp.

MILES GRANT

Lithologhy Well No. 2

Depth (ft)	Lithology
0- 30	Sand: quartz, white to light brown, fine to coarse grained, subangular to subrounded.
30- 55	Sandstone: light grayish brown, well lithified medium to very coarse grained, calcareous cement, iron stained subrounded to subangular, shell: carbonate fragments.
55- 80	Limestone: light to dark gray, well lithified, very fine grained to cryptocrystalline.
80-105	Limestone: as 55-80, mostly dark gray; shell: abundant, white to light gray, fragments fine to pebble size, subrounded to subangular.
105-135	Limestone: very light gray to dark gray, well lithified very fine grained to cryptocrystalline, shell fragments: very fine to very coarse subrounded.
135-145	Limestone: as 105-135; shell: as 105-135; sand: quartz, very fine to coarse, trace heavy minerals.
145-150	Sandy clay: olive green, stiff, silt to fine grained with shell fragments; sand: very fine to fine grained, subrounded to subangular.

MILES GRANT

WELL #4

Depth (ft)	Lithology
0- 42	Sand: quartz, white to light brown, fine to coarse grained, subangular to subrounded.
42- 55	Shell: carbonate, black to white, fragments of pelecypods and gastropods, subrounded to angular; Sand: quartz white to dark brown, fine to coarse grained, subangular to subrounded, unconsolidated; Sandstone: quartz with carbonate cement, trace phosphorite sand, well lithified, fine to medium grained, light to dark gray, thin layer at 42'.
55- 60	Limestone: white to gray, well lithified, fine grained, quartz sand and shell fragments cemented with carbonate cement; Shell: carbonate, black to white, as fragments very poorly sorted, coarse to gravel grained.
60- 80	Shell: carbonate, black to white, slight iron stain, coarse to pebble grained, subrounded to angular, Sandstone: as 42-55 feet; trace quartz sand, transparent
80- 85	Shell: carbonate, black to white, conglomertic,slightly lithified, to gravel size, subrounded to angular, with wood fragments.
85- 95	Limestone: gray to black, cryptocrystalline, well lithified carbonate, black to white, conglomertic grading to poorly sorted with depth, medium to gravel size, iron stained in part, subrounded to angular.
95-125	Limestone: light to dark gray, fine grained to cryptocystalline with shell fragments well lithified; Shell: as 60-80; Sand: quartz transparent to light brown, very fine to medium.
125-135	Sandstone: as 42-55; shell: as 60-80.
135-145	Shell: carbonate black to white, subrounded to subangular, fine to pebble size fragments; Sand: very fine to coarse grained, subrounded to subangular, limestone: as 95-125

Depth (ft)	Lithology
145-150	Sandy clay: olive green, stiff, calcareous, with very fine quartz sand and shell fragments.

MILES GRANT

WELL #5

Depth (ft)	Lithology
0- 35	Sand - silica white to light brown, fine to coarse grained, subangular to subrounded, unconsolidated.
35- 45	Shell - black to white, unconsolidated, rounded fragments of large adult pelecypods and juvenile pelecypods (Tellina sp.) and gastropods (Cerithiopsis sp.), 70% of sample. Sand - white to dark gray, subrounded, lithified to unconsolidated fine to coarse grained.
45- 50	Shell - as above Sand - as above 25% Limestone - gray, well lithified, nonporous, 99% fecal pellets.
50- 55	Shell - white to gray, unconsolidated angular fragments of pelecypods and gastropods, some star coral - pelecypods (Tellina sp., Chione sp., Arca sp.), Gastropod (Oliva sp.)
55- 60	Shell as 50-55 - 60% Limestone - as 45-50 - 20% Limestone - white to gray well lithified, finely granular to cryptocrystalline, subrounded 20% of sample.
60- 65	Limestone as 55-60', 80% of sample. Shell as 50-55', 20% of sample.
65- 70	Limestone as 55-60' but all dark grey - 90% of sample Shell as 50 - 55' with the gastropod (Modulus sp.) 10% of sample.
70- 75	Limestone as 55-60', 50% Shell - as 50-55', 20% Limestone - as 45-50, 5% Sandstone - grey, lithified with carbonate fine to medium grained silica, sand and shell fragments cemented together 25%.
75- 80	As 70-75 with echinoid plates and spines.
80- 85	Limestone - white, lithified, fine grained silica and black shell fragments cemented with carbonate - salt & pepper appearance, 50% of sample, some reddish brown iron staining. Limestone - white, well lithified with 95% white fecal pellets in a white to gray calcite matrix, 20% sample Shell as 50-55' (but no Oliva sp.), 20% of sample.

Depth (ft)	Lithology
85-105	As 75 to 80' but no Olivas sp.
105-110	As 85-105 with bryazoa
110-120	As 85-105.
120-125	As 85-105, with the gastropod Caecaem cooperi.
125-130	Sandstone - light gray - lithified with carbonate to consolidated, very fine to coarse grained subrounded to rounded silica, shell and carbonate sand - 5% of grains are stained olive green to black - 85% of sample. Shell - white - unconsolidated angular fragments of pelecypods (Chione, Tellira, Arca) and gastropods Cerithoopsis).
130-135	Clay - silty, olive green stiff, very calcareous with unconsolidated sand and shell as 125-130'.
135-140	As 130-135' with fine to coarse grained well rounded phosphate sand.
140-145	As 130-135'

APPENDIX B

APPENDIX B

TABLE OF CONTENTS

APPENDIX B

HYDROGEOLOGIC INVESTIGATION

B.1 General Information:

On October 3, 1979, an aquifer test was performed on the property of Miles Grant Development to obtain aquifer parameters to aid in the planning and management of the public water supply system. The primary purpose of the study was to determine the impact of pumping the public supply wells, both at the present time and at build-out. The impact is to be evaluated for both saltwater intrusion and the adjacent users. The results of the study, to be described in following sections, also givens necessary information to resolve an ongoing dispute between the Breedloves and Miles Grant concerning the deterioration of Mr. Breedlove's water quality as a result of dewatering activities by Miles Grant starting in 1971.

The aquifer test involved pumping one well (PW-1) at a constant rate (150 gpm) four seven hours and observing the resulting drawdowns in nearby observation wells (PW-2, M-1004, S-7, D-4, S-6). Figure B-1 shows the configuration of the wells used.

Waterflow in a water table aquifer is governed by the permeability of the material, flow gradient, thickness of the aquifer and gravity flow of water from soil interstices in response to water level declines. Coring data and analytical solutions of the aquifer test data were used to determine the values of the aquifer parameters and to evaluate the system. The driller's logs do not show the presence of any confining layers, (Appendix A). The Jacob and Boulton's Delayed Yield Methods have been utilized and included in this report as the methods of analysis.

B.2 Methods of Data Analysis:

B.2.1 Jacob Method:

The Jacob method of aquifer analysis is based on the Theis formula but is more restricted in its applicability and is based on the following assumptions:

- aquifer is confined
- flow to the well is unsteady
- water removed from storage is discharged instantaneously with decline of head
- storage in the pumped well can be neglected
- the valves of u are small ($u<0.01$), i.e., r is small and t is large (the condition that u is small will be satisfied in confined aquifers for moderate distances from the pumped well in a short period of time. For unconfined aquifers, longer periods of pumping may be required).

Two procedures were used to calculate the transmissivity and storage coefficient.

(a) The first procedure involved the plotting of drawdown against time on semi-logarithmic paper of the data obtained for each of the observation wells. The equations used were:

$$T = \frac{264Q}{\Delta s} \qquad \text{and} \qquad S = \frac{0.3Tt_o}{r^2}$$

where

T = transmissivity (gpd/ft)

S = storage coefficient (dimensionless)

s = slope of the time - drawdown graph expressed as a change in drawndown over one log cycle of time (ft)

Q = discharge from pumping well (gpm)

r = distance of observation wells from pumped well(ft)

t_o = intercept of the straight line at zero drawdown (days)

(b) The second procedure involved the plotting of data from the observation wells for specified times on a drawdown vs. distance from pumped well graph. The equations used were:

$$T = \frac{528Q}{\Delta s} \quad \text{and} \quad S = \frac{0.3Tt}{r_o^2}$$

where T, S, Q, and Δs are defined the same as in A, and where

t = time since pumping started (days)

r_o = intercept at zero drawdown of the extended straight line (ft)

B.2.2 Boulton Method:

Boulton (1963) assumes that the amount of water derived from storage within an aquifer, due to an increment of drawdown, Δs, between times r and r + r since pumping began consists of two components:

(1) A volume of water instantaneously released from storage per unit horizontal area.

(2) A delayed yield from storage, per unit horizontal area, at any time t, $(t > r)$ from the start of pumping.

The following assumptions apply when using the Boulton Method:

- aquifer has seemingly infinite areal extent
- the aquifer is homogenous, isotropic, and of uniform thickness over the area influenced by the pumping test
- prior to pumping, the phreatic surface is horizontal over the area influenced by the pumping test.
- the discharge rate is constant from the pumped well
- the pumped well penetrates the entire thickness of the aquifer and receives water by horizontal flow.
- the aquifer is unconfined but showing delayed yield phenomena or the aquifer is semi-unconfined.
- the flow to the well is in an unsteady state
- the diameter of the well is small, ie. the storage in the well can be neglected.

To calculate the aquifer parameters, drawdown is plotted against time on double logarithmic graph paper. By curve matching with the Boulton Delayed Yield Type Curves, match points are determined allowing the following equations to be used to calculate the transmissivity and storage coefficient for early time and late time data:

$$T = \frac{114.6Q}{s} W(u_{AY}, r/B) \quad \text{and} \quad S = \frac{Tt}{2693r^2} u_{AY}$$

where T, S, r, s and Q were defined earlier and

W (u, r/B) = "well function of Boulton"
subscript A = early time
subscript Y = late time

B.3 Results of Aquifer Test Analysis

Listed below are the results obtained from the various methods of analysis:

SUMMARY OF AQUIFER COEFFICIENTS

	Transmissivity (gpd/ft)	Storage Coefficient
Boulton Method	(See Figures B-2, B-3)	
PW-2 (Early Time)	40,000	6.6×10^{-4}
M-1004 (Early Time)	57,300	5.7×10^{-3}
M-1044 (Late Time)	66,000	0.16
Average	54,500	
Jacob Method	(See Figures B-4, B-5)	
PW-2	67,000	
M-1004	293,000	
PW-1	27,300	

It should be noted that the Jacob method utilizes only the very early part of drawdown and, therefore, observes artesian storage and transmissivity values. These values are not to be used in determining cones of depression or projecting water level declines.

B.4 Cone of Depression

The cone of depression was determined for 100 days of continuous pumping assuming no recharge. An average transmissivity of 54,500 gpd/ft and water table storage coefficient of 0.16 was used in the determination. Using the equations:

$$u = \frac{1.87\ r^2\ S}{Tt} \qquad s = \frac{114.6Q}{T}\ Wu$$

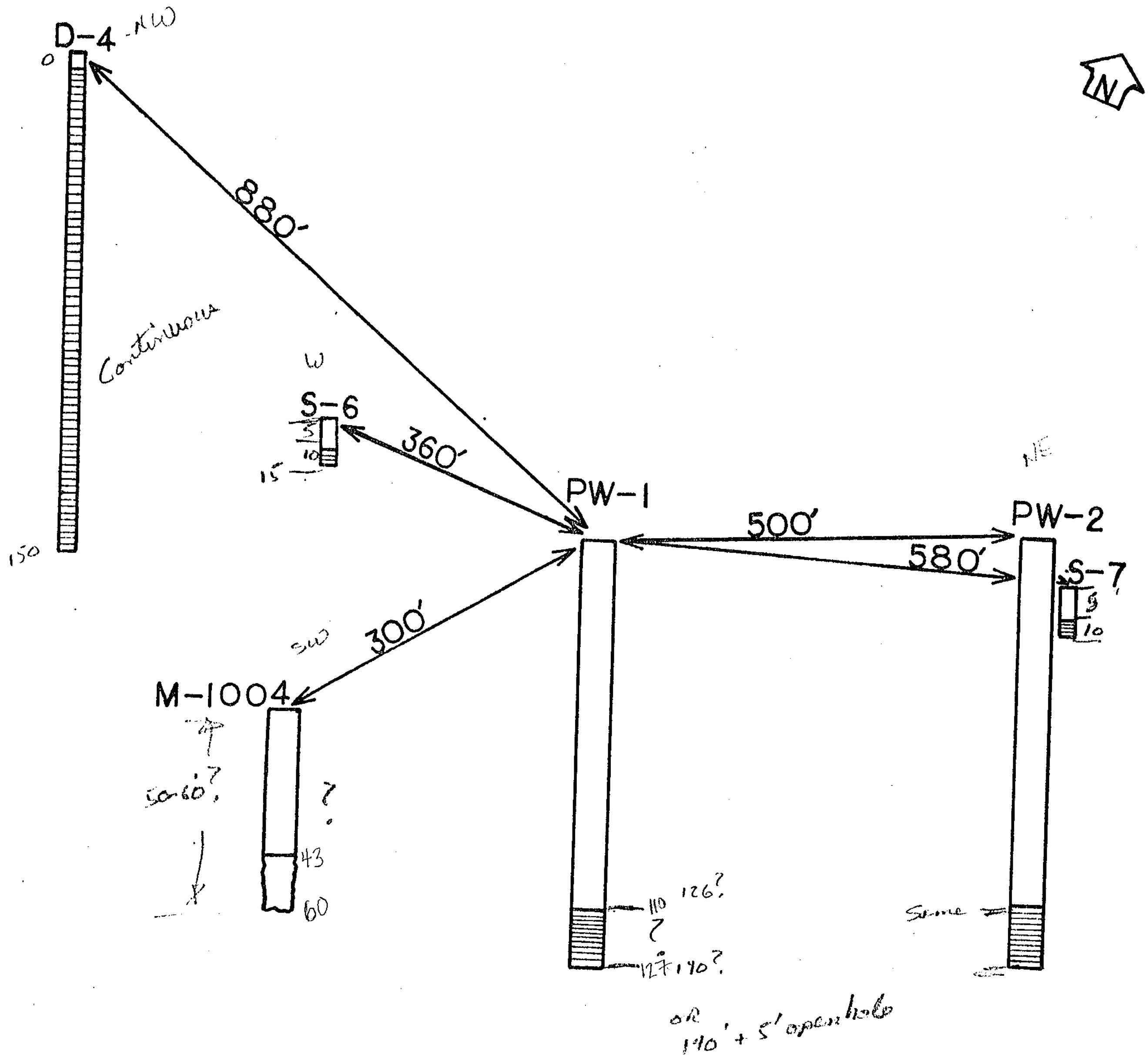
The following data was obtained for the cone of depression from the graph.

Drawdown	Distance from Pumped Well
3'	28'
2'	~~350'~~ /39'
1'	660'

Figure B-7 shows the cone of depression. It can be seen that the extra 1 foot drawdown contour for 100 days of pumping occurs approximately 660 feet from the pumped well at a pumping rate of 150 gpm.

If both supply wells 1 and 4 are pumped simultaneously, the cones of depression do not intersect. In addition, the 1 foot drawdown contour is about 400 feet from the

Miles Grant northern property boundary at its closest point. Impact on adjacent users, even at build-out consumption will not measurably impact adjacent users. Additionally, aquifer test data shows that withdrawing potable water from the base of the aquifer will have little effect on shallow wells greater than 500' from the production wells.



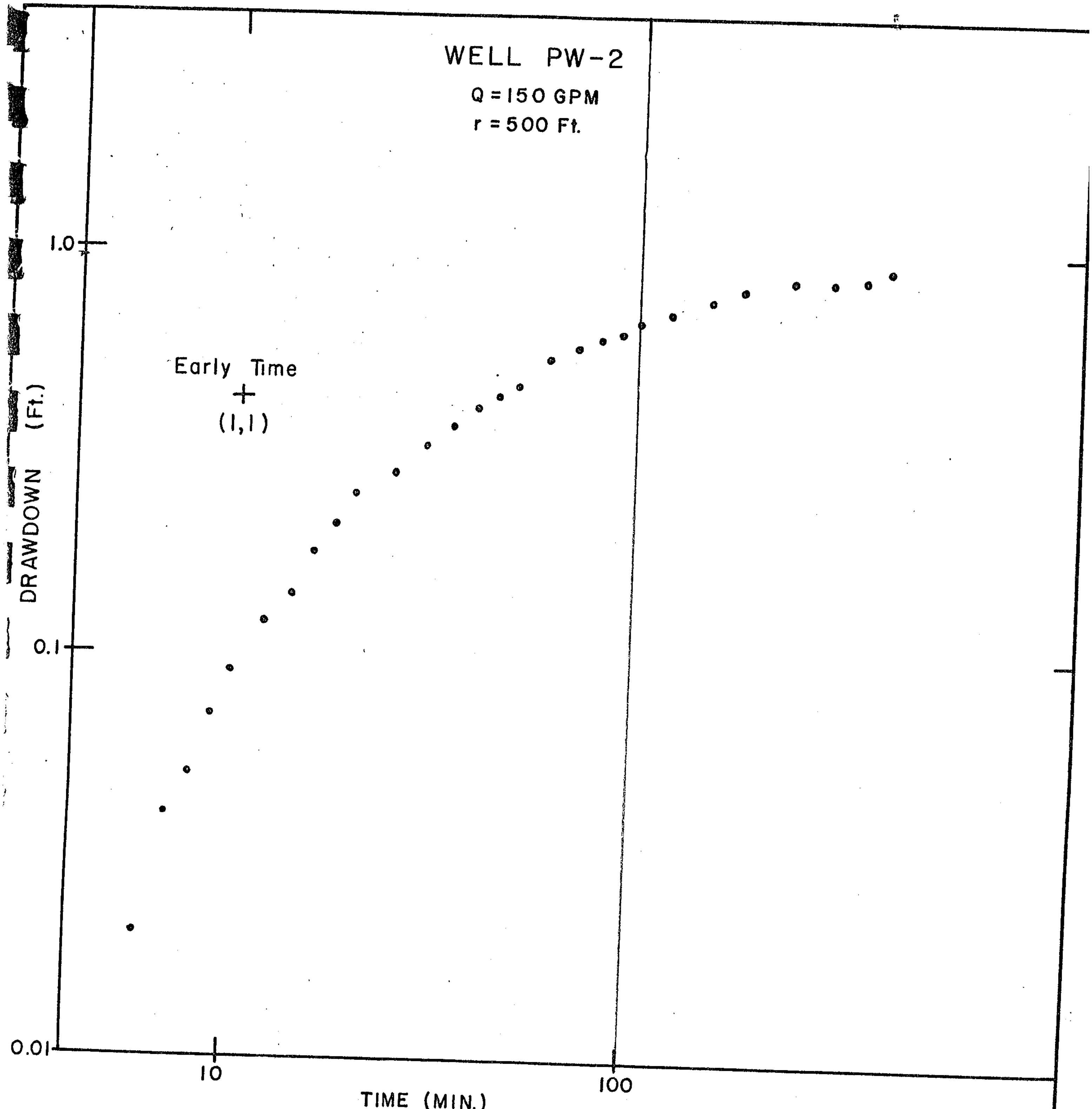
SCALE: HORIZ. 1" = 200'
VERT. 1" = 50'

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.
WEST PALM BEACH, FLORIDA

MILES GRANT

PUMP TEST WELL LOCATIONS

DESIGNED	DRAWN	CHECKED	JOB NO.	DRAWING NO.
RB	RB	JF	79-40	
DATE	SCALE	APPROVED	FILE NO.	SHEET OF
10-79		SN		



T= 39,976 GPD/Ft.
S= 6.6x10⁻⁴

Boulton Method

$T = \frac{114.6Q}{s} W(u_{AY}, r/B)$

$S = \frac{Tt}{2693r^2} u_{AY}$

Early Time

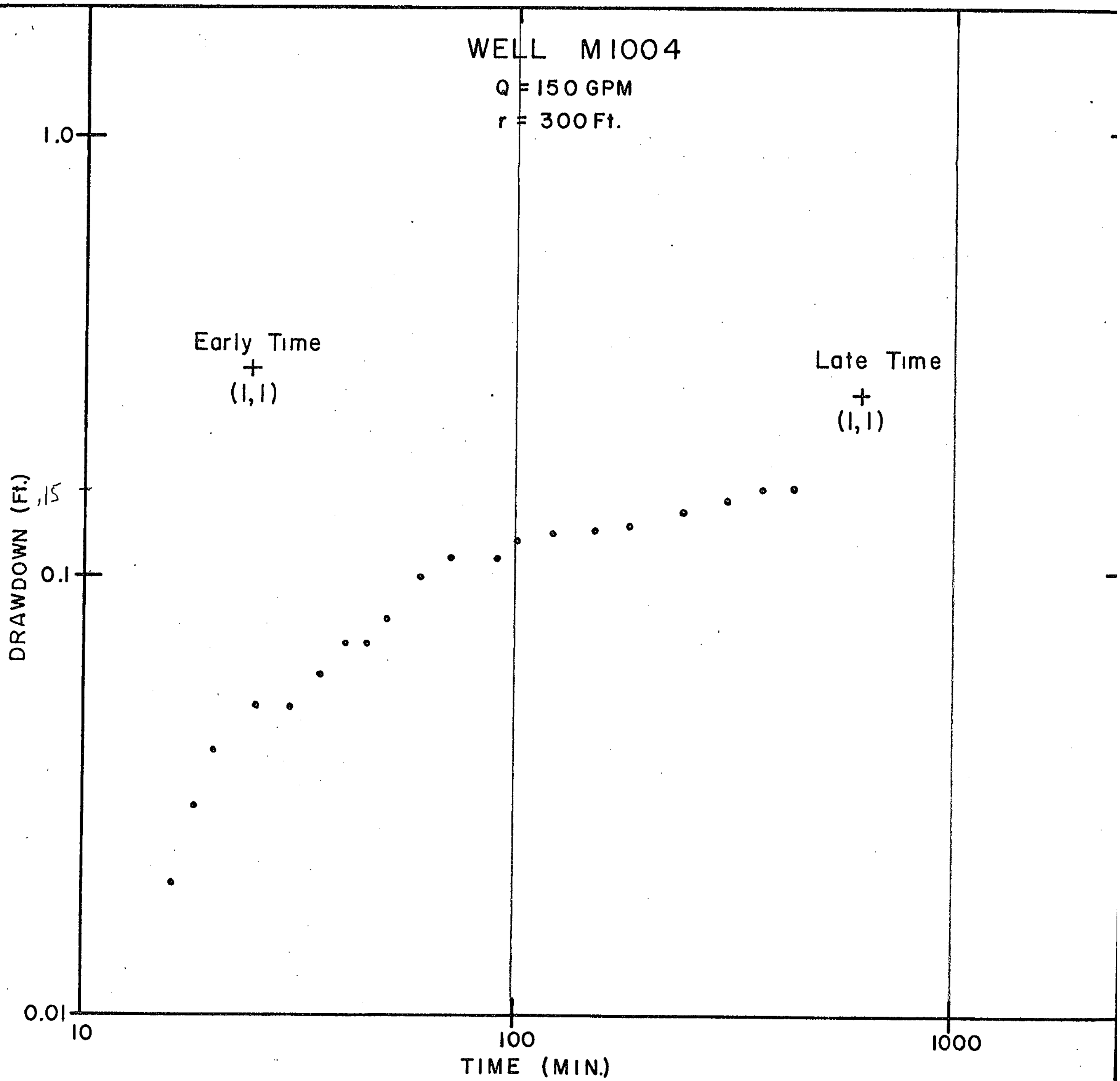
$\frac{r}{B} = 0.4$

s = 0.43 Ft.
t = 10.3 Min.

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.
WEST PALM BEACH, FLORIDA

MILES GRANT
HYDROGEOLOGICAL DATA

DESIGNED	DRAWN	CHECKED	JOB NO.	DRAWING NO.
H.V.	K.H.	H.V.	79-40	
DATE	SCALE	APPROVED	FILE NO.	SHEET OF
Oct. 79	Graphic	S.N.		



Boulton Method

$T = \frac{114.6Q}{s} W(u_{AY}, r/B)$ $S = \frac{Tt}{2693r^2} u_{AY}$

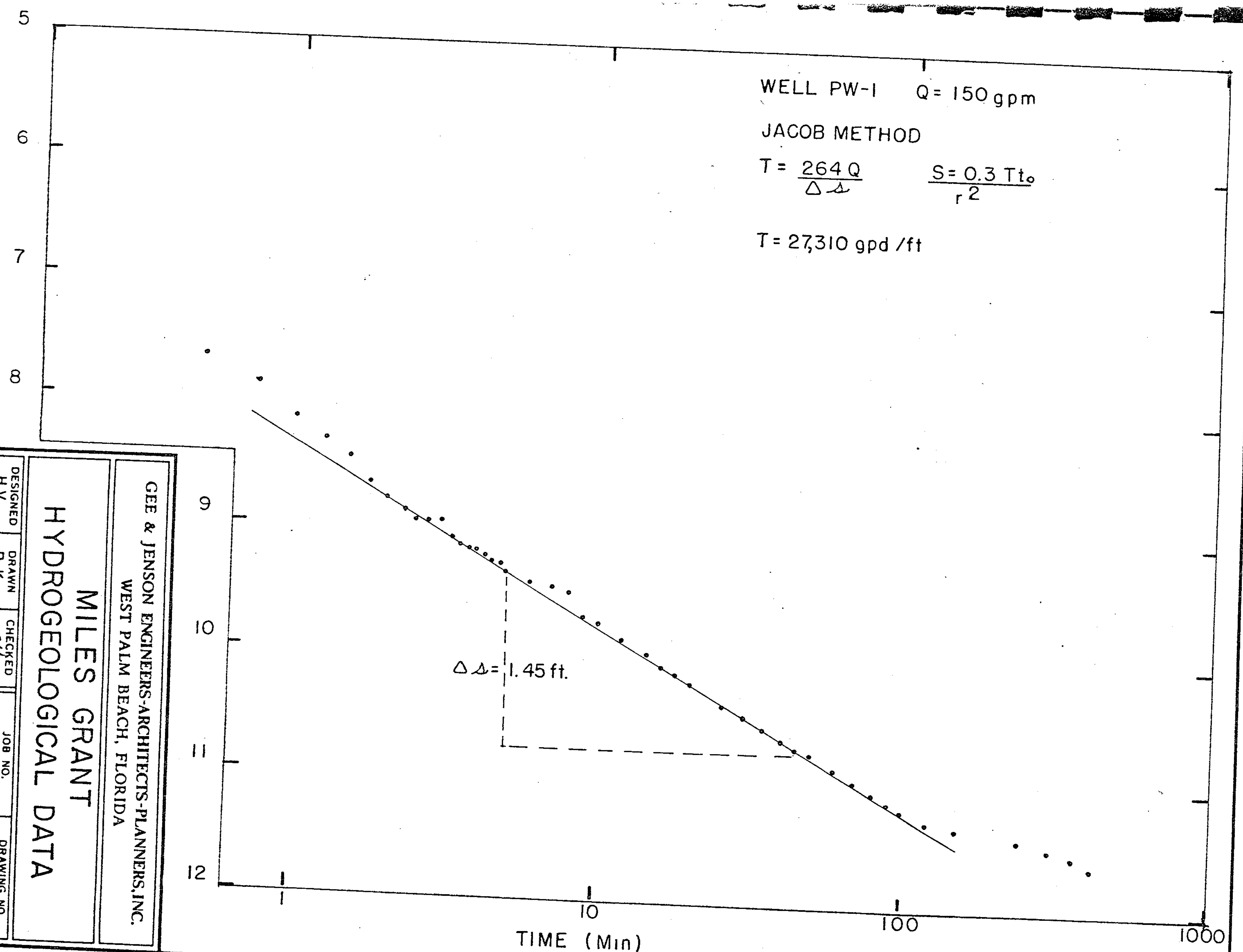
Early Time	Late Time
$\frac{r}{B} = 1.5$	$\frac{r}{B} = 1.5$
s = 0.3 Ft.	s = 0.26 Ft.
t = 24 Min.	t = 600 Min.
T = 57,300 GPD / Ft	T = 66,115 GPD / Ft.
$S = 5.7 \times 10^{-3}$	S = 0.16

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.
WEST PALM BEACH, FLORIDA

MILES GRANT
HYDROGEOLOGICAL DATA

DESIGNED	DRAWN	CHECKED	JOB NO.	DRAWING NO.
H.V.	K H	H.V.	79-40	
DATE	SCALE	APPROVED	FILE NO.	SHEET OF
Oct 79	Graphic	SN		

FIGURE B-3



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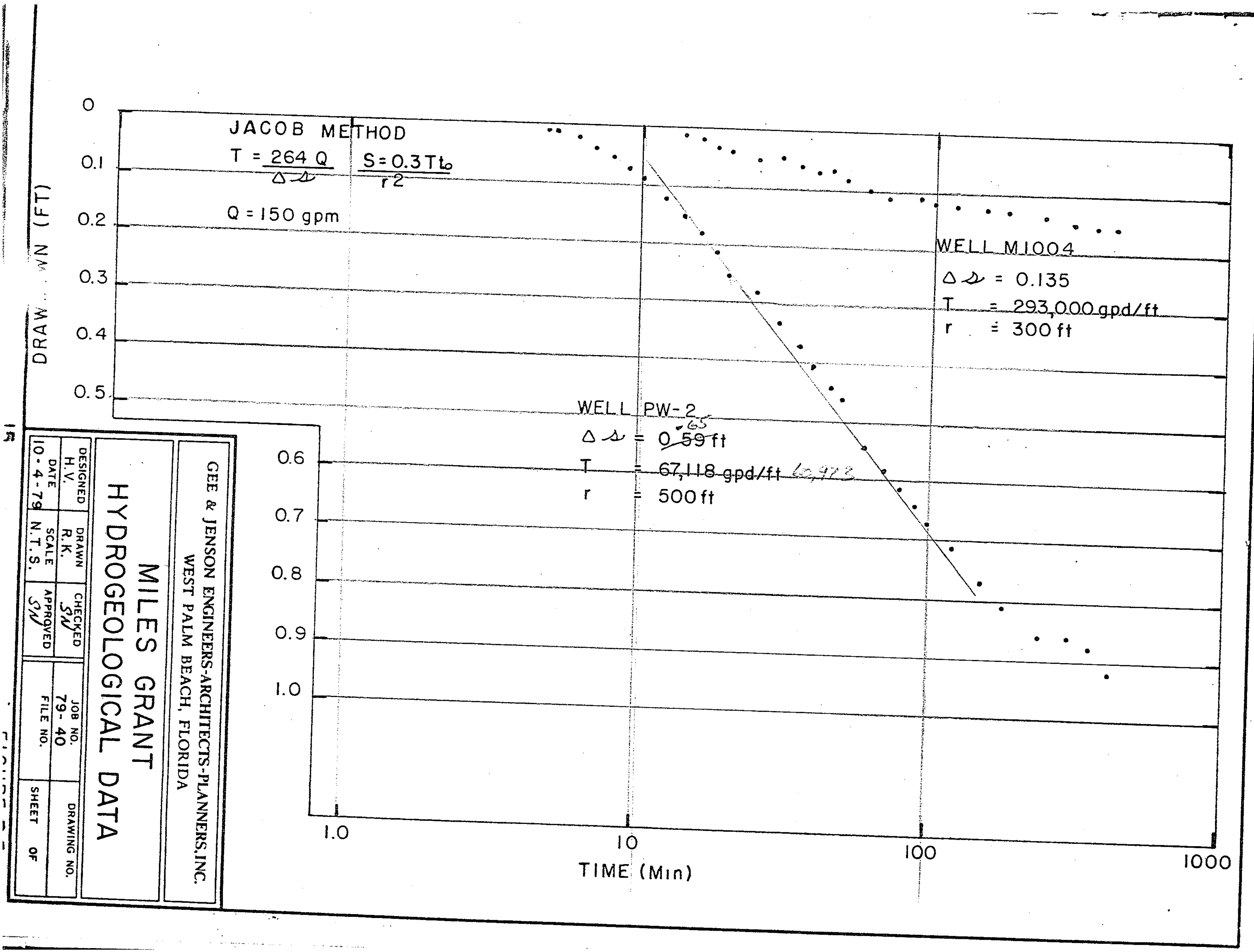
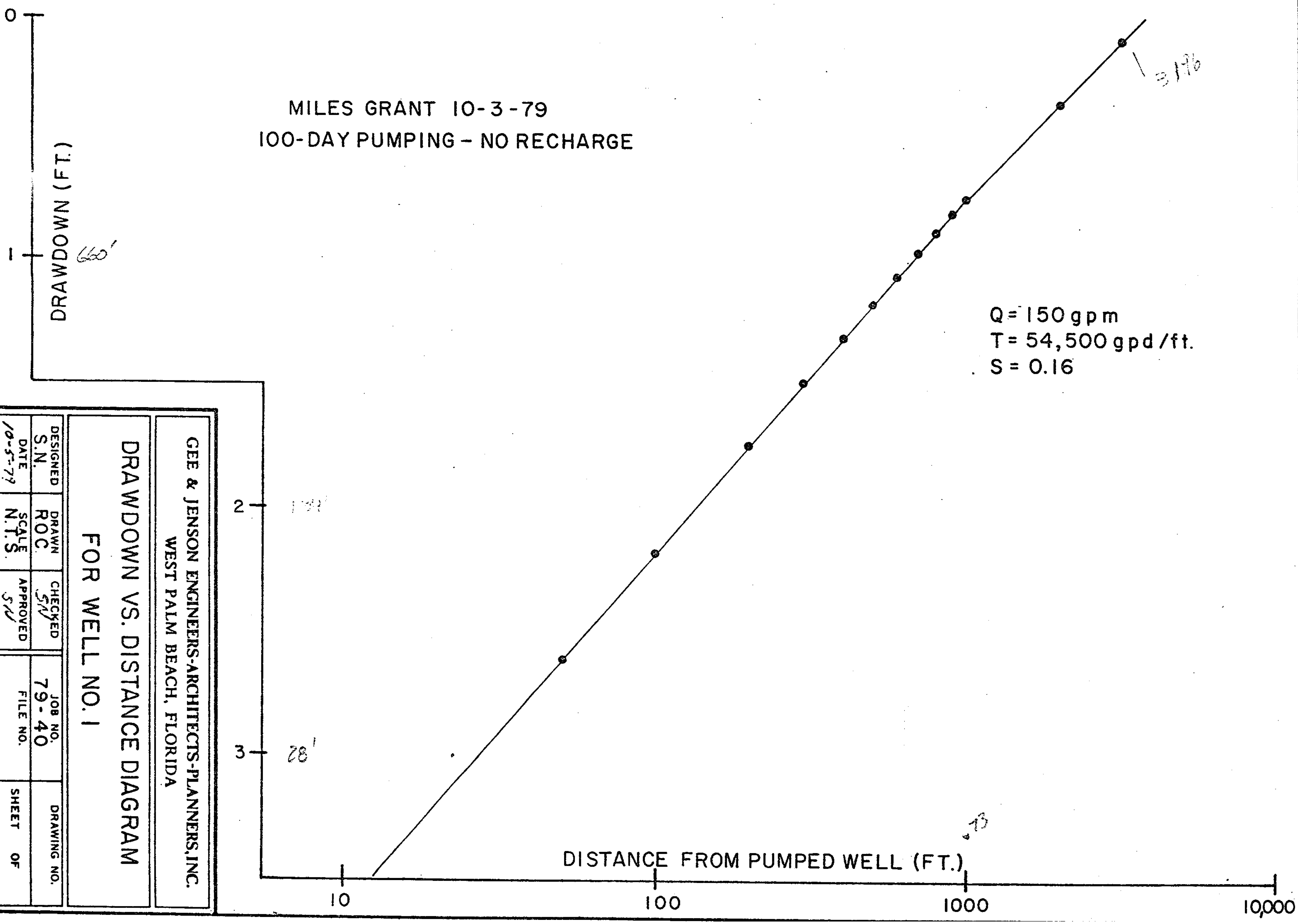
MILES GRANT
HYDROGEOLOGICAL DATA

DESIGNED H.V.	DRAWN R.K.	CHECKED SN	JOB NO. 79-40
DATE 10-4-79	SCALE N.T.S.	APPROVED SN	FILE NO.
DRAWING NO.			
SHEET OF			



JACOB METHOD
T = 264 Q / Δs
S = 0.3 T t₀ / r2
Q = 150 gpm
DRAWDOWN (FT)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
WELL M1004
Δs = 0.135
T = 293,000 gpd/ft
r = 300 ft
WELL PW-2
Δs = 0.59 ft .65
T = 67,118 gpd/ft 60,923
r = 500 ft
1.0
10
100
1000
TIME (Min)
GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.
WEST PALM BEACH, FLORIDA
MILES GRANT
HYDROGEOLOGICAL DATA
DESIGNED H.V.
DRAWN R.K.
CHECKED SN
DATE 10-4-79
SCALE N.T.S.
APPROVED SN
JOB NO. 79-40
FILE NO.
DRAWING NO.
SHEET OF



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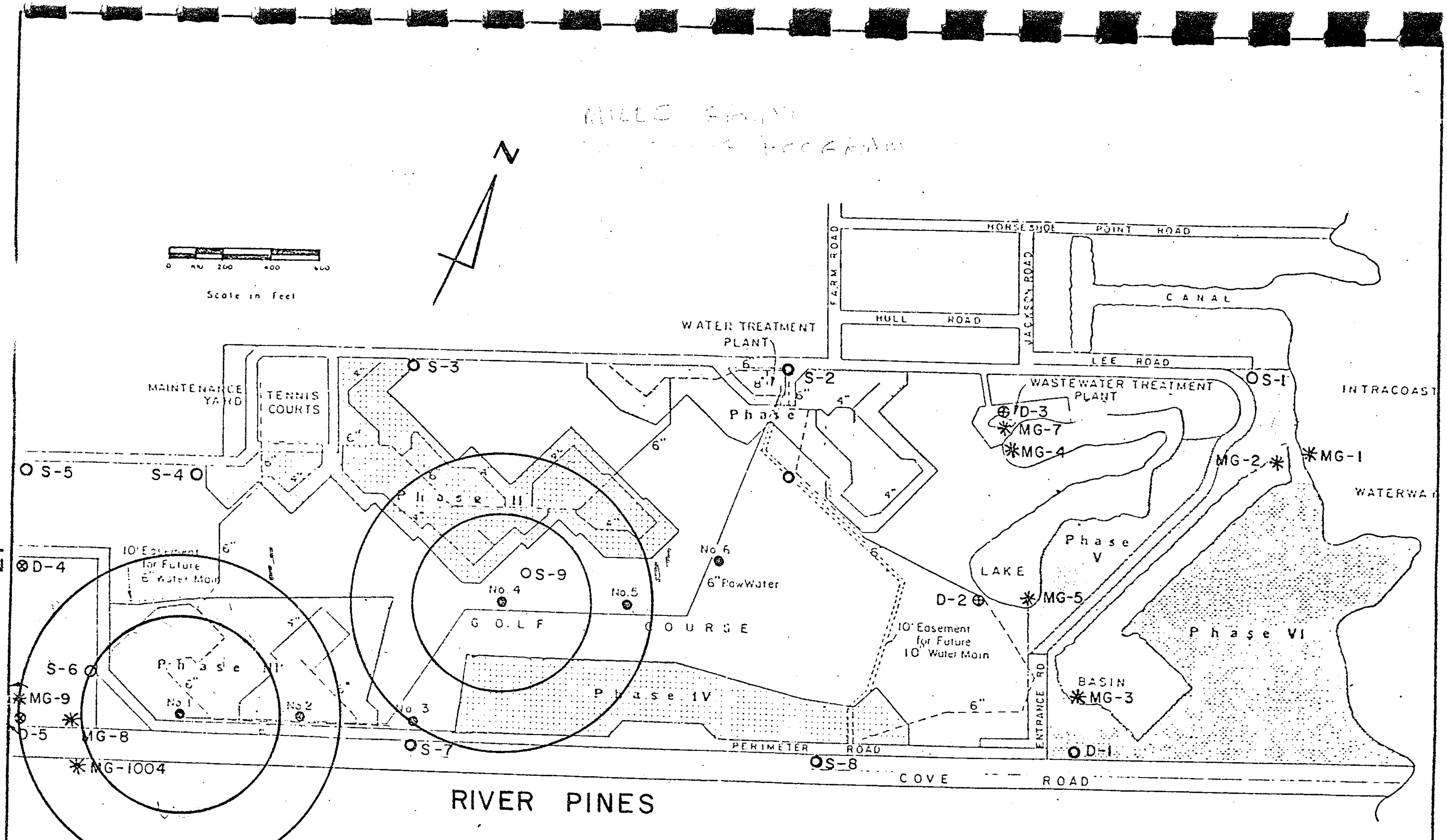
WEST PALM BEACH, FLORIDA

DRAWDOWN VS. DISTANCE DIAGRAM
FOR WELL NO. 1

DESIGNED S.N.	DRAWN ROC.	CHECKED SN	JOB NO. 79-40
DATE 10-5-79	SCALE N.T.S.	APPROVED SN	FILE NO.
DRAWING NO.	SHEET OF		



● PRODUCTION WELLS

CONE OF DEPRESSION AFTER 100 DAYS OF CONTINUOUS PUMPING WITH NO RECHARGE

T = 54,500 gpd/ft ; S = 0.16

DRAWDOWN	DISTANCE FROM PUMPED WELL
3'	28'
2'	350'
1'	660'

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.
WEST PALM BEACH, FLORIDA

MILES GRANT

CONE OF DEPRESSION

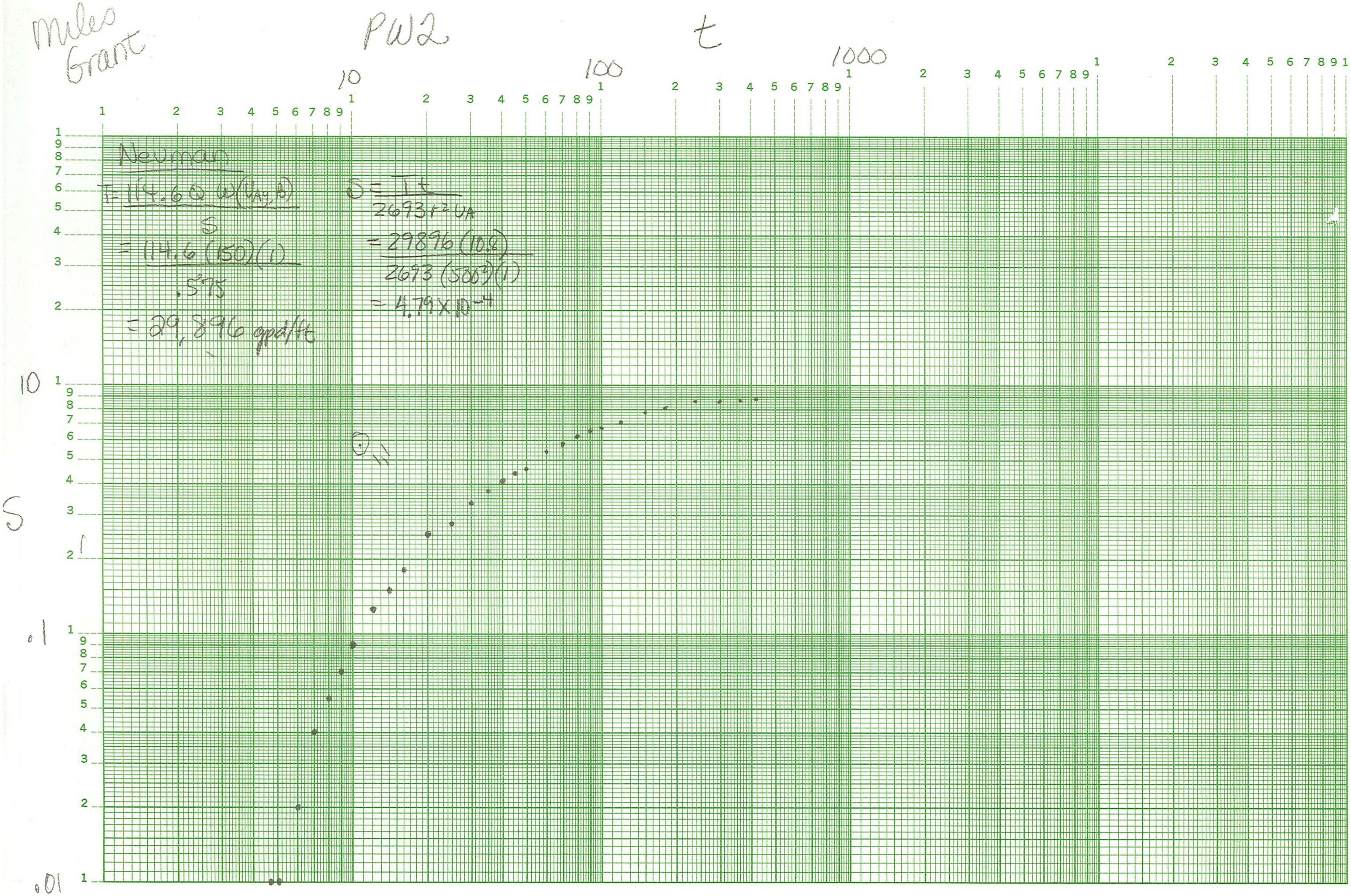
DESIGNED	DRAWN	CHECKED	JOB NO.	DRAWING NO.
H. V.	KH	H. V.	79-40	
DATE	SCALE	APPROVED	FILE NO.	SHEET 1 OF 1
OCT 79	GRAPHIC			

K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7522

Miles Grant

PW2



s values from plot

time deduced from other G&J pump tests

PW2

t	s	t	s
4.75	.01	50	.465
5	.01	60	.545
6	.02	70	.585
7	.04	80	.62
8	.055	90	.65
9	.07	100	.675
10	.09	120	.71
12	.125	150	.775
14	.15	180	.81
16	.18	240	.86
18	.21	300	.865
20	.25	360	.87
25	.28	420	.92
30	.335		
35	.375		
40	.41		
45	.445		