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HYDROLOGIC INVESTIGATION
FOR THE
BANYAN BAY SITE

Prepared for

Banyan Bay Development, Inc.

March 1982

81-227.3

GEE & JENSON
Engineers, Architects,
Planners, Inc.

2090 Palm Beach Lakes Blvd.
Drawer No. 4600,
West Palm Beach, FL 33402
305/683-3301
Telex 513472 G&J WPB

March 19, 1982

Mr. Georg Koszulinski
Avatar Properties, Inc.
201 Alhambra Circle
Coral Gables, Florida 33134

Re: Report entitled "Hydrogeologic Investigation of the Banyan Bay Site"

Dear Mr. Koszulinski:

This report presents a detailed technical evaluation of raw water supply development potential and impacts associated with groundwater withdrawals.

The findings of the investigation indicate there is sufficient groundwater in the surficial aquifer system underlying the Banyan Bay site to meet proposed demands at build-out. Utilizing hydrologically sound wellfield operating and management practices, this withdrawal rate (0.379 MGD) is expected to have negligible impact on the water resources.

Very truly yours,

Gee & Jenson
Engineers-Architects-Planners, Inc.

Heidi Vandor

Heidi Vandor
Hydrogeologist

HV/nc
81-227.3

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SUMMARY

Gee & Jenson Engineers-Architects-Planners, Inc. was contracted by Avatar Properties, Inc. for Banyan Bay Development Corporation to perform a comprehensive hydrogeologic investigation at the proposed Banyan Bay Development site. The purpose of this program was to determine the availability of a potable water supply source from the surficial aquifer underlying the project property and its subsequent impacts on the existing hydrologic system, to satisfy DRI requirements and the Informational Adequacy Statement (IAS) regarding water supply development.

The proposed Banyan Bay development, at buildout in 1990, will consist of 251 acres with 1255 units. At 2.5 persons per dwelling unit, the projected population is 2886. The proposed raw water supply demand is 0.379 MGD on an average day basis and 0.669 MGD on a maximum day basis.

Objectives

The primary objectives of this hydrogeologic investigation area:

- Define the geology of the site with respect to lithology, depth and thickness of the water producing zones and confining zones within the surficial aquifer.
- Define the straigraphy of the geologic units in the surficial aquifer across the property.
- Determine the groundwater gradient across the property.
- Determine the head differential between the water table system and the underlying potable supply producing zone.
- Locate the fresh/saltwater interface on the property, if present.
- Design and construct a test (supply) well maximizing use of available aquifer thickness for developing the most efficient well yield.
- Perform an aquifer performance test to determine the aquifer coefficients of transmissivity and storage of the potable water supply producing zone.
- Determine the leakance value of the confining or semi-confining zone overlying the potable supply producing zone.

- Determine the hydraulic relationship of the water producing zones and semi-confining zones within the surficial aquifer.
- Determine the quality of groundwater in the surficial aquifer with respect to Department of Environmental Regulation (DER) potable drinking water standards and for design of the potable water treatment plant.
- Design a wellfield for supplying buildout potable and irrigation water demands and propose a wellfield operating program to minimize adverse water withdrawal impacts.
- Evaluate irrigation water demands and coordinate reuse of effluent with surface and groundwater supply sources during construction phases of the project.
- Provide a well inventory and determine chloride and iron concentrations in non-permitted domestic and irrigation wells within 0.5 miles to the south and east of the property.
- Design and construct SWIMM and Water Level Monitoring Programs in compliance with SFWMD requirements.

Conclusions

The surficial aquifer in the Banyan Bay area, consists of approximately 130 feet of marine sediments which are lithologically stratified into four permeable units (water transmitting) and three semi-confining units (limited water transmitting capacity). A 500 foot thick impermeable confining bed, the Hawthorn Formation underlies the surficial aquifer at 130 feet, thereby, effectively separating it from the saline Floridan Aquifer.

No correlations of water quality variation with depth can be discerned from the off-site well inventory. It shows chloride concentrations are low and consistent, and iron concentrations are highly variable. These two water quality characteristics have been confirmed in numerous other areas in Martin County and Florida where surficial aquifer water quality data has been analyzed.

There is no degradation in water quality due to pumping. On-site groundwater quality meets the DER recommended potable water quality standards except for iron, hydrogen sulfide and color. Concentrations of these three parameters can be readily reduced to acceptable potable levels by conventional lime softening and aeration water treatment methods.

Analysis and evaluation of the aquifer performance test data provide the information base required for wellfield design. In order to meet a projected average day demand of 0.379 MGD, two wells will be required. These two wells will be operated on an alternating 24 hour schedule to allow each well to rest and the surrounding groundwater level to recover to static levels in between pumping episodes. Each well will be designed to produce 263 gpm. Peaking conditions will be met by storage facilities. The well spacing should be about 2,600 feet between the two wells to minimize drawdown impacts.

Treated water will be used to meet the potable and non-potable water demands, except the golf course. Wastewater treatment plant effluent will ultimately be used for irrigation of the proposed golf course within the development. The total irrigation demands for the proposed golf course are estimated to be 0.287 MGD, based on approximately 1.5 inch/acre/week for 45.5 acres. In the interim, until sufficient quantities of effluent area available, make-up water for irrigation demands will be met primarily by groundwater supplies, with minor surface water augmentation during year 6 of the development schedule.

The projected cone of influence, for the proposed design withdrawal rate of 263 gpm for 24 hours will occur at a distance of approximately 1,300 feet from the production well. At this distance, withdrawal impacts on existing adjacent supply wells will be negligible.

The proposed withdrawal rate and wellfield operation schedule will not adversely impact adjacent supply wells or promote saltwater intrusion. Potential for saltwater intrusion is not relative to the Banyan Bay area because the fresh/saltwater interface is located 4 to 5 miles east of the site. The proposed wellfield operation schedule is also designed to minimize withdrawal impacts on surface waterbodies and the water table on the Banyan Bay property.

Water level and aquifer performance test data from the Banyan Bay property indicate proposed groundwater withdrawals for meeting potable and irrigation demands of the development will not adversely impact:

- The fresh/saltwater interface stability
- Groundwater quality in on-site or off-site wells
- Adjacent supply well's operation or efficiency
- Surface water levels
- Environmental concerns relative to wet weather ponds
- The St. Lucie River

These data have identified the need for careful planning and design with respect to drainage and storm water management retention and excavation for fill as these dewatering and runoff storage activities can impact the natural hydroperiod of the ephemeral ponds.

At various times of the year, water levels can be affected by the surrounding hydrologic conditions. Therefore, it is anticipated that water table elevations will continue to fluctuate during the dry season and wet season. Swales interconnecting the lake and preserve areas will have bottom elevations that vary such that runoff from the upstream basin will flow to downstream basins. Control of the system is to be accomplished by the use of structures at each of the lake outfalls. The Water Management System discharges to the river through four control structures. Three of these structures will be located adjacent to a large preserve area in the northwest corner of the project. The fourth will be located adjacent to a smaller preserve further south. All runoff discharged from the project will sheetflow through one of these preserve areas before entering the river.

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1.0 INTRODUCTION

1.1 Purpose

Gee & Jenson Engineers-Architects-Planners, Inc. was contracted by Avatar Properties, Inc. for Banyan Bay Development Corporation to perform a comprehensive hydrogeologic investigation at the proposed Banyan Bay Development site (Figure 1-1). The purpose of this program was to determine the availability of a potable water supply source from the surficial aquifer underlying the project property and its subsequent impacts on the existing hydrologic system, to satisfy DRI requirements and the Informational Adequacy Statement (IAS) regarding water supply development.

The proposed Banyan Bay development, at buildout in 1990, will consist of 251 acres with 1255 units. At 2.3 persons per dwelling unit, the projected population is 2886. The proposed raw water supply demand is 0.379 MGD on an average day basis and 0.669 MGD on a maximum day basis.

1.2 Objectives

The primary objectives of this hydrogeologic investigation are:

- Define the geology of the site with respect to lithology, depth and thickness of the water producing zones and confining zones within the surficial aquifer.

- Define the stratigraphy of the geologic units in the surficial aquifer across the property.

- Determine the groundwater gradient across the property.

- Determine the head differential between the water table system and the underlying potable supply producing zone.

- Locate the fresh/saltwater interface on the property, if present.

- Design and construct a test (supply) well for maximizing use of available aquifer thickness for developing the most efficient well yield.

- Perform an aquifer performance test to determine the aquifer coefficients of transmissivity and storage of the potable water supply producing zone.

- Determine the leakance value of the confining or semi-confining zone overlying the potable supply producing zone.

- Determine the hydraulic relationship of the water producing zones and semi-confining zones within the surficial aquifer.

- Determine the quality of groundwater in the surficial aquifer with respect to Department of Environmental Regulation (DER) potable drinking water standards and for design of the potable water treatment plant.

- Design a wellfield for supplying buildout potable and irrigation water demands and propose a wellfield operating program to minimize adverse water withdrawal impacts.

- Evaluate irrigation water demands and coordinate reuse of effluent with surface and groundwater supply sources during construction phases of the project.

- Provide a well inventory and determine chloride and iron concentrations in non-permitted domestic and irrigation wells within 0.5 miles to the south and east of the property.

- Design and construct SWIMM and Water Level Monitoring Programs in compliance with SFWMD requirements.

1.3 Scope

The scope of work to accomplish the objectives are outlined below:

- Test wells were constructed on the property (Figure 1-2). These wells consist of one test (supply) well (PW-1), 4 deep observation wells (OW-1D, OW-2D, OW-3D, OW-4D), and 2 shallow observation wells (OW-1S, OW-4S). Wells PW-1, OW-1D, OW-2D, OW-3D, OW-1S and existing well E-1 were used in the aquifer performance test. Each of these wells were used to determine the groundwater gradient across the property and evaluate the hydraulic relationship of the various water producing zones in the surficial aquifer system. Cutting samples were collected during drilling of these wells and described according to lithology. From this data, stratigraphic correlations were made across the property and the thickness and lithologic character of the water producing and semi-confining zones were determined.

- A 72-hour aquifer performance test was conducted to determine on-site aquifer parameters (transmissivity, storage, leakance) for the purposes of wellfield design and management. These test data were also used to evaluate on and off-site impacts due to withdrawals from future supply wells at design (buildout) capacity for both potable and irrigation demands. Water quality samples taken from the supply well discharge during the test were analyzed for potable water quality standards.

- A well inventory was performed on existing wells on and abutting the property (non-permitted areas) to the east and south within a 0.5 mile radius. Water samples were taken and analyzed for chloride and iron concentrations from these wells.

- Head differentials between the water table and the potable producing zone were determined by comparing water levels in the shallow monitoring well network (WT-1 through WT-9), and water levels in wells

PW-1, OW-1D, OW-2D, OW-3D, OW-4D and E-1 (Figure 1-3). In addition, these data would provide information on the hydraulic relationships between the various zones and the impacts that pumping would have on the water table and surface water bodies.

- Evaluation of all the hydrogeologic data was made to design the wellfield and recommend optimum operating and management practices.

- Observation wells OW-1D, OW-1S, OW-4D and OW-4S will be maintained and monitored in compliance with SFWMD requirements for a SWIMM and Water Level Monitoring Program.

2.0 WELL CONSTRUCTION

2.1 Scope of Work

Six test wells and one test (supply) well were constructed on the Banyan Bay property. Locations of these wells are shown in Figure 1-2. Table 2-1 lists observation well and test (supply) well construction data.

All wells were constructed using the mud rotary drilling method. During construction of each well, cutting samples were collected at five foot intervals and described according to lithology. These lithology descriptions are presented in Appendix A. Construction methodology is outlined in the next section. Figure 2-1 shows a generalized well construction diagram.

2.2 Method of Construction

2.2.1 Observation Well Construction

Six 2-inch observation wells were constructed on the Banyan Bay property identified as OW-1S, OW-1D, OW-2D, OW-3D, OW-4S and OW-4D. The six observation wells were constructed by drilling a nominal four inch hole to the designated well depth. Two inch schedule 40 PVC casing was installed from land surface to the designated casing depth. Two inch schedule 40, #40 slot PVC screen was installed below the casing to the total depth of the well. Silica sand (0.75 mm) was used as annular gravel pack between the casing and the formation, from the bottom of the screen up to the surface in the shallow wells. In the deep wells, the gravel pack was installed to 10 feet above the top of the screen. A 10 foot bentonite and grout plug was then installed on top of the gravel pack. The remaining annular space above the plug was filled with native sediments. The wells were developed with compressed air with a 175 cfm air compressor until the discharge water was free of drilling mud and formation fines. On completion of development, the wells were capped and a 30 inch x 30 inch x 4 inch reinforced concrete pad was constructed around each well.

This effectively increases screen length by 10' does it? (radial flow)

2.2.2 Test (Supply) Well Construction

One test (supply) well, identified as PW-1, was constructed on the Banyan Bay property. Construction began on PW-1 by drilling a twenty-six inch hole from the surface down to a depth of 60 feet. Sixty feet of twenty inch steel casing was then installed and grouted to surface. After the cement had set, a nominal twenty inch hole was drilled from the bottom of the steel casing to a depth of 130 feet. Twelve inch telescope size #80 slot stainless steel well screen was installed from 60 to 130 feet. Twelve inch schedule 40 PVC casing was installed from the top of the well screen to land surface. The annular space from the bottom of the well to the surface was gravel packed with 1/8 inch to 1/4 inch graded silica gravel. The well was then developed by air lifting with a 650 cfm air compressor until the discharge was clear of sediment and mud. A 6 foot x 6 foot x 12 inch reinforced concrete pad was constructed around the well. A three inch gravel tube for addition of gravel to the annulus was welded onto the outer casing of the well. A two inch water level tube was attached to the inner casing. The well was finished by welding a steel plate between the inner and outer casing, and a cap was installed to seal the top of the twelve inch inner casing.

3.0 GEOLOGY

A determination of the hydrogeologic characteristics of an area are essential to understanding the hydraulic properties of underlying water producing zones and their hydraulic relationship to one another and to adjacent confining strata. Cutting samples were collected from each of the test wells during construction and described according to lithology. Detailed lithologic descriptions for each well are presented in Appendix A. Based upon these descriptions, the lithology of the surficial aquifer system in the Banyan Bay area can be divided into four water producing zones separated by three semi-confining layers. Describing the units from the surface down these are: — need to review test data.

Gammel & Assc 1982

K_h = 14 ft/day	Unit 1:	Sand - water producing 5'
K_h = 0.01 ft/day	Unit 2:	Clayey sand - semi-confining 10'
K_h = 9 ft/day	Unit 3:	Sand - water producing 7'
	Unit 4:	Sandy clay - semi-confining 5'
	Unit 5:	Sand, shell and limestone - water producing 25'
	Unit 6:	Sandy clay - semi-confining 5'
	Unit 7:	Sandy limestone and limestone with trace of clay - water producing 50' Production zone
	Unit 8:	Silty clay and clayey limestone - confining
	Unit 9:	Clay (Hawthorn Formation) - confining

WT AQUIFER T_1 = 133.1 ft/day, T_1 = 997.5 gpd/ft, confining zone

A lithologic cross section, A to A' was drawn from west to east (from Well OW-4D to OW-1D) across the Banyan Bay property (Figure 3-1). The cross section depicted in Figure 3-2 shows the various units underlying the project area. The units consist of a series of marine sediments laid down in different depositional environments. The more permeable sediments consist of Units 1, 3, 5 and 7 and were deposited in high energy environments, while sediments with low permeability (Units 2, 4, 6, 8 and 9) were deposited in low energy environments, or, are weathered transition zones resulting from fluctuations in sea level. These units have a regional westerly dip of 10 to 20 feet, corresponding to the topography of the area.

Outlined below is a geologic description of the sediments underlying the Banyan Bay property.

Unit 1 is comprised of unconsolidated, light brown to grey, fine to medium grained silica sand with organic silts near the base of the unit. Thickness of this unit ranges from 2 to 6 feet, averaging approximately 5 feet. Thickness variations occur across the property where shallow depressions exist in the typically flat, east to west sloping topography of the site. Generally, this unit has a relatively constant thickness across the property.

Unit 2 is comprised of unconsolidated, light grey to brown, fine to medium grained silica sand, with abundant organic silts and light grey plastic calcareous clay. Thickness of this unit ranges from 3 to 15 feet, averaging approximately 10 feet. The top of this unit is encountered at about 5 feet below land surface.

Unit 3 is comprised of unconsolidated, tan to grey, fine to medium grained silica sand with iron staining. Thickness of this unit ranges from 5 to 17 feet, averaging approximately 7 feet. Top of this unit is generally encountered at depths of 14 to 16 feet below land surface.

Unit 4 consists of unconsolidated, light grey, fine to medium grained silty silica sand, greenish brown calcareous clay and dark brown to black organic silts with minor shell fragments. Unit 4 is a semi-confining zone separating Units 3 and 5. Thickness of Unit 4 is approximately 5 to 6 feet across the property and occurs at depths of about 20 to 30 feet below land surface.

Unit 5 is comprised of unconsolidated light grey, fine to medium grained, silica and carbonate sand and abundant white and black, pelecypod and gastropod shell fragments, and lenses of lithified grey to tan limestone consisting of silica sand and shell fragments in a micrite matrix. At approximately 50 feet below land surface, Unit 5 increases in clay content until it grades into the clay confining layer of Unit 6.

Unit 6 is a semi-confining sandy clay layer 3 to 5 feet thick at depths generally between 55 and 60 feet below land surface. The clay is grey, somewhat plastic and calcareous.

Unit 7 is the primary potable water production zone in the Banyan Bay area. Lithologically, Unit 7 is a dark grey to black, well lithified, fossiliferous limestone with unconsolidated, fine grained, grey to black carbonate sand and shell filling solution holes. Seams of white calcareous clay become more prevelant below 100 feet of depth. The white calcareous clay increases significantly from 100 to 130 feet below land surface. Unit 7 grades into the silty clay and clayey limestone of Unit 8. Unit 8 is not a water producing unit and is the base of the surficial aquifer in this area.

Unit 9 is an olive green, stiff, plastic, calcareous, silty, phosphatic clay which is characteristic of the Hawthorn Formation. This formation is approximately 500 feet thick in the Stuart area and effectively separates the potable surficial aquifer from the artesian, highly mineralized waters of the Floridan Aquifer.

In summary, the surficial aquifer in the Banyan Bay area consists of approximately 130 feet of marine sediments which are lithologically stratified into four permeable units (water transmitting) and three semi-confining units (limited water transmitting capacity). A thick impermeable confining bed, the Hawthorn Formation underlies the surficial aquifer at 130 feet, thereby effectively separating it from the saline Floridan Aquifer.

4.0 WELL QUALITY

4.1 Off-Site Water Quality

The off-site well inventory for the Banyan Bay area was performed on February 27, 1982 to obtain existing background water quality data, and determine water quality variations in the area in compliance with SFWMD regulatory requirements.

The inventory consisted of identifying all existing wells in non-permitted areas to the south and east within 0.5 miles radius of the property boundaries. The 38 off-site wells are shown in Figure 4-1. Table 4-1 lists the data that was available from the wells.

Water samples were collected from 31 of the 38 inventoried wells and analyzed for chloride and iron concentration. Access was not available to the remaining 7. Any available construction information was also recorded so that correlations of water quality variations with depth could be made (Table 4-1).

It was found that the use of the wells was either domestic or irrigation. Where the data were available, it was found that most of the wells were 2 inches in diameter with depths ranging from 40 to 140 feet. The chloride concentrations were low, ranging from 15 to 38 mg/l. Iron concentrations showed a broad range from 0.02 to 5.13 mg/l which is typical of the surficial aquifer. Twenty-two samples had iron in excess of the recommended potable standard of 0.3 mg/l.

No correlations of water quality variation with depth can be discerned from this information. It shows a constant water quality with respect to chloride concentrations and a highly variable water quality with respect to iron concentrations. These two water quality characteristics have been confirmed in numerous other areas in Martin County and Florida as a whole where surficial aquifer water quality data has been analyzed.

4.2 On-Site Water Quality

All on-site wells, including those constructed as part of this study, are shown in Figure 1-2.

Initial water quality surveys on the Banyan Bay property consisted of conductivity surveys in observation wells OW-1D and OW-4D (Table 4-2). Well OW-4D, located adjacent to the St. Lucie River, exhibited conductivities ranging from 440 to 900 umhos/cm on February 21, 1982, and from 443 to 730 umhos/cm on February 23, 1982, through the screened section of the well (60 to 135 feet). These two surveys were taken during the aquifer performance test to determine if pumping would cause deterioration of water quality. The results of these surveys show the presence of potable water through the entire thickness of the surficial aquifer in this area and no water quality degradation as a result of continuous pumping for 3 days at a rate of 741 gpm. These data are supported by conductivity surveys in Well OW-1D which exhibited values ranging from 314 to 670 umhos/cm through the screened section of the well. These wells indicate that the production zone at the Banyan Bay site is not affected by the fresh/ saltwater interface which is located east of the Banyan Bay site, along the Atlantic coast line, at a distance of approximately 4 to 5 miles. Interchange of saline water from St. Lucie River does not appear to occur except possibly in Unit 1 of the surficial aquifer. Water quality in OW-4S, which extends into and monitors Unit 3, is also in the potable range of 355 umhos/cm. These data, supported by similar data collected at Martin Downs and Miles Grant developments, indicate the potential for saltwater intrusion from these tidal riverine systems is not a significant threat.

During the aquifer performance test, the discharge water was measured for conductivity and temperature. These data showed the conductivity of the potable water ranged from 389 to 510 umhos/cm (Table 4-3) during the aquifer performance test. Water samples for potable quality analysis were taken after 1 hour and 72 hours of pumping at a rate of 741 gpm. These data are presented in Table 4-4. These analyses indicate the groundwater in the potable supply zone (Unit 7), beneath Banyan Bay to be hard, high in total dissolved solids, hydrogen sulfide and iron concentration, and low in chloride, sulfate and fluoride concentration. In addition, there is no degradation in water quality due to pumping as evidenced by these two analyses. This groundwater meets the DER recommended potable water quality standards except for iron, hydrogen sulfide and color. Concentrations of these three parameters can be readily reduced to acceptable potable levels by conventional lime softening and aeration water treatment methods.

5.0 AQUIFER PERFORMANCE TEST

5.1 General Description

An aquifer performance test was conducted on the Banyan Bay property to determine the site specific aquifer parameters necessary for the planning and management of the water resources of the area and the proposed public water supply system. It involved pumping one well at a constant rate of 741 gpm for a duration of 72 hours and observing the resulting drawdowns and changes in water levels in nearby observation wells and ponds. The site of the test was in the southeast part of the property (Figure 1-2).

The well network and instrumentation for the test consisted of one 12-inch test (supply) well (PW-1), which was the discharge well, and four 2-inch observation wells (OW-1D, OW-2D, OW-3D and OW-1S), which consisted of three deep wells constructed similarly to PW-1 and one shallow well which penetrated to a shallow producing zone. More specific construction data are presented in Table 2-1 and Figure 2-1. The aquifer test site configuration is shown in Figure 5-1 indicating general construction and relative depths of wells. Two staff gages (SG-1 and SG-2) were also installed in the ponds nearest the aquifer test site to measure any drawdown that may have occurred due to pumping. In addition, a temporary rain gage (RG-1) was also installed to measure the occurrence of any rainfall during the test. An automatic water level recorder was installed on the 6-inch well (E-1), in the northeast corner of the property. The recorder was used to measure the impacts of pumping in the primary producing zone of the surficial aquifer over a long distance (2700 ft.), in addition to water level impacts that may have been caused by off-site pumping. Both pre and post testing water level data were collected which was utilized in the evaluation of the aquifer test data.

The data from the test were analyzed using analytical techniques to obtain aquifer parameters. The conjunctive use of drilling data, lithologic interpretations and analytical solutions were used to evaluate the surficial aquifer system underlying the project site. Comparison of analytical solutions with actual collected field data was made to obtain the aquifer parameters.

The methods of analysis used in this study are presented in the following section. These consist of the Jacob Method (Method I and Method II), the Hantush Method (Method I and Method II), and the Hantush-Jacob Method. The methods selected are those that provide best correlation with actual field data and where the underlying assumptions best fit the project site.

As discussed earlier, analysis of the aquifer performance test provided the aquifer parameters necessary for the design of the wellfield system and impact evaluations. These parameters are outlined below. (Lohman, 1972)

5.2 Methods of Data Analysis

The successful plan for developing a potable water supply system at the Banyan Bay site depends on two inherent characteristics of the surficial aquifer; the ability of the aquifer to store and transmit water. It also depends on the rate of leakage from overlying semi-confining beds. The amount of water that can be withdrawn from the surficial aquifer depends chiefly upon the aquifer's capacity to transmit water from the areas of recharge to points of withdrawal, the amount of water available in the areas of recharge to replace the water that moves to points of withdrawal, and the amount of water available from storage as the water level declines. At Banyan Bay, recharge to the surficial aquifer is chiefly from rainfall recharge as leakage through the overlying semi-confining beds.

The coefficient of permeability, P, of the material comprising a formation, is a measure of the capacity of the material to transmit water. The coefficient of permeability was expressed by Neinzer (1923) as the rate of flow of water in gallons per day through a cross section 1-foot square under a hydraulic gradient of 100 percent. Theis (1935) introduced the term coefficient of transmissibility, T, now called transmissivity, which is expressed as the rate of flow of water, at the prevailing water temperature, in gallons per day, through a vertical strip of the aquifer 1 foot wide extending to full saturated height of the aquifer under a hydraulic gradient of 100 percent. A hydraulic gradient of 100 percent means a 1 foot drop of water level in 1 foot of flow distance. Thus, the coefficient of transmissivity, T, is equal to the coefficient of permeability, P, multiplied by the thickness of the aquifer.

The amount of water available from storage as the water level declines depends on the coefficient of storage of the aquifer. The coefficient of storage, S, is the volume of water in cubic feet that an aquifer with a base 1-foot square releases from or takes into storage as the water level declines 1 foot.

The prediction of the ultimate water-level drawdown that will result from pumping is a common problem of economic importance. Mathematically, the problem is one of computing drawdowns for the steady-state condition, which occurs when the rate of withdrawal has been balanced entirely by the capture of water from sources outside the aquifer -- that is, when water is no longer being withdrawn from storage within the aquifer. The capture may consist of an increase in the rate of recharge to the aquifer, a decrease in the rate of discharge from the aquifer, or, more probably, a combination of both (Theis, 1940).

When water is being withdrawn from an artesian aquifer, the potentiometric surface of the water in the aquifer is lowered throughout a large circular area that has the well at its center. Because all confining beds probably are permeable to some degree, the lowering of the potentiometric surface results in a change in the rate of leakage through the confining bed. The change may consist of a decrease in the rate of leakage out of the aquifer or an increase in the rate of leakage into the aquifer, but in either case the change results in a net increase to the supply of water to the aquifer, and, therefore, constitutes capture.

As the permeability of an effective confining bed is small, the leakage through the confining bed ordinarily is only a small fraction of a gallon per day per square foot. However, because the cone of depression that will be created by pumping of potable water-supply wells at Banyan Bay will encompass many hundred thousands of square feet, leakage through the confining bed will result in the capture by the surficial aquifer of a considerable quantity of water. The rate of leakage is generally called leakance (L), which may be expressed as the amount of water in gallons per day per square foot that moves into or out of an aquifer through the confining bed.

5.2.1 Theis Method

Theis was the first to develop a nonsteady state formula which introduces the time factor and storage coefficient. In order to use the methods, basic underlying limiting conditions and assumptions must be met (Kruseman, 1976). These are listed as follows:

- the aquifer has a seemingly infinite areal extent
- the aquifer is homogeneous, isotropic and of uniform thickness over the area influenced by the pumping test

- prior to pumping, the piezometric surface and/or phreatic surface are (nearly) horizontal over the area influenced by the pumping test
- the aquifer is pumped at a constant discharge rate
- the pumped well penetrates the entire aquifer and thus receives water from the entire thickness of the aquifer by horizontal flow
- the aquifer is confined
- the flow to the well is in an unsteady state, i.e. the drawdown differences with time are not negligible nor is the hydraulic gradient constant with time
- the water removed from storage is discharged instantaneously with decline of head
- the diameter of the pumped well is very small, i.e. the storage in the well can be neglected

The Theis nonequilibrium formula is:

$$s = \frac{114.6Q}{T} W(u) \quad (1)$$

$$u = \frac{1.87\ r^2 S}{Tt} \quad (2)$$

where:

s	=	drawdown at any point of observation in the vicinity of a well discharging at a constant rate (ft)
Q	=	discharge from pumping well (gpm)
r	=	distance from discharging well to point of observation (ft)
t	=	time since pumping started (days)
T	=	transmissivity (gpd/ft)
S	=	coefficient of storage (dimensionless)
W(u)	=	well function

The restrictive assumptions on which this method is based limits the applicability of this method to the aquifer tests conducted in the study area. However, the nonequilibrium formula has been successfully applied to many problems of groundwater flow in other areas and is the basis for the development of many methods of data analysis.

5.2.2 Jacob Method:

The Jacob method of aquifer analysis is based on the Theis formula (Lohman, 1972) however, the conditions for its application are somewhat more restricted. It is based on the following assumptions:

- the same conditions as for the Theis method (Section 5.2.1)
- the values 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 can be used to calculate the values for transmissivity and storage coefficient.

Method I

The first procedure involved the plotting of drawdown against time on semi-logarithmic paper for each of the observation wells. A straight line is drawn through the points and a value for t_o is obtained where $s = o$. The slope of this line is Δs. Then T and S may be obtained by substituting into the following equations:

$$T = \frac{264Q}{\Delta s} \qquad (3)$$

$$S = \frac{0.3Tt_o}{r^2} \qquad (4)$$

where:

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

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

Method II

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:

$$T = \frac{528Q}{\Delta s} \qquad (5)$$

$$S = \frac{0.3Tt}{r_o^2} \qquad (6)$$

where:

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

5.2.3 Hantush Method

Hantush developed several methods of analyzing aquifer test data in semi-confined aquifers (Kruseman, 1976). The Hantush I and Hantush II Methods have been used in the analysis. Listed below are the assumptions and limiting conditions that must be satisfied:

- the aquifer is semi-confined
- the flow to the well is in an unsteady state, i.e. the drawdown differences with time are not negligible nor is the hydraulic gradient constant with time

- the water removed from storage is discharged instantaneously with decline of head
- the well diameter is very small, so that the storage in the well can be neglected
- the steady-state drawdown should be (approximately) known

Hantush I

The test data are plotted on semi-logarithmic paper to obtain a time-drawdown curve, with time on the logarithmic scale. The inflection point is determined by extrapolating the maximum drawdown and solving the following equation:

$$s_p = \frac{1}{2} s_m \qquad (7)$$

where:

s_p = drawdown at the inflection point (ft)

s_m = maximum drawdown (ft)

Plotting s_p on the time-drawdown curve gives the value of time at the inflection point (t_p) from the time-axis. The slope of the curve (Δs_p) is then calculated at the inflection point. The values of s_p and Δs_p are then substituted into the following equation to solve for $e^{r/L} K_o (r/L)$:

$$2.3 \frac{s_p}{\Delta s_p} = e^{r/L} K_o (r/L) \qquad (8)$$

where:

K_o = modified Bessel function of the second kind and zero order

Δs_p = slope of the curve at the inflection point (i.e. the drawdown difference per log cycle of time) (ft.)

L = leakage factor of the water bearing layer (ft)

Then solve for r/L using a table of the modified Bessel function and calculate L. The transmissivity may now be calculated using the formula:

$$T = \frac{2.3Q}{4\pi\Delta s_p} e^{-r/L} \qquad (9)$$

where:

$e^{-r/L}$ = modified Bessel function e^{-x}

The storage is calculated by introduction of the appropriate values into the following equation:

$$S = \frac{r4Tt_p}{2Lr^2} \qquad (10)$$

To calculate the hydraulic conductivity of the semi-pervious layer, first determine the hydraulic resistance by:

$$c = \frac{L^2}{T} \qquad (11)$$

where:

c = hydraulic resistance of the semi-pervious layer (days)

Then substitute c into the following equation:

$$K' = \frac{b'}{c} \qquad (12)$$

where:

b' = thickness of the semi-pervious layer (ft)

K' = hydraulic conductivity of the semi-pervious layer (gpd/ft^2).

Hantush II

The slope (Δs_p) of each semi-logarithmic time-drawdown plot, used in Method I, is plotted on semi-logarithmic paper versus distance (r), with Δs_p on the logarithmic scale. A line of best-fit is drawn through the plotted points and is a graphic representation of the equation:

$$r = 2.3L \left(\log \frac{2.3Q}{4\pi T} - \log \Delta s_p\right) \qquad (13)$$

Determine the slope of the line (Δr) and extend the straight line until it intercepts the abscissa and read the value of Δs_o. Having obtained the values of Δr and Δs_o, calculate L and T from the following equations:

$$L = \frac{1}{2.3} \Delta r \qquad (14)$$

where:

Δr = slope of the line

$$T = 2.3 \frac{Q}{4\pi \Delta s_o} \qquad (15)$$

where:

Δs_o = intercept along the abscissa

Then S, c, and K' are calculated for each observation well using equations (10), (11) and (12) in Hantush I.

5.2.4 Hantush - Jacob Method

Hantush and Jacob (Lohman, 1972) derived the equation below for nonsteady radial flow in an infinite leaky confined aquifer.

Type curves were developed by Cooper and Hantush (Lohman, 1972).

$$s = \frac{Q}{4\pi T} L(u,v) \qquad (16)$$

where:

L = leakance expressed as a function of u and v.

To calculate the aquifer parameters, the drawdown data from the observation wells are plotted on semi-logarithmic graph paper against t/r^2 on the logarithmic scale. By curve matching with the Cooper type curve, match points are determined. The following equations are used to calculate T and S from each semi-logarithmic plot:

$$T = \frac{Q}{4\pi s} L(u,v) \qquad (19)$$

$$S = 4T \frac{t/r^2}{1/u} \qquad (20)$$

The hydraulic resistance of the semi-pervious confining layer may be calculated using the following equation:

$$\frac{K'}{b'} = 4T \frac{v^2}{r^2}$$

K' is found by determining b' and then solving for K'.

5.3 Results

As discussed earlier, the aquifer at Banyan Bay was pumped continuously for 72 hours at a constant rate of 741 gpm. Water level data were collected to measure drawdown from four observation wells near the pumped well (OW-1D, OW-1S, OW-2D, OW-3D), one distant well with a recorder (E-1), and two staff gages (SG-1, SG-2)in nearby ponds. Appendix B contains the raw field data.

Outlined below is a discussion of the results obtained from the various methods of data analysis.

The results are listed in Table 5-1. As can be seen from the chart, there is excellent agreement in the aquifer parameters that were obtained from the various methods of analysis. Figures 5-2 to 5-4 are plots of Jacob Method I; Figure 5-5 is for Jacob Method II; Figures 5-6 to 5-8 are data plots of Hantush Method I, Figure 5-9 is for Hantush Method II; and Figure 5-10 to 5-12 are for the Jacob-Hantush Method.

The range in transmissivity is from 28,200 to 34,000 gpd/ft. The average for all methods is 30,140 gpd/ft. The coefficient of storage ranges from 3.24×10^{-1} to 5.38×10^{-4} with an average of 2.3×10^{-2} which is indicative of a semi-confined aquifer. Leakance ranges from 1.72×10^{-3} to 4.72×10^{-2} gpd/ft^2 with an average of 3.22×10^{-2} gpd/ft^2. The close conformance of results between the various methods indicate that reliable aquifer parameters were determined. The higher storage and leakance values obtained for well OW-1D indicate this well is beginning to respond as a water table well since it is closest to the pumping well and responds to dewatering the earliest. Long term (30 days) pumping of well PW-1 would probably cause wells OW-2D and OW-3D to eventually respond as water table wells also. wrong

NOT WATER TABLE CONDITIONS

5.4 Analysis of Results

In using analytical methods to calculate the hydraulic properties of an aquifer, consideration must be given to the limiting conditions associated with each method. The degree to which a particular method fits the actual field conditions has a significant effect upon the results obtained.

For wellfield design and impact evaluations, the more conservative values of T = 28,200 gpd/ft, and $S = 2.5 \times 10^{-3}$, using the Jacob Method II, were used. The results obtained from this method were determined to be the ones which yielded parameters specifically defining the cone of depression measured in wells OW-1D, OW-2D, OW-3D and E-1 during the aquifer performance test. Extrapolation of the distance-drawdown curve in Figure 5-5 shows the amount of drawdown that occurs with distance from the pumped well at a given pumping rate and specific interval of time. The straight line drawn between wells OW-2D, OW-3D and E-1, in Figure 5-5, is most representative of the real cone of depression created by pumping well PW-1 because of the great lateral distance between wells. As such, Jacob Method II is the basis for evaluating off-site impacts due to pumping.

5.5 Wellfield Design and Management

Analysis and evaluation of the aquifer performance test data provide the information base required for wellfield design. In order to meet a projected average day demand of 0.379 MGD, two wells will be required. These two wells will be operated on an alternating 24 hour schedule to allow each well to rest and the surrounding groundwater level to recover to static levels in between pumping episodes. Each well will be designed to produce 263 gpm. Peaking conditions will be met by storage facilities. The well spacing should be about 2,600 feet between the two wells to minimize drawdown impacts. The approximate locations of the production wells are shown in Figure 5-13.

Treated water will be used to meet the potable and non-potable water demands, except the golf course. Table 5-2 provides the average and maximum daily flows expected through the treatment plant at the end of each phase of development. The treatment plant will be sized based on maximum daily demands with an estimated ultimate capacity of 0.669 MGD.

Wastewater treatment plant effluent will be ultimately used for irrigation of the proposed golf course within the development. The total irrigation demands for the proposed golf course are estimated to be 0.287 MGD, based on approximately 1.5 inch/acre/ week for 45.5 acres (SFWMD's Green Grass Guide).

In the interim, until sufficient quantities of effluent are available, make-up water for irrigation demands will be met primarily by groundwater supplies, with minor surface water augmentation during year 6 of the development schedule (Table 5-2).

6.0 IMPACT EVALUATION

6.1 Projected Cone of Influence

The cone of influence around a pumping well is defined by the transmissivity, storage coefficient, leakance value of the aquifer and the rate and duration of withdrawals. Given these factors, the shape and extent of the cone of depression around a pumping well may be predicted. Utilizing transmissivity and storage coefficient values of 28,200 gpd/ft ok and 2.5 x 10^{-3}, respectively, the drawdown with distance from the pumping well is obtained. Figure 6-1 illustrates this under test conditions. It shows that after three days of continuous pumping at a rate of 741 gpm, the one foot drawdown contour occurs at a distance of about 2700 feet from the pumping well. Table 6-1 contains calculations of drawdown with distance from the pumped well for 1, 3, 10 and 30 days of continuous pumping at 263 gpm. However, in reality, the wells will never be pumped for longer than one day, as outlined in Section 5.5.

At buildout, the Banyan Bay project will have an average day demand of 0.379 MGD (263 gpm). To supply this demand from the surficial aquifer, two supply wells operating on alternating 24 hour rotational schedule at a rate of 263 gpm will be required. This alternating withdrawal schedule permits recovery of groundwater levels around each well during its rest period. Permitting the groundwater levels to recover every other day will mitigate withdrawal impacts on the hydrologic system and insure that the well is operating at peak efficiency because of maximum thickness of saturated aquifer. Long term pumping from the surficial aquifer can cause excessive dewatering of the aquifer and significantly reduce the specific capacity and efficiency of the well.

The projected cone of influence, for the proposed design withdrawal rate of 263 gpm for 24 hours, is shown in Figures 5-13 and 6-1 indicating the 1 foot drawdown contour will occur at a distance of approximately 1300 feet from the production well. At this distance, impacts of withdrawal on existing adjacent supply wells will be negligible. Even at a withdrawal rate of 465 gpm only one of the existing supply wells (well 1 on Figure 4-1) will experience a 1 foot decline in water level after 24 hours of pumping.

6.2 Groundwater Withdrawal Impacts On the Hydrologic System

To adequately evaluate withdrawal impacts of the proposed Banyan Bay wellfield, a thorough knowledge of the hydraulic characteristics of the four producing zones and three interbedded semi-confining layers is necessary. In Section 6.1, it was determined that the proposed withdrawal rate and wellfield operation schedule will not adversely impact adjacent supply wells or promote saltwater intrusion. Potential for salt water intrusion is not relative to the Banyan Bay area because the fresh/saltwater interface is located 4 to 5 miles east of the site. The proposed wellfield operation schedule is also designed to minimize withdrawal impacts on surface waterbodies and the water table on the Banyan Bay property.

Each of the water producing zones described in Section 3.0 may be influenced to a minor degree by groundwater withdrawals on the property. The degree of impact will be a function of the depth of separation of each unit from the producing zone (Unit 7), the water levels in each producing zone, hydraulic characteristics of each producing zone (Units 1, 3, and 5) and each semi-confining unit (Units 2, 4, and 6), in addition to the rate and duration of withdrawals.

To evaluate potential impacts of head differentials observed under static and pumping conditions, between the water table and producing zone, a series of water table wells and surface water level observation stations were constructed (WT-1 through WT-9). Locations of these water table and surface to determine if the wet weather pond water levels are perched or are a surface expression of the water table. To determine the relationship of the water table and surface water levels, 1.25 inch diameter well points were driven 1 to 1.5 feet below 5 of the pond bottoms. After installation, water levels in each well were permitted to reach equilibrium. After equilibrium was reached the levels in the wells equalled the surface water level where surface water was present, Table 6-2. Wells WT-2 and WT-5 were originally constructed as open ended wells and were not reflecting true groundwater levels. These wells were replaced with screens. Groundwater levels beneath these ponds also equalled surface water levels after equilibrium. Table 6-3 lists the water level of wells with elevations on the property. These data show that water levels in Unit 1 range from greater than 2.5 feet below land surface to 1.5 feet above land surface in surface depressions. Greatest depth to water level in Unit 1 is adjacent to the St. Lucie River which drains this unit. Water levels in Unit 1 are generally within 1 foot of the land surface over the site. Where shallow depressions occur (ephemeral ponds), the groundwater levels equal surface water levels. These data confirm that water levels in the ponds are controlled by the elevation of the water table. This correlation of water table to surface water is a critical design criterion, since dewatering excavations, lake construction, infiltration potential of wastewater disposal and surface water management programs must be designed to maintain the existing water table elevation around the wet weather ponds to retain their hydrobiological integrity. To evaluate impacts of the proposed development on the wet weather ponds the hydraulic characteristics of Unit 1 were determined. Jammal and Associates (February, 1982) have, as part of their on-site soils investigation, determined a vertical permeability in Unit 1 of 12 feet/day and a horizontal permeability of 14 feet/day, based on field permeability tests.

Unit 2 has a very low vertical permeability of less than 0.001 feet/day and a low horizontal permeability of 0.01 feet/day (Jammal, 1982). This low permeability creates a semi-confining layer separating the more permeable Units 1 and 3. Consequently, Unit 1 responds immediately as a water table aquifer with water levels near land surface and responds directly to rainfall and evapotranspiration.

Unit 3, as a result of the semi-confining zone above it, exhibits artesian water levels under static conditions (unpumped). Leakance of water through Unit 2 occurs at a slow rate as indicated by the 72 hour aquifer performance test. Throughout the 72 hour test, water was pumped from the discharge well at a constant rate of 741 gpm from Unit 7, which occurs at a depth of 60 to 130 feet. Staff gages (SG-1, SG-2) installed in the two ponds closest to the production well indicated no discernable dewatering during the test (Table 6-4). This indicates groundwater withdrawal, as proposed, will not have an adverse impact on the environmentally sensitive water levels naturally occurring in Unit 1. The combined effects of the semi-confining Units 2, 4 and 6 effectively retard dewatering of Unit 1 by short term (1 to 5 days) pump withdrawals.

Long term withdrawals at high pumping rates (750 gpm) may eventually cause dewatering after 5 to 10 days of continuous pumping from one well. For this reason, recommended pumping schedules from the potable system will not exceed 24 hours.

Vertical permeability in Unit 3 was determined to be 6 feet/day and the horizontal permeability was measured at 9 feet/day (Jammal, 1982). Water levels measured in the two shallow observation wells (OW-1S and OW-4S) in this unit (Figure 1-2), and in the test holes constructed by Jammal and Associates (which were measuring water levels in this unit) indicate the water levels range from 2.5 to 4.85 feet below land surface. Unit 3 water levels are artesian under static conditions as a result of the semi-confining nature of Unit 2. Water levels in Unit 3 are generally 3 feet below Unit 1 water levels and tend to follow the stratigraphic dip of Unit 3. During the aquifer performance test, OW-1S, located 25 feet west of the production well, had a delayed drawdown response to the pumping (Appendix B, Aquifer Performance Test Data) indicating that underlying Units 4 and 6 have semi-confining characteristics which retard the downward percolation of water. Part of this delayed water level response is caused by partial penetration effects resulting from Well OW-1S not penetrating the production zone (Unit 7).

Unit 4 is a semi-confining zone separating Units 3 and 5.

No wells specifically monitored water levels in Unit 5. Due to the presence of semi-confining clayey sediments above and below Unit 5, water levels in this unit are probably slightly lower than those measured in Unit 3 and higher than those measured in Unit 7.

Unit 6 is a semi-confining zone.

Unit 7 responds as a semi-unconfined artesian aquifer, as determined from water level responses measured during the aquifer performance test. Water levels measured in Wells OW-1D, OW-2D, OW-3D, OW-4D, PW-1, and E-1 indicate water levels in Unit 7 are generally 5 to 7 feet below land surface, coming to within 2.5 feet of the surface at the lower land elevations (3.8 ft. msl) adjacent to the St. Lucie River. Unit 7 water levels are approximately 1 to 2 feet below Unit 3 water levels over the property except at the lower land elevations along the St. Lucie River. As exhibited in wells OW-4D and OW-4S, Unit 7 exhibits water levels one half to one foot higher than Unit 3 in this area. This reversal may indicate hydraulic connection of Unit 3 to the St. Lucie River. The hydraulic gradient of Unit 7, across the Banyan Bay property, (Figure 6-2) is east to west about 6 feet/mile. $L = 3600$ f

Discharge to St Lucie: $Q_0 = 2Q_1 + Q_2$ $Q_1 = TIL = (997.5)(3600)\frac{6}{5280}$

Unit 8 is a confining zone. $Q_2 = K'IA = (3.22 \times 10^{-3})\left(\frac{1.32\ [redacted]}{35}\right)\left(\frac{3600 \times [redacted]}{100}\right)$

$Q_1 = 4080$

$Q_2 = 43$ $2Q_1 =$ [redacted] 8160 $Q_0 = 8203$ gpd/L

Unit 9 is the lower confining zone known as the Hawthorn Formation. It is approximately 500 feet thick in the study area and effectively separates the surficial aquifer from the highly mineralized waters of the artesian Floridan Aquifer.

Water level and aquifer performance test data from the Banyan Bay property indicate proposed groundwater withdrawals

o Reduction in potentiometric heads of deep aquifer will not adversely impact esturine salinity

oo Significant base flow reduction occurs to the esturine if the ... head decline.

for meeting potable and irrigation demands of the development will not adversely impact:

- The fresh/salt water interface stability
- Groundwater quality in on-site or off-site wells
- Adjacent supply well's operation or efficiency
- Surface water levels
- Environmental concerns relative to wet weather ponds
- The St. Lucie River

These data have identified the need for careful planning and design with respect to drainage and storm water management retention and excavation for fill as these dewatering and runoff storage activities can impact the natural hydroperiod of the ephemeral ponds.

6.3 Mitigating Impacts on the Water Table and Surface Water Levels

The water management plan for Banyan Bay will be designed to meet the water management goals for a residential-golf course community in Martin County. The system will help: (1) regulate the water levels within the project, (2) provide for the removal of excess surface runoff, (3) detain and regulate the release of flood waters, (4) incorporate features for the improvement of the quality of surface runoff, (5) supply minor amounts of irrigation water (6) maintain maximum freshwater head for salinity control of the St. Lucie River and the water management plan will serve a land use concept which will preserve the wetland features of the site and provide for the development and use of suitable land within the project.

The physical components of the system will consist of numerous interconnected detention lakes which will discharge at controlled rates to the St. Lucie River. Water level investigations on the site indicate observed seasonal surface water is a reflection of the existing groundwater table and not a function of perched conditions. These water table levels are maintained by a silty clay sand layer (hardpan) ranging from 3 to 5 feet below land surface. If this 10 foot thick confining layer were breached, the water table would drop 3 to 4 feet below land surface. Preservation of the wetlands during construction of the project will result in the retention of the hardpan layer existing below the wetlands. Since this hardpan layer is primarily responsible for the existing ponded water (seasonal) in the wetland areas, its preservation will allow for the continuance of ponded water in areas where it presently exists. Control elevations will be set so that approximately one foot of water will be retained in the wetland areas prior to discharge.

The 251 acre site will contain approximately 17 acres of internal lakes and water management areas designed to detain for five days the first 3/4-inch of runoff from the site in accordance with SFWMD requirements. Detention of runoff has been found to have approximately (95%) the same water quality benefits as retention. It has been used in the design of this project so that lake elevations will be more easily maintained. Grassed swales will be utilized to convey runoff from roads and building areas to the lakes. The swales and the detention features in the lakes will allow for removal of settleable solids and for uptake of nutrients in the runoff before discharge into the river.

The control of the lake levels will be set at the wet season water table elevation and vary across the site from 3 to 11 feet msl except for the large lake in the center of the property which will be excavated 15 to 20 feet below land surface, penetrating semi-confining Unit 2. Penetration of Unit 2 by the lake excavation will cause water levels around the lake to drop to those levels exhibited by Unit 3, which are approximately 3 feet below existing Unit 1 levels. This dewatering impact will be limited to a drawdown of 0.5 feet

Theis Simulation

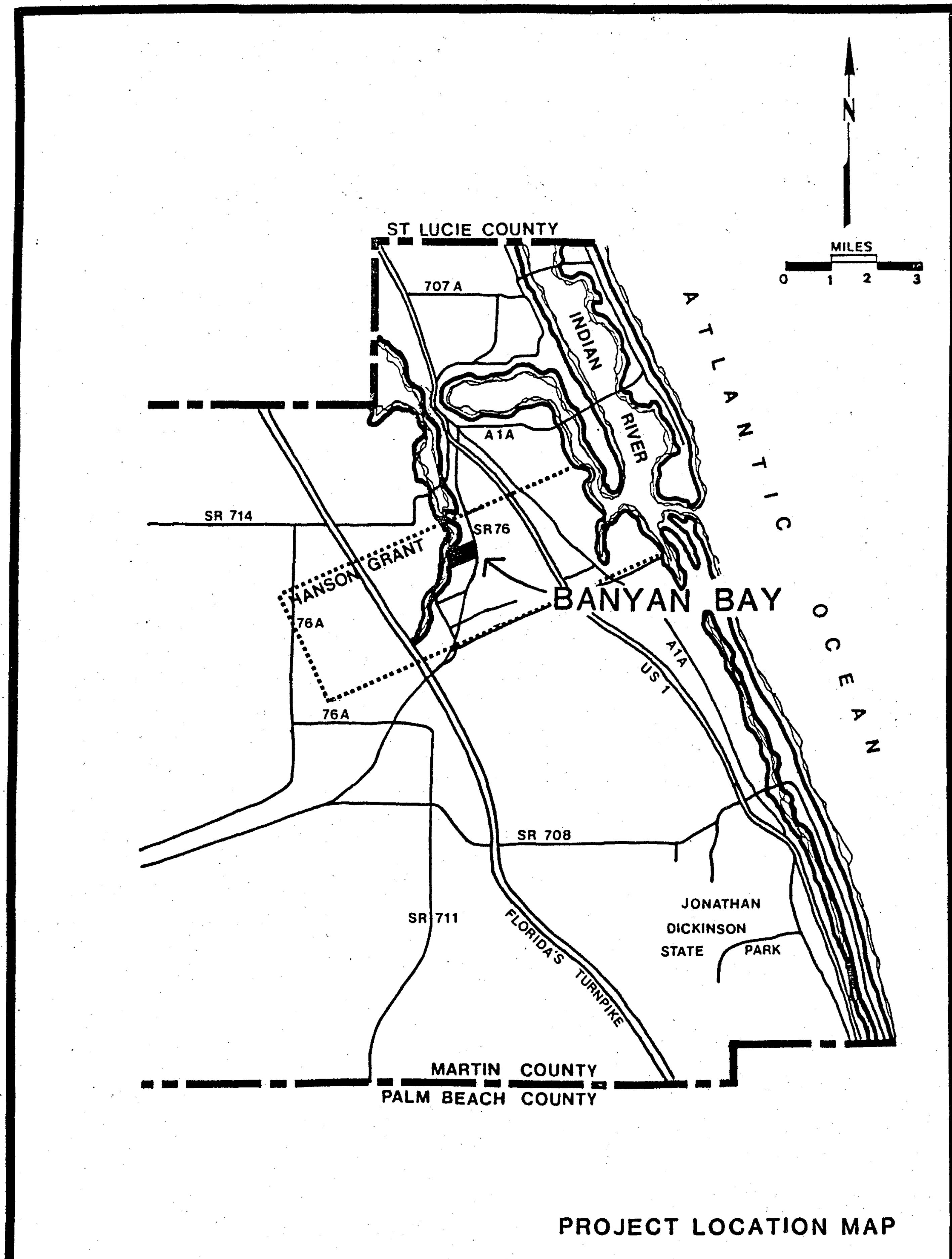
for a distance of about 100 feet around the perimeter of the lake assuming constant drainage and no recharge for 120 days. Where these impacts will intercept surface water or wet weather ponds, a low permeability dike can be constructed between the lake and the pond from land surface into Unit 2 to prevent dewatering. According to the proposed development plan only one of the wetland preserve areas may be impacted by up to 0.5 feet of dewatering in extreme drought conditions. A low permeability dike, approximately 600 feet, long will be required to mitigate this dewatering impact.

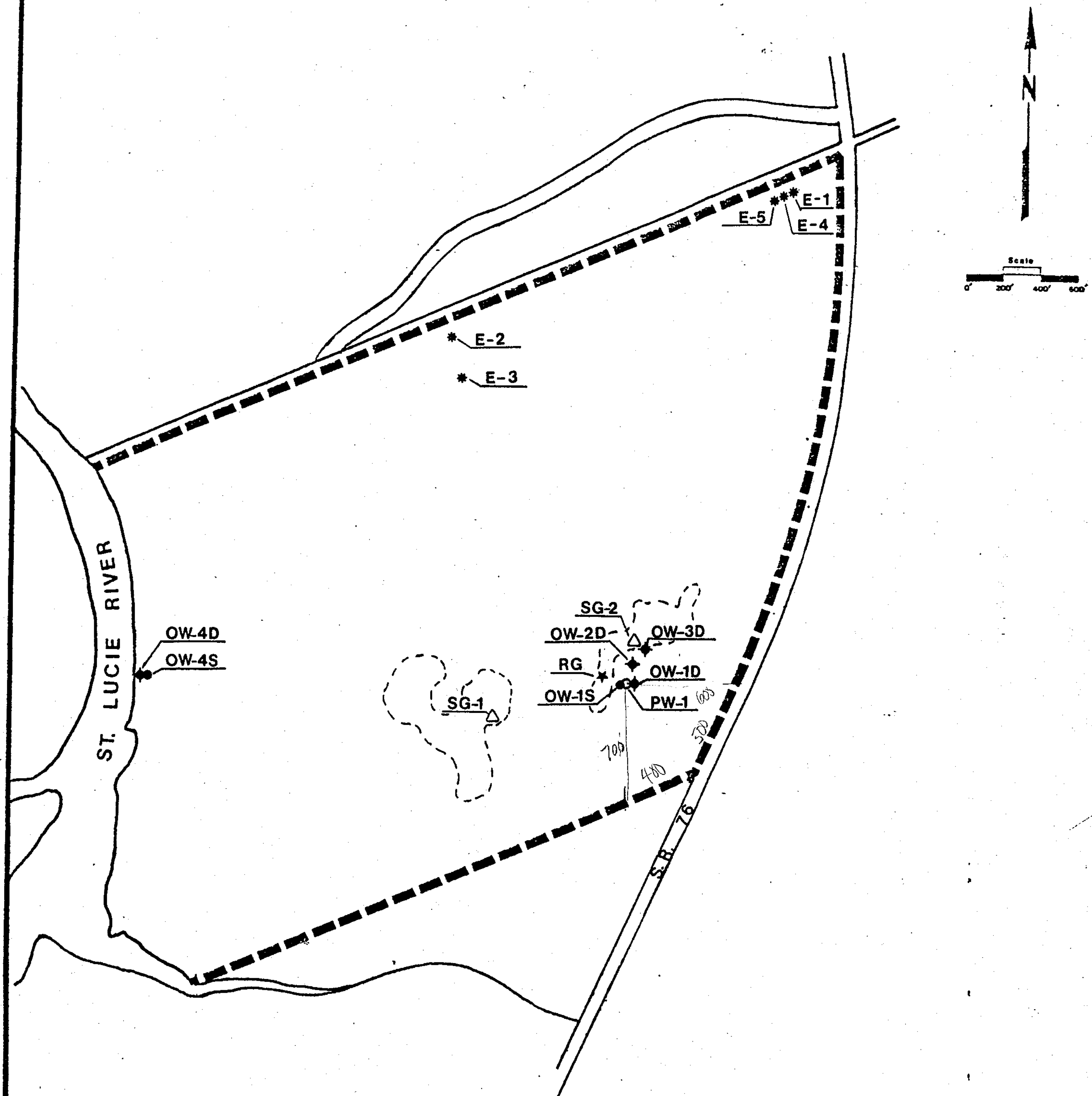
will the SFWMD requi this let alone permit it.

At various times of the year, water levels can be affected by the surrounding hydrologic conditions. Therefore, it is anticipated that water table elevations will continue to fluctuate during the dry season and wet season. Swales interconnecting the lake and preserve areas will have bottom elevations that vary such that runoff from the upstream basin will flow to downstream basins. Control of the system is to be accomplished by the use of structures at each of the lake outfalls. The Water Management System discharges to the River through four control structures. Three of these structures will be located adjacent to a large preserve area in the northwest corner of the project. The fourth will be located adjacent to a smaller preserve further

This lake will act as a drain either from surface sources or from shallow unconfined WT south. All runoff discharged from the project will sheetflow through one of these preserve areas before entering the river.

FIGURES


N
MILES
0 1 2 3
ST LUCIE COUNTY
707 A
INDIAN
RIVER
ATLANTIC OCEAN
A1A
SR 714
SR76
HANSON GRANT
BANYAN BAY
76A
76A
A1A
US 1
SR 708
SR 711
FLORIDA'S TURNPIKE
JONATHAN
DICKINSON
STATE PARK
MARTIN COUNTY
PALM BEACH COUNTY
PROJECT LOCATION MAP



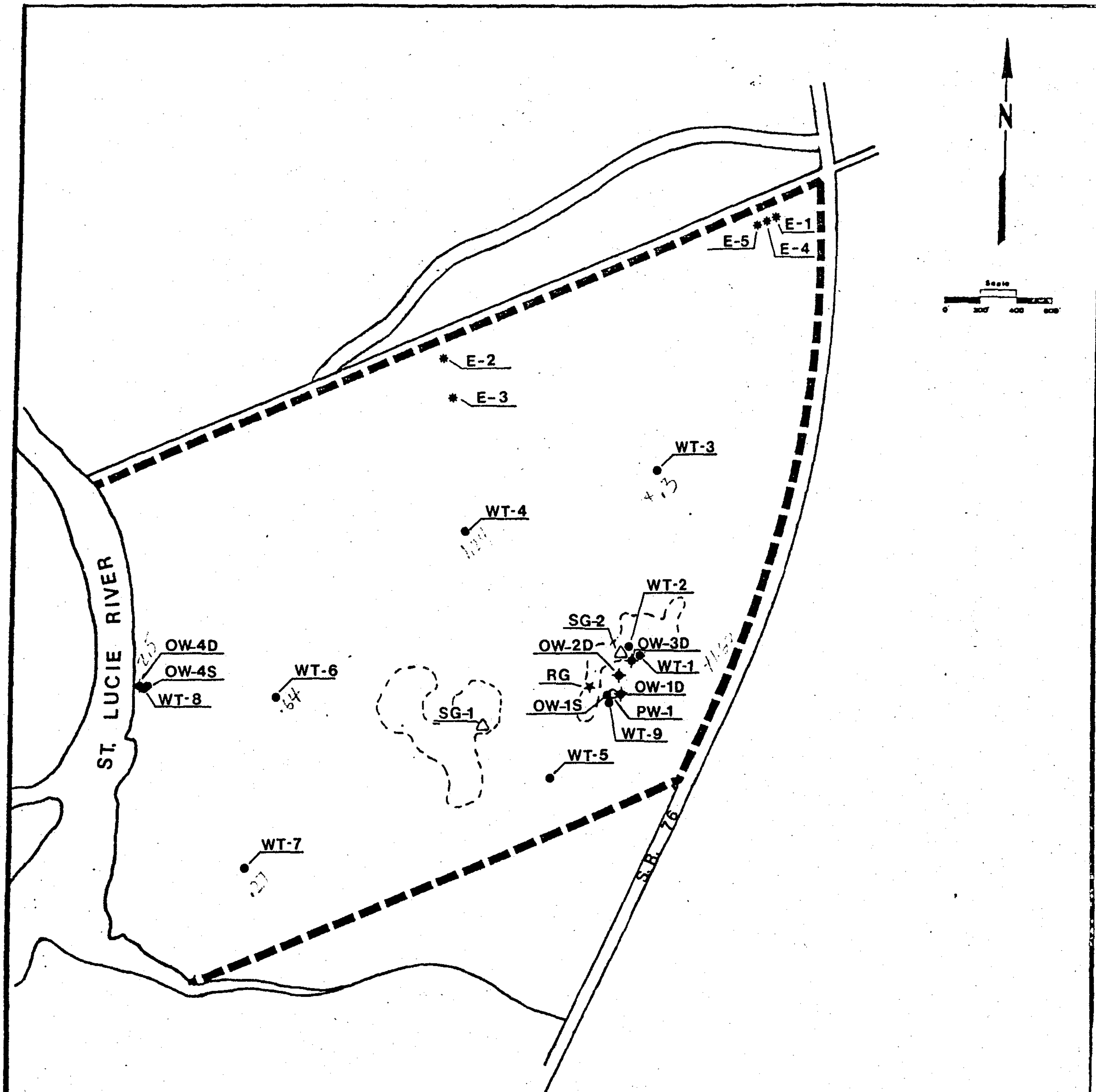
LEGEND

- ○ PUMPED WELL
- ✦ DEEP OBSERVATION WELL
- ● SHALLOW OBSERVATION WELL
- △ STAFF GAGE
- ★ RAIN GAGE
- ✱ EXISTING ON SITE WELL

WELL LOCATION MAP

81-227.3

FIGURE 1-2



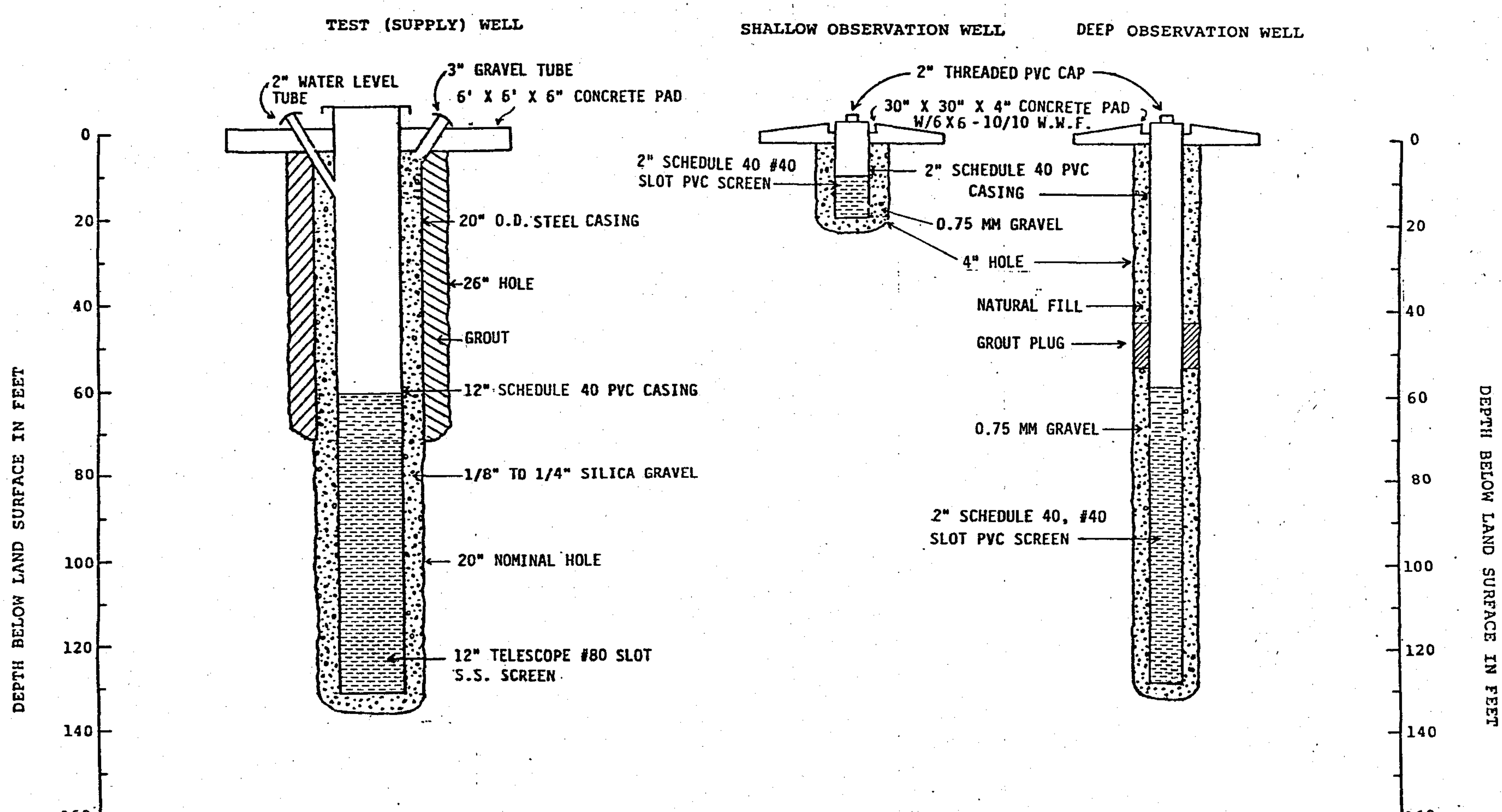
LEGEND

- ○ PUMPED WELL
- ✦ DEEP OBSERVATION WELL
- ● SHALLOW OBSERVATION WELL
- △ STAFF GAGE
- ★ RAIN GAGE
- ✱ EXISTING ON SITE WELL

WATER LEVEL MONITORING NETWORK

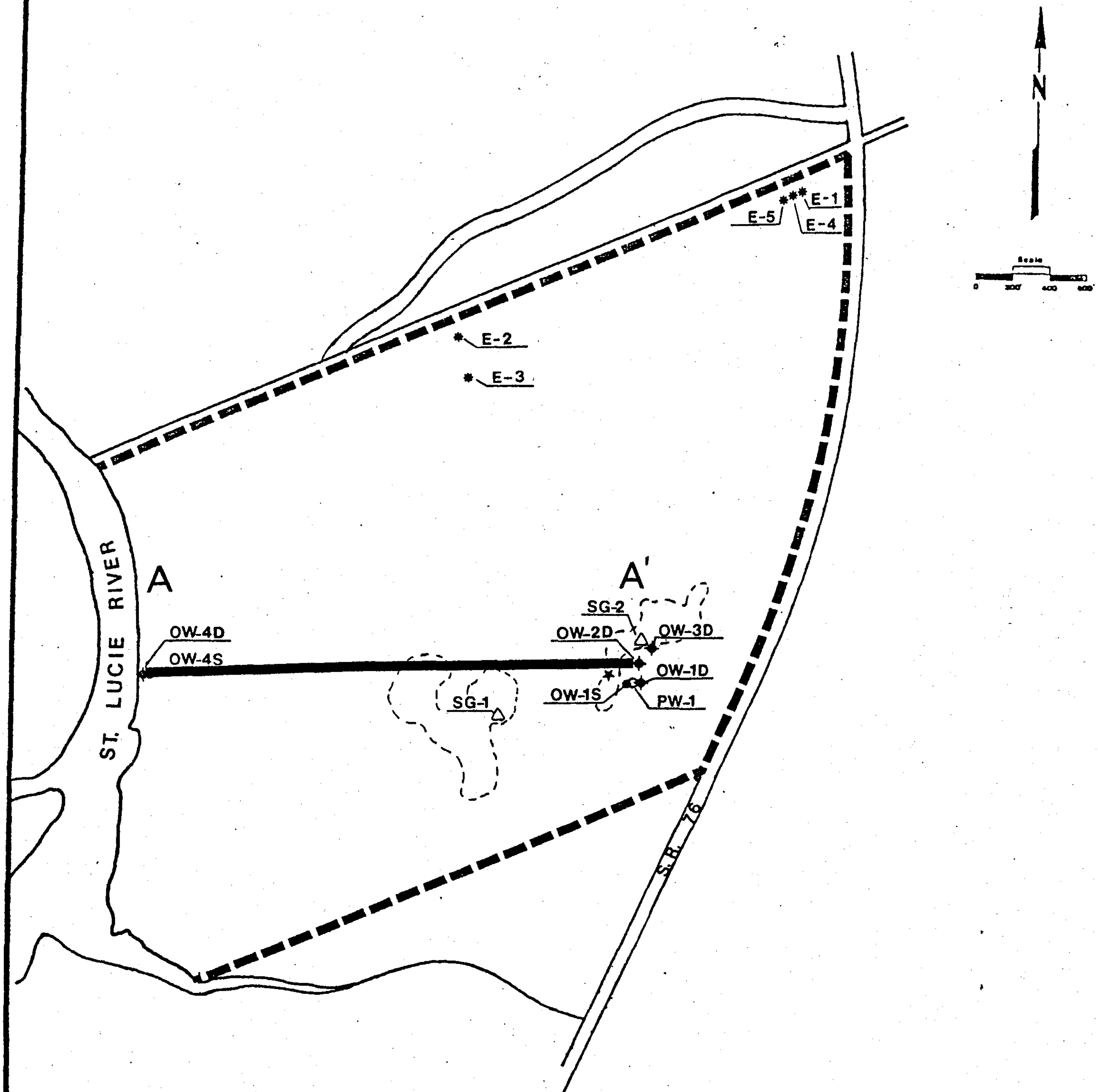
81-227.3

FIGURE 1-3



GENERALIZED WELL CONSTRUCTION DIAGRAM

FIGURE 2-1

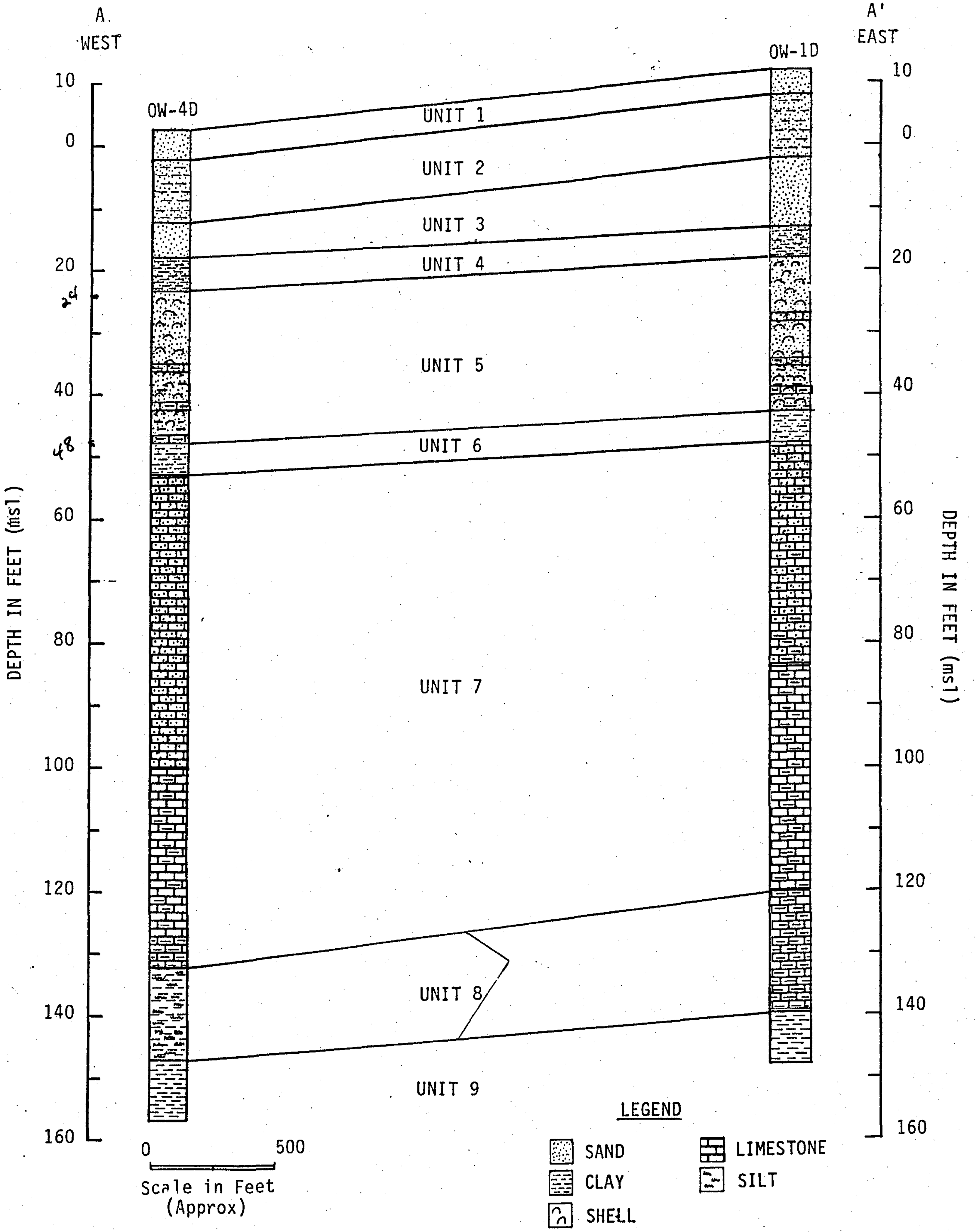


LEGEND

- o PUMPED WELL
- ✦ DEEP OBSERVATION WELL
- • SHALLOW OBSERVATION WELL
- △ STAFF GAGE
- ★ RAIN GAGE
- * EXISTING ON SITE WELL

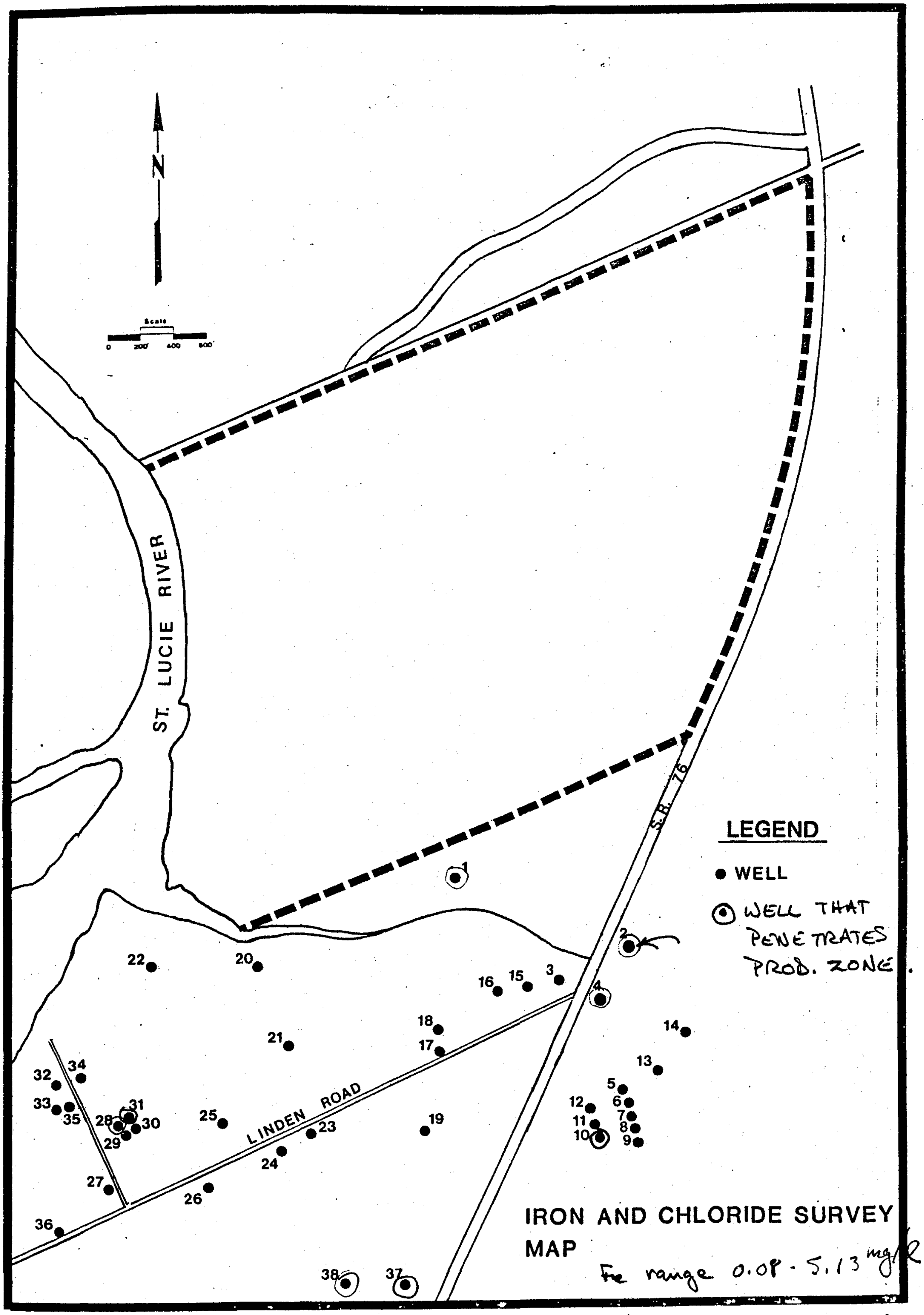
LOCATION OF LITHOLOGIC CROSS-SECTION

FIGURE 3-1



LITHOLOGIC CROSS-SECTION

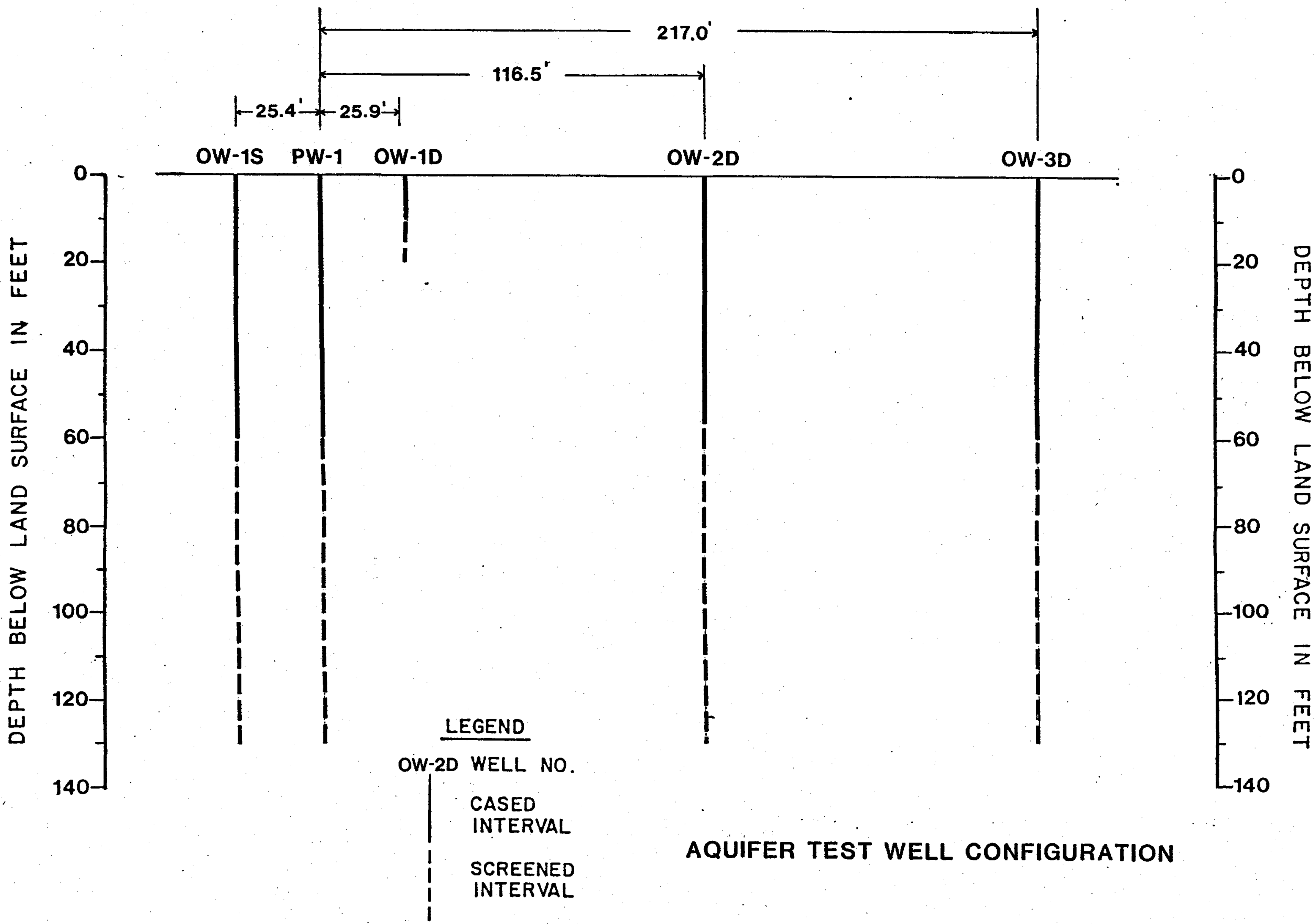
FIGURE 3-2



Cl range 15 to 34 mg/l

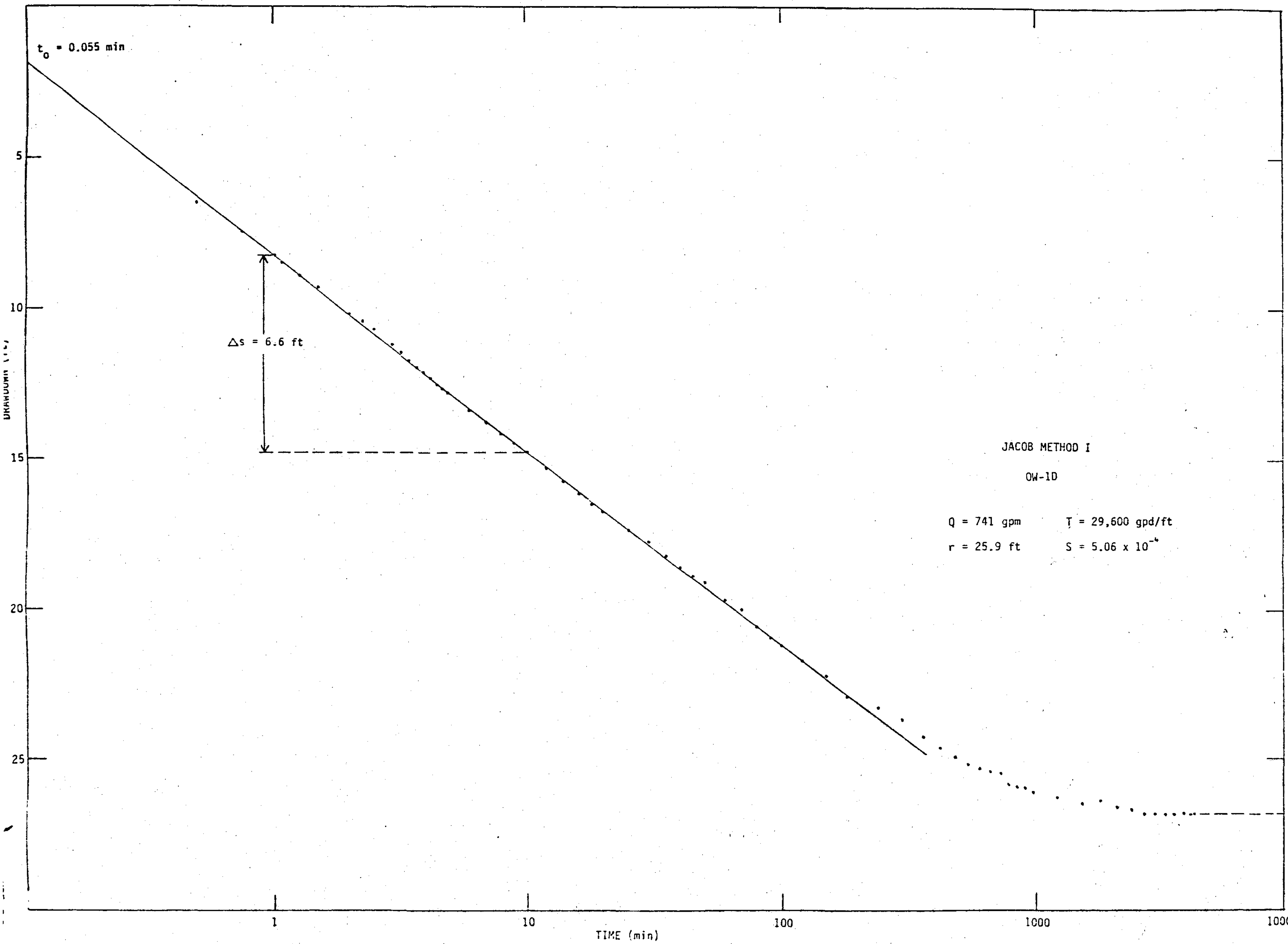
81-227.3

FIGURE 4-1

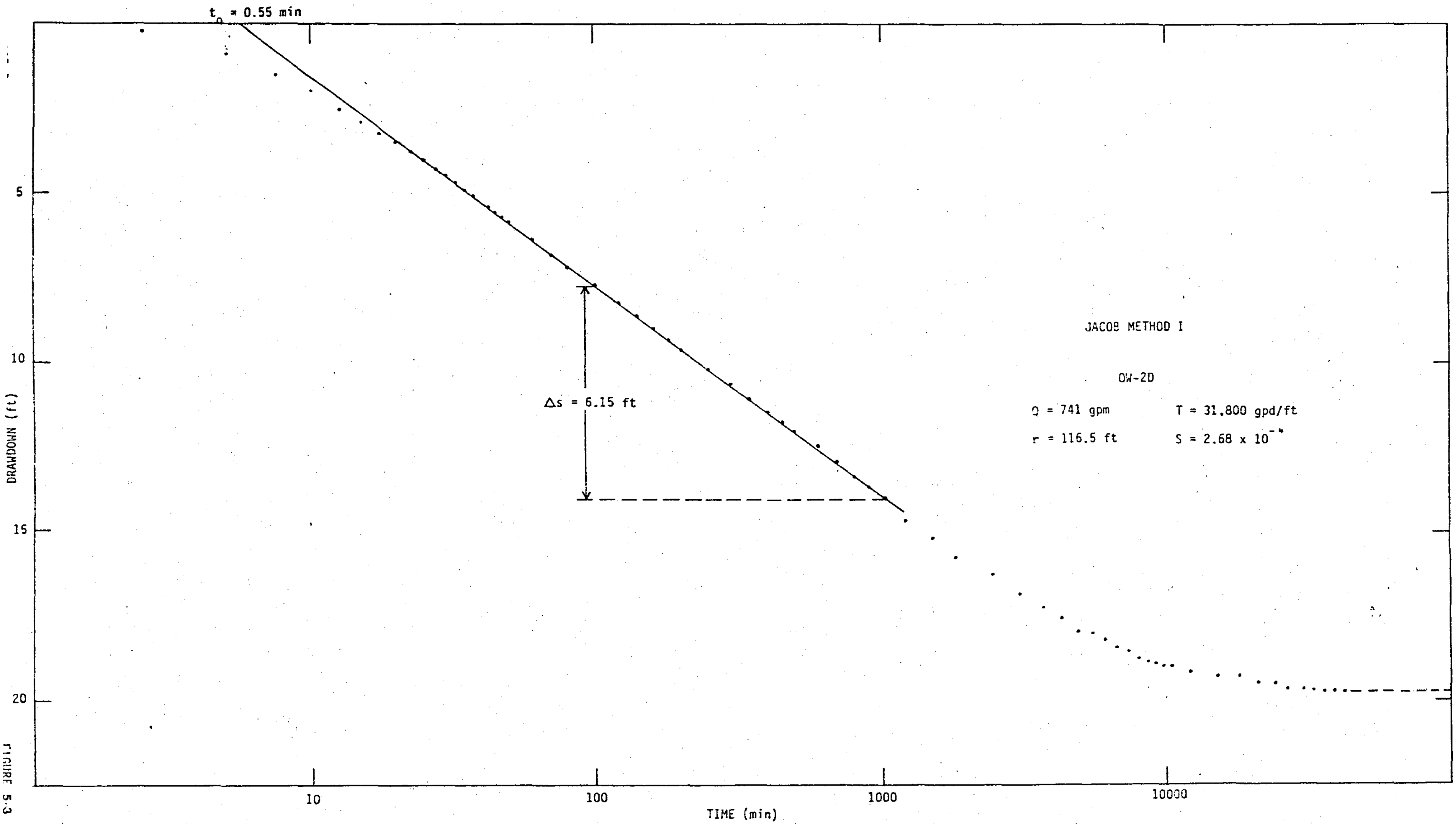


AQUIFER TEST WELL CONFIGURATION

FIGURE 5-1

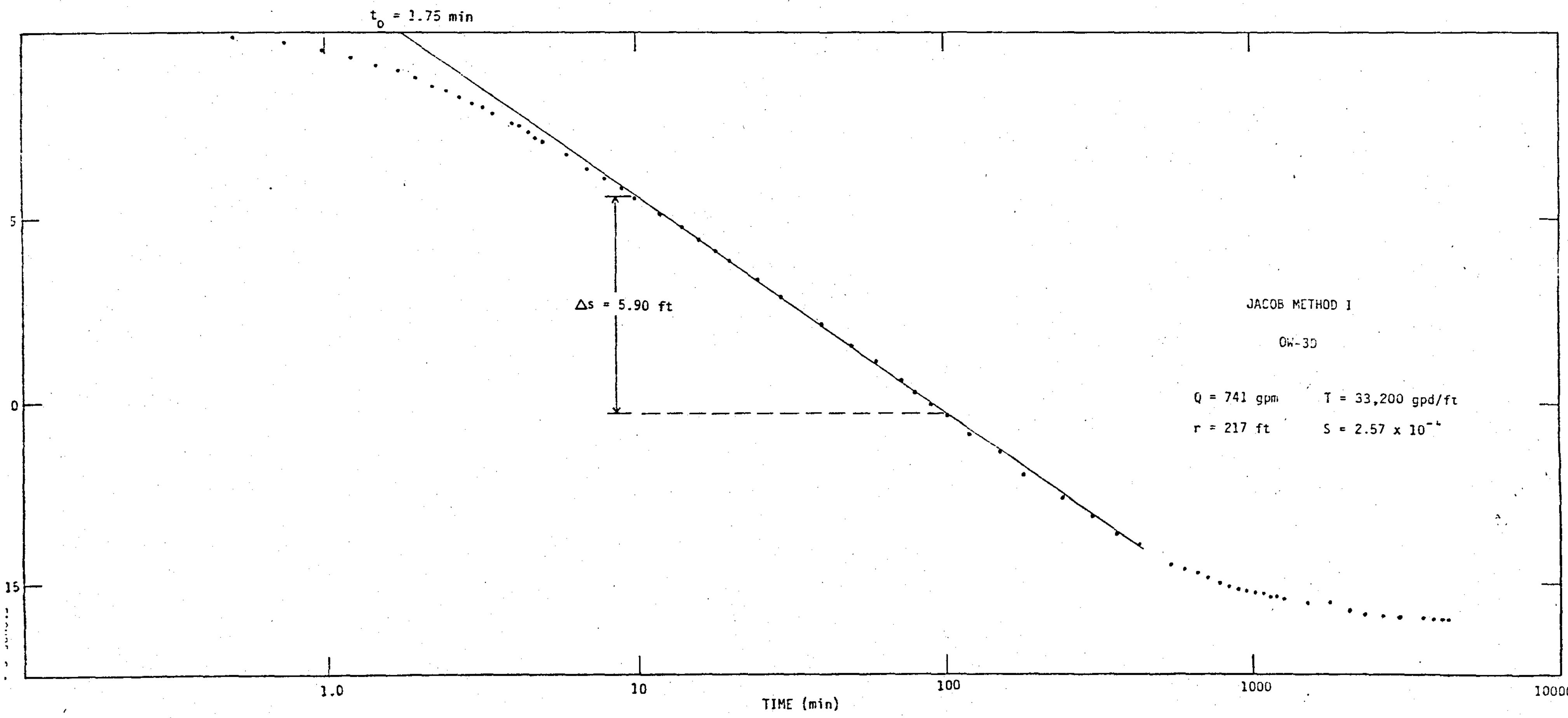


t_o = 0.055 min
Δs = 6.6 ft
JACOB METHOD I
OW-1D
Q = 741 gpm
T = 29,600 gpd/ft
r = 25.9 ft
S = 5.06 x 10^{-4}
DRAWDOWN (ft)
5
10
15
20
25
1
10
100
1000
10000
TIME (min)



t_0 = 0.55 min
JACOB METHOD I
OW-2D
Q = 741 gpm
T = 31,800 gpd/ft
r = 116.5 ft
S = 2.68 x 10^{-4}
Δs = 6.15 ft
DRAWDOWN (ft)
5
10
15
20
10
100
1000
10000
TIME (min)

FIGURE 5.3



t_0 = 1.75 min
Δs = 5.90 ft
JACOB METHOD I
OW-3D
Q = 741 gpm
T = 33,200 gpd/ft
r = 217 ft
S = 2.57 x 10⁻⁴
5
0
15
1.0
10
100
1000
10000
TIME (min)

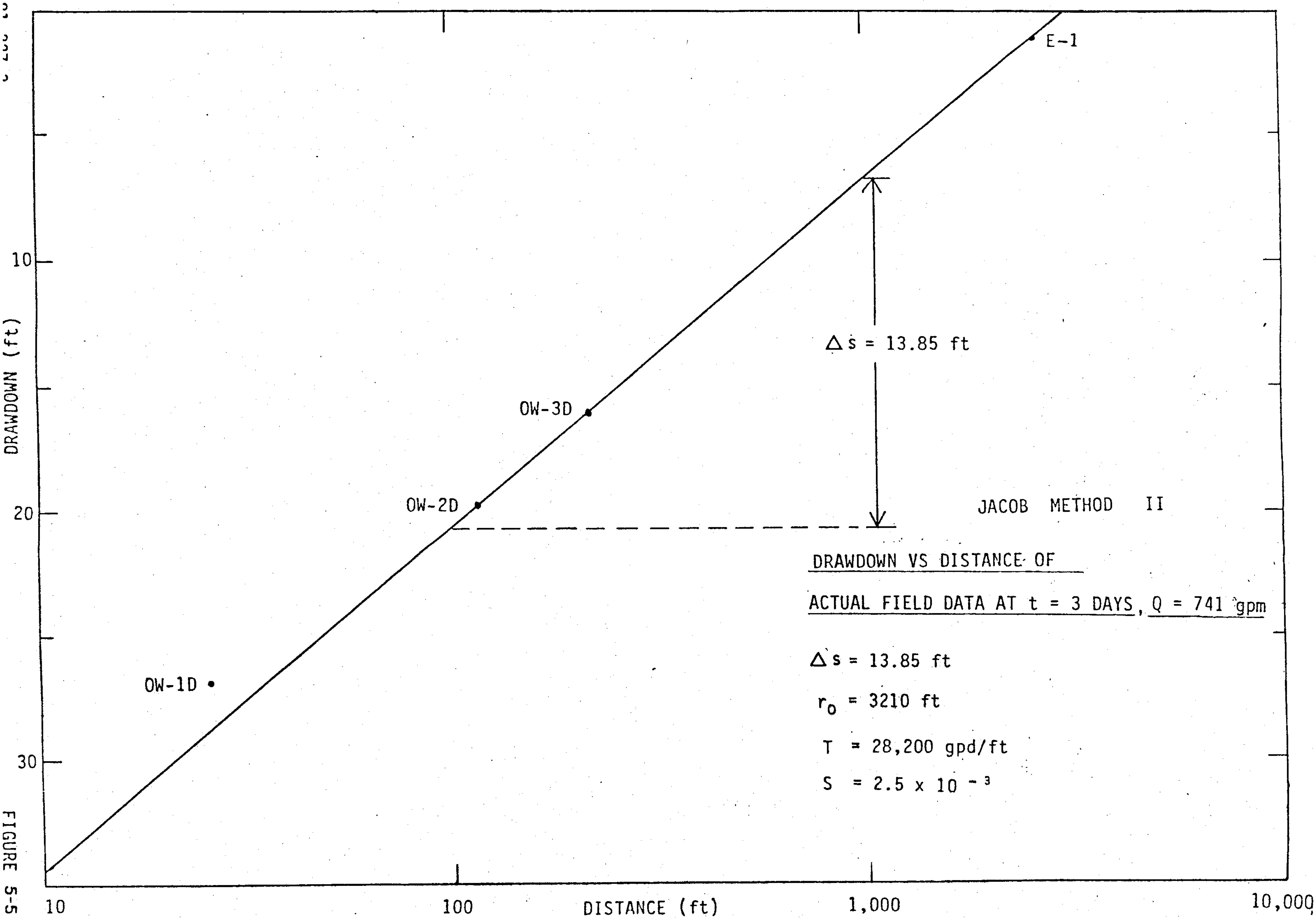
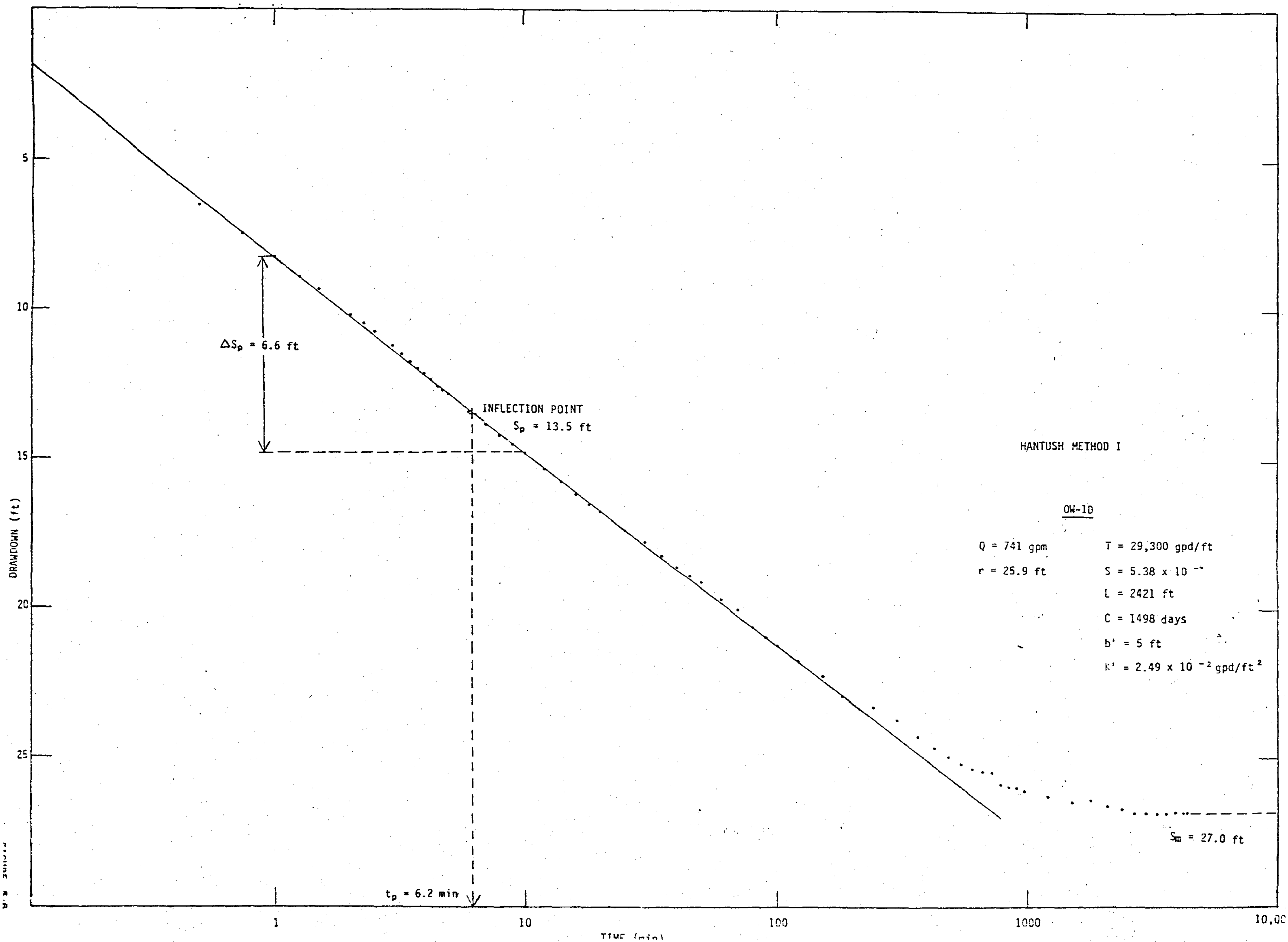
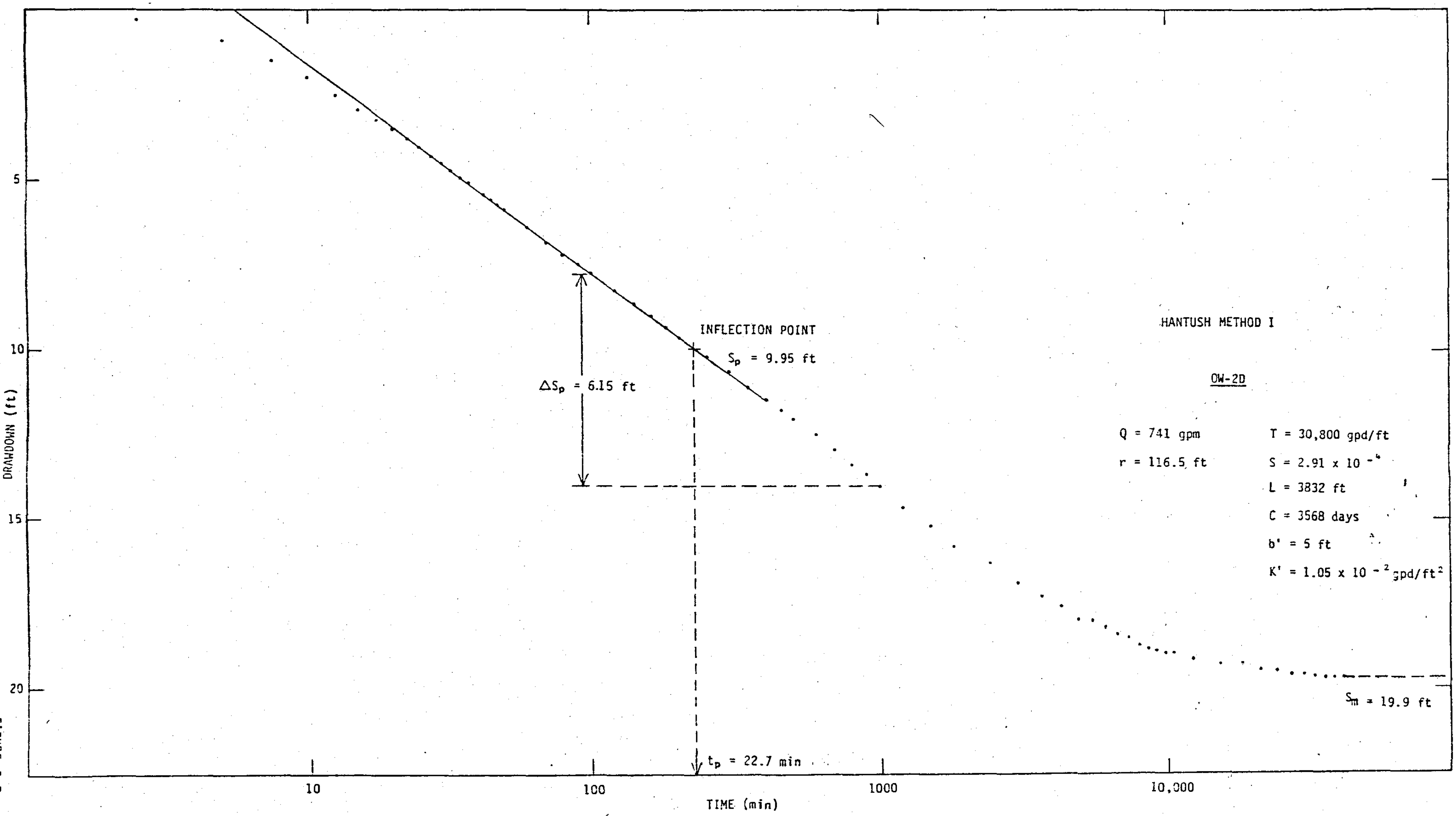

E-1
Δs = 13.85 ft
OW-3D
OW-2D
OW-1D
JACOB METHOD II
DRAWDOWN VS DISTANCE OF
ACTUAL FIELD DATA AT t = 3 DAYS, Q = 741 gpm
Δs = 13.85 ft
r_o = 3210 ft
T = 28,200 gpd/ft
S = 2.5×10^{-3}
DRAWDOWN (ft)
10
20
30
10
100
1,000
10,000
DISTANCE (ft)

FIGURE 5-5

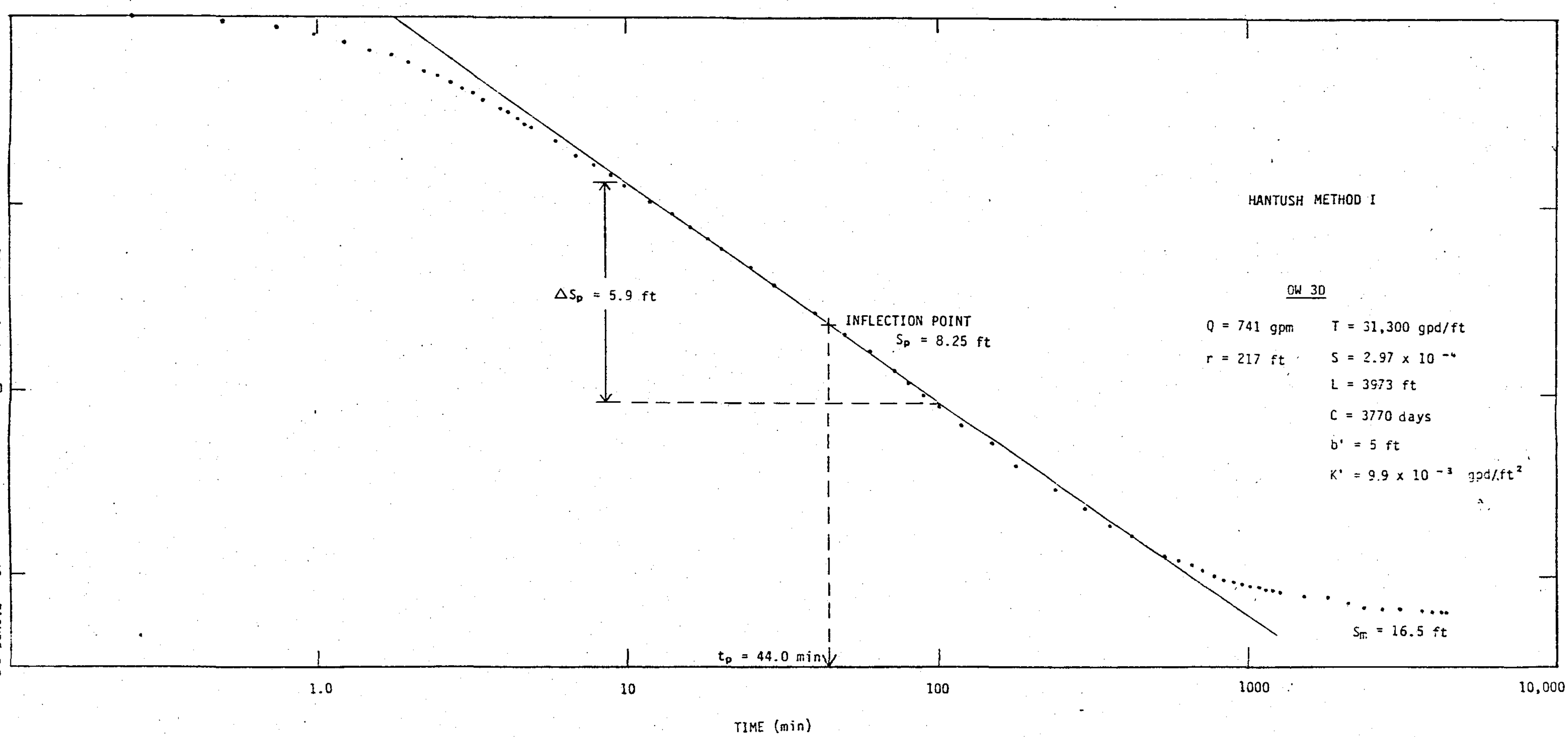


HANTUSH METHOD I
OW-10
Q = 741 gpm
r = 25.9 ft
T = 29,300 gpd/ft
S = 5.38 x 10
L = 2421 ft
C = 1498 days
b' = 5 ft
K' = 2.49 x 10 -2 gpd/ft 2
INFLECTION POINT
Sp = 13.5 ft
ΔSp = 6.6 ft
tp = 6.2 min
Sm = 27.0 ft
DRAWDOWN (ft)
5
10
15
20
25
1
10
100
1000



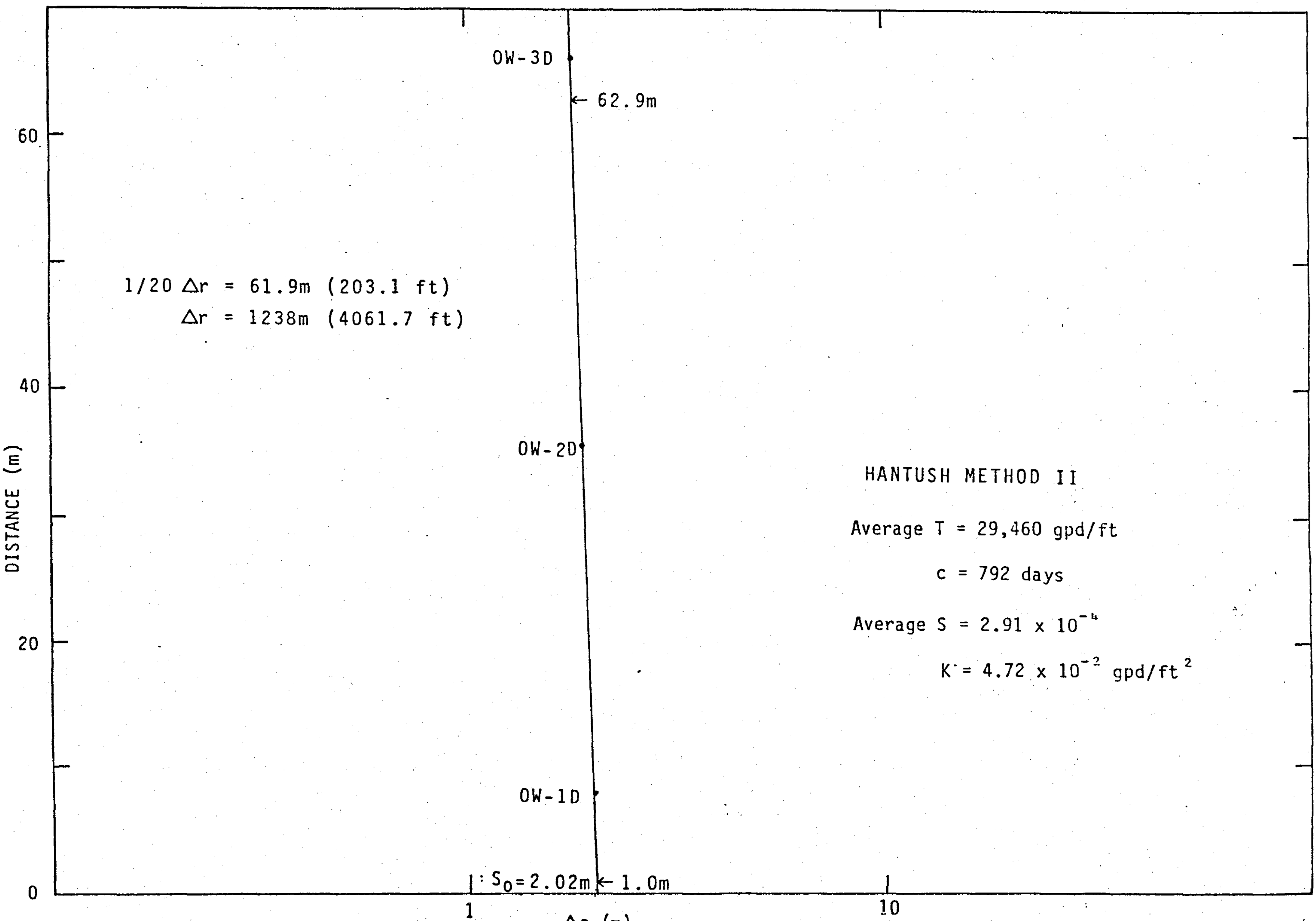
HANTUSH METHOD I
OW-2D
Q = 741 gpm
r = 116.5 ft
T = 30,800 gpd/ft
S = 2.91 x 10⁻⁴
L = 3832 ft
C = 3568 days
b' = 5 ft
K' = 1.05 x 10⁻² gpd/ft²
INFLECTION POINT
S_p = 9.95 ft
ΔS_p = 6.15 ft
t_p = 22.7 min
S_m = 19.9 ft
DRAWDOWN (ft)
5
10
15
20
TIME (min)
10
100
1000
10,000

FIGURE 5-7



DRAWDOWN (ft)
5
10
15
1.0
10
100
1000
10,000
TIME (min)
ΔS_p = 5.9 ft
INFLECTION POINT
S_p = 8.25 ft
t_p = 44.0 min
S_m = 16.5 ft
HANTUSH METHOD I
OW 3D
Q = 741 gpm
r = 217 ft
T = 31,300 gpd/ft
S = 2.97 x 10^{-4}
L = 3973 ft
C = 3770 days
b' = 5 ft
K' = 9.9 x 10^{-3} gpd/ft^2

FIGURE 5.8



HANTUSH METHOD II
Average T = 29,460 gpd/ft
c = 792 days
Average S = 2.91 x 10⁻⁴
K' = 4.72 x 10⁻² gpd/ft²
1/20 Δr = 61.9m (203.1 ft)
Δr = 1238m (4061.7 ft)
OW-3D
62.9m
OW-2D
OW-1D
S0=2.02m
1.0m
DISTANCE (m)
0
20
40
60
1
10

81-227.3

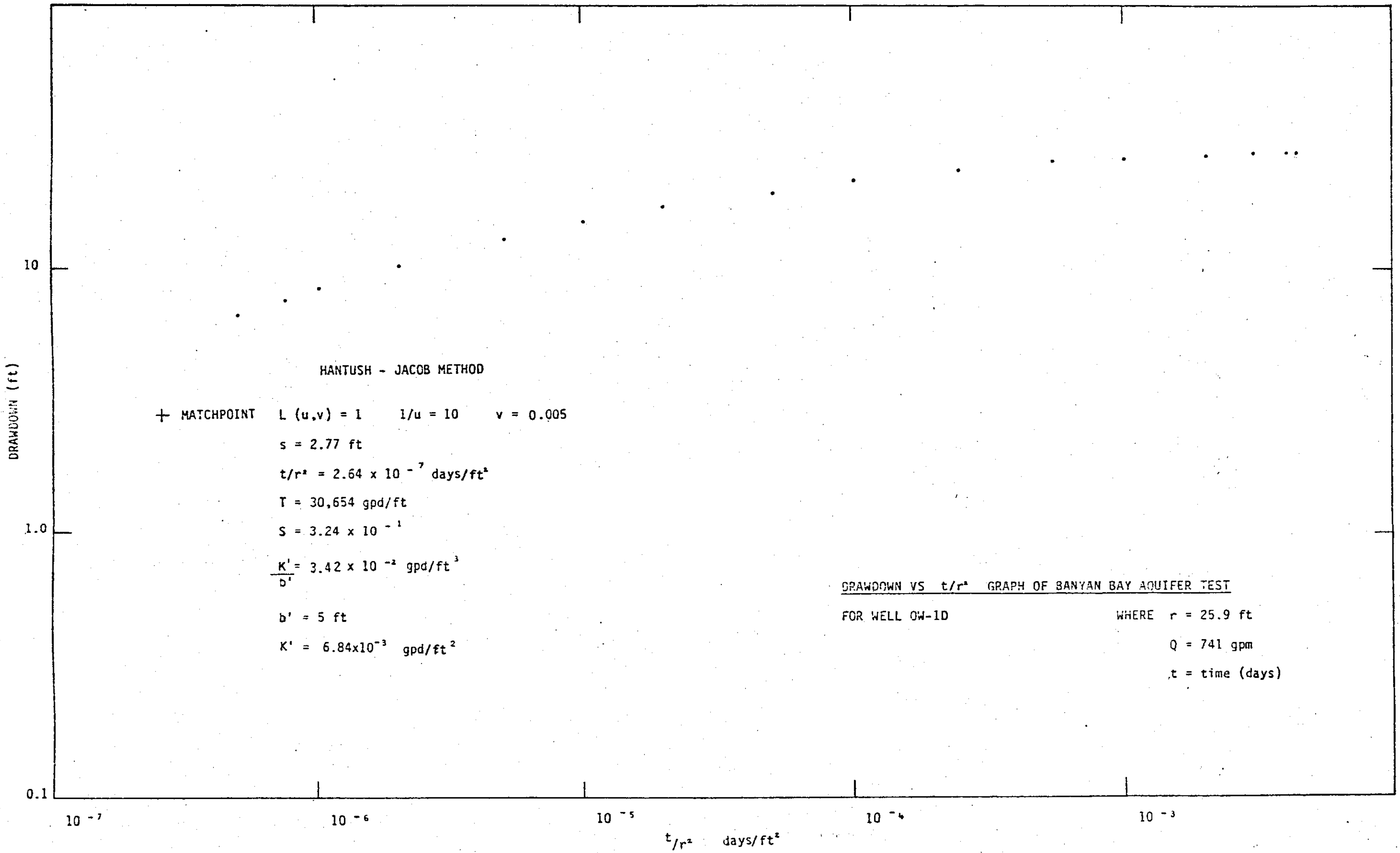


FIGURE 5-10

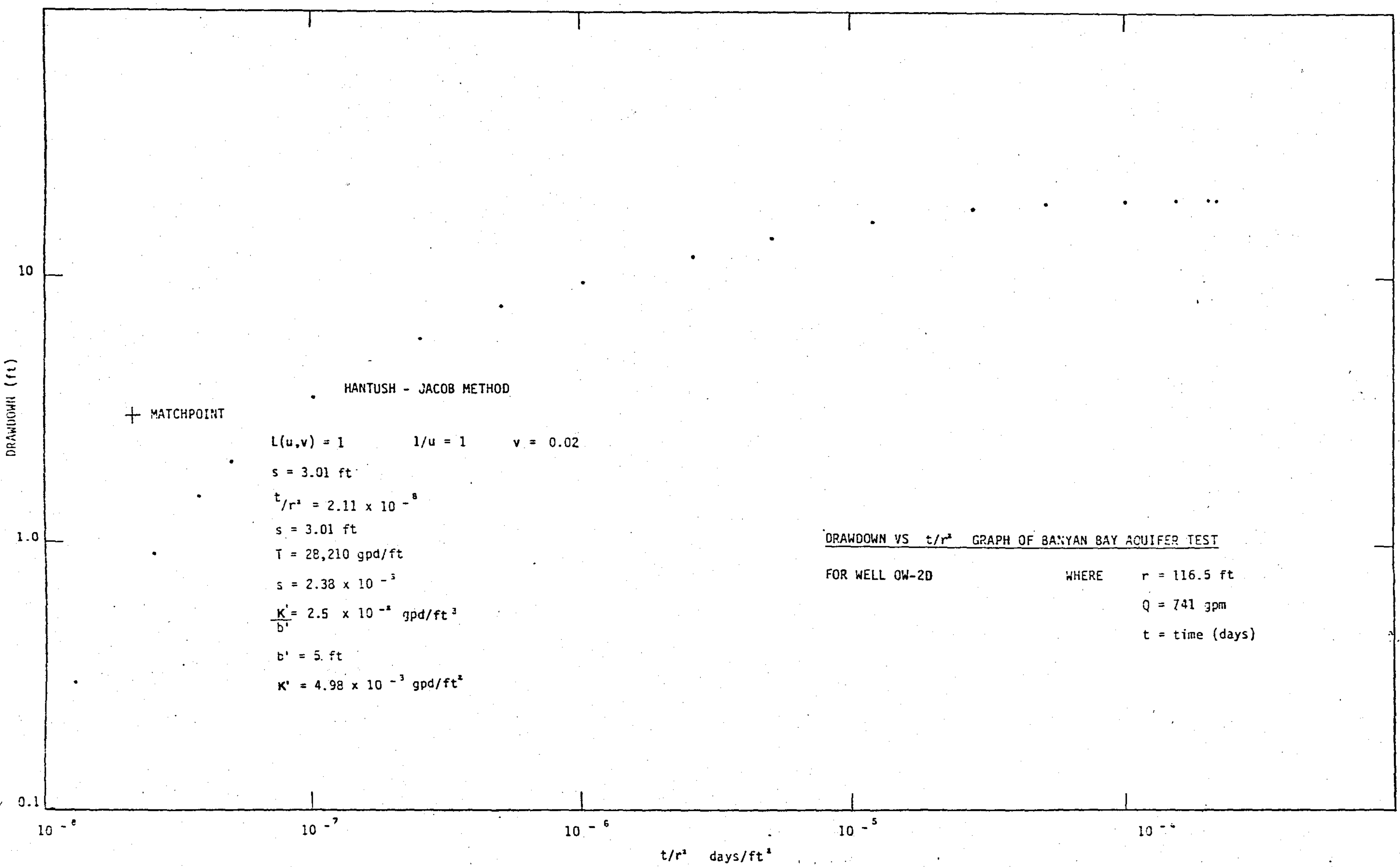

HANTUSH - JACOB METHOD
+ MATCHPOINT
L(u,v) = 1 1/u = 1 v = 0.02
s = 3.01 ft
t/r² = 2.11 x 10⁻⁸
s = 3.01 ft
T = 28,210 gpd/ft
s = 2.38 x 10⁻⁵
K'/b' = 2.5 x 10⁻² gpd/ft³
b' = 5 ft
K' = 4.98 x 10⁻³ gpd/ft²
DRAWDOWN VS t/r² GRAPH OF BANYAN BAY ACUIFER TEST
FOR WELL OW-2D
WHERE r = 116.5 ft
Q = 741 gpm
t = time (days)
DRAWDOWN (ft)
10
1.0
0.1
10⁻⁸
10⁻⁷
10⁻⁶
10⁻⁵
10⁻⁴
t/r² days/ft²

FIGURE 5-11

81-227.3

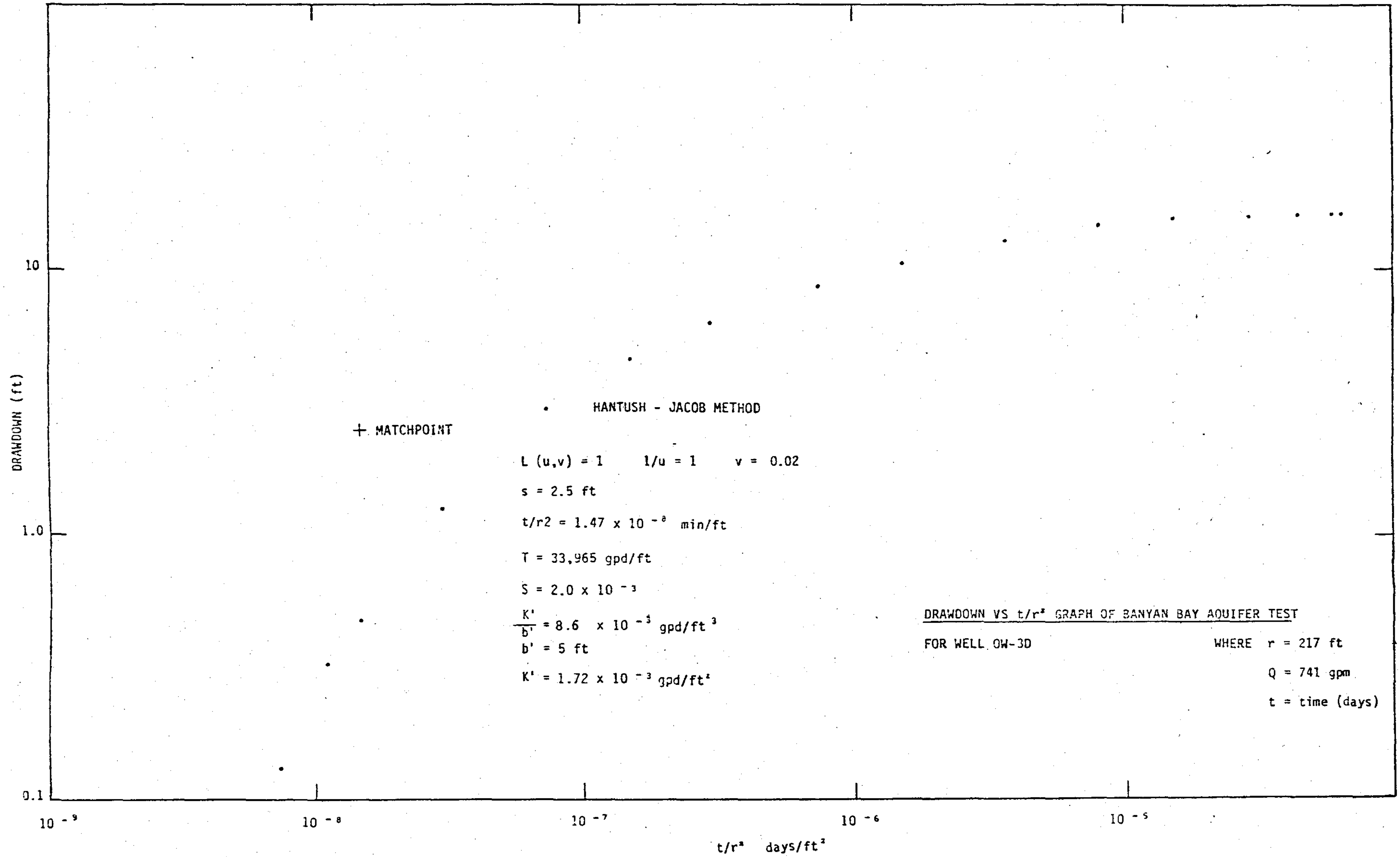
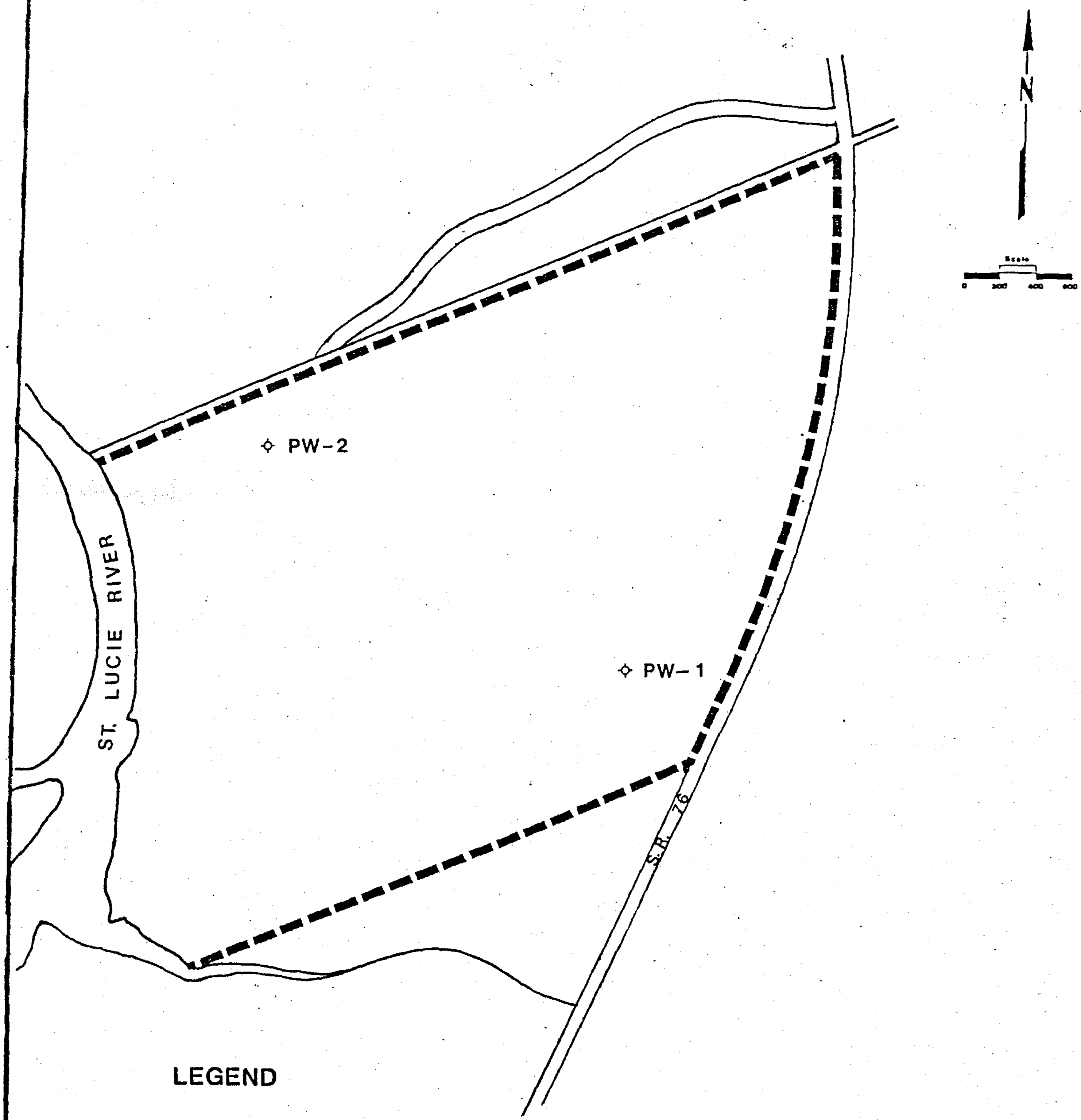


FIGURE 5-12



LEGEND

PW-1
PW-2 PROPOSED SUPPLY WELLS

" " schedule alternate days

263 gpm / 2 = 131.5 gpm / continuous generation

24 HRS/day 365 days/year.

PROPOSED SUPPLY WELL LOCATIONS

FIGURE 5-13

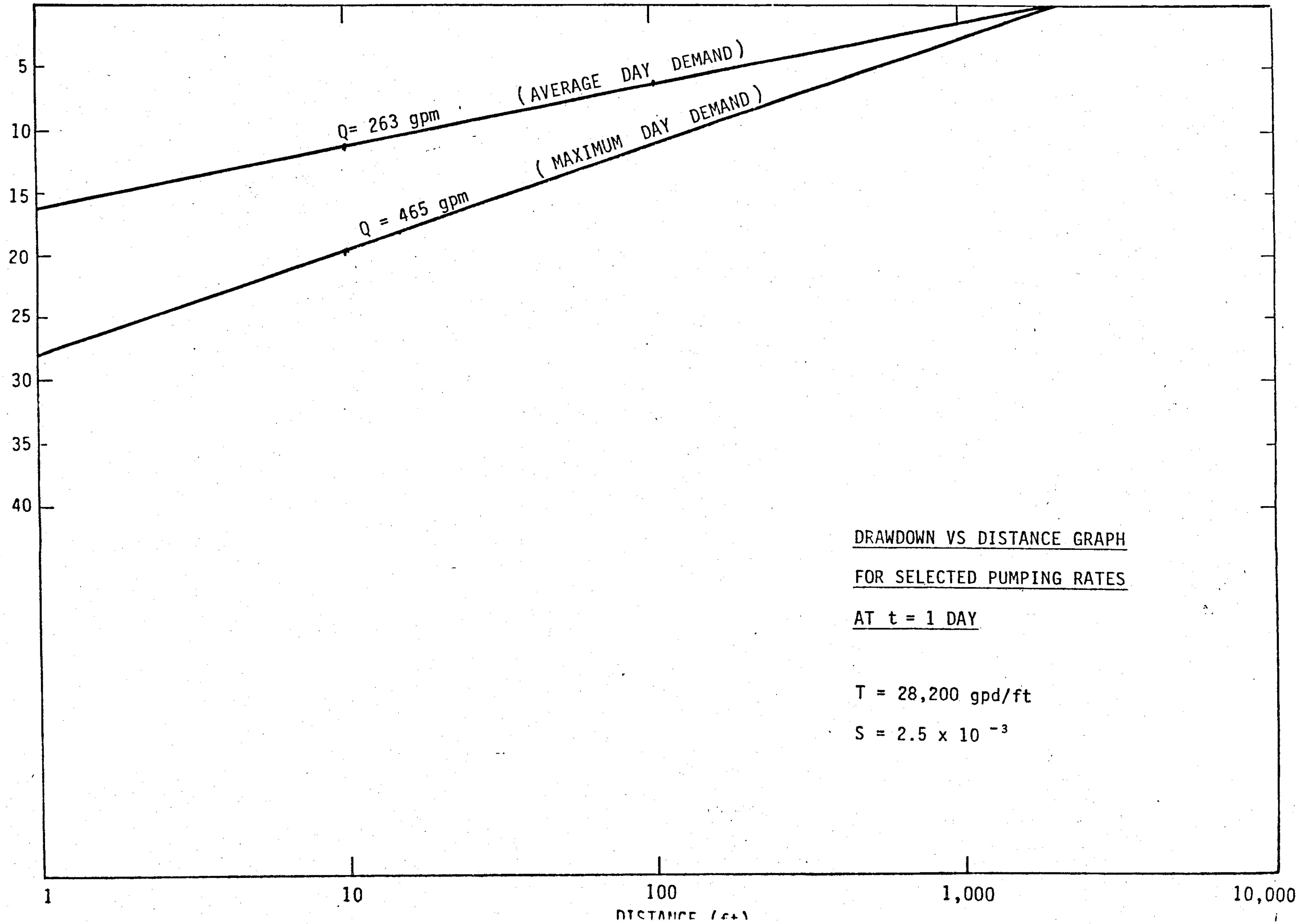
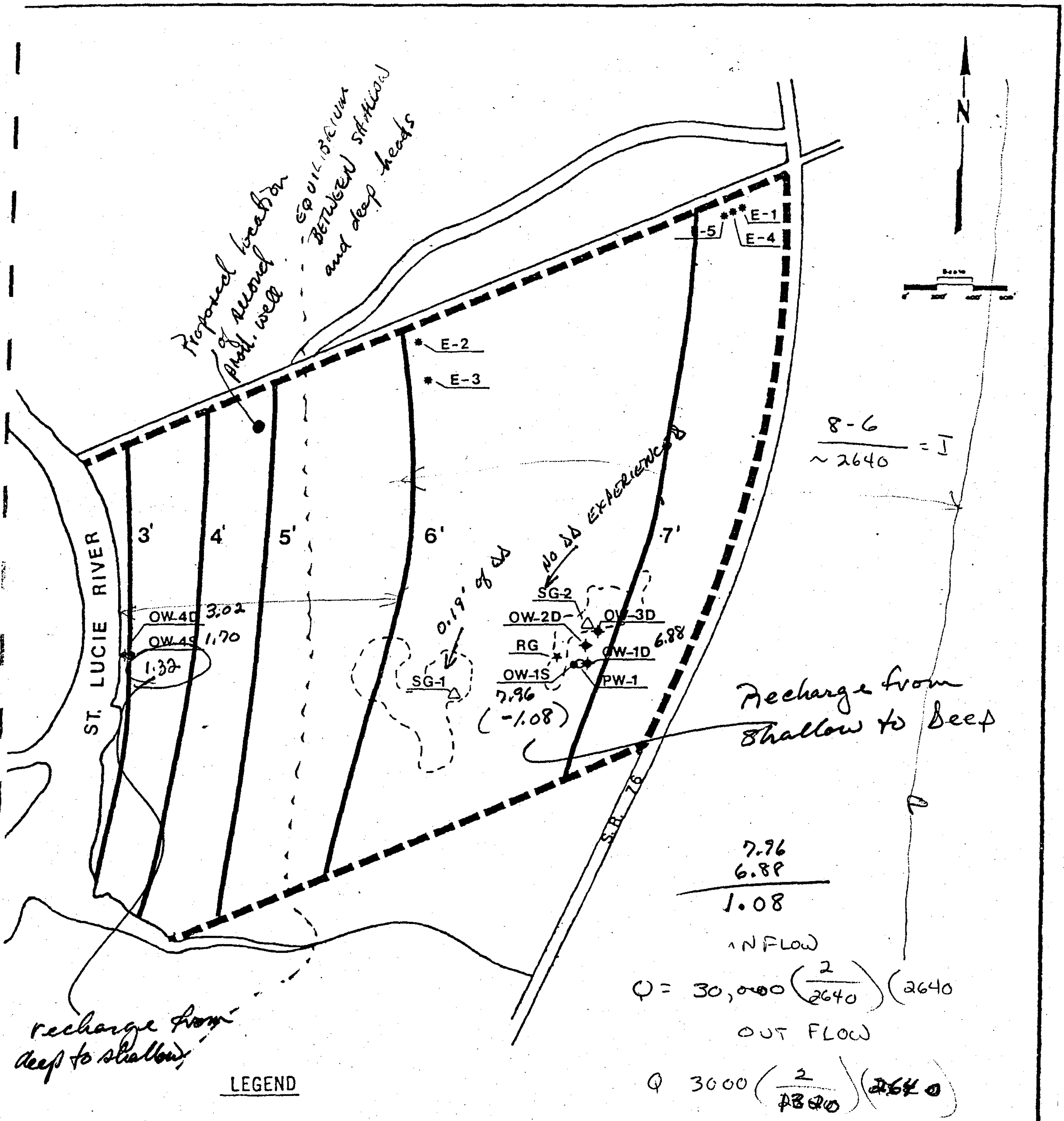

Q= 263 gpm
(AVERAGE DAY DEMAND)
Q = 465 gpm
(MAXIMUM DAY DEMAND)
5
10
15
20
25
30
35
40
DRAWDOWN (ft)
1
10
100
1,000
10,000
DRAWDOWN VS DISTANCE GRAPH
FOR SELECTED PUMPING RATES
AT t = 1 DAY
T = 28,200 gpd/ft
S = 2.5 x 10 ⁻³

FIGURE 6-1



LEGEND

- o PUMPED WELL
- ✦ DEEP OBSERVATION WELL
- • SHALLOW OBSERVATION WELL
- △ STAFF GAGE
- ★ RAIN GAGE
- * EXISTING ON SITE WELL

GROUNDWATER HYDRAULIC GRADIENT IN PRODUCTION ZONE

3/8/82

FIGURE 6-2

TABLES

TABLE 2-1

WELL CONSTRUCTION DATA

BANYAN BAY

Well No.	Ground Elevation (ft)(MSL)	Elevation at m.p. (ft)(MSL)	Diameter (inches)	Total Depth (ft)	Cased Interval (ft)	Screened Interval (ft)	Date Drilled
OW-1S	3.30	3.58	2	20	0-10	10-20	1/26/82
OW-1D	3.30	3.30	2	130	0-60	60-130	1/25/82
OW-2D	11.50	11.75	2	130	0-60	60-130	1/27/82
OW-3D	12.00	12.16	2	130	0-60	60-130	1/28/82
OW-4S	11.80	12.25	2	25	0-10	10-25	1/21/82
OW-4D	10.40	10.79	2	135	0-60	60-135	1/21/82
PW-1	11.30	13.25	12 (inner) 20 (outer)	130	0-60	60-130	2/14/82

TABLE 4-1

WELL INVENTORY - FEBRUARY 27, 1982

BANYAN BAY

Well No.	Depth (ft)	Casing (type)	Diameter (inches)	Lift (Type)	Power (Type)	Use	Water Analysis Chloride (mg/l)	Iron (mg/l)
1	60	Steel	2	Cent	Elec	D & I	26	0.64 ✓
2	80	Steel	2	Cent	Elec	D & I	27	0.98 ✓
3	n/a [1]	Steel	2	Cent	Elec	D & I	27	2.07
4	130-140	Steel	2	Cent	Elec	D & I	38	0.19 ✓
5	n/a	Steel	2	Cent	Elec	D	26	0.20
6	n/a	Steel	2	Cent	Elec	D	25	0.16
7	n/a	Steel	2	Cent	Elec	D	24	0.61
8	n/a	Steel	2	Cent	Elec	D	26	0.09
9	n/a	Steel	2	Cent	Elec	D	23	0.46
10	60-80	Steel	2	Cent	Elec	D	32	0.08 ✓
11	n/a	Steel	2	Cent	Elec	D	23	0.89
12	n/a	Steel	2	Cent	Elec	D	25	1.11
13	No Access					D	(3)	(3)
14	No Access						(3)	(3)
15	n/a	Steel	2	Cent	Elec	D & I	25	4.50
16	40-60	Steel	2.5	Cent	Elec	D & I	24	0.51
17	n/a	Steel	2	Wind	Piston		(3)	(3)
18	No Access						(3)	(3)
19	n/a	Steel	2	Cent	Elec	D & I	17	2.49
20	40-60	Steel	2	Cent	Elec	D	18	4.05
21	n/a	Steel	2	Cent	Elec	D	15	3.97
22	n/a	Steel	2	Cent	Elec	D	26	1.77
23	63	Steel	2	Cent	Elec	I	19	0.25
24	63	Steel	2	Cent	Elec	D	23	0.76
25	n/a	Steel	2	Cent	Elec	D & I	(3)	(3)
26	n/a	Steel	2	Cent	Elec	D	18	1.01
27	n/a	Steel	2	Cent	Elec	D	19	0.41
28	100	Steel	2	Cent	Elec	D	34	1.51 ✓
29	36	Steel	2	Cent	Elec	I	22	0.14
30	36	Steel	2	Cent	Elec	I	19	0.43
31	80	Steel	2	Cent	Elec	I	22	0.40 ✓
32	n/a	Steel	2	Cent	Elec	D	17	4.67
33	n/a	Steel	2	Cent	Elec	I	18	0.91
34	n/a	Steel	2	Cent	Elec	D	(3)	(3)
35	n/a	Steel	2	Cent	Elec	D	(3)	(3)
36	n/a	Steel	2	Cent	Elec	D	21	5.13
37	95	Steel	3	Cent	Elec	D & I	24	0.16 ✓
38	95	Steel	2	Cent	Elec	D	30	0.02 ✓

(1) Not available

(2) D refers to domestic use
I refers to irrigation use

(3) Not able to sample

TABLE 4-2

GROUNDWATER CONDUCTIVITY SURVEYS

AND WATER LEVELS

BANYAN BAY

Well No.	E-1	OW-4D	OW-4D	OW-1D	OW-4D	OW-4S	E-1	E-2	E-3
Date	1-20-82	2-21-82	2-23-82	2-23-82	3-17-82	3-17-82	3-17-82	3-17-82	3-17-82
WL (ft) held	-	2.00	20.00	34.00	1.00	3.00	6.00	6.00	4.00
wet	-	0.13	17.97	0.48	0.26	0.52	1.22	1.96	0.72
below mp	6.00	1.97	2.03	33.52	0.74	2.48	4.78	4.04	3.28
elev of mp, msl (ft)	12.01	3.30	3.30	12.16	3.30	3.58	11.89[2]	-	-
elev of WL, msl (ft)	6.01	1.33	1.27	21.36	2.66	0.90	7.11	-	-
Cased depth (ft)	-	60	60	60	60	10	-	-	-
TOTAL depth (ft)	98.5	135	135	130	135	24.5	98.5	107	123
Conductivity (umhos/cm)									
5 (ft) below mp					440	190	265	220	211
10	320				440	182	272	218	220
15	310				447	174	280	220	222
20	315				450	355*	289	221	225
25	318				456	356	295	224	229
30	319			310	460		300	228	230
35	321			320	460	*Sample	304	229	231
40	322			320	461	depth	310	229	232
45	322			317	463	Cond = 321	310	230	234
50	325	438	441	312	466	Cl[1] = 22	312	230	235
55	325	440	443	314	470		316	231	238
60	329	440	443	510	470		320	232	238
65	348	440	446	520	466		340	232	240
70	349	440	450	530	468		340	234	240
75	350	445	450	530	469		341	236	241
80	350	445	451	530	470		343	238	243
85	351	449	451	530	472		343	239	246
90	351	449	455	530	474		345	240	248
95	373	449	456	530	470		347*	240	249
100		449	459	550	477			241	249
105		449	460	560	480		*Sample	375*	250
110		450	460	570	491		depth		250*
115		500	461	650	790		Cond = 324	*Sample	448
120		690	461	670	920		Cl[1] = 16	depth	448
125		900	610	670	980			Cond = 239	
130		900	730		1,000*			Cl[1] = 39	
135					1,060				*Sample
140									depth
145					*Sample				Cond = 240
150					depth				Cl[1] = 39
155					Cond = 650				
160					Cl[1] = 75				
165									
170									
175									
180									
185									
190									
195									
200									
MEASURED DEPTH (Feet)	98.5	134	134	129	133.5	24.5	98.5	107	123

[1] Chloride concentration in mg/l

[2] mp changed on 2/12/82

TABLE 4-3

CONDUCTIVITY AND TEMPERATURE DATA OF PW-1 DURING

AQUIFER PERFORMANCE TEST

BANYAN BAY

Time (hours)	Conductivity (umhos/cm)	Temperature (°C)
0.42	410 [1]	24.0
1.0	410 [1]	25.5
2.0	410 [1]	24.0
2.5	417 [1]	23.5
3.0	417 [1]	23.5
4.0	417 [1]	23.5
5.0	408 [1]	23.0
6.0	410 [1]	22.5
7.0	410 [1]	22.5
8.0	400 [1]	22.0
9.0	400 [1]	21.5
10.0	406 [1]	22.0
11.0	402 [1]	21.5
12.0	401 [1]	21.0
13.0	402 [1]	21.5
14.0	398 [1]	21.5
15.0	406 [1]	21.5
16.0	405 [1]	21.5
17.0	409 [1]	22.3
18.0	402 [1]	22.2
19.0	421 [1]	23.5
20.0	425 [1]	23.5
21.0	425 [1]	23.4
22.0	450 [1]	23.8
23.0	428 [1]	24.0
24.0	431 [1]	24.0
25.0	423 [1]	24.0
26.0	418 [1]	23.1
27.0	432 [1]	23.1
28.0	410 [1]	22.1
29.0	403 [1]	22.0
30.0	405 [1]	22.0
31.0	408 [1]	21.9
32.0	404 [1]	21.5
33.0	402 [1]	21.2
34.0	401 [1]	21.7
35.0	400 [1]	21.0
36.0	402 [1]	21.1
37.0	398 [1]	21.0
38.0	399 [1]	21.0
39.0	395 [1]	-
40.0	389 [1]	-
41.0	399 [1]	-
42.0	397 [1]	-
43.0	418 [1]	-
44.0	430 [1]	-
45.0	420 [1]	-
46.0	430 [1]	-
47.0	431 [1]	-
48.0	430 [1]	-
49.0	430 [1]	-
50.0	410 [1]	-
51.0	403 [1]	-
52.0	470/400 [2]	-
53.0	470/400 [2]	-
54.0	480/405 [2]	-
55.0	480/400 [2]	-
56.0	470/395 [2]	-
57.0	470/400 [2]	-
58.0	470/390 [2]	-
59.0	470/400 [2]	-
60.0	470/400 [2]	-
61.0	460/380 [2]	-
62.0	470/390 [2]	-
63.0	460/390 [2]	-
64.0	440/380 [2]	-
65.0	480/410 [3]	-
66.0	485 [3]	-
67.0	485 [3]	-
68.0	500 [3]	-
69.0	510 [3]	-
70.0	510 [3]	-
71.0	510 [3]	-
72.0	502 [3]	-

[1] YSI Model 33 conductivity meter x1 scale

[2] YSI Model 33 conductivity meter x10/x1 scale

[3] Beckman Model RB3-338 conductivity meter (Beckman Meter = x10 scale of the YSI Meter)

TABLE 4-4

POTABLE GROUNDWATER QUALITY OF PW-1

BANYAN BAY

Sampled after 1 hour and 72 hours of pumping at a rate of 741 gpm

Parameter	Units	2-20-82 1 hour	2-23-82 72 hours
Conductivity	umhos/cm	410	432
Temperature	°C	25.5	24
pH	-	7.5	7.2
pHs	-	7.1	7.1
Color	PCU	20	25
Turbidity	JTU	0.42	0.98
Odor	TON	1	1
Hardness as $CaCO_3$	mg/l	248	250
Alkalinity as $CaCO_3$	mg/l	231	228
Non-carbonate hardness as $CaCO_3$	mg/l	17	22
Bicarbonate as $CaCO_3$	mg/l	231	228
Bicarbonate as HCO_3	mg/l	282	278
Carbonate as $CaCO_3$	mg/l	0.0	0.0
Hydroxide as $CaCO_3$	mg/l	0.0	0.0
Calcium as Ca	mg/l	92	92
Magnesium as Mg	mg/l	4.4	4.9
Carbon Dioxide as CO_2	mg/l	218	229
Fluoride as F	mg/l	0.11	0.11
Chloride as Cl	mg/l	26	25
Sulphate as SO_4	mg/l	<5	<5
Total dissolved solids	mg/l	320	312
Stability index	-	6.7	7.0
Saturation index	-	0.4	0.1
Hydrogen Sulfide as H_2S	mg/l	(1)	0.23
Iron as Fe	mg/l	(1)	0.64
Copper as Cu	mg/l	(1)	0.002
Manganese as Mn	mg/l	(1)	0.029
Zinc as Zn	mg/l	(1)	0.002
Nitrate nitrogen as N	mg/l	(1)	<0.1
Foaming agents	mg/l	0.11	1.00
Arsenic as Ar	mg/l	(1)	<0.01

TABLE 4-4 (continued)

POTABLE GROUNDWATER QUALITY OF PW-1

BANYAN BAY

Parameter	Units	2-20-82 1 hour	2-23-82 72 hours
Barium as Ba	mg/l	(1)	<0.1
Cadmium as Cd	mg/l	(1)	<0.01
Chromium as Cr	mg/l	(1)	<0.01
Lead as Pb	mg/l	(1)	<0.01
Mercury as Hg	mg/l	(1)	<0.001
Selenium as Se	mg/l	(1)	<0.01
Silver as Ag	mg/l	(1)	<0.01
Endrin	ug/l	(1)	<0.1
Lindane	ug/l	(1)	<0.1
Methoxychlor	ug/l	(1)	<1.0
Toxaphene	ug/l	(1)	<1.0
2,4-D	ug/l	(1)	<1.0
2,4,5-TP, Silvex	ug/l	(1)	<1.0
Gross alpha	pCi/l	(1)	(2)
Radium 226	pCi/l	(1)	(2)

(1) Not Sampled

(2) Presently being analyzed

Umhos/cm = micromhos per centimeter

^{o}C = degrees centigrade
mg/l = miligrams per liter
PCU = Platinum Cobalt Units
JTU = Jackson Turbidity Units
TON = Threshold Odor Number
ug/l = micrograms per liter
pCi/l = picoCuries per liter

Analyzed by Environmental Services Inc., West Palm Beach, Florida

TABLE 5-1

SUMMARY OF AQUIFER PARAMETERS

BANYAN BAY

		Transmissivity (gpd/ft)	Storage	Leakance [2] (gpd/ft²)
Jacob Method				
Method I				
OW-1D		29,600	$5.06x10^{-4}$	-
OW-2D		31,800	$2.68x10^{-4}$	-
OW-3D		33,200	$2.57x10^{-4}$	-
	Average	31,500	$3.44x10^{-4}$	
Method II [1]		28,200	$2.50x10^{-3}$	-
Hantush Method				
Method I				
OW-1D		29,300	$5.38x10^{-4}$	$2.49x10^{-2}$
OW-2D		30,800	$2.91x10^{-4}$	$1.05x10^{-2}$
OW-3D		31,300	$2.97x10^{-4}$	$9.90x10^{-3}$
	Average	30,500	$3.75x10^{-4}$	$4.5x10^{-2}$
Method II [1]		29,500	$2.91x10^{-4}$	$4.72x10^{-2}$
Hantush - Jacob Method				
OW-1D		30,700	$3.24x10^{-1}$	$6.84x10^{-3}$
OW-2D		28,200	$2.38x10^{-3}$	$4.98x10^{-3}$
OW-3D		34,000	$2.00x10^{-3}$	$1.72x10^{-3}$
	Average	31,000	$1.10x10^{-1}$	$4.52x10^{-3}$
Average of all methods:		30,140	$2.3x10^{-2}$	$3.22x10^{-2}$

(1) Wells OW-1D, OW-2D and OW-3D were used to calculate the aquifer parameters.

(2) Hydraulic conductivity of the upper confining layer

TABLE 5-2

POTABLE AND NON-POTABLE WATER USE PROJECTIONS (MGD) AND SUPPLY SOURCES

BANYAN BAY

		1	2	3	4	5	6	7
Phase	Year	Average Day Available Water[1]	Average Day Potable Demand[2]	Non-Potable Irrigation Demand (Excluding Golf Course)	Excess Groundwater Capacity Available for Irrigation	Total Golf Course Irrigation Demand	Make-up Water Needed[3] (Groundwater)	Additional Make-up Required[4] (Surface Water)
I	1	0.379	0.038	0.011	0.330	0.134	0.096	0.000
	2	0.379	0.073	0.022	0.284	0.134	0.061	0.000
	3	0.379	0.107	0.032	0.240	0.134	0.027	0.000
	4	0.379	0.142	0.043	0.194	0.134	0.000	0.000
II	5	0.379	0.179	0.054	0.146	0.287	0.108	0.000
	6	0.379	0.217	0.065	0.097	0.287	0.070	0.029
	7	0.379	0.255	0.077	0.047	0.287	0.032	0.000
	8	0.379	0.292	0.088	0.000	0.287	0.000	0.000

1 Based upon average day potable demand at build-out.

2 Same as effluent available for irrigation (excluding non-potable uses).

3 Golf course irrigation demand in excess of available effluent (column 5 minus column 2 equals column 6), make-up water to be supplied by potable supply wells.

4 Demand in excess of available potable groundwater supply to be supplied from on-site lake.

TABLE 6-1

DISTANCE - DRAWDOWN

CALCULATIONS

BANYAN BAY

T = 28,200 gpd/ft
$S = 2.5 \times 10^{-3}$
Q= 263 gpm

	r = 25.9 ft	r = 116.5 ft	r = 217 ft	r = 500 ft	r = 1000 ft	r = 2000 ft	r = 2600 ft
t = 1 day	$u = 1.112 \times 10^{-4}$ W(u) = 8.5270 s= 9.11 ft	$u = 2.250 \times 10^{-3}$ W(u) = 5.5219 s= 5.90 ft	$u = 7.806 \times 10^{-3}$ W(u) = 4.2834 s= 4.58 ft	$u = 4.145 \times 10^{-2}$ W(u) = 2.6472 s= 2.83 ft	$u = 1.658 \times 10^{-1}$ W(u) = 1.3790 s= 1.47 ft	$u = 6.631 \times 10^{-1}$ W(u) = 0.4012 s= 0.43 ft	u= 1.121 W(u) = 0.1798 s= 0.19 ft
t = 3 days	$u = 3.707 \times 10^{-5}$ W(u) = 9.6256 s= 10.29 ft	$u = 7.500 \times 10^{-4}$ W(u) = 6.6190 s= 7.07 ft	$u = 2.602 \times 10^{-3}$ W(u) = 5.3768 s= 5.75 ft	$u = 1.382 \times 10^{-2}$ W(u) = 3.7186 s= 3.97 ft	$u = 5.526 \times 10^{-2}$ W(u) = 2.3730 s= 2.54 ft	$u = 2.210 \times 10^{-1}$ W(u) = 1.1416 s= 1.22 ft	$u = 3.736 \times 10^{-1}$ W(u) = 0.7489 s= 0.80 ft
t = 10 days	$u = 1.112 \times 10^{-5}$ W(u) = 10.8295 s= 11.57 ft	$u = 2.250 \times 10^{-4}$ W(u) = 7.8224 s= 8.36 ft	$u = 7.806 \times 10^{-4}$ W(u) = 6.5790 s= 7.03 ft	$u = 4.145 \times 10^{-3}$ W(u) = 4.9129 s= 5.25 ft	$u = 1.658 \times 10^{-2}$ W(u) = 3.5390 s= 3.78 ft	$u = 6.631 \times 10^{-2}$ W(u) = 2.2014 s= 2.35 ft	$u = 1.12 \times 10^{-1}$ W(u) = 1.7205 s= 1.84 ft
t = 30 days	$u = 3.707 \times 10^{-6}$ W(u) = 11.9281 s= 12.75 ft	$u = 7.500 \times 10^{-5}$ W(u) = 8.9209 s= 9.53 ft	$u = 2.602 \times 10^{-4}$ W(u) = 7.6771 s= 8.21 ft	$u = 1.382 \times 10^{-3}$ W(u) = 6.0088 s= 6.42 ft	$u = 5.526 \times 10^{-3}$ W(u) = 4.6266 s= 4.94 ft	$u = 2.210 \times 10^{-3}$ W(u) = 3.2568 s= 3.48 ft	$u = 3.736 \times 10^{-2}$ W(u) = 2.7471 s= 2.94 ft

TABLE 6-2

GROUNDWATER LEVELS (IN FEET, BELOW lsd)

BANYAN BAY

Well No.	1982 - Date measured 2-17	2-18	2-19	2-20	2-21[1]	2-22[1]	2-23[1]	2-26	3-3	3-4	3-5	3-8
Unit 7 Water Levels												
PW-1	5.57	-	5.63	5.50	44.15	44.98	45.00	5.69	5.65	5.69	5.24	4.59
OW-1D			4.84	6.41	32.64	33.31	33.27	6.29	6.18	6.23	5.77	5.12
OW-2D				6.13	25.18	25.79	25.89	6.00	5.92	5.96	5.51	4.86
OW-3D	4.60			4.68	20.15	20.74	20.84	4.58	4.59	4.53	4.07	3.43
OW-4D				-	1.97	-	2.03	1.12	1.00	1.15	0.70	0.28
E-1				3.99	4.02	4.3	4.37	3.36	3.26	3.42	2.70	2.03
E-2											2.15	1.78
E-3											-	0.78
E-4											-	4.12
E-5											4.14	4.14
Unit 3 Water Levels												
OW-1S				4.70	5.74	6.22	6.42	4.85	4.78	4.80	4.25	3.54
OW-4S				-	-	-	-	2.14	2.38	2.33	2.14	1.60
Unit 1 Water Levels												
WT-1								1.48	-	-	0.60	0.65
WT-2[3]									+0.95 / +0.90	+0.62[2] / +0.87	+0.77[2] / +1.23	+0.85 / +0.85
WT-3[3]									+0.32 / +0.32	+0.30 / +0.30	+0.84 / +0.84	+0.92 / +0.92
WT-4[3]									1.5 / 0.0	1.24 / 0.0	+0.30 / +0.30	-
WT-5[3]									+1.35[2] / +1.12	+1.5[2] / +1.1	-	+0.84[2] / +1.38
WT-6[3]									0.62 / 0.0	0.64 / 0.0	-	+0.49 / +0.49
WT-7									0.44 / 0.0	0.27 / 0.0	-	-
WT-8									-	>2.50	1.32	0.77
WT-9								2.33	-	-	-	-
Surface Water Levels												
SG-1[4]	3.99	4.04	4.04	4.02	4.02	-	4.00	3.94	-	3.86	4.14	4.90
SG-2[4]	-	-	-	0.53	0.50	0.40	0.35	-	-	-	-	-

[1] Water levels at 0800 hrs during Aquifer Performance Test

[2] Well plugged, replaced on 3-8-82

[3] +0.95 groundwater level
+0.90 surface water level

[4] Water levels from SG-1 and SG-2 are surface water levels not related to level below lsd.

Note: Miles Grant Rainfall 3/5/82 1.5 inches
3/8/82 2.6 inches

TABLE 6-3

GROUNDWATER LEVELS (IN FEET, MSL)

BANYAN BAY

1982 - Date measured

Well No.	2-17	2-18	2-19	2-20	2-21	2-22	2-23	2-26	3-3	3-4	3-5	3-8
Unit 7 Water Levels												
PW-1	5.73	-	5.67	5.80	-32.85	-33.68	-33.70	5.61	5.65	5.61	6.06	6.71
OW-1D			7.16	4.59	-20.64	-21.31	-21.27	5.71	5.82	5.77	6.23	6.88
OW-2D				5.67	-13.38	-13.99	-14.09	5.80	5.88	5.84	6.29	6.94
OW-3D	5.80			5.72	-9.75	-10.34	-10.44	5.82	5.81	5.87	6.33	6.97
OW-4D					1.33		1.27	2.18	2.30	2.15	2.60	3.02
E-1					5.78	5.50	5.43	6.44	6.54	6.38	7.10	7.77
Unit 3 Water Levels												
OW-1S				6.80	5.76	5.28	5.08	6.65	6.72	6.70	7.25	7.96
OW-4S								1.16	0.92	0.97	1.16	1.70
Unit 1 Water Levels												
WT-1								8.92			9.80	9.75
WT-8										<1.08	1.98	2.53
WT-9								9.17				

NOTE: Miles Grant rainfall 3-5-82 1.5 inches
3-8-82 2.6 inches

3.02 − 1.70 = 1.32
2.53 − 1.70 = 1.23
WT 9 9.75 ; OW 1S 7.96 ; OW 1D 6.88 — 1.99, 1.08
9.75 − 6.88 = 2.87
OW 4D 3.02
OW 4S 1.70
WT 8 2.53

TABLE 6-4

SURFACE WATER LEVEL DATA

DURING THE AQUIFER PERFORMANCE TEST

BANYAN BAY

DD in OW 15 was 1.81'

Date	Time	SG-1(ft.)	SG-2(ft.)
2/17/82	--	3.99	--
2/18/82	--	4.04	--
2/19/82	--	4.04	--
2/20/82	1330	4.02	0.53 - 0.34 = .19'
	1530	--	0.53
	2100	4.02	--
	2400	--	0.53
2/21/82	0400	--	0.49
	0600	--	0.48
	0700	--	0.48
	0800	--	0.48
	0900	--	0.48
	1000	--	0.48
	1100	--	0.48
	1200	--	0.48
	1300	--	0.48
	1400	--	0.48
	1500	4.02	0.48
2/22/82	1100	--	0.42
	1300	--	0.40
	1900	--	0.40
	2000	--	0.39
	2100	--	0.39
	2200	--	0.39
	2300	--	0.39
	2400	--	0.38
2/23/82	0100	--	0.38
	0200	--	0.38
	0300	--	0.38
	0400	--	0.38
	0500	--	0.38
	0600	--	0.38
	0700	--	0.37
	0800	--	0.37
	0900	4.00	0.37
	1000	--	0.37
	1100	--	0.36
	1200	--	0.36
	1300	--	0.36
	1400	--	--
	1500	--	0.35
	1600	--	0.34
2/26/82	--	3.94	--
3/4/82	--	3.86	--
3/5/82	--	4.14	--
3/8/82	--	4.90	--

APT STARTED 3.10 PM 2/20/82

LIST OF REFERENCES

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APPENDICES

APPENDIX A

LITHOLOGY DESCRIPTIONS

WELL CONSTRUCTION

Well No. PW-1

Driller: Drilling Services

Samples: Cuttings x , Core

Casing: Depth 0 - 60 ft

Diameter 12 in (inner)/20 in (outer)

Material Schedule 40 PVC/steel

Location: Banyan Bay

Recorded by: GR

Date Drilled: 2/9/82, 2/19/82

Screen: Depth 60 - 130 ft

Diameter 12 in

Material 80 slot stainless steel

DEPTH BELOW LAND SURFACE (FEET)	LITHOLOGY DESCRIPTION
0 - 5	Sand - silica, light brown, medium to fine grained, unconsolidated
5 - 10	Clayey Sand - silica, brown, medium to very fine grained, unconsolidated with clays, silty and organic debris
10 - 30	Sand - silica, light gray, medium to very fine grained, unconsolidated
30 - 35	Sand and shell - sand - silica, light gray, medium to fine grained, unconsolidated with shell fragments
35 - 55	Sandy shell - dark gray cemented sand and shell fragments in a carbonate matrix with unconsolidated silica sand, gray, fine grained shell fragments
55 - 65	Limestone - dark gray to black, well lithified with lenses of light gray to calcareous clay, unconsolidated silica sand
65 - 130	Same as above with abundant unconsolidated very light gray shell fragments

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

WELL CONSTRUCTION

Well No. OW-1D

Location: Banyan Bay

Driller: McKwen rilling

Recorded by: BS

Samples: Cuttings x , Core

Date Drilled: 1/22/82, 1/25/82

Casing: Depth 0 - 60 ft

Diameter 2 in

Material PVC

Screen: Depth 60 - 130 ft

Diameter 2 in

Material PVC

DEPTH BELOW LAND SURFACE (FEET)	LITHOLOGY DESCRIPTION
130 - 145	Limestone - light green, friable with unconsolidated silica sand, gray, fine grained and trace of clays, greenish
145 - 160	Limestone - as from 130 - 145 ft with light gray to greenish clay, with increase in green color with depth

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

WELL CONSTRUCTION

Well No. OW-3D

Driller: McKwen Drilling

Samples: Cuttings x , Core

Casing: Depth 0 - 60 ft

Diameter 2 in

Material PVC

Location: Banyan Bay

Recorded by: BS

Date Drilled: 1/27/82

Screen: Depth 60 - 130 ft

Diameter 2 in

Material PVC

DEPTH BELOW LAND SURFACE (FEET)	LITHOLOGY DESCRIPTION
0 - 5	Sand - silica - light gray to tan, medium to fine grained, unconsolidated with heavy organic debris
5 - 10	Clayey Sand - silica, light gray to tan, medium to fine grained, unconsolidated with trace of light gray clays at 6.5 ft
10 - 20	Sand - silica, light gray to tan, medium to fine grained, unconsolidated
20 - 25	Sand - silica, tan to light gray, medium to fine grained with grains of brown throughout - maybe just brown silica sand
25 - 30	Clayey Sand - sand - silica, light gray to gray, medium to fine grained, unconsolidated
	Clays - greenish brown, silty
30 - 35	Sand - silica, light gray to gray, unconsolidated with small amount clays, silty, greenish brown and small shell fragments, white to black
35 - 55	Sand and Shell - Sand - silica, light gray to gray, medium to fine grained with abundant shell fragments
55 - 60	Sandy Clay - silica, gray to dark gray, fine grained, unconsolidated shell fragments
	Clays - green, silty with balls of white calcareous clay occuring infrequently throughout

WELL CONSTRUCTION

Well No. OW-4D

Location: Banyan Bay

Driller: Drilling Services Inc

Recorded by: SN/JF

Samples: Cuttings x , Core

Date Drilled: 1/20/82

Casing: Depth 0 - 60 ft

Diameter 2 in

Material PVC

Screen: Depth 0 - 135 ft

Diameter 2 in

Material PVC

DEPTH BELOW LAND SURFACE (FEET)	LITHOLOGY DESCRIPTION
0 - 5	Sand - silica, light brown, very fine to fine grained, unconsolidated, somewhat clayey
5 - 15	Sandy silt - silica, grayish brown, fine to medium grained silica sand and silt, unconsolidated with light gray calcareous clay and minor heavy metals
15 - 20	Sand - silica, brown, fine to medium grained, unconsolidated, iron stains on grains
20 - 25	Marl - dark greenish black, organic silts with unconsolidated fine grained silica sand, silt and a trace of clay
25 - 35	Shell - white to black, unconsolidated (pelecypods - tellina sp. - cardium sp.) with 50% very fine grained, carbonate and silica sand, dark gray to black unconsolidated, trace of light gray, calcareous clay
35 - 60	Sandy clay - light gray, calcareous, unconsolidated with fine silica sand and shell fragments, picking up dark gray limestone between 55 and 60 feet.
60 - 65	Limestone - dark gray to black, cemented silica sand and shell fragments in a carbonate matrix with unconsolidated dark gray, fine grained silica sand and shell fragments

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

WELL CONSTRUCTION

Well No. OW-4S

Driller: Drilling Services, Inc.

Samples: Cuttings x, Core

Casing: Depth 0 - 10 ft

Diameter 2 in

Material PVC

Location: Banyan Bay

Recorded by: BS

Date Drilled: 1/21/82

Screen: Depth 0 - 25 ft

Diameter 2 in

Material PVC

DEPTH BELOW LAND SURFACE (FEET)	LITHOLOGY DESCRIPTION
0 - 5	Silty Sand - greenish brown, poorly consolidated to consolidated, high organic content, very fine grained, silica sand, somewhat clayey
5 - 15	Sandy silt - grayish brown, very clayey, consolidated, somewhat plastic
15 - 20	Sand - silica, brown, fine to medium grained, iron stained, unconsolidated
20 - 25	Marl - dark greenish black, organic silts with very fine silica sand and silt, unconsolidated, somewhat clayey

APPENDIX B

AQUIFER PERFORMANCE TEST

AND

SPECIFIC CAPACITY TEST

DATA

AQUIFER

PERFORMANCE

TEST DATA

MANOMETER READINGS

PROJECT No. 81-227.3 LOCATION Banyan Bay

METHOD OF MEASURING 10" x 6" Orifice AVERAGE DISCHARGE 741 GPM

STARTING DATE OF TEST 2/20/82

Time (hr)	Time (min)	Inches	Discharge (gpm)	Staff Gage (ft)	Temp (oC)	Cond. (umhos/cm)	Measured by	Remarks
	.5	27.5	741				SN	
	1	28.0	747					
	1.5	27.5	741					
	2	27.5	741					
	2.5	27.5	741					
	3.0	27.5	734					adjusting valve
	3.5	27.0	734					
	4.0	27.5	741					
	4.5	28.0	747					adjust valve
	5.0	27.5	741					
	6	27.5	741					
	7	27.5	741					
	8	27.0	734					adjusting valve
	9	27.0	734					
	10	27.5	741		24.0	410	SN	Conductivity measured with a 1/SI 33 (x) Scale
	12	27.0	734					adjusting valve
	14	28.0	747					
	16	27.5	741					
	18	27.5	741					
	20	27.5	741					
	25	27.5	741					
	30	27.5	741					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS,INC.

MANOMETER READINGS

PROJECT No. 81-227.3 LOCATION Banyan Bay

METHOD OF MEASURING 10" X 6" Orifice AVERAGE DISCHARGE 741 GPM

STARTING DATE OF TEST 2/20/82

Time (hr)	Time (min)	Inches	Dis-charge (gpm)	Staff Gage (ft)	Temp (oC)	Cond. (umhos/cm)	Mea-sured by	Remarks
14	840	27.5	741		21.5	398	RW	
15	900	27.5	741		21.5	406	JF	
16	960	27.5	741		21.5	405		
17	1020	27.5	741		22.3	409		
18	1080	27.0	734		22.2	402		Open valve 1 turn to adjust to 27.5
19	1140	27.25	738		23.5	421		Open valve 2 inches
20	1200	27.5	741		23.5	425		
21	1260	27.5	741		23.4	425		
22	1320	27.5	741		23.8	450		
23	1380	27.5	741		24.0	428		
24	1440	27.75	744		24.0	431		Adjust rpms 1775 again to 1750
25	1500	27.75	744		24.0	423	JF	Adjust to 1745
26	1560	27.25	738		23.1	418	JF/BB	Adjust rpm 1750
27	1620	27.50	741		23.1	432	BB	
28	1680	27.50	741		22.1	410	BB	
29	1740	27.25	738		22.0	403		Adjust rpm 1790
30	1800	27.50	741		22.0	405		
31	1860	27.25	738		21.9	408		Adjust rpm to 1800
32	1920	27.50	741		21.5	404	BB	
33	1980	27.50	741		21.2	402		
34	2040	27.50	741		21.7	401		
35	2100	27.50	741		21.0	400		

MANOMETER READINGS

PROJECT No. 81-227.3 LOCATION Banyan Bay

METHOD OF MEASURING 10" X 6" Orifice AVERAGE DISCHARGE 741 GPM

STARTING DATE OF TEST 2/20/82

Time (hr)	Time (min)	Inches	Dis-charge (gpm)	Staff Gage (ft)	Temp (oC)	Cond. (umhos/cm)	Mea-sured by	Remarks
58	3480	27.75	744			470/390	GR	
59	3540	28.50	741			470/400		
60	3600	27.50	741			470/400		
61	3660	27.50	741			460/380		
62	3720	27.50	741			470/390		
63	3780	27.50	741			460/390		
64	3840	27.50	741			440/380		
65	3900	27.25	738			480/410		
66	3960	27.50	741			485*		*Beckman Cond. Mtr.
67	4020	27.25	738			485*		
68	4080	27.25	738			500*		
69	4140	27.50	741			510*		
70	4200	27.50	741			510*		
71	4260	27.50	741			510*	SN	
72	4320	27.50	741			502*	SN	Took water quality sample for complete potable analysis

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

Well No. PW-1

Project Banyan Bay 81-227.3 Starting date of Test 2-20-82

Time (hr)	Time (min)	Water Level (ft.) Held	Water Level (ft.) Wet	Water Level (ft.) Below MP	Draw-Down (ft)	Mea-sured by	Adjustments De-water-ing	Adjustments Back-ground Levels		Remarks
	3.00			31.08	23.33					
	3.25			-	-					
	3.50			31.94	24.19					
	3.75			-	-					
	4.00			32.24	24.49					
	4.25			-	-					
	4.50			32.54	24.79					
	4.75			-	-					
	5			32.82	25.07					
	6			33.37	25.62					
	7			33.77	26.02					
	8			31.15	23.40					
	9			34.48	26.73					
	10			34.75	27.00					
	12			35.47	27.72					
	14			36.00	28.25					
	16			36.25	28.50					
	18			36.54	28.79					
	20			36.84	29.09					
	25			37.44	29.69					
	30			38.03	30.28					
	35			38.31	30.56					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

Well No. PW-1

Project Banyan Bay 81-227.3 Starting date of Test 2-20-82

Time (hr)	Time (min)	Water Level (ft.) Held	Wet	Below MP	Draw-Down (ft)	Mea-sured by	Adjustments De-watering	Back-ground Levels		Remarks
15	900	47.00	0.95	46.05	38.34	JF				
16	960	47.00	0.87	46.13	38.42					
17	1020	47.00	0.90	46.10	38.39					
18	1080	47.00	0.85	46.15	38.44					
19	1140	47.00	0.73	46.27	38.56					
20	1200	47.00	0.59	46.41	38.70					
21	1260	47.00	0.56	46.44	38.73					
22	1320	47.00	0.57	46.43	38.72					
23	1380	47.00	0.55	46.45	38.74					
24	1440	48.00	1.37	46.63	38.92					
25	1500	48.00	1.40	46.60	38.89					
26	1560	48.00	1.68	46.32	38.61	JF/BB				
27	1620	48.00	1.60	46.40	38.69	BB				
28	1680	48.00	1.66	46.34	38.63					
29	1740	48.00	1.66	46.34	38.63					
30	1800	48.00	1.60	46.40	38.69					
31	1860	48.00	1.66	46.34	38.63					
32	1920	48.00	1.41	46.59	38.88					
33	1980	48.00	1.38	46.62	38.91					
34	2040	48.00	1.26	46.74	39.03					
35	2100	48.00	1.21	46.79	39.08					
36	2160	48.00	1.38	46.62	38.91					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS,INC.

RECORD OF WATER LEVELS

Well No. PW-1

Project Banyan Bay 81-227.3 Starting date of Test 2-20-82

Time (hr)	Time (min)	Water Level (ft.) Held	Wet	Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Back-ground Levels		Remarks
59	3540			46.94	39.25	GR				
60	3600			46.98	39.29					
61	3660			46.96	39.27					
62	3720			46.99	39.30					
63	3780			46.95	39.26					
64	3840			47.03	39.34					
65	3900			46.95	39.26					
66	3960			46.98	39.29					
67	4020			46.91	39.22					
68	4080			46.84	39.15					
69	4140			47.06	39.37					
70	4200			47.00	39.31					
71	4260			46.93	39.24					
72	4320			47.01	39.32					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

BB1S

Well No. OW-1S

Project Banyan Bay 81-227.3 Starting date of Test 2-20-82

Time (hr)	Time (min)	Water Level (ft.) Held	Wet	Below MP	Draw-Down (ft)	Mea-sured by	Adjustments De-water-ing	Back-ground Levels		Remarks
		Start on next page								
	3.00			4.69	-0.16	RW				
	3.25			4.69	-0.16	RW				
	3.50			4.69	-0.16					
	3.75			4.69	-0.16					
	4.00			4.69	-0.16					
	4.25			4.69	-0.16					
	4.50			4.69	-0.16					
	4.75			4.69	-0.16					
	5			4.69	-0.16					
	6			4.69	-0.16					
	7			4.69	-0.16					
	8			4.69	-0.16					
	9			4.70	-0.15					
	10			4.70	-0.15					
	12			4.70	-0.15					
	14			4.70	-0.15					
	16			4.70	-0.15					
	18			4.71	-0.14					
	20			4.72	-0.13					
	25			4.73	-0.12					
	30			4.76	-0.09					
	35			4.79	-0.06					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS,INC.

RECORD OF WATER LEVELS

Well No. OW-1S

Project Banyan Bay 81-227.3 Starting date of Test 2/20/82

Time (hr)	Time (min)	Water Level (ft.) Held	Wet	Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Back-ground Levels		Remarks
		Start here		↓						
15	900	7.00	1.12	5.88	1.03	JF				
16	960	7.00	1.07	5.93	1.08					
17	1020	7.00	1.01	5.99	1.14					
18	1080	7.00	0.99	6.01	1.16					
19	1140	7.00	0.97	6.03	1.18					
20	1200	7.00	0.94	6.06	1.21					
21	1260	7.00	0.92	6.08	1.23					
22	1320	7.00	0.92	6.08	1.23					
23	1380	7.00	0.92	6.08	1.23					
24	1440	7.00	0.90	6.10	1.25					
25	1500	7.00	0.88	6.12	1.27					
26	1560	7.00	0.85	6.15	1.30	JF/BB				
27	1620	7.00	0.83	6.17	1.32	BB				
28	1680	7.00	0.80	6.20	1.35					
29	1740	7.00	0.74	6.26	1.41					
30	1800	7.00	0.77	6.23	1.38					
31	1860	7.00	0.70	6.30	1.45					
32	1920	7.00	0.68	6.32	1.47					
33	1980	7.00	0.66	6.34	1.49					
34	2040	7.00	0.65	6.35	1.50					
35	2100	7.00	0.64	6.36	1.51					
36	2160	7.00	0.63	6.37	1.52					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS,INC.

RECORD OF WATER LEVELS

Well No. OW-1S

Project Banyan Bay 81-227.3 Starting date of Test 2/20/82

Time (hr)	Time (min)	Water Level (ft.) Held	Water Level (ft.) Wet	Water Level (ft.) Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Adjustments Background Levels		Remarks
59	3540	7.00	0.37	6.63	1.78	GR				
60	3600	7.00	0.37	6.63	1.78					
61	3660	7.00	0.36	6.64	1.79					
62	3720	7.00	0.35	6.65	1.80					
63	3780	7.00	0.35	6.65	1.80					
64	3840	7.00	0.32	6.68	1.83					
65	3900	7.00	0.33	6.67	1.82					
66	3960	7.00	0.30	6.70	1.85					
67	4020	7.00	0.30	6.70	1.85					
68	4080	7.00	0.31	6.69	1.84					
69	4140	7.00	0.32	6.68	1.83					
70	4200	7.00	0.33	6.67	1.82					
71	4260	7.00	0.33	6.67	1.82					
72	4320	7.00	0.34	6.66/6.64	1.81					tape ~~m scope~~

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

Well No. OW-1S BB1SR

Project No. 81-227.3 Starting date of Test 2/20/82

Time (hr) Recovery	(min)	Water Level (ft.) Held	Wet	Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Background Levels		Remarks
	6			6.79	1.96	MO				
	7			6.78	1.95					
	8			6.81	1.98					
	9			6.79	1.96					
	10			6.79	1.96					
	12			6.79	1.96					
	14			6.79	1.96					
	16			6.79	1.96					
	18			6.78	1.95					
	20			6.79	1.96					
	25			6.80	1.97					
	30			6.78	1.95					
	35			6.78	1.95					
	40			6.75	1.92					
	45			6.76	1.93					
	50			--	--					
1	60			6.74	1.91					
	70			6.70	1.87					
	80			6.69	1.86					
	90			6.68	1.85					
	100			6.58	1.75					
2	120									
	150									
3	180									

BB1D

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

Well No. OW-1D

ject Banyan Bay 81-227.3 Starting date of Test 2/20/82

(min)	Water Level (ft.) Held	Wet	Below MP	Draw-Down (ft)	Mea-sured by	Adjustments De-water-ing	Back-ground Levels		Remarks
3.00			17.93	11.25	JF				
3.25			18.17	11.49					
3.50			18.44	11.76					
3.75			18.70	12.02					
4.00			18.85	12.17					
4.25			19.06	12.38					
4.50			19.24	12.56					
4.75			19.39	12.71					
5			19.52	12.84					
6			20.11	13.43					
7			20.53	13.85					
8			20.89	14.21					
9			21.21	14.53					
10			21.49	14.81					
12			22.05	15.37					
14			22.47	15.79					
16			22.86	16.18					
18			23.24	16.56					
20			23.47	16.79					
			24.06	17.38					
			24.53	17.75					
			24.96	18.28					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

Well No. OW-1D

Project Banyan Bay 81-227.3 Starting date of Test 2/20/82

Time (hr)	Time (min)	Water Level (ft.) Held	Wet	Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Background Levels		Remarks
59	3540	34.00	0.46	33.54	26.87	GR				
60	3600	34.00	0.44	33.56	26.89					
61	3660	34.00	0.44	33.56	26.89					
62	3720	34.00	0.45	33.55	26.88					
63	3780	34.00	0.47	33.53	26.86					
64	3840	34.00	0.43	33.57	26.90					
65	3900	34.00	0.48	33.52	26.85					
66	3960	34.00	0.47	33.53	26.86	SN				
67	4020	34.00	0.50	33.50	26.83					
68	4080	34.00	0.55	33.45	26.78					
69	4140	34.00	0.44	33.56	26.89					
70	4200	34.00	0.45	33.55	26.87					
71	4260	34.00	0.46	33.54	26.85					
72	4320	34.00	0.45	33.55 / 33.59	26.87					Tape / M scope

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

BB2D

Well No. OW-2D

Project Banyan Bay 81-227.3 Starting date of Test 2/20/82

Time (hr)	Time (min)	Water Level (ft.) Held	Water Level (ft.) Wet	Water Level (ft.) Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Adjustments Background Levels		Remarks
	3.00			11.18	4.55	GR				
	3.25			11.41	4.78					
	3.50			11.57	4.94					
	3.75			11.74	5.11					
	4.00			11.93	5.31					
	4.25			12.08	5.45					
	4.50			12.24	5.61					
	4.75			12.38	5.75					
	5			12.54	5.91					
	6			13.04	6.41					
	7			13.46	6.83					
	8			13.82	7.19					
	9			14.13	7.50					
	10			14.39	7.76					
	12			14.90	8.27					
	14			15.31	8.67					
	16			15.67	9.03					
	18			15.99	9,35					
	20			16.27	9.63					
	25			16.84	10.20					
	30			17.31	10.66					
	35			17.75	11.10					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

Well No. OW-2D

Project Banyan Bay 81-227.3 Starting date of Test 2/20/82

Time (hr)	Time (min)	Water Level (ft.) Held	Water Level (ft.) Wet	Water Level (ft.) Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Adjustments Back-ground Levels		Remarks
15	900	27.00	1.47	25.53	18.88	JF				
16	960	27.00	1.39	25.61	18.96					
17	1020	27.00	1.37	25.63	18.98					
18	1080	27.00	1.33	25.67	19.02					
19	1140	27.00	1.24	25.76	19.11					
20	1200	27.00	1.18	25.82	19.17					
21	1260	27.00	1.16	25.84	19.19					
22	1320	27.00	1.15	25.85	19.20					
23	1380	27.00	1.12	25.88	19.23					
24	1440	27.00	1.05	25.95	19.30					
25	1500	27.00	1.02	25.98	19.33					
26	1560	27.00	1.12	25.88	19.23	JF/BB				
27	1620	27.00	1.11	25.89	19.24	BB				
28	1680	27.00	1.23	25.77	19.12					
29	1740	27.00	1.08	25.92	19.27					
30	1800	27.00	1.05	25.95	19.30					
31	1860	27.00	1.07	25.93	19.28					
32	1920	27.00	0.97	26.03	19.38					
33	1980	27.00	0.95	26.05	19.40					
34	2040	27.00	0.91	26.09	19.44					
35	2100	27.00	0.89	26.11	19.46					
36	2160	27.00	0.89	26.11	19.46					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

Well No. OW-2D

Project Banyan Bay 81-227.3 Starting date of Test 2/20/82

Time (hr)	Time (min)	Water Level (ft.) Held	Water Level (ft.) Wet	Water Level (ft.) Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Adjustments Back-ground Levels		Remarks
59	3540	27.00	0.65	26.35	19.70	GR				
60	3600	27.00	0.65	26.35	19.70					
61	3660	27.00	0.66	26.34	19.69					
62	3720	27.00	0.60	26.40	19.75					
63	3780	27.00	0.67	26.33	19.68					
64	3840	27.00	0.64	26.36	19.71					
65	3900	27.00	0.66	26.34	19.69					
66	3960	27.00	0.65	26.35	19.70					
67	4020	27.00	0.67	26.33	19.68					
68	4080	27.00	0.70	26.30	19.65					
69	4140	27.00	0.62	26.38	19.73					
70	4200	27.00	0.64	26.36	19.71					
71	4260	27.00	0.63	26.37	19.72					
72	4320	27.00	0.63	26.37/26.42	19.72					Tape/M-Scope

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

BB2DR

Well No. OW-2D

Project Banyan Bay 81-227.3 Starting date of Test 2/20/82

Time (hr) Recovery	Time (min)	Water Level (ft.) Held	Water Level (ft.) Wet	Water Level (ft.) Below MP	Draw-Down (ft)	Mea-sured by	Adjustments De-watering	Adjustments Back-ground Levels		Remarks
	6			19.78	13.08	GR				
	7			19.38	12.68					
	8			19.02	12.32					
	9			18.72	12.02					
	10			18.43	11.73					
	12			17.98	11.28					
	14			17.59	10.89					
	16			17.24	10.54					
	18			16.95	10.25					
	20			16.68	9.98					
	25			16.12	9.42					
	30			15.63	8.93					
	35			15.22	8.52					
	40			14.86	8.16					
	45			14.54	7.84					
	50			14.25	7.55					
1	60			13.74	7.04					
	70			13.30	6.60					
	80			12.88	6.18					
	90			12.50	5.80					
	100			-	-					
2	120			11.69	4.99					
	150									

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

B63D

Well No. OW-3D

Project Banyan Bay 81-227.3 Starting date of Test 2/20/82

Time (hr)	(min)	Water Level (ft.) Held Static	Wet 5.15	Below MP	Draw-Down (ft)	Mea-sured by	Adjustments De-water-ing	Back-ground Levels	SG-2	Remarks
15	900	22.00	1.57	20.43	15.27	JF			0.48	
16	960	22.00	1.49	20.51	15.35				0.48	
17	1020	22.00	1.46	20.54	15.38				0.48	
18	1080	22.00	1.42	20.58	15.42				0.475	
19	1140	22.00	1.35	20.65	15.49				0.475	
20	1200	22.00	1.30	20.70	15.54				0.475	
21	1260	22.00	1.26	20.74	15.58				0.475	
22	1320	22.00	1.25	20.75	15.59				0.475	
23	1380	22.00	1.22	20.78	15.62				0.475	
24	1440	22.00	1.16	20.84	15.68				0.475	
25	1500	22.00	1.16	20.84	15.68				-	
26	1560	22.00	1.20	20.80	15.64				-	
27	1620	22.00	1.20	20.80	15.64				-	
28	1680	22.00	1.17	20.83	15.67				-	
29	1740	22.00	1.17	20.83	15.67				-	
30	1800	22.00	1.14	20.86	15.70				-	
31	1860	22.00	1.15	20.85	15.69				-	
32	1920	22.00	1.06	20.94	15.78				-	
33	1980	22.00	1.06	20.94	15.78				-	
34	2040	22.00	1.02	20.98	15.82				-	
35	2100	22.00	0.99	21.01	15.85				-	
36	2160	22.00	0.99	21.01	15.85				-	

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

Well No. OW-3D

Project Banyan Bay 81-227.3 Starting date of Test 2/20/82

Time (hr)	Time (min)	Water Level (ft.) Held	Water Level (ft.) Wet	Water Level (ft.) Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Adjustments Back-ground Levels	SG-2	Remarks
59	3540	22.00	0.75	21.25	16.09	GR			0.38	
60	3600	22.00	0.75	21.25	16.09				0.38	
61	3660	22.00	0.76	21.24	16.08				0.38	
62	3720	22.00	0.76	21.24	16.08				0.38	
63	3780	22.00	0.77	21.23	16.07				0.38	
64	3840	22.00	0.74	21.26	16.10				0.37	
65	3900	22.00	0.77	21.23	16.07				0.37	
66	3960	22.00	0.75	21.25	16.09				0.37	
67	4020	22.00	0.76	21.24	16.08				0.37	
68	4080	22.00	0.78	21.22	16.06				0.36	
69	4140	22.00	0.78	21.22	16.06				0.36	
70	4200	22.00	0.75	21.25	16.09				0.36	
71	4260	22.00	0.75	21.25	16.09				-	
72	4320	22.00	0.75	21.25 / 21.26	16.09				0.35	Tape / M-scope

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS

BB3DR

Well No. OW-3D

Project Banyan Bay 81-227.3 Starting date of Test 2/20/82

Time (hr) Recovery	Time (min)	Water Level (ft.) Held	Water Level (ft.) Wet	Water Level (ft.) Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Adjustments Back-ground Levels	SG-2	Remarks
	6			17.70	12.53	HV				
	7			17.36	12.19					
	8			17.08	11.91					
	9			16.80	11.63					
	10			16.54	11.37					
	12			16.13	10.96					
	14			15.77	10.60					
	16			15.45	10.28					
	18			15.17	10.00					
	20			14.93	9.76					
	25			14.42	9.25					
	30			13.95	8.78					
	35			13.56	8.39					
	40			13.20	8.03					
	45			12.91	7.74					
	50			12.63	7.46					
1	60			12.15	6.98					
	70			11.71	6.54				0.34	
	80			11.35	6.18					
	90			10.99	5.82					
	100			-	-					
2	120			10.20	5.03					
	150									

STEP DRAWDOWN

TEST DATA

STEP DRAWDOWN TEST

MANOMETER READINGS

PROJECT Banyan Bay 81-227.3 LOCATION 100' north of PW-1

METHOD OF MEASURING 6" x 5" manometer AVERAGE DISCHARGE 892 GPM

STARTING DATE OF TEST 2/19/82

Step 1

Time (hr)	Time (min)	Inches	Discharge (gpm)	Staff Gage (ft)	Temp (oC)	Cond. (umhos/cm)	Measured by	Remarks
	.5	48.0	855				JF	
	1	52.0	888					
	1.5	59.0	942					
	2	59.0	942					
	2.5	59.0	942					
	3.0	59.0	942					
	3.5	58.5	938					
	4.0	58.0	934					
	4.5	58.0	934					
	5.0	57.5	930					
	6	57.5	930					
	7	57.0	927					
	8	57.0	927					
	9	56.5	923					
	10	57.0	927					
	12	56.5	923					
	14	56.0	919					
	16	56.0	919					
	18	55.0	912					
	20	55.0	912					
	25	55.0	912					
	30	54.0	904					

STEP DRAWDOWN TEST

MANOMETER READINGS

PROJECT Banyan Bay 81-227.3 LOCATION 100' north of PW-1

METHOD OF MEASURING 6" x 5" orifice AVERAGE DISCHARGE 462 GPM

STARTING DATE OF TEST 2/19/82

Step 3

Time (hr)	Time (min)	Inches	Discharge (gpm)	Staff Gage (ft)	Temp (oC)	Cond. (umhos/cm)	Measured by	Remarks
	.5	13.0	448				JF	
	1	11.0	412					
	1.5	11.0	412					
	2	12.0	430					
	2.5	17.0	510					
	3.0	17.5	517					
	3.5	17.5	517					
	4.0	13.5	457					
	4.5	12.5	439					
	5.0	11.0	412					
	6	15.5	488					
	7	13.5	457					
	8	11.5	421					
	9	10.5	402					
	10	10.5	402					
	12	11.0	412					
	14	16.0	495					
	16	26.0	620					
	18	34.0	715					
	20	17.0	510					
	25	17.5	517					
	30	13.5	457					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS INC

STEP DRAWDOWN TEST

MANOMETER READINGS

PROJECT Banyan Bay 81-227.3 LOCATION 100' north of PW-1

METHOD OF MEASURING 6" x 5" orifice AVERAGE DISCHARGE 306 GPM

STARTING DATE OF TEST 2/19/82

Step 4

Time (hr)	Time (min)	Inches	Dis-charge (gpm)	Staff Gage (ft)	Temp (oC)	Cond. (umhos/cm)	Measured by	Remarks
	.5	6.5	316				JF	
	1	6.25	311					
	1.5	6.00	305					
	2	6.25	311					
	2.5	6.00	305					
	3.0	6.00	305					
	3.5	5.75	297					
	4.0	5.75	297					
	4.5	5.75	297					
	5.0	5.75	297					
	6	6.00	305					
	7	5.75	297					
	8	6.00	305					
	9	6.25	311					
	10	6.25	311					
	12	6.50	316					
	14	6.00	305					
	16	6.00	305					
	18	6.00	305					
	20	6.00	305					
	25	6.00	305					
	30	6.00	305					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.
2019 OKEECHOBEE BOULEVARD, WEST PALM BEACH, FLORIDA . . . 33409 . . . 305 - 683-3301

FRED A. GREENE, P.E.
RICHARD M. MILLER, P.E.
WALTER D. STEPHENS, JR., P.E.
WILLIAM G. WALLACE, JR., P.L.S.
PHILIP A. CRANNELL JR., A.I.A.
JOHN C. WISE, P.E.
Director Emeritus
H.C. GEE, P.E.
THEODORE B. JENSON, P.E.

STEP DRAWDOWN TEST

Step 1

RECORD OF WATER LEVELS

Well No. PW-1

Project No. 81-227.3 Location Banyan Bay

Elevation 13.25 MSL Measuring Point Top of 12 inch casing

Distance to Pumped Well - feet Discharge 892 GPM

Total Depth 130 feet Cased Depth 60 feet Diameter 20 x 12 IN

Starting Date of Test 2/19/82

Time		Water Level (ft)			Draw-Down (ft)	Mea-sured by	Adjustments			Remarks
(hr)	(min)	Held	Wet	Below MP			De-water-ing	Back-ground Levels		
				7.51		JF/RW				Static 1023
				7.51						1025
										1030 pump on
	.25									
	.50									
	.75									
	1.00									
	1.25			35.40	27.89					
	1.50			36.50	28.99					
	1.75			37.28	29.77					
	2.00			37.85	30.34					
	2.25			38.35	30.84					
	2.50			38.90	31.39					
	2.75			39.22	31.71					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS
STEP DRAWDOWN TEST

Well No. PW-1

Project Banyan Bay 81-227.3 Starting date of Test 2/19/82

Step 1 (continued)

Time (hr)	Time (min)	Water Level (ft.) Held	Wet	Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Back-ground Levels		Remarks
	40			48.51	41.00	RW				
	45			48.79	41.28					
	50			49.10	41.59					
1	60			49.61	42.10					
	70			50.00	42.54					
	80			50.44	42.93					
	90			50.96	43.45					
	100			51.22	43.71					
2	120			51.71	44.20					
	150			52.23	44.72					Conductivity 425 umhos/cm
3	180									
4	240									specific capa city at the e
5	300									of the first step = 19.9gp
6	360									ft. of draw- down.
7	420									
8	480									
9	540									
10	600									
11	660									
12	720									
13	780									
14	840									

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS
STEP DRAWDOWN TEST

Well No. PW-1

Project Banyan Bay 81-227.3 Starting date of Test 2/19/82

Step 2 (continued)

Time (hr)	Time (min)	Water Level (ft.) Held	Wet	Below MP	Draw-Down (ft)	Measured by	Adjustments De-watering	Back-ground Levels		Remarks
	3.00			45.05	37.54	RW				
	3.25			45.15	37.64					
	3.50			45.17	37.66					
	3.75			44.35	36.84					
	4.00			44.28	36.77					
	4.25			44.18	36.67					
	4.50			44.12	36.61					
	4.75			44.06	36.55					
	5			44.00	36.49					
	6			43.86	36.35					
	7			43.67	36.16					
	8			43.53	36.02					
	9			43.58	36.07					
	10			43.53	36.02					
	12			43.34	35.83					
	14			43.27	35.76					
	16			43.17	35.66					
	18			43.13	35.62					
	20			43.01	35.50					
	25			42.98	35.47					
	30			42.95	35.44					
	35			42.93	35.42					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.
2019 OKEECHOBEE BOULEVARD, WEST PALM BEACH, FLORIDA . . . 33409 . . . 305 - 683-3301

FRED A. GREENE, P.E.
RICHARD M. MILLER, P.E.
WALTER D. STEPHENS, JR., P.E.
WILLIAM G. WALLACE, JR., P.L.S.
PHILIP A. CRANNELL JR., A.I.A.
JOHN C. WISE, P.E.
Director Emeritus
H.C. GEE, P.E.
THEODORE B. JENSON, P.E.

STEP DRAWDOWN TEST

Step 3

RECORD OF WATER LEVELS

Well No. PW-1

Project No. 81-227.3 Location Banyan Bay

Elevation 13.25 MSL Measuring Point Top of 12 inch casing

Distance to Pumped Well - feet Discharge 462 GPM

Total Depth 130 feet Cased Depth 60 feet Diameter 20 x 12 IN

Starting Date of Test 2/19/82

Time (hr)	Time (min)	Water Level (ft) Held	Water Level (ft) Wet	Water Level (ft) Below MP	Draw-Down (ft)	Mea-sured by	Adjustments De-watering	Adjustments Back-ground Levels		Remarks
	.25			36.82	29.31	RW				
	.50			36.65	29.14					
	.75			36.48	28.97					
	1.00			36.33	28.82					
	1.25			-	-					
	1.50			37.25	29.74					
	1.75			37.49	29.98					
	2.00			37.51	30.00					
	2.25			37.55	30.04					
	2.50			37.52	30.01					
	2.75			37.54	30.03					

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS
STEP DRAWDOWN TEST
Well No. PW-1

Project Banyan Bay 81-227.3 Starting date of Test 2/19/82

Step 3 (continued)

Time (hr)	Time (min)	Water Level (ft.) Held	Water Level (ft.) Wet	Water Level (ft.) Below MP	Draw-Down (ft)	Mea-sured by	Adjustments De-watering	Adjustments Back-ground Levels		Remarks
	40			34.31	26.80	RW				
	45			34.21	26.70					
	50			34.09	26.58					
1	60			33.97	26.46					
	70			33.86	26.35					
	80			33.79	26.28					
	90			33.72	26.21					
	100			33.68	26.17					
2	120			33.58	26.07					
	150									Specific capa city at the e
3	180									of 3rd step = 17.7 gpm/ft c
4	240									drawdown.
5	300									
6	360									
7	420									
8	480									
9	540									
10	600									
11	660									
12	720									
13	780									
14	840									

GEE & JENSON ENGINEERS-ARCHITECTS-PLANNERS, INC.

RECORD OF WATER LEVELS
STEP DRAWDOWN TEST
Well No. PW-1

Project Banyan Bay 81-227.3 Starting date of Test 2/19/82

Step 4 (continued)

Time (hr)	Time (min)	Water Level (ft.) Held	Water Level (ft.) Wet	Water Level (ft.) Below MP	Draw-Down (ft)	Mea-sured by	Adjustments De-water-ing	Adjustments Back-ground Levels		Remarks
	3.00			27.93	20.42	RW				
	3.25			27.86	20.35					
	3.50			27.78	20.27					
	3.75			27.75	20.24					
	4.00			27.71	20.20					
	4.25			27.65	20.14					
	4.50			27.61	20.10					
	4.75			27.57	20.06					
	5			27.53	20.02					
	6			27.41	19.90					
	7			27.28	19.77					
	8			27.58	20.07					
	9			27.60	20.09					
	10			27.57	20.06					
	12			27.50	19.90					
	14			27.22	19.71					
	16			27.05	19.54					
	18			26.95	19.44					
	20			27.88	20.37					
	25			26.73	19.22					
	30			26.59	19.08					
	35			26.50	18.99					