Hydrogeologic Investigation and Aquifer Performance Testing at Morikami Park, Southeastern Palm Beach County, Florida

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EXECUTIVE SUMMARY

This report documents the findings of a hydrogeologic investigation and two aquifer performance tests (APTs) of the surficial aquifer system (SAS) conducted in 1987 at the Morikami Museum and Japanese Gardens (hereafter referred to as Morikami Park) in southeastern Palm Beach County, Florida. The results were used as part of the South Florida Water Management District groundwater resource assessment for eastern Palm Beach County and in two subsequent United States Geological Survey scientific investigations of the SAS in Palm Beach County.

The SAS is the source of most potable water in Palm Beach County. Its lithology and stratigraphy are composed primarily of sand, sandstone, shell, and limestone deposited during the Pleistocene and Pliocene epochs. The SAS is very heterogeneous, with complex facies changes, and has been divided into several hydrogeologic zones by various investigators over the years. The uppermost zone of the SAS, anywhere from 20 to more than 50 feet (ft) in thickness in the southeastern portion of Palm Beach County, typically is composed of friable calcareous sand, shells, and shell fragments with some localized interbedded clay. Underlying this, in the eastern part of the county, is a sandy limestone interval with highly developed secondary permeability considered to be the northernmost extension of the Biscayne aquifer. It often is referred to as “a discontinuous zone of secondary permeability” and is the most productive SAS zone. These two SAS zones are reflected in the lithology found at Morikami Park, with the upper zone being a layer of sand and shell fragments approximately 95 ft thick, overlying the highly solutioned limestone zone of secondary permeability, estimated to be approximately 135 ft thick at this location.

Original plans for the hydrogeologic investigation and APTs called for a test boring drilled to the base of the SAS (top of the Hawthorn Group), to be completed as a deep production well along with three pairs of shallow and deep monitor wells and one background monitor well. The shallow and deep wells were used to monitor the upper zone of sand and shell fragments and the lower zone of secondary permeability, respectively. However, due to difficult drilling conditions (e.g., collapsing boreholes), neither the test boring/production well nor the subsequent deeper monitor wells reached the bottom of the SAS. The production well, two pairs of deep and shallow monitor wells, two unpaired shallow wells, and the background monitor well were completed, albeit to shallower depths.

Two APTs were conducted at Morikami Park; the first was conducted on the deeper zone of secondary permeability from March 23 to 26, 1987, and the second was performed in the shallower sand/shell zone on June 11, 1987. For the first APT, results showed maximum drawdown of 2 ft in the deep monitor wells. Very little drawdown was observed in the shallow monitor wells. Test data collected from the deeper wells and the two shallow wells paired with them were analyzed to determine transmissivity, storativity, and hydraulic conductivity values of the lower SAS zone of secondary permeability. These values averaged 114,260 ft^2/day, 2.57E-5, and 847 ft/day, respectively. The transmissivity number is somewhat comparable to previous investigations in the areas, although different assumptions and methods may have been applied that would account for the differences. For the upper zone of the SAS tapped by the shallow wells, these hydraulic characteristics averaged 3,813 ft^2/day, 1.1E-3, and 84.5 ft/day, respectively.

A second APT was conducted to obtain hydraulic information on the upper sand/shell zone of the SAS. Unfortunately, during the drawdown phase, numerous issues arose, including an inconsistent and inadequate pumping rate, a collapsed suction line, a faulty recording system, and an insufficient pumping duration. This combination of issues resulted in a compromised data set and insufficient drawdown values that could not be analyzed with any level of confidence.

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ACRONYMS AND ABBREVIATIONS

APT	aquifer performance test
bls	below land surface
DTW	depth to water
ft	foot
gpm	gallons per minute
MP	Measuring Point
NGVD29	National Geodetical Vertical Datum of 1929
PVC	polyvinyl chloride
SAS	surficial aquifer system
SFWMD	South Florida Water Management District

1.0 INTRODUCTION

In 1987, a hydrogeologic investigation was conducted at the Morikami Museum and Japanese Gardens (hereafter referred to as Morikami Park) as part of the eastern Palm Beach County groundwater resources assessment. Morikami Park is in southeastern Palm Beach County, Florida. The site location and features present at the time of the investigation (1986-1987) are shown in **Figure 1**. The site was chosen to fill a gap in existing surficial aquifer system (SAS) information, including thickness, lithology, zonation/layering, and hydraulic characteristics. Work conducted at the site included test drilling and two aquifer performance tests (APTs) designed to provide information on the hydraulic characteristics and interaction of the different zones in the SAS. Some data were used in a two-part South Florida Water Management District (SFWMD) technical publication on the groundwater resources of eastern Palm Beach County (Shine et al. 1989) and in a United States Geological Survey scientific investigations map and report on the SAS in Palm Beach County (Reese and Wacker 2007, 2009). This report documents the findings of the 1987 investigation based on available well drilling and construction information, the project hydrogeologists' draft report, hand-written notes and records, sketch maps and diagrams, and water level data available in historical files.

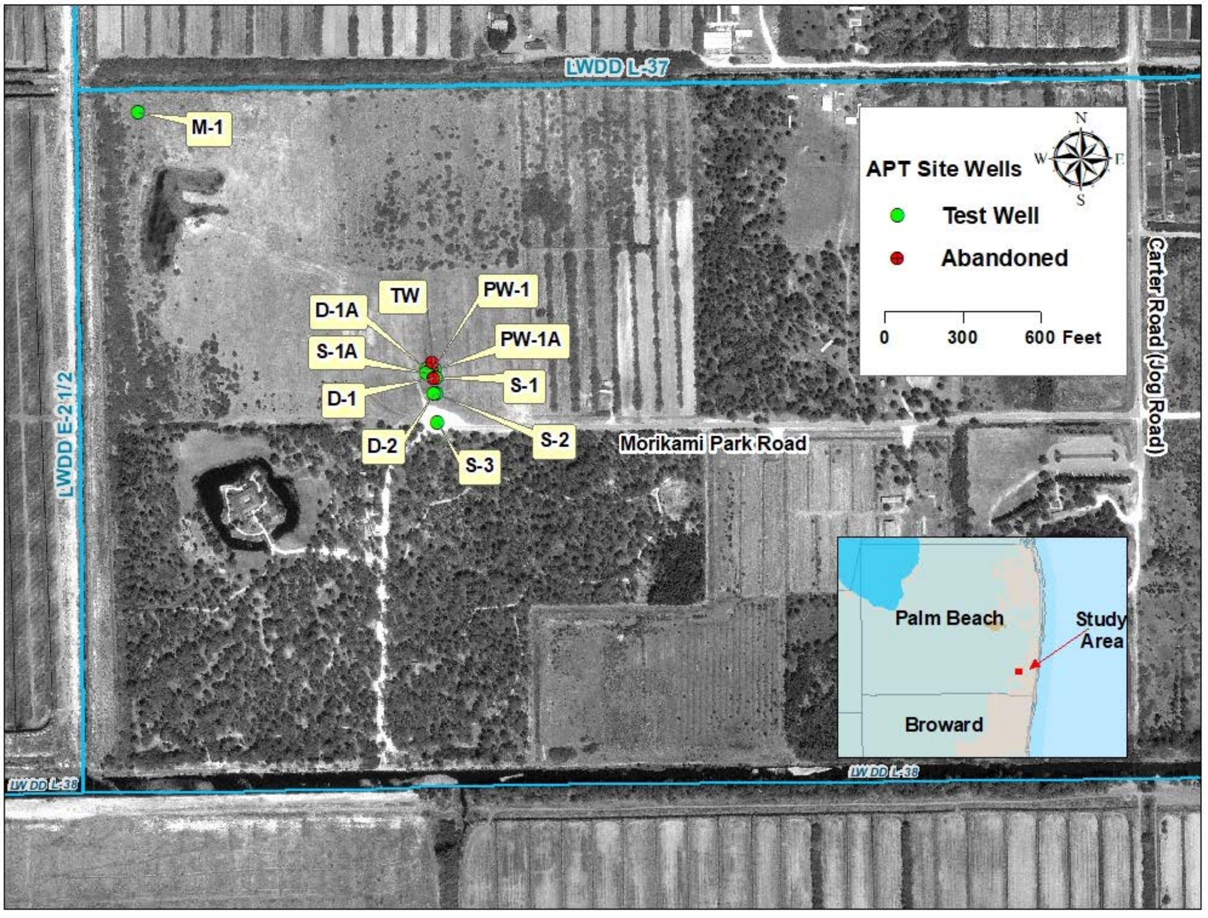


Figure 1. Site map of the Morikami Park hydrogeologic investigation and aquifer performance tests, Palm Beach County (circa 1986-1987).

2.0 SITE SETTING AND DESCRIPTION

Morikami Park is in western Delray Beach within southeastern Palm Beach County, Florida. The park opened in 1977 and is a center for Japanese arts and culture. In 1987, Morikami Park was surrounded by agricultural fields. There was one exhibition building on a small island, shown in the southwestern portion of the map in **Figure 1**, and most of the southern portion of the property was covered in trees. Access to the property was via Morikami Park Road off Carter Road (since renamed Jog Road) to the east. An open field just north of where Morikami Park Road curves southward was selected as the test site.

3.0 DRILLING AND WELL CONSTRUCTION

Drilling commenced in December 1986 and was extremely difficult. The wells initially planned for the site included a test well drilled to the Hawthorn Group, a production well, three pairs of shallow and deep monitor wells, and a background monitor well, all to be used for aquifer performance testing. However, only the production well (MORI_PW-1A), two pairs of deep and shallow monitor wells (MORI_D-1A/MORI_S-1A and MORI_D-2/MORI_S-2), two unpaired shallow monitor wells (MORI_S-1 and MORI_S-3), and the background monitor well (MORI_M-1) were completed. Well locations (except MORI_M-1) are shown in **Figure 2**. The MORI_M-1 well is shown in **Figure 1** in the northwestern corner of the property. Construction information and measuring point elevations for each well are listed in **Table 1**.

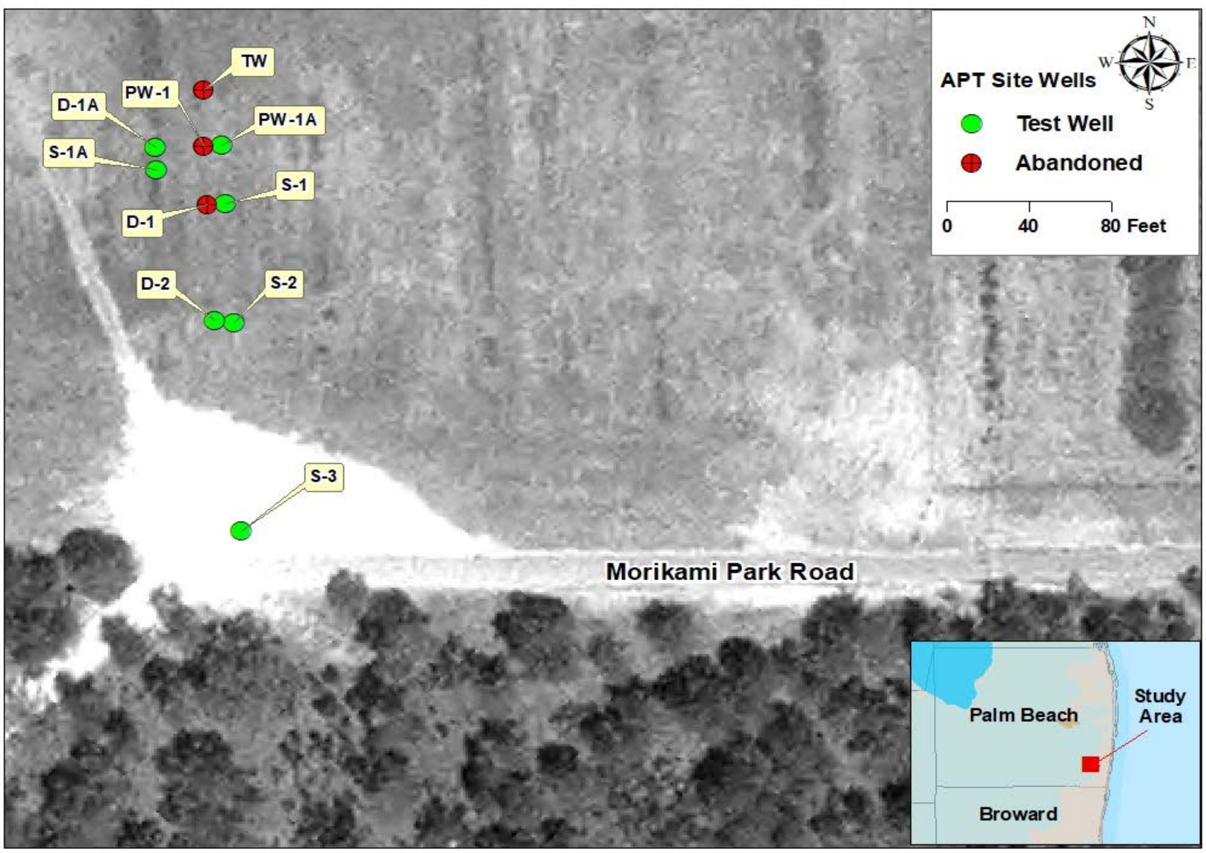


Figure 2. Well locations at the Morikami Park site, including those successfully completed and used for aquifer performance testing and those abandoned due to complications.

Table 1. Well construction and measuring point elevations.

Well	Distance from Production Well (ft)	Diameter (inches)	Total Depth (ft bls)	Cased Depth (ft bls)	Screen Interval (ft bls)	Measuring Point Elevation (ft NGVD29)
MORI_PW-1A	0	6	185	116	Open	19.76
MORI_D-1A	30	6/2*	155	145	145-155	19.47
MORI_S-1A	30	2	45	40	40-45	19.70
MORI_S-1	30	2	45	40	40-45	19.34
MORI_D-2	90	6/2*	123	113	113-123	19.49
MORI_S-2	90	2	45	40	40-45	19.55
MORI_S-3	200	2	45	40	40-45	19.72
MORI_M-1	1,520	2	45	40	40-45	19.04

ft = foot; bls = below land surface; NGVD29 = National Geodetic Vertical Datum of 1929.
* Casing diameter changed from 6 to 2 inches.

Three attempts were made to drill the pilot hole to the bottom of the SAS (top of the Hawthorn Group). The first attempt, at location TW in **Figure 2**, was made on December 10, 1986, using the mud-rotary method, which had been used for pilot holes at two other sites. The hole was drilled through a sand and shell layer to 95 feet (ft) below land surface (bls), at which point a sandy limestone referred to as the "Turnpike aquifer" or "zone of secondary permeability" was encountered. Drilling continued to 187 ft bls, but the formation was taking up fluid almost continuously, with circulation losses at 136, 173, and 184 ft bls. At 187 ft bls, circulation was lost again and could not be regained. The drill string stuck in the hole, and the hole collapsed; therefore, the well had to be abandoned.

As a result of this experience, a two-step approach was formulated for the second attempt (at location PW-1 in **Figure 2**): 1) drill the hole with the mud-rotary method through the sand and shell layer into the top of the sandy limestone and set a 6-inch casing; and 2) drill the remainder of the hole with the air-rotary method to avoid mud circulation losses. In the second attempt, the hole was drilled with the mud-rotary method to 95 ft bls, approximately 2 ft into the sandy limestone, and 6-inch casing was set as planned. When drilling continued with the air-rotary method, large amounts of sand were washed out, making it impossible to keep the hole open. Either the casing was not set deep enough and the limestone collapsed, allowing the sand above the casing depth to cave in, or there was an unexpected pocket of sand below 95 ft bls. Consequently, this well also had to be abandoned.

In the third drilling attempt, a hole was drilled at location PW-1A using the mud-rotary method to 116 ft bls, after which a 6-inch polyvinyl chloride (PVC) casing was set. Drilling continued to 195 ft bls using the air-rotary method. At 178 ft bls, the percentage of fine sand began increasing, and at 195 ft bls, it was no longer possible to keep the hole open. Drilling stopped at 195 ft bls, after which the hole caved in back to 185 ft bls. The borehole remained open from 116 to 185 ft bls and was completed as the production well (MORI_PW-1A). No further attempts were made to complete a pilot hole to the top of the Hawthorn Group.

Drilling the two deep monitor wells encountered the same problems as the pilot hole. These wells were anticipated to be only 2 inches in diameter and screened in the middle of the production zone from 145 to 155 ft bls. On February 10, 1987, an attempt was made to use the mud-rotary method with mud additives to prevent circulation loss while drilling the first deep well (MORI_D-1). The borehole was drilled to 140 ft bls; however, circulation was lost at 118 and 135 ft bls, and the formation took on an estimated 1,200 gallons of mud and water. The hole became unstable and drilling stopped. The hole collapsed at 15 ft bls when the drill string was removed and had to be abandoned.

The two deep monitor wells (MORI_D-1A and MORI_D-2) ended up being constructed by setting 6-inch PVC casings into the limestone, drilling out the remainder of the hole with air, and setting 2-inch PVC casings inside the 6-inch casings with a 2-inch screen placed at the desired monitoring interval. **Figures 3** and **4** show the construction of the two deep monitor wells. MORI_D-1A was completed to 150 ft bls, with a 6-inch PVC casing set to 113 ft bls and a 2-inch PVC casing with a gravel-packed screened interval from 140 to 150 ft bls. MORI_D-2 could only be completed to a total depth of 123 ft bls (rather than 155 ft bls as planned) because it was impossible to keep the borehole open below 123 ft bls. The well was completed with a 6-inch casing set to 85 ft bls and a 2-inch PVC casing with a gravel-packed screened interval from 113 to 123 ft bls. A third deep monitor well, MORI_D-3, was not installed due to the continued drilling difficulties and time constraints.

The four shallow monitor wells (MORI_S-1, MORI_S-1A, MORI_S-2, and MORI_S-3) and the background well (MORI_M-1) were drilled without incident to a depth of 45 ft bls and constructed with a 2-inch PVC casing screened from 40 to 45 ft bls. On May 20, 1987, all eight wells were surveyed to establish their measuring point elevations, which are provided in **Table 1**.

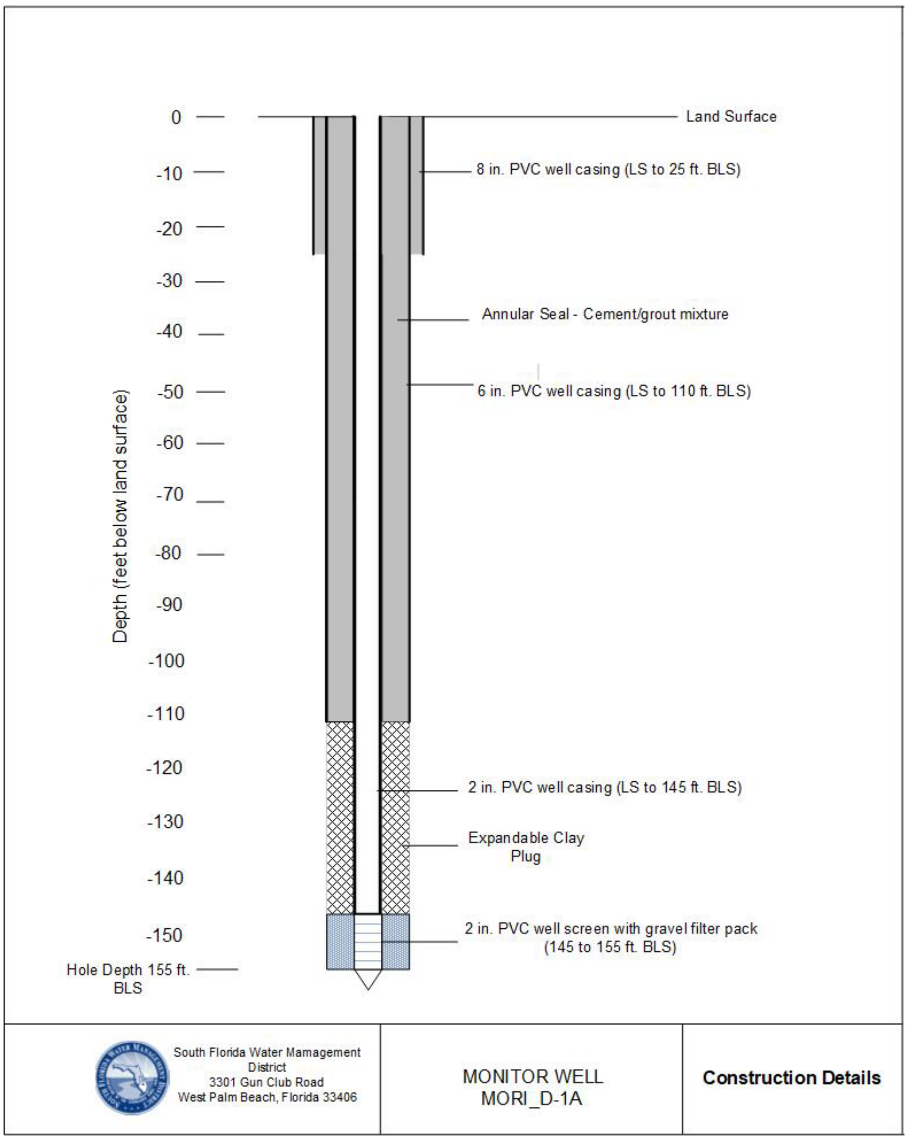


Figure 3. Well construction diagram of deep monitor well MORI_D-1A.

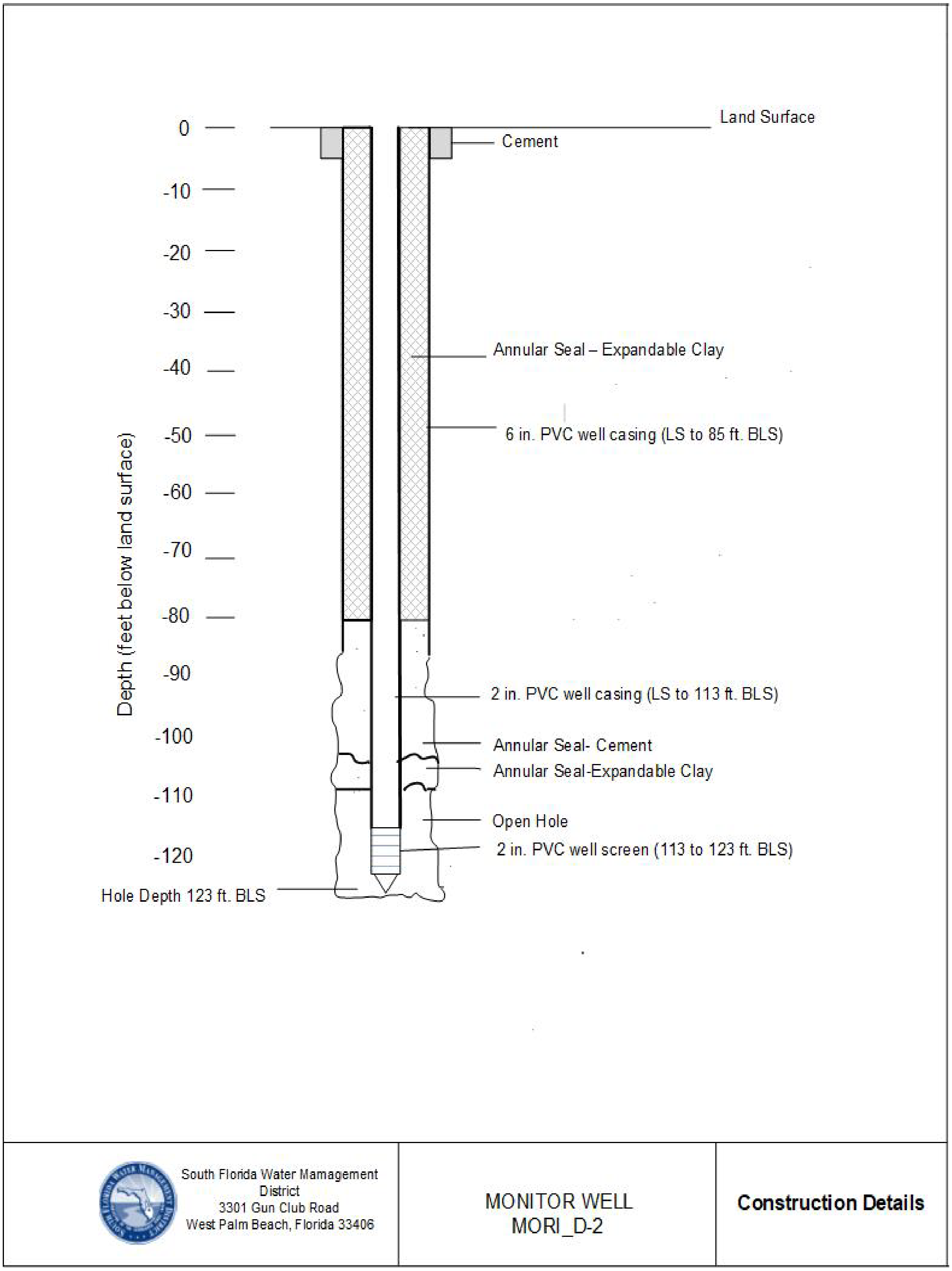


Figure 4. Well construction diagram of deep monitor well MORI_D-2.

4.0 SITE HYDROGEOLOGY

The SAS, the source of most potable water in eastern Palm Beach County, is composed of many components of varying lithology and hydraulic characteristics. The SAS is a mixture of sand, sandstone, shells, calcareous silt and clays, and limestone deposited during the Pleistocene and Pliocene epochs. County-wide, it ranges in thickness from approximately 115 ft in the west to more than 400 ft at some locations in the east (Shine et al. 1989), and it unconformably overlies the relatively impermeable silts and clays of the intermediate confining unit of the upper Hawthorn Group (Miocene).

Because the SAS is so heterogeneous, various investigators over the years have attempted to divide it into several hydrogeologic zones using different naming conventions. The uppermost section of the SAS, an unconfined aquifer, typically is composed of unconsolidated sand, friable calcareous sandstone, shells, and shell fragments, with some locally interbedded layers of clay, marl, and silt. It has been referred to as Zone Z-3 by Scott (1977); Zone 2 by Miller (1988); a less transmissive, non-production zone by Shine et al. (1989); and Permeable Zone 1 (PZ-1) by Reese and Wacker (2009). The thickness of this zone ranges from 20 to more than 50 ft in the southeastern portion of Palm Beach County.

Underlying the surficial sandy sediments of PZ-1 is a localized zone of limestone with highly developed secondary permeability only found in the eastern third of the county, extending from Juno Beach south into Broward County. This zone, which is the most productive in the SAS, can be more than 150 ft thick in places. It is believed to be the northernmost extension of the Biscayne aquifer and has been referred to as a discontinuous zone of secondary permeability (Swayze and Miller 1984, Shine et al. 1989). Rodis and Land (1976) described it as a cavity-riddled sandy limestone, which Scott (1977) called Zone Z-1. Miller (1988) identified this most permeable part of the SAS as Zone 1 and noted that it was locally known as the "Turnpike aquifer" because its subsurface presence trends along Florida's Turnpike. Reese and Wacker (2009) indicated the discontinuous zone of secondary permeability, which they called Permeable Zone 2 (PZ-2), may be more extensive than Swayze and Miller (1984) originally mapped. Because it underlies the much less permeable sediments of PZ-1, the zone of secondary permeability may be considered a semi-confined or leaky aquifer.

Where PZ-2 is thickest, it unconformably overlies the impermeable green clays and silts of the intermediate confining unit. As it thins to the west and east, PZ-2 transitions horizontally and vertically into the poorly to moderately permeable mix of sand, sandstone, shell, clay, and limestone, which is either part of the non-production zone according to Shine et al. (1989) or the undifferentiated PZ-2/3 according to Reese and Wacker (2009).

This report will use the most recent naming convention of Reese and Wacker (2009): PZ-1 for the upper sand/shell zone of the SAS, PZ-2 for the lower zone of secondary permeability, and PZ-2/3 for undifferentiated zones of low to moderate permeability.

At Morikami Park, lithologic descriptions of SAS cuttings from the test well (TW) and the lower sections of the production well (MORI_PW-1A) included in **Appendix A**, clearly indicate the presence of PZ-1 and PZ-2. An upper layer of sand and shell fragments approximately 95 ft thick, equivalent to PZ-1, overlies a highly solutioned sandy limestone layer considered to be part of the zone of secondary permeability (PZ-2). The total depth of the SAS at the site and the thickness of PZ-2 are unknown because the test well could not be completed to the top of the Hawthorn Group as planned. However, Miller (1987) estimated the bottom of the SAS to be approximately 230 ft bls. This is supported by lithologic and geophysical logs from a nearby well (PB-1103) to the west included in Swayze et al. (1980), which show the bottom of the SAS at approximately 220 ft bls. Therefore, the thickness of PZ-2 is estimated to be approximately 135 ft. **Figure 5** is a generalized west-to-east cross-sectional interpretation of the SAS hydrogeology through the Morikami Park study area, using lithologic data obtained from wells PB-1108, PB-1103, MORI-TW, and PB-1101.

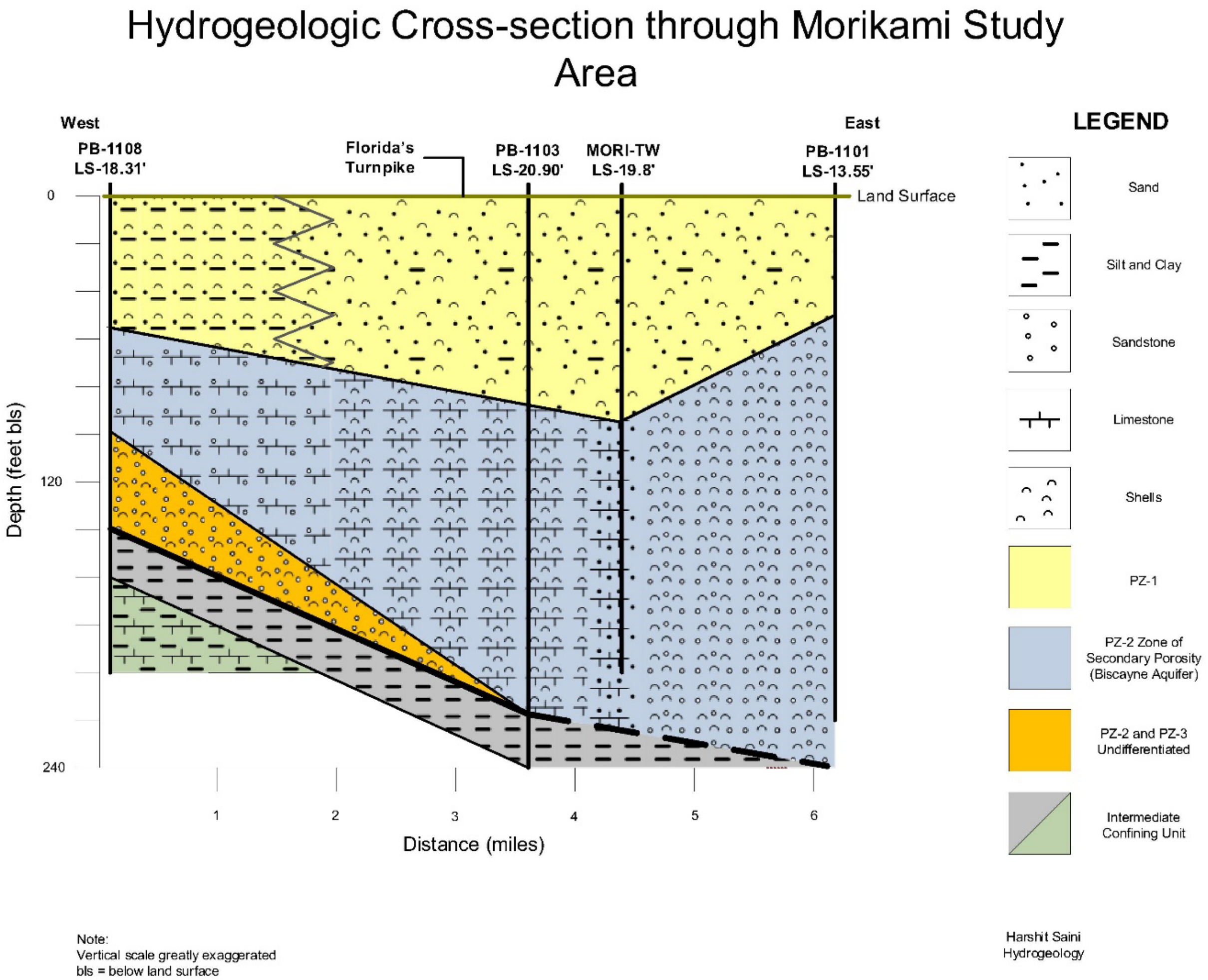


Figure 5. Generalized west-to-east hydrogeologic cross-section based on the lithology recorded at Morikami Park and the lithologic logs from PB-1108, PB-1103, and PB-1101.

5.0 AQUIFER PERFORMANCE TESTING

Two APTs were conducted at Morikami Park. The first APT was conducted in the deeper production zone (zone of secondary permeability [PZ-2]) from March 23 through 26, 1987. The second APT was conducted on June 11, 1987 in the shallower sand/shell zone (PZ-1). All test data collected manually and via pressure transducer were transcribed from original 1987 hard copy records to Excel digital files and are presented in **Appendix B**. Data from the pressure transducers were formatted to allow hydraulic analyses using AQTESOLV™ Version 4.5 (Duffield 2007).

5.1 APT 1: PZ-2 Zone of Secondary Permeability Test

Water levels were measured once per day for 5 days prior to the first APT as background data. **Appendix B**, Table B-1, shows the pre-test measuring point and water level elevations collected from the eight wells. Water levels among the four shallow monitor wells tracked very closely during this period, with an average difference between wells of only 0.02 ft. There also was excellent agreement between the two deep monitor wells, with an average difference of 0.01 ft. The shallow wells had higher water levels than the deep wells, with an average difference of 0.49 ft and a maximum difference of 0.67 ft. According to the nearest rainfall monitoring station, no rainfall occurred at the site during this time.

Water levels in the background well (MORI_M-1) tracked closely but somewhat lower than in the shallow monitor wells, possibly due to the location being slightly lower in elevation. However, the differences in water levels between MORI_M-1 and the shallow monitor wells ranged from 0.01 to 0.30 ft over the 5-day period, indicating poor correlation between the wells.

For the first APT, pumping for the drawdown phase began at 16:09 on March 23, 1987 and stopped at 17:00 on March 26, 1987, at which time the test went into recovery. The production well (MORI_PW-1A) was pumped at 890 gallons per minute (gpm) for 4,490.3 minutes (almost 75 hours) using a 6×6 centrifugal pump attached to the wellhead. Discharge water was conveyed through a 6-inch collapsible hose to a canal approximately 1,000 ft north of the well. Discharge was measured with a circular orifice weir using a 5.7-inch inner diameter discharge pipe with a 5-inch round orifice plate. The discharge rate was steady during the test, fluctuating by less than 0.02% (**Appendix B**).

Water levels in all monitor wells, except MORI_M-1, were measured continuously during the APT with pressure transducers using a HERMIT SE200 Hydrologic Analysis System developed by In-Situ, Inc. For an unknown reason, the transducer in MORI_D-2 started recording approximately 10 seconds earlier than those in the other wells. Water levels were measured manually with a chalked steel tape every 2 hours in all wells, including MORI_M-1, to verify the pressure transducer data. There were several light rain events during pumping and drawdown that had no effect on the APT results. After pumping ceased, recovery water level measurements were collected for 634.75 minutes (10.6 hours). Approximately 0.46 inches of rainfall occurred at the beginning of the recovery period, which caused some fluctuation in water levels for the first 2 minutes of recovery. Water levels at the end of the recovery period for the two deeper wells and the shallow well MORI_S-1A returned to original pre-pumping levels. Water levels in the other three shallow wells did not quite recover to pre-test levels, with MORI_S-3 recovering to within 0.10 ft.

The resulting APT data showed maximum drawdowns of 2 ft in MORI_D-1A and 1.4 ft in well MORI_D-2, which were located 30 and 90 ft from the production well (MORI_PW-1A), respectively. Although it was not possible to measure drawdown in the production well because the pump was attached to the wellhead, it was assumed to be less than 32 ft given the suction limitations of the 6×6 centrifugal pump.

Very little drawdown was observed in the shallow monitor wells (MORI_S-1, MORI_S-1A, MORI_S-2, and MORI_S-3); the maximum being less than 0.30 ft, and lagged behind that of the two deeper wells by approximately 20 minutes. MORI_M-1, located more than 1,530 ft from the production well, had a maximum drawdown of 0.47 ft based on manual readings.

Production Zone PZ-2 Analysis

APT data were analyzed using AQTESOLV™ Version 4.5 (Duffield 2007). After many analytical attempts, the most appropriate solution used to obtain the best curve fit and hydraulic characteristics of this aquifer zone was the Neuman-Witherspoon (1969) solution for a pumping test in a leaky aquifer. The analyses paired the data and the aquifer and well parameters from the two deeper wells (MORI_D-1A and MORI_D-2) with the two shallow wells (MORI_S-1A and MORI_S-2). Results of the analyses are provided in **Table 2**, showing corresponding transmissivity, storativity, leakage parameter, and hydraulic conductivity values. Graphs and reports from the two analyses are included in **Appendix B**. These reports also document the assumptions made and values used for the aquifer and well parameters in the analyses.

The analytical solution assumed the saturated aquifer thicknesses of PZ-2 (pumped aquifer) to be 135 ft. For PZ-1 (unpumped aquifer), 45 ft (depth of the shallow wells) was used for the saturated thickness, with the lower remaining 50 ft being the thickness of the upper aquitard. The wells were partially penetrating and the aquifer heterogeneous and anisotropic, as some layering of sediments was apparent from the lithologic logs. An estimated lower aquitard thickness of 100 ft was applied.

Table 2. Aquifer performance test 1 analytical results of MORI_D-1A/S-1A and MORI_D-2/S-2 data, using the Neuman-Witherspoon (1969) solution.

Well	Transmissivity (ft^2/day)	Storativity	Leakage (1/B) (ft^{-1})	Leakage (β/r) (ft^{-1})	Hydraulic Conductivity (ft/day)
MORI_D-1A	99,120	1.54E-5			735
MORI_D-2	129,400	3.60E-5			959
Average	**114,260**	**2.57E-5**			**847**
MORI_S-1A	3,300	1.42E-3	4.4E-5	1.4E-5	73
MORI_S-2	4,330	7.8E-4	4.7E-5	2.5E-6	96
Average	**3,813**	**1.1E-3**	**4.55E-5**	**8.3E-5**	**84.5**

ft = foot.

The overall average transmissivity and storativity for PZ-2 were estimated to be 114,260 ft^2/day and 2.57E-5, respectively, while those for the shallower zone PZ-1 were 3,813 ft^2/day and 1.1E-3. Hydraulic conductivity values were estimated by dividing the calculated transmissivity values by each zone's estimated saturated aquifer thickness. The two leakage values were generated in the analysis as an estimation of the amount of groundwater leaking into PZ-2 from the overlying aquitard, where B represents a leakage factor (in feet), r is the radial distance (in feet) between the production well and the monitor well, and β is a dimensionless leakage parameter = r/B. In this case, leakage from the overlying aquitard appeared to be minimal.

Swayze and Miller (1984) estimated transmissivities ranging from 1,000 ft^2/day on the flanks of this productive zone to 100,000 ft^2/day along the axis on which the Morikami Park site is located. Shine et al. (1989) estimated transmissivity to be approximately 140,000 ft^2/day at this location, having used a saturated aquifer thickness of 105 ft in the computation. Reese and Wacker (2009) calculated a transmissivity of only 70,000 ft^2/day, but the assumptions made to arrive at this value were not provided.

5.2 APT 2: Shallow Zone Test

A short-duration, low-flow pump test was conducted on June 11, 1987 in the upper sand/shell zone of the SAS to obtain information on the hydraulic characteristics. However, the testing process was riddled with problems and resulted in a corrupted data set that could not be effectively analyzed with any level of confidence.

Test setup began at 09:00. Between 09:40 and 09:52, one set of manual water levels was collected from seven of the eight wells (not MORI_M-1) using hand-held chalk tape. Those measurements are provided in **Appendix C**, Table C-1. Because there was no production well in the shallow zone, shallow monitor well MORI_S-1 was used as a proxy. The 2-inch centrifugal pump with a 1.25-inch diameter drop hose was placed approximately 5 ft from MORI_S-1. A 20-ft long section of 2-inch diameter, semi-rigid hose was attached to the discharge end of the pump and a 2-inch diameter, continuous rate, propeller-type flow meter was attached to the discharge end of this hose. Water leaving the flow meter went directly into 300 ft of 2-inch diameter collapsible hose. This hose discharged to the ground surface approximately 350 ft north of MORI_S-1. From the original investigators' records, a longer discharge hose was not used due to adverse pressure effects on the maximum achievable pump rates.

At 10:34, the pump was turned on and primed using water suctioned from a barrel through the 1.25-inch hose. Once the water reached the bottom of barrel, the suction hose was removed and inserted approximately 20 ft into MORI_S-1, which took approximately 4 seconds, during which time the pump lost part of its prime. The pump did not regain its full prime until 4 seconds after the start of automatic recording of drawdowns at 10:36. The time (in seconds) it took for every 10 gallons to flow through the meter was recorded and used to calculate the discharge rate (**Appendix C**, Table C-1).

The initial discharge measured at the flow meter was 19.5 gpm as the pump re-primed itself, but the flow rate may have been somewhat erratic during that 4-second lag. Discharge increased to a maximum of 33.4 gpm, then dropped to 27.6 gpm after 6 minutes as the well drew down and resistive pressure head built up in the discharge line. Discharge gradually decreased to 24.7 gpm over the remainder of the test. In addition to the inconsistent discharge rate, the suction hose in the well collapsed, which could not be resolved by increasing the throttle speed on the pump. Pumping duration was slightly less than 175 minutes (approximately 3 hours), which may not have been long enough to obtain reasonable levels of drawdown.

During the second APT, water levels in the wells (MORI_PW-1A, MORI_D-1A, MORI_D-2A, MORI_S-1A, MORI_S-2, and MORI_S-3) were measured continuously with pressure transducers attached to the In-Situ SE200 Hydrologic Analysis System and manually on an hourly basis with chalked tape. Results are shown **Appendix C**, Tables C-2 and C-3.

Water levels in MORI_S-1A and MORI_S-2 responded to the pumping well MORI_S-1, but problems developed with the In-Situ SE200 Hydrologic Analysis System during the APT, resulting in random erratic fluctuations up to 0.15 ft in the water level readings, especially in MORI_S-3. Because the maximum observed drawdown was 0.40 ft, this amount of fluctuation significantly compromised the data. The APT was conducted on a very hot day, and the problems may have been caused by temperature changes in the pressure transducer cables. The two deeper wells, MORI_D-1A and MORI_D-2, showed little, if any drawdown.

The pump was shut off at 13:30, and the In-Situ SE200 Hydrologic Analysis System began recording recovery data. The wells were monitored until 14:54, at which time the water level in the pumped well (MORI_S-1) returned to within 0.05 ft of its starting elevation, a duration of 84 minutes.

Overall, the drawdown portion of the second APT was not well controlled. A slightly greater pump rate could have been attained and maintained using a rigid suction line and a pump with a greater capacity. However, the efficiency of MORI_S-1 probably would have prevented any pump from achieving a steady withdrawal rate of 50 gpm without collapsing the well screen. A recent review of what transpired during the test and the data revealed the duration of the pumping phase of the test probably was not long enough to obtain adequate drawdown in any of the wells that could provide a curve suitable for analysis. In 1987, the project hydrogeologists attempted to manually analyze the data (after discarding the earliest measurements and using the remaining ones uncorrected). Applying the Neuman (1974) solution using a β curve of 0.1, they calculated an average transmissivity of 3,815 ft^2/day, storativity of 0.0013, and hydraulic conductivity of 69 ft/day, but ultimately felt the results were subjective and unreliable.

6.0 SUMMARY

The hydrogeologic investigation and APTs conducted at Morikami Park in 1987 were a challenging undertaking and did not achieve the original project objectives. The drilling phase involved multiple attempts to drill several of the deeper wells, but never reached the base of the SAS due to the unstable lithology. A production well (MORI_PW-1A), two deep monitor wells (MORI_D-1A and MORI_D-2), four shallow monitor wells (MORI_S-1, MORI_S-1A, MORI_S-2 and MORI_S-3), and one background well (MORI_M-1) eventually were installed. This was followed by an APT, conducted from March 23 through 26, 1987, focused on the deeper portion (discontinuous zone of secondary permeability [PZ-2]) of the SAS. Analyses of the water level data collected during the APT from the deeper monitor wells, MORI_D-1A and MORI_D-2, estimated average transmissivity, storativity, and hydraulic conductivity to be 114,260 ft^2/day, 2.57E-5, and 847 ft/day, respectively. Drawdowns in the shallow monitor wells during this APT were negligible; however, data from shallow wells MORI_S-1A and MORI_S-2 were paired with that from the two deep wells and used as the unpumped aquifer in the analysis applying the Neuman-Witherspoon (1969) solution.

A second APT was conducted on June 11, 1987, for the unconfined upper zone (PZ-1) of the aquifer, using the shallow MORI_S-1 monitor well as the pumping well. The APT encountered problems during the drawdown phase (inconsistent and inadequate pumping rate, collapsed suction line, faulty recording system, and insufficient pumping duration), which resulted in compromised data and a lack of drawdown sufficient for analysis using any of the AQTESOLV solutions. Efforts in 1987 to analyze these data using manual calculations produced results that were considered subjective and unreliable for future use.

LITERATURE CITED

Duffield, G.M. 2007. AQTESOLV™ for Windows Version 4.5.

Miller, W.L. 1987. Lithology and base of the surficial aquifer system, Palm Beach County, Florida. United States Geological Survey, Water-Resources Investigations Report 86-4067. 1 sheet.

Miller, W.L. 1988. Description and evaluation of the effects of urban and agricultural development on the surficial aquifer system, Palm Beach County, Florida. United States Geological Survey, Water-Resources Investigations Report 88-4056. 64 pp.

Neuman, S.P. 1974. Effect of partial penetration on flow in unconfined aquifers considering delayed gravity response. Water Resources Research, vol. 10, no. 2, pp. 303-312.

Neuman, S.P. and P.A. Witherspoon. 1969. Theory of flow in a confined two aquifer system, Water Resources Research, vol. 5, no. 4, pp. 803-816.

Reese, R.S. and M.A. Wacker. 2007. A preliminary hydrogeologic framework for the surficial aquifer system in Palm Beach County, Florida. United States Geological Survey, Scientific Investigations Map 2971. 2 sheets.

Reese, R.S. and M.A. Wacker. 2009. Hydrogeologic and hydraulic characterization of the surficial aquifer system, and origin of high salinity groundwater, Palm Beach County, Florida. United States Geological Survey, Scientific Investigations Report 2009-5113. 42 pp.

Rodis, H.G. and L.F. Land. 1976. The shallow aquifer - a prime freshwater resource in eastern Palm Beach County, Florida. United States Geological Survey Investigations Report 76-21. Tallahassee, FL. 12 pp.

Scott, W.B. 1977. Hydraulic conductivity and water quality of the shallow aquifer, Palm Beach County, Florida. United States Geological Survey, Water-Resources Investigations Report 76-119. 22 pp

Shine, M.J., D.G.J. Padgett, and W.M. Barfknecht. 1989. Ground water resource assessment of eastern Palm Beach County, Florida. South Florida Water Management District DRE-278 and 279. Technical Publication 89-4. South Florida Water Management District, West Palm Beach, FL. 372 pp. and appendices.

Swayze, L.J. and W.L. Miller. 1984. Hydrogeology of a zone of secondary permeability in the surficial aquifer of eastern Palm Beach County, Florida. United States Geological Survey, Water-Resources Investigation Report 83-4249. 39 pp.

Swayze, L.J., M.C. McGovern, and J.N. Fischer. 1980. Lithologic logs and geophysical logs from test drilling in Palm Beach County, Florida, since 1974. United States Geological Survey, Open File Report 81-68, Tallahassee, FL. 93 pp.

APPENDICES

APPENDIX A:
LITHOLOGIC DESCRIPTIONS

Table A-1. Lithologic descriptions from the Morikami Park test well (TW).

Depth (ft bls)	Description
0 – 2	Sand: sand, quartz, 99%, light olive gray (87), high porosity (30%), intergranular, medium grain size mode with medium to coarse size distribution, sub-rounded, medium sphericity, unconsolidated, frosted, trace of shells, and trace of phosphate. Low permeability.
2 – 7	Sand: sand, quartz, 97%, light olive gray (87), with trace of light brown (28), high porosity (30%), intergranular, medium grain size mode with medium to coarse size distribution, sub-rounded, medium sphericity, unconsolidated to poorly consolidated, frosted, trace of iron stain; Sandstone, 3%, dusky brown (23), moderate porosity (10%), poorly indurated, iron cement, trace of shell. Low to moderate permeability.
7 – 12	Sand, Shell, Sandstone: sand, quartz, 35%, as above but with less iron stain and less frosting; shell, 35%, very pale orange (29), very high porosity (40%), relatively unworn whole shell with some bivalve fragments, *Chione* and *Turritella* sp.; sandstone, 30%, grayish orange (33), low porosity (5%), intergranular, medium grain size with fine to coarse grain distribution, sub-rounded, medium sphericity quartz grains, fine calcite grains, moderate induration, sparry calcite cement, trace of phosphate. Low to moderate permeability.
12 – 21	Sand and Shell: sand, quartz, 90%, dark yellowish brown (31), very porous (30%), medium grain size mode with medium to coarse grain size distribution, subangular, medium sphericity, non-indurated, fragmented and slightly worn *Chione* and *Turritella* sp., trace of phosphate. Moderate permeability.
21 – 30	Sand: sand, quartz, 98%, grayish brown (26) to colorless, very porous (30%), medium grain size mode with medium grain size distribution, subangular, medium sphericity, non-indurated, iron stained, shell fragments and sandstone, 2%, probably contamination from above. Low to moderate permeability.
30 – 40	Sand: sand, quartz, 100%, moderate brown (22) to colorless, very porous (30%), intergranular, medium grain size mode with trace of coarse grains, subangular, medium sphericity, non-indurated, 40% of grains are iron stained, trace of shell, trace of limestone. Low to moderate permeability.
40 – 47	Sand: sand, same as above.
47 – 60	Sand: sand, quartz, 100%, pale yellowish brown (30) to colorless, very porous (30%), intergranular, medium grain size mode, medium with trace of coarse grain size distribution, subangular to sub rounded, medium sphericity, non-indurated, trace of frosting on larger grains, trace of iron staining; trace of phosphate. Low to moderate permeability.
60 – 70	Sand: sand, quartz, 100%, pale yellowish brown (30) to colorless, very porous (28%), intergranular, medium grain size mode, medium to coarse grain size distribution, subangular, medium sphericity, non-indurated, frosting on larger grains, trace of iron staining. Low permeability.
70 – 80	Sand: sand, quartz, 100%, as above.
80 – 90	Sand: sand, quartz, 100%, as above; trace of shell.
90 – 95	Sand: sand, quartz, 100%, as above; trace of limestone, intrasparite. Low permeability.
95 – 100	Top of Zone of Secondary Permeability Limestone: siliceous calcarenite, 100%, light olive gray (87) to olive gray (88), intergranular, pinpoint vugs, possibly high permeability, calcareous and siliceous intraclasts with some biogenic grains, >95% of grains larger than 0.062 mm, medium grain size mode with fine to medium grain size distribution, good induration, sparry calcite cement, very phosphatic, granular texture, low recrystallization, organics. High permeability.
100 – 110	Limestone: siliceous calcarenite, 100%, light olive gray (87), as above with some biogenic grains. High permeability.
110 – 118	Limestone: siliceous calcarenite, 100%, as above with increase in siliceous grains, trace of shell. High permeability.

Depth (ft bls)	Description
118 – 124	Limestone: siliceous calcarenite, 100%, grayish orange (33) to light olive gray (87), very porous (20%), intergranular, pinpoint vugs, possibly high permeability, calcareous and siliceous intraclasts, increase in biogenic grains. >95% of grains larger than 0.062 mm, fine grain size mode with fine to very coarse grain size distribution, good induration, sparry calcite cement, slightly phosphatic, sucrosic texture, low recrystallization, trace of shell. Very high permeability.
124 – 128	Limestone: limestone, 100%, very pale orange (29) to light olive gray (87), porous (10%), intergranular, intraclasts with some biogenic grains, 80% grains, 0.0655 mm, bimodal grain size mode, fine and medium, very fine to medium grain size distribution, good induration, sparry calcite cement, trace of phosphate, moderate to recrystallization, trace of shell. Moderate permeability.
128 – 134	Limestone: siliceous calcarenite, 100%, light olive gray (87), moderately porous (18%), intergranular, pinpoint vugs, siliceous and calcareous, intraclasts with a trace of biogenic grains, 95% grains >0.065 mm, medium grain size mode with fine to medium grain size distribution, good induration, sparry calcite cement, phosphate, low recrystallization. High permeability.
134 – 138	Poor returns. Limestone: limestone, 100%, yellowish gray (86) to light olive gray (87), moderately porous (18%), intergranular, pinpoint vugs, siliceous and calcareous intraclasts with trace biogenic grains, 90% grains >0.065 mm, medium grain mode, fine to medium grain size distribution, good induration, sparry calcite cement, phosphatic, trace of shell. High permeability.
138 – 140	Limestone: siliceous calcarenite, 100%, light olive gray (87), porous to very porous (20%), intergranular, pinpoint vugs, siliceous and calcareous intraclasts 90% >0.065 mm, medium grain mode, fine to medium grain size distribution, good induration, sparry calcite cement, very phosphatic, moderate recrystallization. High permeability.
140 – 150	Limestone: siliceous calcarenite, 100%, as above, fine to coarse grain size distribution, granular texture, very phosphatic. High permeability.
150 – 160	Limestone: siliceous calcarenite, 100%, as above, less phosphate. High permeability.
160 – 170	Limestone: siliceous calcarenite, 100%, as above, increase in calcareous intraclasts, trace of shell. High permeability.
170 – 185	Limestone: siliceous, calcarenite, 100%, as above. High permeability.

ft bls = feet below land surface; mm = millimeter.

Table A-2. Lithologic descriptions from the lower half of the Morikami Park Production Well (MORI_PW-1A)

Depth (ft bls)	Description
0 – 120	No samples.
120 – 130	Sand (quartz): yellowish-gray, unconsolidated, 25% varies between calcareous sandstone to sandy limestone; some rounded, polished phosphate grains; 20% porosity.
130 – 160	Limestone: yellowish-gray, good induration, some calcareous sandstone, finely ground shells, very fine to coarse grained, drusy calcite over some pieces; some rounded, polished phosphate grains; 15% porosity.
160 – 170	Limestone: yellowish-gray, good induration, some finely ground shells, 2% to 10% rounded, polished phosphate grains very fine-coarse grained; last 5 feet includes fine-grained mix of sand, sparry calcite, shell, and phosphate calcite; 15% porosity.
170 – 174	Limestone: yellowish-gray, good induration, same as above but with very fine-grained phosphatic sandstone: 10% porosity.
174 – 175	Limestone: yellowish-gray, moderate induration; more sparry calcite and less fine unconsolidated material; 15% porosity.
175 – 179	Sand (quartz): yellowish-gray, unconsolidated, with about 10% fine-grained sandy coquina; 25% porosity.
179 – 180	Limestone: yellowish-gray, moderate induration, very fined grained phosphate.
180 – 190	Sand (quartz): yellowish-gray, unconsolidated, with very-fine grained rounded, polished phosphate; 25% porosity.
190 – 190	Limestone: light gray; moderate induration, varies from very fine-grained sandy phosphatic coquina to coarser-grained less phosphatic limestone; 20% porosity.
190 – 194	Sand (quartz): yellowish gray, unconsolidated, with *Bryozoa*, very fine rounded, polished phosphate grains and some limestone as above; 20% porosity.
194 – 195	Limestone: yellowish-gray, good induration, 15% porosity.
195 – 200	Limestone: yellowish-gray, good induration, varies from fine-grained coquina to coarser-grained limestone and trace to 40% rounded, polished phosphate.

ft bls = feet below land surface.
Table descriptions extracted from DBHydro: MORI_PW-1A

APPENDIX B:
AQUIFER PERFORMANCE TEST 1

Table B-1. Pre-test measuring point and water level elevations (in feet NGVD29) for aquifer performance test 1.

Well	Measuring Point Elevation	Water Level Elevation				
		3/19/1987	3/20/1987	3/21/1987	3/22/1987	3/23/1987
MORI_PW-1A	19.76	15.99	15.79	15.97	16.06	-
MORI_D-1A	19.47	15.99	15.82	15.97	16.05	16.04
MORI_S-1	19.34	16.57	16.47	16.44	16.44	16.39
MORI_S-1A	19.70	16.56	16.47	16.44	16.45	16.39
MORI_D-2	19.49	16.01	15.80	15.96	16.05	16.06
MORI_S-2	19.55	16.57	16.47	16.45	16.43	16.37
MORI_S-3	19.72	16.58	16.50	16.50	16.43	16.37
MORI_M-1	19.04	16.47	16.20	16.34	16.44	16.32

NGVD29 = National Geodetic Vertical Datum of 1929.

Table B-2. Discharge flow rates during aquifer performance test 1.

Date	Time	Pressure Head (inches)	Flow Rate (gpm)	Comments
3/23/1987	16:09	51.00	880.0	
	16:10	51.25	882.0	
	16:11	51.50	884.0	
	16:12	51.75	886.0	
	16:13	51.75	886.0	
	16:14	52.00	888.0	
	16:15	52.50	890.0	
	16:16	52.50	890.0	
	16:18	52.00	888.0	
	16:20	52.00	888.0	
	16:25	52.00	888.0	
	16:52	51.50	884.0	
	17:52	51.75	886.0	
	18:50	52.00	888.0	
	19:57	52.00	888.0	
	21:26	52.50	890.0	
	21:59	52.50	890.0	
	23:02	52.30	889.2	
3/24/1987	00:00	52.30	889.2	
	01:00	52.30	889.2	
	02:01	52.20	888.8	
	03:01	52.30	889.2	
	04:00	52.30	889.2	
	04:58	52.30	889.2	
	05:57	52.30	889.2	
	06:56	52.30	889.2	
	07:30			Rain sprinkles
	07:58	52.30	889.2	
	09:50	52.40	889.6	
	10:00	52.25	889.0	Rain sprinkles – no accumulation
	11:00	52.50	890.0	

Date	Time	Pressure Head (inches)	Flow Rate (gpm)	Comments
3/24/1987 (cont.)	12:00	52.45	889.8	
	13:00	52.45	889.8	
	14:00	52.75	891.0	Rain sprinkles cont. – trace accumulation
	14:30			Raining harder
	15:00	52.45	889.8	Rain stopped; .01 accumulation
	16:00	52.50	890.0	
	17:00	52.50	890.0	
	18:00	52.25	889.0	
	18:55	52.30	889.2	
	21:04	52.30	889.2	
	21:57	52.30	889.2	
	22:59	52.30	889.2	
	23:57	52.30	889.2	
3/25/1987	01:03	52.30	889.2	
	02:59	52.30	889.2	
	04:02	52.20	888.8	
	05:02	52.30	889.2	
	06:01	52.10	888.4	
	07:00	52.10	888.4	
	08:03	52.20	888.8	
	09:00	52.40	889.6	
	10:00	52.25	889.0	
	12:00	52.40	889.6	
	13:00	52.40	889.6	
	14:00	52.25	889.0	
	15:00	52.25	889.0	
	16:00	52.25	889.0	
	17:00	52.25	889.0	
	18:00	52.50	890.0	
	19:00	52.25	889.0	
	20:00	52.25	889.0	
	22:59	52.10	888.4	
	00:03	52.25	889.0	
3/26/1987	00:57	52.10	888.4	
	02:07	52.30	889.2	
	03:00	52.10	888.4	
	04:00	52.20	888.8	
	04:57	52.10	888.4	
	05:55	52.10	888.4	
	06:50	52.00	888.0	
	08:01	52.20	888.8	
	09:00	52.00	888.0	
	10:00	52.25	889.0	
	11:00	51.75	886.0	
	12:00	51.75	886.0	
	13:00	52.00	888.0	
	14:00	52.25	889.0	
	15:00	51.50	884.0	
	16:00	51.50	884.0	
	17:00	51.75	886.0	

gpm = gallons per minute.

Table B-3. Morikami Park aquifer performance test 1 manual water level depths and elevations (in feet).

Date	D-1A (19.47 MP)			S-1A (19.7 MP)			D-2 (19.49 MP)			S-2 (19.55 MP)			S-1 (19.34 MP)			S-3 (19.72 MP)			M-1 (19.04 MP)			PW-1A (19.76 MP)		
	Time	Water Level		Time	Water Level		Time	Water Level		Time	Water Level		Time	Water Level		Time	Water Level		Time	Water Level		Time	Water Level	
		Depth	Elevation		Depth	Elevation		Depth	Elevation		Depth	Elevation		Depth	Elevation		Depth	Elevation		Depth	Elevation		Depth	Elevation
3/19/87	12:12	3.48	15.99	12:10	3.14	16.56	12:05	3.48	16.01	11:57	2.98	16.57	12:07	2.77	16.57	11:55	3.14	16.58	11:39	2.57	16.47	12:15	3.77	15.99
3/20/87	11:45	3.65	15.82	11:47	3.23	16.47	11:40	3.69	15.80	11:38	3.08	16.47	11:42	2.87	16.47	11:36	3.22	16.50	11:29	2.84	16.20	11:49	3.97	15.79
3/21/87	09:51	3.50	15.97	09:50	3.26	16.44	09:39	3.53	15.96	09:39	3.10	16.45	09:43	2.90	16.44	09:33	3.22	16.50	10:04	2.70	16.34	09:53	3.79	15.97
3/22/87	08:35	3.42	16.05	08:33	3.25	16.45	08:28	3.44	16.05	08:26	3.12	16.43	08:30	2.90	16.44	08:21	3.29	16.43	08:47	2.60	16.44	08:39	3.70	16.06
3/23/87	10:38	3.43	16.04	10:37	3.31	16.39	10:33	3.43	16.06	10:31	3.18	16.37	10:35	2.95	16.39	10:29	3.35	16.37	10:44	2.72	16.32			
	12:30	3.42	16.05	12:30	3.33	16.37	12:30	3.42	16.07	12:30	3.18	16.37	12:30	2.97	16.37	12:30	3.35	16.37						
	14:00	3.39	16.08	14:00	3.31	16.39	14:00	3.41	16.08	14:00	3.17	16.38	14:00	2.97	16.37	14:00	3.36	16.36						
	17:11	5.20	14.27	17:10	3.40	16.30	17:06	4.60	14.89	17:03	3.23	16.32	17:08	3.01	16.33	17:00	3.40	16.32	17:05	2.86	16.18			
	19:20	5.29	14.18	19:17	3.43	16.27	19:14	4.66	14.83	19:10	3.25	16.30	19:25	3.05	16.29	19:02	3.42	16.30	19:01	2.90	16.14			
	21:18	5.27	14.20	21:16	3.42	16.28	21:12	4.65	14.84	21:10	3.27	16.28	21:14	3.05	16.29	21:05	3.42	16.30	21:31	2.91	16.13			
	23:15	5.26	14.21	23:14	3.42	16.28	23:09	4.65	14.84	23:06	3.25	16.30	23:11	3.04	16.30	23:01	3.42	16.30	23:21	2.91	16.13			
3/24/87	01:14	5.26	14.21	01:12	3.42	16.29	01:05	4.65	14.84	01:02	3.25	16.30	01:09	3.05	16.29	00:59	3.43	16.29	01:18	2.92	16.12			
	03:19	5.30	14.17	03:17	3.44	16.29	03:10	4.71	14.78	03:07	3.27	16.28	03:13	3.07	16.27	03:02	3.44	16.28	03:09	2.95	16.09			
	05:11	5.38	14.10	05:09	3.45	16.25	05:04	4.77	14.72	05:02	3.28	16.27	05:07	3.08	16.26	04:59	3.45	16.27	05:06	2.98	16.06			
	07:12	5.44	14.04	07:10	3.48	16.23	07:05	4.85	14.65	07:03	3.31	16.24	07:07	3.10	16.24	07:00	3.48	16.24	07:05	3.03	16.01			
	09:00	5.38	14.09	09:00	3.45	16.25	09:00	4.78	14.71	09:00	3.31	16.24	09:00	3.10	16.24	09:00	3.48	16.24	09:00	2.99	16.05			
	11:00	5.31	14.16	11:00	3.44	16.26	11:00	4.71	14.78	11:00	3.30	16.25	11:00	3.10	16.24	11:00	3.49	16.23	11:00	3.00	16.04			
	13:00	5.31	14.16	13:00	3.45	16.25	13:00	4.71	14.78	13:00	3.31	16.24	13:00	3.10	16.24	13:00	3.48	16.24	13:00	3.02	16.02			
	15:00	5.30	14.17	15:00	3.47	16.23	15:00	4.70	14.79	15:00	3.31	16.24	15:00	3.11	16.23	15:00	3.47	16.25	15:00	3.00	16.04			
	17:26	5.33	14.14	17:22	3.50	16.20	17:15	4.74	14.75	17:11	3.34	16.21	17:20	3.13	16.21	17:05	3.51	16.21	17:37	3.06	15.98			
	19:32	5.35	14.12	19:26	3.52	16.18	19:29	4.74	14.75	19:07	3.36	16.19	19:23	3.14	16.20	19:03	3.52	16.20	19:45	3.08	15.96			
	21:12	5.32	14.15	21:10	3.51	16.19	21:05	4.73	14.76	21:07	3.34	16.21	21:08	3.14	16.20	21:02	3.51	16.21	21:15	3.10	15.94			
	23:19	5.31	14.16	23:11	3.51	16.19	23.02	4.72	14.77	22:59	3.34	16.21	23:04	3.12	16.22	22:52	3.49	16.23	23:04	3.10	15.94			

Date	D-1A (19.47 MP)			S-1A (19.7 MP)			D-2 (19.49 MP)			S-2 (19.55 MP)			S-1 (19.34 MP)			S-3 (19.72 MP)			M-1 (19.04 MP)			PW-1A (19.76 MP)		
	Time	Water Level Depth	Water Level Elevation	Time	Water Level Depth	Water Level Elevation	Time	Water Level Depth	Water Level Elevation	Time	Water Level Depth	Water Level Elevation	Time	Water Level Depth	Water Level Elevation	Time	Water Level Depth	Water Level Elevation	Time	Water Level Depth	Water Level Elevation	Time	Water Level Depth	Water Level Elevation
3/25/87	01:15	5.30	14.17	01:16	3.51	16.19	01:09	4.70	14.79	01:05	3.35	16.20	01:12	3.15	16.19	01:03	3.51	16.21	01:08	3.10	15.94			
	03:07	5.32	14.15	03:09	3.51	16.19	03:02	4.73	14.76	03:00	3.35	16.20	03:04	3.15	16.19	02:58	3.53	16.19	03:12	3.11	15.93			
	05:13	5.43	14.04	05:14	3.53	16.17	05:08	4.83	14.66	05:05	3.37	16.18	05:10	3.16	16.18	05:02	3.53	16.20	05:08	3.15	15.89			
	07:10	5.47	14.00	07:09	3.55	16.15	07:05	4.89	14.60	07:04	3.38	16.17	07:07	3.18	16.16	07:02	3.55	16.17	07:06	3.19	15.85			
	09:00	5.44	14.03	09:00	3.59	16.11	09:00	4.85	14.68	09:00	3.38	16.17	09:00	3.17	16.17	09:00	3.56	16.16	09:00	3.19	15.85			
	11:00	5.43	14.04	11:00	3.56	16.14	11:00	4.84	14.67	11:00	3.40	16.15	11:00	3.19	16.15	11:00	3.56	16.16	11:00	3.18	15.86			
	13:00	5.44	14.03										13:00	3.19	16.15				13:00	3.17	15.87			
	15:00	5.42	14.05	15:00	3.57	16.13	15:00	4.81	14.68	15:00	3.40	16.15	15:00	3.20	16.14	15:00	3.56	16.16	15:00	3.17	15.87			
	17:00	5.43	14.04	17:16	3.60	16.10	17:11	4.82	14.67	17:08	3.43	16.12	17:14	3.21	16.13	17:05	3.60	16.12	17:27	3.18	15.86			
	19:08	5.41	14.06	19:03	3.60	16.10	19:00	4.82	14.67	18:56	3.44	16.11	19:00	3.22	16.12	18:54	3.59	16.13	19:18	3.18	15.86			
	21:45	5.38	14.09	21:44	3.59	16.11	21:31	4.80	14.69	21:29	3.44	16.11	21:34	3.22	16.12	21:27	3.60	16.12						
	23:07	5.37	14.10	23:08	3.59	16.11	23:02	4.78	14.71	23:00	3.42	16.13	23:04	3.21	16.13	22:58	3.59	16.13	23:10	3.16	15.88			
3/26/87	01:07	5.36	14.11	01:08	3.59	16.11	01:02	4.77	14.72	01:01	3.44	16.11	01:05	3.22	16.12	00:58	3.59	16.13	01:08	3.16	15.88			
	03:10	5.35	14.12	03:11	3.58	16.12	03:02	4.76	14.73	03:00	3.43	16.12	03:08	3.22	16.12	02:58	3.60	16.12	03:05	3.15	15.89			
	05:00	5.43	14.04	05:07	3.60	16.10	05:02	4.83	14.66	05:00	3.44	16.11	05:04	3.23	16.11	04:57	3.62	16.11	05:02	3.16	15.88			
	07:06	5.48	13.99	07:08	3.62	16.08	07:00	4.91	14.58	07:00	3.45	16.10	07:00	3.24	16.10	06:50	3.61	16.10	07:04	3.18	15.86			
	09:00	5.36	14.11	09:00	3.60	16.10	09:00	4.76	14.73	09:00	3.45	16.10	09:00	3.24	16.10	09:00	3.63	16.09	09:00	3.15	15.89			
	11:00	5.34	14.13	11:00	3.61	16.09	11:00	4.76	14.73	11:00	3.46	16.09	11:00	3.24	16.10	11:00	3.63	16.09	11:00	3.15	15.89			
	13:00	5.35	14.12	13:00	3.62	16.08	13:00	4.77	14.72	13:00	3.47	16.08	13:00	3.26	16.08	13:00	3.63	16.09	13:00	3.16	15.88			
	15:00	5.33	14.14	15:00	3.60	16.10	15:00	4.74	14.75	15:00	3.48	16.07	15:00	3.26	16.08	15:00	3.64	16.08	15:00	3.14	15.90			
	17:16	5.31	14.16	17:14	3.63	16.07	17:09	4.72	14.77	17:06	3.49	16.06	17:12	3.27	16.07	17:03	3.65	16.07	17:25	3.10	15.94			

MP = measuring point.

Table B-4. Aquifer performance test 1 transducer data (pumping rate = 890 gallons per minute).

Time	Elapsed Time (min.)	S-1		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
16:09	0.000	0.00	3.00	0.00	3.39	0.00	3.51	0.00	3.20	0.00	3.52	0.00	3.40
Drawdown													
16:09	0.017									0.02	3.54		
16:09	0.034									0.06	3.58		
16:09	0.050									0.12	3.64		
16:09	0.067									0.21	3.73		
16:09	0.084									0.31	3.83		
16:09	0.100									0.41	3.93		
16:09	0.117									0.50	4.02		
16:09	0.134									0.56	4.08		
16:09	0.150									0.59	4.11		
16:09	0.167									0.58	4.10		
16:09	0.257	-0.04	2.96	-0.04	3.35	0.73	4.24	-0.01	3.19	0.45	3.97	-0.03	3.37
16:09	0.340	-0.04	2.96	-0.04	3.35	1.39	4.90	-0.01	3.19	0.62	4.14	-0.03	3.37
16:09	0.424	-0.04	2.96	-0.04	3.35	1.28	4.79	-0.02	3.18	0.56	4.08	-0.03	3.37
16:10	0.507	-0.04	2.96	-0.04	3.35	0.99	4.50	-0.02	3.18	0.61	4.13	-0.03	3.37
16:10	0.590	-0.04	2.96	-0.04	3.35	1.49	5.00	-0.02	3.18	0.63	4.15	-0.03	3.37
16:10	0.674	-0.04	2.96	-0.04	3.35	1.15	4.66	-0.02	3.18	0.62	4.14	-0.03	3.37
16:10	0.757	-0.04	2.96	-0.04	3.35	1.22	4.73	-0.01	3.19	0.66	4.18	-0.03	3.37
16:10	0.840	-0.04	2.96	-0.04	3.35	1.43	4.94	-0.01	3.19	0.65	4.17	-0.03	3.37
16:10	0.924	-0.03	2.97	-0.04	3.35	1.16	4.67	-0.01	3.19	0.67	4.19	-0.03	3.37
16:10	1.007	-0.03	2.97	-0.03	3.36	1.36	4.87	-0.01	3.19	0.67	4.19	-0.03	3.37
16:10	1.398	-0.03	2.97	-0.03	3.36	1.28	4.79	-0.01	3.19	0.71	4.23	-0.02	3.38
16:11	1.731	-0.03	2.97	-0.03	3.36	1.39	4.90	-0.01	3.19	0.73	4.25	-0.02	3.38
16:11	2.065	-0.02	2.98	-0.02	3.37	1.36	4.87	-0.01	3.19	0.75	4.27	-0.02	3.38
16:11	2.398	-0.02	2.98	-0.02	3.37	1.40	4.91	-0.01	3.19	0.76	4.28	-0.02	3.38
16:12	2.731	-0.03	2.97	-0.03	3.36	1.40	4.91	-0.01	3.19	0.78	4.3	-0.02	3.38
16:12	3.065	-0.03	2.97	-0.03	3.36	1.42	4.93	-0.01	3.19	0.79	4.31	-0.03	3.37
16:12	3.398	-0.03	2.97	-0.03	3.36	1.42	4.93	-0.01	3.19	0.80	4.32	-0.03	3.37
16:13	3.731	-0.02	2.98	-0.03	3.36	1.44	4.95	-0.01	3.19	0.81	4.33	-0.03	3.37
16:13	4.065	-0.02	2.98	-0.02	3.37	1.44	4.95	-0.01	3.19	0.82	4.34	-0.02	3.38
16:13	4.398	-0.01	2.99	-0.02	3.37	1.46	4.97	0.00	3.20	0.83	4.35	-0.01	3.39
16:14	4.731	-0.01	2.99	-0.01	3.38	1.46	4.97	0.00	3.20	0.85	4.37	-0.01	3.39
16:14	5.065	-0.01	2.99	-0.01	3.38	1.47	4.98	0.00	3.20	0.85	4.37	-0.01	3.39
16:14	5.398	-0.01	2.99	-0.01	3.38	1.49	5.00	0.00	3.20	0.87	4.39	-0.01	3.39
16:15	5.731	0.00	3.00	0.00	3.39	1.49	5.00	0.00	3.20	0.87	4.39	0.00	3.40
16:15	6.065	0.00	3.00	0.00	3.39	1.50	5.01	0.00	3.20	0.88	4.4	0.00	3.40
16:15	6.398	-0.01	2.99	-0.01	3.38	1.51	5.02	0.00	3.20	0.88	4.4	-0.01	3.39
16:16	6.731	-0.02	2.98	-0.01	3.38	1.49	5.00	-0.01	3.19	0.88	4.4	-0.02	3.38
16:16	7.065	-0.03	2.97	-0.02	3.37	1.50	5.01	-0.01	3.19	0.88	4.4	-0.03	3.37
16:16	7.398	-0.03	2.97	-0.02	3.37	1.51	5.02	-0.01	3.19	0.89	4.41	-0.02	3.38
16:17	7.731	-0.01	2.99	-0.01	3.38	1.52	5.03	0.00	3.20	0.90	4.42	-0.01	3.39
16:17	8.065	-0.01	2.99	-0.01	3.38	1.52	5.03	0.00	3.20	0.90	4.42	-0.01	3.39
16:17	8.398	-0.01	2.99	-0.01	3.38	1.52	5.03	-0.01	3.19	0.91	4.43	-0.01	3.39

Time	Elapsed Time (min.)	S-1		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
16:18	8.731	-0.02	2.98	-0.01	3.38	1.52	5.03	-0.01	3.19	0.91	4.43	-0.02	3.38
16:18	9.065	-0.01	2.99	-0.01	3.38	1.53	5.04	-0.01	3.19	0.91	4.43	-0.01	3.39
16:18	9.398	0.00	3.00	-0.01	3.38	1.54	5.05	-0.01	3.19	0.92	4.44	-0.01	3.39
16:19	9.731	0.00	3.00	0.00	3.39	1.55	5.06	0.00	3.20	0.93	4.45	0.00	3.40
16:19	10.650	-0.01	2.99	0.00	3.39	1.55	5.06	0.00	3.20	0.93	4.45	0.00	3.40
16:21	12.184	-0.01	2.99	-0.01	3.38	1.57	5.08	0.00	3.20	0.95	4.47	-0.02	3.38
16:23	14.184	0.01	3.01	0.02	3.41	1.60	5.11	0.01	3.21	0.97	4.49	0.01	3.41
16:25	16.213	0.00	3.00	0.00	3.39	1.59	5.10	0.01	3.21	0.98	4.5	0.00	3.40
16:27	18.213	-0.01	2.99	-0.02	3.37	1.60	5.11	0.00	3.20	0.98	4.5	-0.02	3.38
16:29	20.213	0.00	3.00	0.00	3.39	1.61	5.12	0.01	3.21	1.00	4.52	-0.01	3.39
16:31	22.213	0.02	3.02	0.01	3.40	1.64	5.15	0.02	3.22	1.01	4.53	0.01	3.41
16:33	24.213	0.01	3.01	0.01	3.40	1.64	5.15	0.01	3.21	1.02	4.54	0.01	3.41
16:35	26.213	0.01	3.01	0.01	3.40	1.64	5.15	0.01	3.21	1.02	4.54	0.00	3.40
16:37	28.213	0.01	3.01	0.01	3.40	1.65	5.16	0.01	3.21	1.03	4.55	0.00	3.40
16:39	30.213	0.00	3.00	0.00	3.39	1.65	5.16	0.01	3.21	1.03	4.55	-0.01	3.39
16:41	32.213	0.01	3.01	0.02	3.41	1.66	5.17	0.01	3.21	1.04	4.56	0.01	3.41
16:43	34.213	0.02	3.02	0.01	3.40	1.66	5.17	0.02	3.22	1.05	4.57	0.01	3.41
16:45	36.213	0.03	3.03	0.01	3.40	1.68	5.19	0.03	3.22	1.05	4.57	0.01	3.41
16:47	38.213	0.03	3.03	0.03	3.42	1.68	5.19	0.03	3.23	1.06	4.58	0.02	3.42
16:49	40.213	0.02	3.02	0.01	3.40	1.68	5.19	0.03	3.23	1.06	4.58	0.01	3.41
16:51	42.213	0.01	3.01	0.01	3.40	1.68	5.19	0.02	3.22	1.06	4.58	0.01	3.41
16:53	44.213	0.01	3.01	0.01	3.40	1.68	5.19	0.02	3.22	1.07	4.59	0.00	3.40
16:55	46.213	0.03	3.03	0.03	3.42	1.70	5.21	0.03	3.23	1.08	4.6	0.02	3.42
16:57	48.213	0.03	3.03	0.03	3.42	1.70	5.21	0.02	3.22	1.07	4.59	0.01	3.41
16:59	50.213	0.02	3.02	0.01	3.40	1.69	5.20	0.03	3.23	1.07	4.59	0.00	3.40
17:01	52.213	0.01	3.01	0.01	3.40	1.69	5.20	0.02	3.22	1.07	4.59	-0.02	3.38
17:03	54.213	0.02	3.02	0.01	3.40	1.70	5.21	0.03	3.23	1.08	4.6	0.00	3.40
17:05	56.213	0.03	3.03	0.03	3.42	1.71	5.22	0.03	3.23	1.07	4.59	0.02	3.42
17:07	58.213	0.01	3.01	0.00	3.39	1.70	5.21	0.03	3.23	1.08	4.6	-0.01	3.39
17:09	60.213	0.01	3.01	0.00	3.39	1.70	5.21	0.02	3.22	1.08	4.6	-0.01	3.39
17:11	62.213	0.01	3.01	0.01	3.40	1.69	5.20	0.03	3.23	1.08	4.6	0.00	3.40
17:13	64.213	0.01	3.01	0.01	3.40	1.70	5.21	0.03	3.23	1.08	4.6	0.00	3.40
17:15	66.213	0.02	3.02	0.01	3.40	1.72	5.23	0.03	3.23	1.09	4.61	0.01	3.41
17:17	68.213	0.02	3.02	0.01	3.40	1.72	5.23	0.03	3.23	1.09	4.61	0.01	3.41
1719	70.213	0.02	3.02	0.01	3.40	1.72	5.23	0.03	3.23	1.09	4.61	0.01	3.41
17:21	72.213	0.02	3.02	0.01	3.40	1.72	5.23	0.03	3.23	1.10	4.62	0.01	3.41
17:23	74.213	0.03	3.03	0.02	3.41	1.73	5.24	0.03	3.23	1.10	4.62	0.01	3.41
17:25	76.213	0.03	3.03	0.01	3.40	1.73	5.24	0.03	3.23	1.11	4.63	0.01	3.41
17:27	78.213	0.03	3.03	0.02	3.41	1.73	5.24	0.03	3.23	1.11	4.63	0.01	3.41
17:29	80.213	0.03	3.03	0.02	3.41	1.74	5.25	0.03	3.23	1.11	4.63	0.02	3.42
17:31	82.213	0.04	3.04	0.03	3.42	1.75	5.26	0.04	3.24	1.11	4.63	0.03	3.43
17:34	84.213	0.04	3.04	0.03	3.42	1.74	5.25	0.03	3.23	1.11	4.63	0.02	3.42
17:35	86.133	0.03	3.03	0.02	3.41	1.74	5.25	0.03	3.23	1.11	4.63	0.01	3.41
17:37	88.133	0.03	3.03	0.02	3.41	1.75	5.26	0.03	3.23	1.12	4.64	0.02	3.42
17:39	90.133	0.03	3.03	0.01	3.40	1.74	5.25	0.04	3.24	1.12	4.64	0.01	3.41
17:41	92.133	0.03	3.03	0.01	3.40	1.75	5.26	0.03	3.23	1.12	4.64	0.01	3.41

Time	Elapsed Time (min.)	S-1		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
17:43	94.133	0.03	3.03	0.02	3.41	1.74	5.25	0.04	3.24	1.12	4.64	0.01	3.41
17:45	96.133	0.03	3.03	0.02	3.41	1.75	5.26	0.03	3.23	1.12	4.64	0.02	3.42
17:47	98.133	0.03	3.03	0.02	3.41	1.75	5.26	0.03	3.23	1.12	4.64	0.02	3.42
17:49	100.130	0.03	3.03	0.02	3.41	1.75	5.26	0.03	3.23	1.12	4.64	0.02	3.42
18:09	120.180	0.03	3.03	0.01	3.40	1.75	5.26	0.03	3.23	1.12	4.64	0.01	3.41
18:29	140.180	0.04	3.04	0.02	3.41	1.76	5.27	0.04	3.24	1.12	4.64	0.02	3.42
18:49	160.180	0.06	3.06	0.02	3.41	1.79	5.30	0.04	3.24	1.13	4.65	0.03	3.43
19:09	180.180	0.06	3.06	0.02	3.41	1.79	5.30	0.04	3.24	1.13	4.65	0.03	3.43
20:31	262.180	0.07	3.07	0.04	3.43	1.80	5.31	0.06	3.26	1.14	4.66	0.05	3.45
20:51	282.320	0.06	3.06	0.03	3.42	1.81	5.32	0.06	3.26	1.15	4.67	0.04	3.44
21:11	302.280	0.06	3.06	0.04	3.43	1.81	5.32	0.06	3.26	1.15	4.67	0.05	3.45
21:31	322.280	0.07	3.07	0.04	3.43	1.81	5.32	0.06	3.26	1.15	4.67	0.05	3.45
21:51	342.280	0.07	3.07	0.04	3.43	1.81	5.32	0.06	3.26	1.16	4.68	0.05	3.45
22:11	362.282	0.07	3.07	0.03	3.42	1.82	5.33	0.06	3.26	1.16	4.68	0.04	3.44
22:31	382.280	0.07	3.07	0.04	3.43	1.82	5.33	0.07	3.27	1.16	4.68	0.05	3.45
22:51	402.280	0.07	3.07	0.04	3.43	1.82	5.33	0.06	3.26	1.16	4.68	0.04	3.44
23:11	422.280	0.07	3.07	0.03	3.42	1.81	5.32	0.07	3.27	1.15	4.67	0.05	3.45
23:31	442.280	0.07	3.07	0.04	3.43	1.82	5.33	0.07	3.27	1.16	4.68	0.05	3.45
23:51	462.280	0.07	3.07	0.04	3.43	1.82	5.33	0.07	3.27	1.15	4.67	0.05	3.45
00:11	482.280	0.07	3.07	0.04	3.43	1.82	5.33	0.07	3.27	1.16	4.68	0.05	3.45
00:31	502.280	0.07	3.07	0.04	3.43	1.83	5.34	0.07	3.27	1.16	4.68	0.05	3.45
00:51	522.280	0.08	3.08	0.04	3.43	1.82	5.33	0.07	3.27	1.16	4.68	0.05	3.45
01:11	542.280	0.07	3.07	0.04	3.43	1.82	5.33	0.07	3.27	1.16	4.68	0.05	3.45
01:31	562.280	0.07	3.07	0.04	3.43	1.85	5.36	0.07	3.27	1.18	4.70	0.05	3.45
01:51	582.280	0.08	3.08	0.05	3.44	1.86	5.37	0.08	3.28	1.20	4.72	0.06	3.46
02:11	602.280	0.07	3.07	0.04	3.43	1.86	5.37	0.07	3.27	1.19	4.71	0.05	3.45
02:31	622.280	0.08	3.08	0.04	3.43	1.86	5.37	0.08	3.28	1.20	4.72	0.06	3.46
02:51	642.280	0.08	3.08	0.05	3.44	1.87	5.38	0.08	3.28	1.20	4.72	0.06	3.46
03:11	662.280	0.08	3.08	0.05	3.44	1.88	5.39	0.08	3.28	1.21	4.73	0.06	3.46
03:31	682.280	0.08	3.08	0.05	3.44	1.88	5.39	0.08	3.28	1.22	4.74	0.06	3.46
03:51	702.300	0.08	3.08	0.06	3.45	1.90	5.41	0.09	3.29	1.23	4.73	0.06	3.46
04:11	722.300	0.08	3.08	0.06	3.45	1.91	5.42	0.09	3.29	1.24	4.76	0.06	3.46
04:31	742.250	0.09	3.09	0.06	3.45	1.93	5.44	0.10	3.30	1.26	4.78	0.07	3.47
04:51	762.250	0.09	3.09	0.06	3.45	1.94	5.45	0.10	3.30	1.28	4.80	0.07	3.47
05:11	782.250	0.09	3.09	0.07	3.46	1.95	5.46	0.10	3.30	1.29	4.81	0.08	3.48
05:31	802.250	0.10	3.10	0.07	3.46	1.96	5.70	0.10	3.30	1.29	4.81	0.08	3.48
05:51	822.250	0.10	3.10	0.08	3.47	1.98	5.49	0.11	3.31	1.32	4.84	0.08	3.48
06:11	842.300	0.11	3.11	0.08	3.47	2.00	5.51	0.12	3.32	1.33	4.85	0.09	3.49
06:31	862.220	0.10	3.10	0.09	3.48	2.00	5.51	0.12	3.32	1.35	4.87	0.08	3.48
06:51	882.220	0.10	3.10	0.08	3.47	2.00	5.51	0.12	3.32	1.35	4.87	0.08	3.48
07:11	902.220	0.10	3.10	0.09	3.48	1.99	5.50	0.12	3.32	1.35	4.87	0.08	3.48
07:31	922.330	0.10	3.10	0.08	3.47	1.97	5.48	0.12	3.32	1.32	4.84	0.08	3.48
07:51	942.180	0.10	3.10	0.08	3.47	1.95	5.46	0.12	3.32	1.31	4.83	0.08	3.48
08:11	962.180	0.10	3.10	0.08	3.47	1.94	5.45	0.13	3.33	1.31	4.83	0.08	3.48
08:31	982.180	0.11	3.11	0.09	3.48	1.95	5.46	0.13	3.33	1.31	4.83	0.09	3.49
09:49	1,060.300	0.11	3.11	0.09	3.48	1.89	5.40	0.13	3.33	1.25	4.77	0.09	3.49

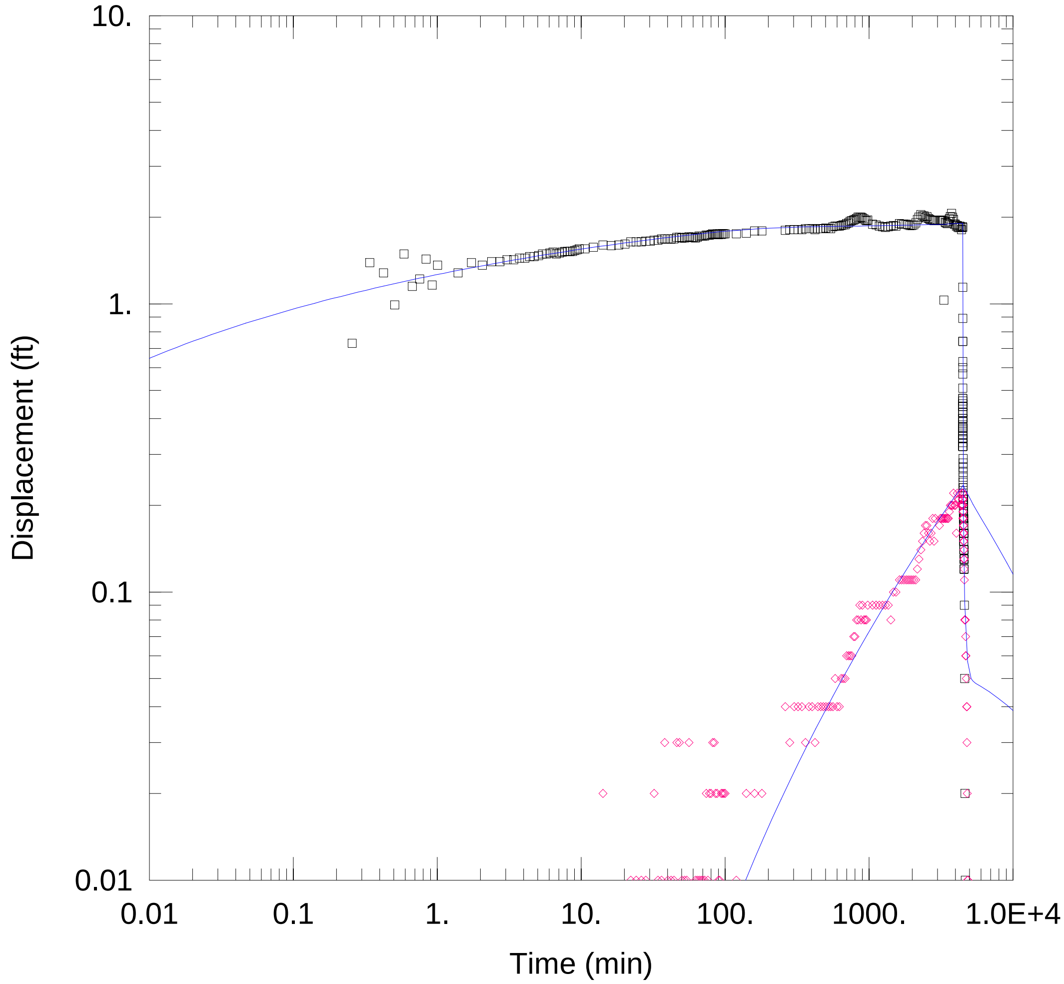
Time	Elapsed Time (min.)	S-1		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
10:49	1,120.300	0.11	3.11	0.09	3.48	1.88	5.39	0.13	3.33	1.24	4.76	0.10	3.50
11:49	1,180.300	0.11	3.11	0.09	3.48	1.86	5.37	0.13	3.33	1.22	4.74	0.10	3.50
12:49	1,240.200	0.11	3.11	0.09	3.48	1.85	5.36	0.14	3.34	1.21	4.73	0.10	3.50
13:49	1,300.300	0.11	3.11	0.09	3.48	1.84	5.35	0.14	3.34	1.20	4.72	0.10	3.50
14:49	1,360.300	0.11	3.11	0.09	3.48	1.85	5.36	0.14	3.34	1.21	4.73	0.10	3.50
15:49	1,420.300	0.10	3.10	0.08	3.47	1.86	5.37	0.14	3.34	1.22	4.74	0.09	3.49
16:49	1,480.200	0.12	3.12	0.10	3.49	1.87	5.39	0.15	3.35	1.23	4.75	0.11	3.51
17:49	1,540.200	0.12	3.12	0.10	3.49	1.86	5.37	0.16	3.36	1.22	4.74	0.11	3.51
19:20	1,631.200	0.14	3.14	0.11	3.50	1.90	5.41	0.16	3.36	1.24	4.76	0.12	3.52
20:20	1,691.200	0.13	3.13	0.11	3.50	1.89	5.40	0.16	3.36	1.23	4.75	0.13	3.53
21:20	1,751.400	0.13	3.13	0.11	3.50	1.89	5.40	0.17	3.37	1.23	4.75	0.13	3.53
22:20	1,811.300	0.14	3.14	0.11	3.50	1.89	5.40	0.17	3.37	1.23	4.75	0.13	3.53
23:20	1,871.300	0.14	3.14	0.11	3.50	1.88	5.39	0.17	3.37	1.21	4.73	0.14	3.54
00:20	1,931.300	0.14	3.14	0.11	3.50	1.87	5.38	0.17	3.37	1.21	4.73	0.14	3.54
01:20	1,991.300	0.14	3.14	0.11	3.50	1.87	5.38	0.17	3.37	1.21	4.73	0.14	3.54
02:20	2,051.300	0.14	3.14	0.11	3.50	1.88	5.39	0.17	3.37	1.21	4.73	0.15	3.55
03:20	2,111.300	0.14	3.14	0.11	3.50	1.91	5.42	0.18	3.38	1.25	4.77	0.15	3.55
04:20	2,171.300	0.15	3.15	0.12	3.51	1.96	5.47	0.18	3.38	1.29	4.81	0.16	3.56
05:20	2,231.300	0.16	3.16	0.13	3.52	2.00	5.51	0.19	3.39	1.33	4.85	0.17	3.57
06:20	2,291.300	0.17	3.17	0.14	3.53	2.04	5.55	0.20	3.40	1.37	4.89	0.17	3.57
07:20	2,351.300	0.17	3.17	0.15	3.54	2.02	5.53	0.21	3.41	1.38	4.90	0.17	3.57
08:20	2,411.200	0.17	3.17	0.16	3.55	2.02	5.53	0.22	3.42	1.27	4.79	0.18	3.58
09:20	2,471.200	0.19	3.19	0.17	3.56	1.99	5.50	0.22	3.42	1.36	4.88	0.19	3.59
10:20	2,531.200	0.18	3.18	0.17	3.56	2.01	5.52	0.23	3.43	1.38	4.90	0.20	3.60
11:20	2,591.300	0.18	3.18	0.16	3.55	1.98	5.49	0.23	3.43	1.34	4.86	0.19	3.59
12:20	2,651.300	0.17	3.17	0.15	3.54	1.96	5.47	0.22	3.42	1.32	4.84	0.18	3.58
13:20	2,711.300	0.18	3.18	0.16	3.55	1.95	5.46	0.23	3.43	1.32	4.84	0.19	3.59
14:20	2,771.200	0.19	3.19	0.18	3.57	1.95	5.46	0.24	3.44	1.32	4.84	0.21	3.61
15:20	2,831.300	0.18	3.18	0.15	3.54	1.94	5.45	0.23	3.43	1.31	4.83	0.18	3.58
16:20	2,891.200	0.20	3.20	0.18	3.57	1.95	5.46	0.24	3.44	1.32	4.84	0.21	3.61
19:34	3,085.200	0.20	3.21	0.17	3.56	1.94	5.45	0.24	3.44	1.28	4.80	0.22	3.62
20:34	3,145.200	0.21	3.21	0.18	3.57	1.95	5.46	0.24	3.44	1.28	4.80	0.22	3.62
21:34	3,205.200	0.21	3.21	0.18	3.57	1.95	5.46	0.24	3.44	1.28	4.80	0.22	3.62
22:34	3,265.200	0.21	3.21	0.18	3.57	1.94	5.45	0.24	3.44	1.27	4.79	0.22	3.62
23:34	3,325.300	0.21	3.21	0.18	3.57	1.03	5.44	0.25	3.25	1.26	4.78	0.22	3.62
00:34	3,385.300	0.21	3.21	0.18	3.57	1.92	5.43	0.24	3.44	1.26	4.78	0.22	3.62
01:34	3,445.300	0.20	3.20	0.18	3.57	1.91	5.42	0.25	3.45	1.25	4.77	0.22	3.62
02:34	3,505.300	0.21	3.21	0.18	3.57	1.90	5.41	0.25	3.45	1.23	4.75	0.23	3.63
03:34	3,565.300	0.21	3.21	0.18	3.57	1.93	5.44	0.25	3.45	1.27	4.79	0.23	3.63
04:34	3,625.300	0.21	3.21	0.19	3.58	1.97	5.48	0.25	3.45	1.31	4.83	0.24	3.64
05:34	3,685.300	0.22	3.22	0.20	3.59	2.01	5.52	0.26	3.46	1.34	4.86	0.24	3.64
06:34	3,745.300	0.23	3.23	0.20	3.59	2.06	5.57	0.26	3.46	1.40	4.92	0.25	3.65
07:34	3,805.300	0.22	3.22	0.20	3.59	2.00	5.51	0.27	3.47	1.36	4.88	0.24	3.64
08:34	3,865.300	0.25	3.25	0.22	3.61	1.96	5.47	0.28	3.48	1.29	4.81	0.27	3.67
09:34	3,925.300	0.21	3.21	0.20	3.59	1.89	5.40	0.27	3.47	1.26	4.78	0.25	3.65
10:34	3,985.300	0.21	3.21	0.20	3.59	1.89	5.40	0.27	3.47	1.22	4.74	0.24	3.64

Time	Elapsed Time (min.)	S-1		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
11:34	4,045.300	0.19	3.19	0.16	3.55	1.86	5.37	0.25	3.45	1.22	4.74	0.29	3.59
12:34	4,105.300	0.24	3.24	0.22	3.61	1.87	5.38	0.29	3.49	1.24	4.76	0.28	3.68
13:34	4,165.300	0.23	3.23	0.21	3.60	1.84	5.35	0.28	3.48	1.21	4.73	0.27	3.67
14:34	4,225.300	0.24	3.24	0.21	3.60	1.84	5.35	0.28	3.48	1.20	4.72	0.27	3.67
15:34	4,285.300	0.24	3.24	0.22	3.61	1.86	5.37	0.29	3.49	1.22	4.74	0.27	3.67
16:34	4,345.200	0.23	3.23	0.20	3.59	1.84	5.35	0.28	3.48	1.20	4.72	0.26	3.66
17:34	4,405.200	0.23	3.23	0.20	3.59	1.81	5.32	0.28	3.48	1.17	4.69	0.26	3.66
18:34	4,465.200	0.25	3.25	0.21	3.61	1.85	5.36	0.28	3.48	1.18	4.70	0.28	3.68
18:59	4,490.300	0.25	3.25	0.21	3.61	1.84	5.35	0.28	3.48	1.18	4.70	0.28	3.68
Recovery													
18:59	4,490.320									1.16	4.68		
18:59	4,490.330									1.12	4.64		
18:59	4,490.350									1.06	4.58		
18:59	4,490.370									0.97	4.49		
18:59	4,490.380									0.86	4.38		
18:59	4,490.400									0.74	4.26		
18:59	4,490.420									0.63	4.15		
18:59	4,490.430									0.54	4.06		
19:00	4,490.450									0.5	4.02		
19:00	4,490.470									0.51	4.03		
19:00	4,490.560	0.26	3.26	0.22	3.61	1.14	4.65	0.30	3.50	0.72	4.24	0.29	3.69
19:00	4,490.640	0.26	3.26	0.22	3.61	0.42	3.93	0.30	3.50	0.51	4.03	0.29	3.69
19:00	4,490.720	0.26	3.26	0.22	3.61	0.57	4.08	0.29	3.49	0.61	4.13	0.29	3.69
19:00	4,490.810	0.26	3.26	0.22	3.61	0.89	4.40	0.30	3.50	0.55	4.07	0.29	3.69
19:00	4,490.890	0.26	3.26	0.22	3.61	0.32	3.83	0.30	3.50	0.53	4.05	0.28	3.68
19:00	4,490.970	0.26	3.26	0.22	3.61	0.74	4.25	0.29	3.49	0.56	4.08	0.28	3.68
19:00	4,491.060	0.26	3.26	0.22	3.61	0.63	4.14	0.30	3.50	0.50	4.02	0.28	3.68
19:00	4,491.140	0.26	3.26	0.22	3.61	0.40	3.91	0.29	3.49	0.53	4.05	0.28	3.68
19:00	4,491.220	0.26	3.26	0.22	3.61	0.74	4.25	0.29	3.49	0.50	4.02	0.28	3.68
19:00	4,491.310	0.26	3.26	0.22	3.61	0.47	3.98	0.29	3.49	0.50	4.02	0.29	3.69
19:01	4,491.700	0.26	3.26	0.22	3.61	0.60	4.11	0.29	3.49	0.46	3.98	0.28	3.68
19:01	4,492.030	0.25	3.25	0.22	3.61	0.46	3.97	0.29	3.49	0.45	3.97	0.28	3.68
19:01	4,492.360	0.25	3.25	0.21	3.60	0.51	4.02	0.29	3.49	0.43	3.95	0.28	3.68
19:02	4,492.700	0.25	3.25	0.21	3.60	0.45	3.96	0.29	3.49	0.41	3.93	0.28	3.68
19:02	4,493.030	0.25	3.25	0.21	3.60	0.47	3.98	0.29	3.49	0.40	3.92	0.28	3.68
19:02	4,493.360	0.25	3.25	0.21	3.60	0.44	3.95	0.29	3.49	0.39	3.91	0.28	3.68
19:03	4,493.700	0.25	3.25	0.21	3.60	0.44	3.95	0.28	3.49	0.37	3.89	0.28	3.68
19:03	4,494.030	0.25	3.25	0.21	3.60	0.42	3.93	0.29	3.49	0.37	3.89	0.28	3.68
19:03	4,494.360	0.25	3.25	0.21	3.60	0.42	3.93	0.28	3.48	0.36	3.88	0.28	3.68
19:04	4,494.700	0.25	3.25	0.21	3.60	0.40	3.91	0.28	3.48	0.35	3.87	0.28	3.68
19:04	4,495.030	0.24	3.24	0.21	3.60	0.40	3.91	0.28	3.48	0.34	3.86	0.28	3.68
19:04	4,495.360	0.24	3.24	0.21	3.60	0.39	3.90	0.28	3.48	0.33	3.85	0.28	3.68
19:05	4,495.700	0.24	3.24	0.21	3.60	0.39	3.90	0.28	3.48	0.33	3.85	0.27	3.67
19:05	4,496.030	0.24	3.24	0.20	3.59	0.38	3.89	0.28	3.48	0.32	3.84	0.27	3.67
19:05	4,496.360	0.24	3.24	0.20	3.59	0.37	3.88	0.28	3.48	0.31	3.83	0.27	3.67
19:06	4,496.700	0.24	3.24	0.20	3.59	0.37	3.88	0.28	3.48	0.31	3.83	0.27	3.67

Time	Elapsed Time (min.)	S-1		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
19:06	4,497.030	0.25	3.25	0.20	3.59	0.37	3.88	0.28	3.48	0.31	3.83	0.28	3.68
19:06	4,497.360	0.24	3.24	0.20	3.59	0.36	3.87	0.28	3.48	0.30	3.82	0.28	3.68
19:07	4,497.700	0.24	3.24	0.20	3.59	0.35	3.86	0.28	3.48	0.30	3.82	0.28	3.68
19:07	4,498.030	0.24	3.24	0.20	3.59	0.35	3.86	0.28	3.48	0.29	3.81	0.27	3.67
19:07	4,498.360	0.24	3.24	0.20	3.59	0.34	3.85	0.28	3.48	0.28	3.80	0.27	3.67
19:08	4,498.700	0.24	3.24	0.20	3.59	0.34	3.85	0.28	3.48	0.28	3.80	0.27	3.67
19:08	4,499.030	0.24	3.24	0.20	3.59	0.34	3.85	0.28	3.48	0.28	3.80	0.28	3.68
19:08	4,499.360	0.24	3.24	0.20	3.59	0.33	3.84	0.28	3.48	0.27	3.79	0.28	3.68
19:09	4,499.700	0.24	3.24	0.20	3.59	0.32	3.83	0.28	3.48	0.27	3.79	0.27	3.67
19:09	4,500.030	0.24	3.24	0.20	3.59	0.32	3.83	0.28	3.48	0.27	3.79	0.27	3.67
19:09	4,500.360	0.24	3.24	0.20	3.59	0.32	3.83	0.28	3.48	0.26	3.78	0.27	3.67
19:12	4,502.680	0.23	3.23	0.20	3.59	0.29	3.80	0.27	3.47	0.24	3.76	0.26	3.66
19:13	4,504.400	0.24	3.24	0.19	3.58	0.28	3.79	0.28	3.48	0.23	3.75	0.26	3.66
19:15	4,506.400	0.24	3.24	0.19	3.58	0.27	3.78	0.28	3.48	0.21	3.73	0.27	3.67
19:17	4,508.400	0.24	3.24	0.19	3.58	0.26	3.77	0.28	3.48	0.21	3.73	0.27	3.67
19:19	4,510.400	0.24	3.24	0.19	3.58	0.25	3.76	0.28	3.48	0.20	3.72	0.27	3.67
19:21	4,512.400	0.23	3.23	0.18	3.57	0.24	3.75	0.27	3.47	0.19	3.71	0.26	3.66
19:23	4,514.400	0.22	3.22	0.18	3.57	0.23	3.74	0.26	3.46	0.18	3.70	0.26	3.66
19:25	4,516.400	0.22	3.22	0.18	3.57	0.23	3.74	0.26	3.46	0.17	3.69	0.26	3.66
19:27	4,518.400	0.23	3.23	0.18	3.57	0.23	3.74	0.26	3.46	0.17	3.69	0.26	3.66
19:29	4,520.400	0.23	3.23	0.18	3.57	0.22	3.73	0.27	3.47	0.16	3.68	0.26	3.66
19:31	4,522.400	0.22	3.22	0.18	3.57	0.21	3.72	0.26	3.46	0.16	3.68	0.26	3.66
19:33	4,524.400	0.22	3.22	0.18	3.57	0.21	3.72	0.26	3.46	0.15	3.67	0.26	3.66
19:35	4,526.400	0.22	3.22	0.18	3.57	0.21	3.72	0.26	3.46	0.15	3.67	0.26	3.66
19:37	4,528.400	0.22	3.22	0.17	3.56	0.20	3.71	0.26	3.46	0.14	3.66	0.26	3.66
19:39	4,530.400	0.22	3.22	0.17	3.56	0.20	3.71	0.26	3.46	0.14	3.66	0.26	3.66
19:41	4,532.400	0.22	3.22	0.17	3.56	0.20	3.71	0.25	3.45	0.14	3.66	0.25	3.65
19:43	4,534.400	0.21	3.21	0.17	3.56	0.19	3.70	0.25	3.45	0.13	3.65	0.25	3.65
19:45	4,536.400	0.21	3.21	0.17	3.56	0.19	3.70	0.25	3.45	0.13	3.65	0.25	3.65
19:47	4,538.400	0.22	3.22	0.17	3.56	0.19	3.70	0.26	3.46	0.13	3.65	0.25	3.65
19:49	4,540.400	0.22	3.22	0.17	3.56	0.18	3.69	0.26	3.46	0.12	3.64	0.25	3.65
19:51	4,542.540	0.22	3.22	0.17	3.56	0.18	3.69	0.26	3.46	0.12	3.64	0.25	3.65
19:53	4,544.430	0.22	3.22	0.16	3.55	0.18	3.69	0.25	3.45	0.12	3.64	0.25	3.65
19:55	4,546.380	0.23	3.23	0.16	3.55	0.19	3.70	0.27	3.47	0.12	3.64	0.25	3.65
19:57	4,548.380	0.22	3.22	0.16	3.55	0.18	3.69	0.26	3.46	0.12	3.64	0.25	3.65
19:59	4,550.380	0.22	3.22	0.16	3.55	0.18	3.69	0.26	3.46	0.12	3.64	0.25	3.65
20:01	4,552.380	0.22	3.22	0.16	3.55	0.17	3.68	0.25	3.45	0.11	3.63	0.25	3.65
20:03	4,554.380	0.22	3.22	0.16	3.55	0.17	3.68	0.25	3.45	0.11	3.63	0.25	3.65
20:05	4,556.380	0.21	3.21	0.16	3.55	0.16	3.67	0.25	3.45	0.11	3.63	0.24	3.64
20:07	4,558.380	0.21	3.21	0.15	3.54	0.16	3.67	0.24	3.44	0.10	3.62	0.24	3.64
20:09	4,560.380	0.21	3.21	0.15	3.54	0.16	3.67	0.24	3.44	0.10	3.62	0.24	3.64
20:11	4,562.380	0.20	3.20	0.16	3.54	0.16	3.67	0.24	3.44	0.10	3.62	0.24	3.64
20:13	4,564.380	0.20	3.20	0.15	3.54	0.16	3.67	0.24	3.44	0.10	3.62	0.24	3.64
20:15	4,566.380	0.20	3.20	0.15	3.54	0.15	3.66	0.24	3.44	0.09	3.61	0.24	3.64
20:17	4,568.380	0.20	3.20	0.15	3.54	0.15	3.66	0.24	3.44	0.09	3.61	0.24	3.64
20:19	4,570.380	0.19	3.19	0.14	3.53	0.14	3.65	0.24	3.44	0.08	3.60	0.23	3.63

Time	Elapsed Time (min.)	S-1		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
20:21	4,572.380	0.19	3.19	0.14	3.53	0.14	3.65	0.23	3.43	0.08	3.60	0.23	3.63
20:23	4,574.380	0.18	3.18	0.13	3.52	0.13	3.64	0.23	3.43	0.08	3.60	0.22	3.62
20:25	4,576.380	0.18	3.18	0.13	3.52	0.13	3.64	0.22	3.42	0.07	3.59	0.22	3.62
20:27	4,578.380	0.18	3.18	0.13	3.52	0.13	3.64	0.22	3.42	0.07	3.59	0.22	3.62
20:29	4,580.380	0.18	3.18	0.13	3.52	0.13	3.64	0.23	3.43	0.07	3.59	0.22	3.62
20:31	4,582.380	0.18	3.18	0.13	3.52	0.13	3.64	0.22	3.42	0.07	3.59	0.23	3.63
20:33	4,584.380	0.18	3.18	0.13	3.52	0.13	3.64	0.22	3.42	0.07	3.59	0.22	3.62
20:35	4,586.380	0.18	3.18	0.13	3.52	0.12	3.63	0.22	3.42	0.07	3.59	0.22	3.62
20:37	4,588.380	0.17	3.17	0.13	3.52	0.12	3.63	0.22	3.42	0.06	3.58	0.21	3.61
20:39	4,590.380	0.17	3.17	0.12	3.51	0.12	3.63	0.22	3.42	0.06	3.58	0.21	3.61
21:00	4,610.470	0.16	3.16	0.11	3.50	0.09	3.60	0.20	3.40	0.03	3.55	0.20	3.60
21:20	4,630.470	0.13	3.13	0.08	3.47	0.05	3.56	0.18	3.38	0.00	3.51	0.18	3.58
21:40	4,650.570	0.13	3.13	0.08	3.47	0.02	3.53	0.17	3.37	0.00	3.49	0.17	3.57
22:00	4,670.570	0.12	3.12	0.08	3.47	0.01	3.52	0.17	3.37	0.00	3.47	0.17	3.57
22:20	4,690.530	0.12	3.12	0.07	3.46	0.00	3.49	0.16	3.36	0.00	3.45	0.17	3.57
22:40	4,710.530	0.10	3.10	0.06	3.45	0.00	3.47	0.15	3.35	0.00	3.43	0.16	3.56
22:59	4,730.430	0.11	3.11	0.06	3.45	0.00	3.46	0.15	3.35	0.00	3.42	0.16	3.56
23:19	4,750.430	0.10	3.10	0.05	3.44	0.00	3.45	0.15	3.35	0.00	3.41	0.15	3.55
23:39	4,770.430	0.09	3.09	0.04	3.43	0.00	3.44	0.14	3.34	0.00	3.40	0.15	3.55
23:59	4,790.430	0.09	3.09	0.04	3.43	0.00	3.44	0.14	3.34	0.00	3.40	0.15	3.55
00:19	4,810.430	0.08	3.08	0.03	3.42	0.00	3.43	0.13	3.33	0.00	3.39	0.14	3.54
00:39	4,830.430	0.07	3.07	0.02	3.41	0.00	3.42	0.13	3.33	0.00	3.38	0.13	3.53
00:59	4,850.430	0.06	3.06	0.01	3.40	0.00	3.41	0.12	3.32	0.00	3.37	0.12	3.52
01:19	4,870.430	0.06	3.06	0.01	3.40	0.00	3.40	0.11	3.31	0.00	3.38	0.12	3.52
01:39	4,890.430	0.06	3.06	0.00	3.39	0.00	3.43	0.11	3.31	0.00	3.38	0.12	3.52
01:59	4,910.430	0.05	3.05	0.00	3.39	0.00	3.43	0.10	3.30	0.00	3.38	0.11	3.51
02:19	4,930.430	0.04	3.04	-0.01	3.38	0.00	3.43	0.10	3.30	0.00	3.39	0.11	3.51
02:39	4,950.430	0.04	3.04	-0.01	3.38	0.00	3.44	0.09	3.29	0.00	3.40	0.11	3.51
02:59	4,970.430	0.04	3.04	-0.01	3.38	0.00	3.45	0.09	3.29	0.00	3.41	0.11	3.51
03:19	4,990.430	0.04	3.04	-0.01	3.38	0.00	3.46	0.09	3.29	0.00	3.42	0.10	3.50
03:39	5,010.430	0.04	3.04	-0.01	3.38	0.00	3.47	0.09	3.29	0.00	3.42	0.10	3.50
03:59	5,030.430	0.04	3.04	-0.01	3.38	0.00	3.48	0.09	3.29	0.00	3.41	0.10	3.50
04:19	5,050.430	0.03	3.03	-0.02	3.37	0.00	3.49	0.09	3.29	0.00	3.40	0.10	3.50
04:39	5,070.430	0.03	3.03	-0.02	3.37	0.00	3.50	0.08	3.28	0.00	3.39	0.10	3.50
04:59	5,090.430	0.03	3.03	-0.02	3.37	0.00	3.51	0.08	3.28	0.00	3.38	0.10	3.50
05:19	5,110.430	0.03	3.03	-0.02	3.37	0.00	3.52	0.08	3.28	0.00	3.36	0.10	3.50
05:34	5,125.050	0.03	3.03	-0.02	3.37	0.00	3.53	0.08	3.28	0.00	3.36	0.10	3.50

DTW = depth to water.
All values presented in feet.



WELL TEST ANALYSIS

Data Set: Z:\...\Neuman-Witherspoon_1A.aqt
Date: 07/27/20 Time: 10:04:56

PROJECT INFORMATION

Company: SFWMD
Location: Morikami Park
Test Well: PW_1A
Test Date: 3/23/1987

AQUIFER DATA

Saturated Thickness: 135. ft
Anisotropy Ratio (Kz/Kr): 0.2
Aquitard Thickness (b'): 50. ft
Aquitard Thickness (b"): 100. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-1A	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ D-1A	30	0
◇ S-1A	30	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 9.921E+4 ft^2/day
1/B = 4.4E-5 ft^{-1}
T2 = 3300. ft^2/day

S = 1.541E-5
ß/r = 1.405E-5 ft^{-1}
S2 = 0.001416

Data Set: Z:\0.0_Morikami_AQT_Files\Neuman-Witherspoon_1A.aqt
Date: 06/05/20
Time: 11:45:55

PROJECT INFORMATION

Company: SFWMD
Location: Morikami Park
Test Date: 3/23/1987
Test Well: PW_1A

AQUIFER DATA

Saturated Thickness: 135. ft
Anisotropy Ratio (Kz/Kr): 0.2
Aquitard Thickness (b'): 50. ft
Aquitard Thickness (b"): 100. ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: PW-1A

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.25 ft
Well Radius: 0.25 ft

Partially Penetrating Well
Depth to Top of Screen: 21. ft
Depth to Bottom of Screen: 90. ft

No. of pumping periods: 3

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	890.	5120.	0.
4490.	0.		

OBSERVATION WELL DATA

No. of observation wells: 3

Observation Well No. 1: D-2

X Location: 0. ft
Y Location: 90. ft

Radial distance from PW-1A: 90. ft

Partially Penetrating Well
Depth to Top of Screen: 18. ft

Depth to Bottom of Screen: 28. ft

No. of Observations: 298

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.02	2051.3	1.21
0.034	1.12	2111.3	1.25
0.05	0.12	2171.3	1.29
0.067	0.21	2231.3	1.33
0.084	0.31	2291.3	1.37
0.1	0.74	2351.3	1.38
0.117	0.5	2411.2	1.27
0.134	0.54	2471.2	1.36
0.15	0.5	2531.2	1.38
0.167	0.58	2591.3	1.34
0.257	0.45	2651.3	1.32
0.34	0.62	2711.3	1.32
0.424	0.56	2771.2	1.32
0.507	0.61	2831.3	1.31
0.59	0.63	2891.2	1.32
0.674	0.62	3085.2	1.28
0.757	0.66	3145.2	1.28
0.84	0.65	3205.2	1.28
0.924	0.67	3265.2	1.27
1.007	0.67	3325.3	1.26
1.398	0.71	3385.3	1.26
1.731	0.73	3445.3	1.25
2.065	0.75	3505.3	1.23
2.398	0.76	3565.3	1.27
2.731	0.78	3625.3	1.31
3.065	0.79	3685.3	1.34
3.398	0.8	3745.3	1.4
3.731	0.81	3805.3	1.36
4.065	0.82	3865.3	1.29
4.398	0.83	3925.3	1.26
4.731	0.85	3985.3	1.22
5.065	0.85	4045.3	1.22
5.398	0.87	4105.3	1.24
5.731	0.87	4165.3	1.21
6.065	0.88	4225.3	1.2
6.398	0.88	4285.3	1.22
6.731	0.88	4345.2	1.2
7.065	0.88	4405.2	1.17
7.398	0.89	4465.2	1.18
7.731	0.9	4490.3	1.18
8.065	0.9	4490.6	0.72
8.398	0.91	4490.6	0.51
8.731	0.91	4490.7	0.61
9.065	0.91	4490.8	0.55
9.398	0.92	4490.9	0.53
9.731	0.93	4491.	0.56
10.65	0.93	4491.1	0.5
12.18	0.95	4491.1	0.53

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
14.18	0.97	4491.2	0.5
16.21	0.98	4491.3	0.5
18.21	0.98	4491.7	0.46
20.21	1.	4492.	0.45
22.21	1.01	4492.4	0.43
24.21	1.02	4492.7	0.41
26.21	1.02	4493.	0.4
28.21	1.03	4493.4	0.39
30.21	1.03	4493.7	0.37
32.21	1.04	4494.	0.37
34.21	1.05	4494.4	0.36
36.21	1.05	4494.7	0.35
38.21	1.06	4495.	0.34
40.21	1.06	4495.4	0.33
42.21	1.06	4495.7	0.33
44.21	1.07	4496.	0.32
46.21	1.08	4496.4	0.31
48.21	1.07	4496.7	0.31
50.21	1.07	4497.	0.31
52.21	1.07	4497.4	0.3
54.21	1.08	4497.7	0.3
56.21	1.07	4498.	0.29
58.21	1.08	4498.4	0.28
60.21	1.08	4498.7	0.28
62.21	1.08	4499.	0.28
64.21	1.08	4499.4	0.27
66.21	1.09	4499.7	0.27
68.21	1.09	4500.	0.27
70.21	1.09	4500.4	0.26
72.21	1.1	4502.7	0.24
74.21	1.1	4504.4	0.23
76.21	1.11	4506.4	0.21
78.21	1.11	4508.4	0.21
80.21	1.11	4510.4	0.2
82.21	1.11	4512.4	0.19
84.21	1.11	4514.4	0.18
86.13	1.11	4516.4	0.17
88.13	1.12	4518.4	0.17
90.13	1.12	4520.4	0.16
92.13	1.12	4522.4	0.16
94.13	1.12	4524.4	0.15
96.13	1.12	4526.4	0.15
98.13	1.12	4528.4	0.14
100.1	1.12	4530.4	0.14
120.2	1.12	4532.4	0.14
140.2	1.12	4534.4	0.13
160.2	1.13	4536.4	0.13
180.2	1.13	4538.4	0.13
262.2	1.14	4540.4	0.12
282.3	1.15	4542.5	0.12
302.3	1.15	4544.4	0.12
322.3	1.15	4546.4	0.12
342.3	1.16	4548.4	0.12

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
362.3	1.16	4550.4	0.12
382.3	1.16	4552.4	0.11
402.3	1.16	4554.4	0.11
422.3	1.15	4556.4	0.11
442.3	1.16	4558.4	0.1
462.3	1.15	4560.4	0.1
482.3	1.16	4562.4	0.1
502.3	1.16	4564.4	0.1
522.3	1.16	4566.4	0.09
542.3	1.16	4568.4	0.09
562.3	1.18	4570.4	0.08
582.3	1.2	4572.4	0.08
602.3	1.19	4574.4	0.08
622.3	1.2	4576.4	0.07
642.3	1.2	4578.4	0.07
662.3	1.21	4580.4	0.07
682.3	1.22	4582.4	0.07
702.3	1.23	4584.4	0.07
722.3	1.24	4586.4	0.07
742.3	1.26	4588.4	0.06
762.3	1.28	4590.4	0.06
782.3	1.29	4610.5	0.03
802.3	1.29	4630.5	0.
822.3	1.32	4650.6	0.
842.3	1.33	4670.6	0.
862.2	1.35	4690.5	0.
882.2	1.35	4710.5	0.
902.2	1.35	4730.4	0.
922.3	1.32	4750.4	0.
942.2	1.31	4770.4	0.
962.2	1.31	4790.4	0.
982.2	1.31	4810.4	0.
1060.3	1.25	4830.4	0.
1120.3	1.24	4850.4	0.
1180.3	1.22	4870.4	0.
1240.2	1.21	4890.4	0.
1300.3	1.2	4910.4	0.
1360.3	1.21	4930.4	0.
1420.3	1.22	4950.4	0.
1480.2	1.23	4970.4	0.
1540.2	1.22	4990.4	0.
1631.2	1.24	5010.4	0.
1691.2	1.23	5030.4	0.
1751.4	1.23	5050.4	0.
1811.3	1.23	5070.4	0.
1871.3	1.21	5090.4	0.
1931.3	1.21	5110.4	0.
1991.3	1.21	5125.1	0.

Observation Well No. 2: D-1A

X Location: 30. ft
Y Location: 0. ft

Radial distance from PW-1A: 30. ft

Partially Penetrating Well
Depth to Top of Screen: 45. ft
Depth to Bottom of Screen: 55. ft

No. of Observations: 288

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.257	0.73	2351.3	2.02
0.34	1.39	2411.2	2.02
0.424	1.28	2471.2	1.99
0.507	0.99	2531.2	2.01
0.59	1.49	2591.3	1.98
0.674	1.15	2651.3	1.96
0.757	1.22	2711.3	1.95
0.84	1.43	2771.2	1.95
0.924	1.16	2831.3	1.94
1.007	1.36	2891.2	1.95
1.398	1.28	3085.2	1.94
1.731	1.39	3145.2	1.95
2.065	1.36	3205.2	1.95
2.398	1.4	3265.2	1.94
2.731	1.4	3325.3	1.03
3.065	1.42	3385.3	1.92
3.398	1.42	3445.3	1.91
3.731	1.44	3505.3	1.9
4.065	1.44	3565.3	1.93
4.398	1.46	3625.3	1.97
4.731	1.46	3685.3	2.01
5.065	1.47	3745.3	2.06
5.398	1.49	3805.3	2.
5.731	1.49	3865.3	1.96
6.065	1.5	3925.3	1.89
6.398	1.51	3985.3	1.89
6.731	1.49	4045.3	1.86
7.065	1.5	4105.3	1.87
7.398	1.51	4165.3	1.84
7.731	1.52	4225.3	1.84
8.065	1.52	4285.3	1.86
8.398	1.52	4345.2	1.84
8.731	1.52	4405.2	1.81
9.065	1.53	4465.2	1.85
9.398	1.54	4490.3	1.84
9.731	1.55	4490.6	1.14
10.65	1.55	4490.6	0.42
12.18	1.57	4490.7	0.57
14.18	1.6	4490.8	0.89
16.21	1.59	4490.9	0.32
18.21	1.6	4491.	0.74
20.21	1.61	4491.1	0.63
22.21	1.64	4491.1	0.4

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
24.21	1.64	4491.2	0.74
26.21	1.64	4491.3	0.47
28.21	1.65	4491.7	0.6
30.21	1.65	4492.	0.46
32.21	1.66	4492.4	0.51
34.21	1.66	4492.7	0.45
36.21	1.68	4493.	0.47
38.21	1.68	4493.4	0.44
40.21	1.68	4493.7	0.44
42.21	1.68	4494.	0.42
44.21	1.68	4494.4	0.42
46.21	1.7	4494.7	0.4
48.21	1.7	4495.	0.4
50.21	1.69	4495.4	0.39
52.21	1.69	4495.7	0.39
54.21	1.7	4496.	0.38
56.21	1.71	4496.4	0.37
58.21	1.7	4496.7	0.37
60.21	1.7	4497.	0.37
62.21	1.69	4497.4	0.36
64.21	1.7	4497.7	0.35
66.21	1.72	4498.	0.35
68.21	1.72	4498.4	0.34
70.21	1.72	4498.7	0.34
72.21	1.72	4499.	0.34
74.21	1.73	4499.4	0.33
76.21	1.73	4499.7	0.32
78.21	1.73	4500.	0.32
80.21	1.74	4500.4	0.32
82.21	1.75	4502.7	0.29
84.21	1.74	4504.4	0.28
86.13	1.74	4506.4	0.27
88.13	1.75	4508.4	0.26
90.13	1.74	4510.4	0.25
92.13	1.75	4512.4	0.24
94.13	1.74	4514.4	0.23
96.13	1.75	4516.4	0.23
98.13	1.75	4518.4	0.23
100.1	1.75	4520.4	0.22
120.2	1.75	4522.4	0.21
140.2	1.76	4524.4	0.21
160.2	1.79	4526.4	0.21
180.2	1.79	4528.4	0.2
262.2	1.8	4530.4	0.2
282.3	1.81	4532.4	0.2
302.3	1.81	4534.4	0.19
322.3	1.81	4536.4	0.19
342.3	1.81	4538.4	0.19
362.3	1.82	4540.4	0.18
382.3	1.82	4542.5	0.18
402.3	1.82	4544.4	0.18
422.3	1.81	4546.4	0.19
442.3	1.82	4548.4	0.18

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
462.3	1.82	4550.4	0.18
482.3	1.82	4552.4	0.17
502.3	1.83	4554.4	0.17
522.3	1.82	4556.4	0.16
542.3	1.82	4558.4	0.16
562.3	1.85	4560.4	0.16
582.3	1.86	4562.4	0.16
602.3	1.86	4564.4	0.16
622.3	1.86	4566.4	0.15
642.3	1.87	4568.4	0.15
662.3	1.88	4570.4	0.14
682.3	1.88	4572.4	0.14
702.3	1.9	4574.4	0.13
722.3	1.91	4576.4	0.13
742.3	1.93	4578.4	0.13
762.3	1.94	4580.4	0.13
782.3	1.95	4582.4	0.13
802.3	1.96	4584.4	0.13
822.3	1.98	4586.4	0.12
842.3	2.	4588.4	0.12
862.2	2.	4590.4	0.12
882.2	2.	4610.5	0.09
902.2	1.99	4630.5	0.05
922.3	1.97	4650.6	0.02
942.2	1.95	4670.6	0.01
962.2	1.94	4690.5	0.
982.2	1.95	4710.5	0.
1060.3	1.89	4730.4	0.
1120.3	1.88	4750.4	0.
1180.3	1.86	4770.4	0.
1240.2	1.85	4790.4	0.
1300.3	1.84	4810.4	0.
1360.3	1.85	4830.4	0.
1420.3	1.86	4850.4	0.
1480.2	1.87	4870.4	0.
1540.2	1.86	4890.4	0.
1631.2	1.9	4910.4	0.
1691.2	1.89	4930.4	0.
1751.4	1.89	4950.4	0.
1811.3	1.89	4970.4	0.
1871.3	1.88	4990.4	0.
1931.3	1.87	5010.4	0.
1991.3	1.87	5030.4	0.
2051.3	1.88	5050.4	0.
2111.3	1.91	5070.4	0.
2171.3	1.96	5090.4	0.
2231.3	2.	5110.4	0.
2291.3	2.04	5125.1	0.

Observation Well No. 3: S-1A

X Location: 30. ft
Y Location: 0. ft

Radial distance from PW-1A: 30. ft

Fully Penetrating Well

No. of Observations: 288

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.257	0.	2351.3	0.15
0.34	0.	2411.2	0.16
0.424	0.	2471.2	0.17
0.507	0.	2531.2	0.17
0.59	0.	2591.3	0.16
0.674	0.	2651.3	0.15
0.757	0.	2711.3	0.16
0.84	0.	2771.2	0.18
0.924	0.	2831.3	0.15
1.007	0.	2891.2	0.18
1.398	0.	3085.2	0.17
1.731	0.	3145.2	0.18
2.065	0.	3205.2	0.18
2.398	0.	3265.2	0.18
2.731	0.	3325.3	0.18
3.065	0.	3385.3	0.18
3.398	0.	3445.3	0.18
3.731	0.	3505.3	0.18
4.065	0.	3565.3	0.18
4.398	0.	3625.3	0.19
4.731	0.	3685.3	0.2
5.065	0.	3745.3	0.2
5.398	0.	3805.3	0.2
5.731	0.	3865.3	0.22
6.065	0.	3925.3	0.2
6.398	0.	3985.3	0.2
6.731	0.	4045.3	0.16
7.065	0.	4105.3	0.22
7.398	0.	4165.3	0.21
7.731	0.	4225.3	0.21
8.065	0.	4285.3	0.22
8.398	0.	4345.2	0.2
8.731	0.	4405.2	0.2
9.065	0.	4465.2	0.21
9.398	0.	4490.3	0.21
9.731	0.	4490.6	0.22
10.65	0.	4490.6	0.22
12.18	0.	4490.7	0.22
14.18	0.02	4490.8	0.22
16.21	0.	4490.9	0.22
18.21	0.	4491.	0.22
20.21	0.	4491.1	0.22
22.21	0.01	4491.1	0.22
24.21	0.01	4491.2	0.22
26.21	0.01	4491.3	0.22

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
28.21	0.01	4491.7	0.22
30.21	0.	4492.	0.22
32.21	0.02	4492.4	0.21
34.21	0.01	4492.7	0.21
36.21	0.01	4493.	0.21
38.21	0.03	4493.4	0.21
40.21	0.01	4493.7	0.21
42.21	0.01	4494.	0.21
44.21	0.01	4494.4	0.21
46.21	0.03	4494.7	0.21
48.21	0.03	4495.	0.21
50.21	0.01	4495.4	0.21
52.21	0.01	4495.7	0.21
54.21	0.01	4496.	0.2
56.21	0.03	4496.4	0.2
58.21	0.	4496.7	0.2
60.21	0.	4497.	0.2
62.21	0.01	4497.4	0.2
64.21	0.01	4497.7	0.2
66.21	0.01	4498.	0.2
68.21	0.01	4498.4	0.2
70.21	0.01	4498.7	0.2
72.21	0.01	4499.	0.2
74.21	0.02	4499.4	0.2
76.21	0.01	4499.7	0.2
78.21	0.02	4500.	0.2
80.21	0.02	4500.4	0.2
82.21	0.03	4502.7	0.2
84.21	0.03	4504.4	0.19
86.13	0.02	4506.4	0.19
88.13	0.02	4508.4	0.19
90.13	0.01	4510.4	0.19
92.13	0.01	4512.4	0.18
94.13	0.02	4514.4	0.18
96.13	0.02	4516.4	0.18
98.13	0.02	4518.4	0.18
100.1	0.02	4520.4	0.18
120.2	0.01	4522.4	0.18
140.2	0.02	4524.4	0.18
160.2	0.02	4526.4	0.18
180.2	0.02	4528.4	0.17
262.2	0.04	4530.4	0.17
282.3	0.03	4532.4	0.17
302.3	0.04	4534.4	0.17
322.3	0.04	4536.4	0.17
342.3	0.04	4538.4	0.17
362.3	0.03	4540.4	0.17
382.3	0.04	4542.5	0.17
402.3	0.04	4544.4	0.16
422.3	0.03	4546.4	0.16
442.3	0.04	4548.4	0.16
462.3	0.04	4550.4	0.16
482.3	0.04	4552.4	0.16

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
502.3	0.04	4554.4	0.16
522.3	0.04	4556.4	0.16
542.3	0.04	4558.4	0.15
562.3	0.04	4560.4	0.15
582.3	0.05	4562.4	0.16
602.3	0.04	4564.4	0.15
622.3	0.04	4566.4	0.15
642.3	0.05	4568.4	0.15
662.3	0.05	4570.4	0.14
682.3	0.05	4572.4	0.14
702.3	0.06	4574.4	0.13
722.3	0.06	4576.4	0.13
742.3	0.06	4578.4	0.13
762.3	0.06	4580.4	0.13
782.3	0.07	4582.4	0.13
802.3	0.07	4584.4	0.13
822.3	0.08	4586.4	0.13
842.3	0.08	4588.4	0.13
862.2	0.09	4590.4	0.12
882.2	0.08	4610.5	0.11
902.2	0.09	4630.5	0.08
922.3	0.08	4650.6	0.08
942.2	0.08	4670.6	0.08
962.2	0.08	4690.5	0.07
982.2	0.09	4710.5	0.06
1060.3	0.09	4730.4	0.06
1120.3	0.09	4750.4	0.05
1180.3	0.09	4770.4	0.04
1240.2	0.09	4790.4	0.04
1300.3	0.09	4810.4	0.03
1360.3	0.09	4830.4	0.02
1420.3	0.08	4850.4	0.01
1480.2	0.1	4870.4	0.01
1540.2	0.1	4890.4	0.
1631.2	0.11	4910.4	0.
1691.2	0.11	4930.4	0.
1751.4	0.11	4950.4	0.
1811.3	0.11	4970.4	0.
1871.3	0.11	4990.4	0.
1931.3	0.11	5010.4	0.
1991.3	0.11	5030.4	0.
2051.3	0.11	5050.4	0.
2111.3	0.11	5070.4	0.
2171.3	0.12	5090.4	0.
2231.3	0.13	5110.4	0.
2291.3	0.14	5125.1	0.

SOLUTION

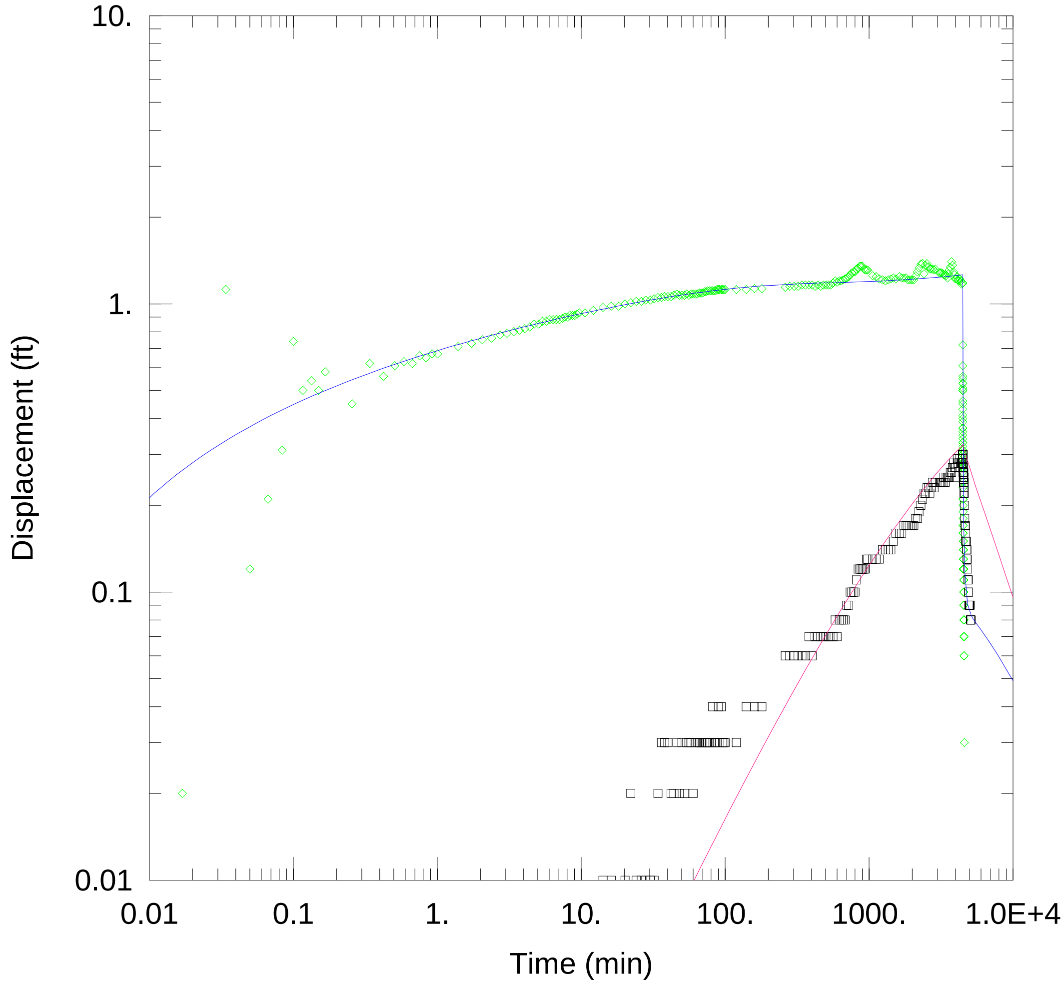
Pumping Test
Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	9.921E+4	ft^2/day
S	1.541E-5	
1/B	4.4E-5	ft^{-1}
ß/r	1.405E-5	ft^{-1}
T2	3300.	ft^2/day
S2	0.001416	

K = T/b = 734.9 ft/day (0.2593 cm/sec)
Ss = S/b = 1.141E-7 1/ft
K'/b' = 1.334E-7 min^{-1}
K' = 0.009603 ft/day



WELL TEST ANALYSIS

Data Set: Z:\...\Nuemann-Witherspoon_D-2.aqt
Date: 07/27/20 Time: 10:03:52

PROJECT INFORMATION

Company: SFWMD
Location: Morikami Park
Test Well: PW_1A
Test Date: 3/23/1987

AQUIFER DATA

Saturated Thickness: 135. ft
Anisotropy Ratio (Kz/Kr): 0.2
Aquitard Thickness (b'): 50. ft
Aquitard Thickness (b"): 100. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW-1A	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
◇ D-2	0	90
□ S-2	0	90

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 1.294E+5 ft^2/day
1/B = 4.715E-5 ft^{-1}
T2 = 4330. ft^2/day

S = 3.596E-5
ß/r = 2.533E-6 ft^{-1}
S2 = 0.00078

Data Set: Z:\0.0_Morikami_AQT_Files\Nuemann-Witherspoon_D-2.aqt
Date: 06/05/20
Time: 11:42:24

PROJECT INFORMATION

Company: SFWMD
Location: Morikami Park
Test Date: 3/23/1987
Test Well: PW_1A

AQUIFER DATA

Saturated Thickness: 135. ft
Anisotropy Ratio (Kz/Kr): 0.2
Aquitard Thickness (b'): 50. ft
Aquitard Thickness (b"): 100. ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: PW-1A

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.25 ft
Well Radius: 0.25 ft

Partially Penetrating Well
Depth to Top of Screen: 21. ft
Depth to Bottom of Screen: 90. ft

No. of pumping periods: 3

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	890.	5120.	0.
4490.	0.		

OBSERVATION WELL DATA

No. of observation wells: 2

Observation Well No. 1: D-2

X Location: 0. ft
Y Location: 90. ft

Radial distance from PW-1A: 90. ft

Partially Penetrating Well
Depth to Top of Screen: 18. ft

Depth to Bottom of Screen: 28. ft

No. of Observations: 298

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.02	2051.3	1.21
0.034	1.12	2111.3	1.25
0.05	0.12	2171.3	1.29
0.067	0.21	2231.3	1.33
0.084	0.31	2291.3	1.37
0.1	0.74	2351.3	1.38
0.117	0.5	2411.2	1.27
0.134	0.54	2471.2	1.36
0.15	0.5	2531.2	1.38
0.167	0.58	2591.3	1.34
0.257	0.45	2651.3	1.32
0.34	0.62	2711.3	1.32
0.424	0.56	2771.2	1.32
0.507	0.61	2831.3	1.31
0.59	0.63	2891.2	1.32
0.674	0.62	3085.2	1.28
0.757	0.66	3145.2	1.28
0.84	0.65	3205.2	1.28
0.924	0.67	3265.2	1.27
1.007	0.67	3325.3	1.26
1.398	0.71	3385.3	1.26
1.731	0.73	3445.3	1.25
2.065	0.75	3505.3	1.23
2.398	0.76	3565.3	1.27
2.731	0.78	3625.3	1.31
3.065	0.79	3685.3	1.34
3.398	0.8	3745.3	1.4
3.731	0.81	3805.3	1.36
4.065	0.82	3865.3	1.29
4.398	0.83	3925.3	1.26
4.731	0.85	3985.3	1.22
5.065	0.85	4045.3	1.22
5.398	0.87	4105.3	1.24
5.731	0.87	4165.3	1.21
6.065	0.88	4225.3	1.2
6.398	0.88	4285.3	1.22
6.731	0.88	4345.2	1.2
7.065	0.88	4405.2	1.17
7.398	0.89	4465.2	1.18
7.731	0.9	4490.3	1.18
8.065	0.9	4490.6	0.72
8.398	0.91	4490.6	0.51
8.731	0.91	4490.7	0.61
9.065	0.91	4490.8	0.55
9.398	0.92	4490.9	0.53
9.731	0.93	4491.	0.56
10.65	0.93	4491.1	0.5
12.18	0.95	4491.1	0.53

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
14.18	0.97	4491.2	0.5
16.21	0.98	4491.3	0.5
18.21	0.98	4491.7	0.46
20.21	1.	4492.	0.45
22.21	1.01	4492.4	0.43
24.21	1.02	4492.7	0.41
26.21	1.02	4493.	0.4
28.21	1.03	4493.4	0.39
30.21	1.03	4493.7	0.37
32.21	1.04	4494.	0.37
34.21	1.05	4494.4	0.36
36.21	1.05	4494.7	0.35
38.21	1.06	4495.	0.34
40.21	1.06	4495.4	0.33
42.21	1.06	4495.7	0.33
44.21	1.07	4496.	0.32
46.21	1.08	4496.4	0.31
48.21	1.07	4496.7	0.31
50.21	1.07	4497.	0.31
52.21	1.07	4497.4	0.3
54.21	1.08	4497.7	0.3
56.21	1.07	4498.	0.29
58.21	1.08	4498.4	0.28
60.21	1.08	4498.7	0.28
62.21	1.08	4499.	0.28
64.21	1.08	4499.4	0.27
66.21	1.09	4499.7	0.27
68.21	1.09	4500.	0.27
70.21	1.09	4500.4	0.26
72.21	1.1	4502.7	0.24
74.21	1.1	4504.4	0.23
76.21	1.11	4506.4	0.21
78.21	1.11	4508.4	0.21
80.21	1.11	4510.4	0.2
82.21	1.11	4512.4	0.19
84.21	1.11	4514.4	0.18
86.13	1.11	4516.4	0.17
88.13	1.12	4518.4	0.17
90.13	1.12	4520.4	0.16
92.13	1.12	4522.4	0.16
94.13	1.12	4524.4	0.15
96.13	1.12	4526.4	0.15
98.13	1.12	4528.4	0.14
100.1	1.12	4530.4	0.14
120.2	1.12	4532.4	0.14
140.2	1.12	4534.4	0.13
160.2	1.13	4536.4	0.13
180.2	1.13	4538.4	0.13
262.2	1.14	4540.4	0.12
282.3	1.15	4542.5	0.12
302.3	1.15	4544.4	0.12
322.3	1.15	4546.4	0.12
342.3	1.16	4548.4	0.12

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
362.3	1.16	4550.4	0.12
382.3	1.16	4552.4	0.11
402.3	1.16	4554.4	0.11
422.3	1.15	4556.4	0.11
442.3	1.16	4558.4	0.1
462.3	1.15	4560.4	0.1
482.3	1.16	4562.4	0.1
502.3	1.16	4564.4	0.1
522.3	1.16	4566.4	0.09
542.3	1.16	4568.4	0.09
562.3	1.18	4570.4	0.08
582.3	1.2	4572.4	0.08
602.3	1.19	4574.4	0.08
622.3	1.2	4576.4	0.07
642.3	1.2	4578.4	0.07
662.3	1.21	4580.4	0.07
682.3	1.22	4582.4	0.07
702.3	1.23	4584.4	0.07
722.3	1.24	4586.4	0.07
742.3	1.26	4588.4	0.06
762.3	1.28	4590.4	0.06
782.3	1.29	4610.5	0.03
802.3	1.29	4630.5	0.
822.3	1.32	4650.6	0.
842.3	1.33	4670.6	0.
862.2	1.35	4690.5	0.
882.2	1.35	4710.5	0.
902.2	1.35	4730.4	0.
922.3	1.32	4750.4	0.
942.2	1.31	4770.4	0.
962.2	1.31	4790.4	0.
982.2	1.31	4810.4	0.
1060.3	1.25	4830.4	0.
1120.3	1.24	4850.4	0.
1180.3	1.22	4870.4	0.
1240.2	1.21	4890.4	0.
1300.3	1.2	4910.4	0.
1360.3	1.21	4930.4	0.
1420.3	1.22	4950.4	0.
1480.2	1.23	4970.4	0.
1540.2	1.22	4990.4	0.
1631.2	1.24	5010.4	0.
1691.2	1.23	5030.4	0.
1751.4	1.23	5050.4	0.
1811.3	1.23	5070.4	0.
1871.3	1.21	5090.4	0.
1931.3	1.21	5110.4	0.
1991.3	1.21	5125.1	0.

Observation Well No. 2: S-2

X Location: 0. ft
Y Location: 90. ft

Radial distance from PW-1A: 90. ft

Fully Penetrating Well

No. of Observations: 288

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.257	0.	2351.3	0.21
0.34	0.	2411.2	0.22
0.424	0.	2471.2	0.22
0.507	0.	2531.2	0.23
0.59	0.	2591.3	0.23
0.674	0.	2651.3	0.22
0.757	0.	2711.3	0.23
0.84	0.	2771.2	0.24
0.924	0.	2831.3	0.23
1.007	0.	2891.2	0.24
1.398	0.	3085.2	0.24
1.731	0.	3145.2	0.24
2.065	0.	3205.2	0.24
2.398	0.	3265.2	0.24
2.731	0.	3325.3	0.25
3.065	0.	3385.3	0.24
3.398	0.	3445.3	0.25
3.731	0.	3505.3	0.25
4.065	0.	3565.3	0.25
4.398	0.	3625.3	0.25
4.731	0.	3685.3	0.26
5.065	0.	3745.3	0.26
5.398	0.	3805.3	0.27
5.731	0.	3865.3	0.28
6.065	0.	3925.3	0.27
6.398	0.	3985.3	0.27
6.731	0.	4045.3	0.25
7.065	0.	4105.3	0.29
7.398	0.	4165.3	0.28
7.731	0.	4225.3	0.28
8.065	0.	4285.3	0.29
8.398	0.	4345.2	0.28
8.731	0.	4405.2	0.28
9.065	0.	4465.2	0.28
9.398	0.	4490.3	0.28
9.731	0.	4490.6	0.3
10.65	0.	4490.6	0.3
12.18	0.	4490.7	0.29
14.18	0.01	4490.8	0.3
16.21	0.01	4490.9	0.3
18.21	0.	4491.	0.29
20.21	0.01	4491.1	0.3
22.21	0.02	4491.1	0.29
24.21	0.01	4491.2	0.29
26.21	0.01	4491.3	0.29

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
28.21	0.01	4491.7	0.29
30.21	0.01	4492.	0.29
32.21	0.01	4492.4	0.29
34.21	0.02	4492.7	0.29
36.21	0.03	4493.	0.29
38.21	0.03	4493.4	0.29
40.21	0.03	4493.7	0.28
42.21	0.02	4494.	0.29
44.21	0.02	4494.4	0.28
46.21	0.03	4494.7	0.28
48.21	0.02	4495.	0.28
50.21	0.03	4495.4	0.28
52.21	0.02	4495.7	0.28
54.21	0.03	4496.	0.28
56.21	0.03	4496.4	0.28
58.21	0.03	4496.7	0.28
60.21	0.02	4497.	0.28
62.21	0.03	4497.4	0.28
64.21	0.03	4497.7	0.28
66.21	0.03	4498.	0.28
68.21	0.03	4498.4	0.28
70.21	0.03	4498.7	0.28
72.21	0.03	4499.	0.28
74.21	0.03	4499.4	0.28
76.21	0.03	4499.7	0.28
78.21	0.03	4500.	0.28
80.21	0.03	4500.4	0.28
82.21	0.04	4502.7	0.27
84.21	0.03	4504.4	0.28
86.13	0.03	4506.4	0.28
88.13	0.03	4508.4	0.28
90.13	0.04	4510.4	0.28
92.13	0.03	4512.4	0.27
94.13	0.04	4514.4	0.26
96.13	0.03	4516.4	0.26
98.13	0.03	4518.4	0.26
100.1	0.03	4520.4	0.27
120.2	0.03	4522.4	0.26
140.2	0.04	4524.4	0.26
160.2	0.04	4526.4	0.26
180.2	0.04	4528.4	0.26
262.2	0.06	4530.4	0.26
282.3	0.06	4532.4	0.25
302.3	0.06	4534.4	0.25
322.3	0.06	4536.4	0.25
342.3	0.06	4538.4	0.26
362.3	0.06	4540.4	0.26
382.3	0.07	4542.5	0.26
402.3	0.06	4544.4	0.25
422.3	0.07	4546.4	0.27
442.3	0.07	4548.4	0.26
462.3	0.07	4550.4	0.26
482.3	0.07	4552.4	0.25

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
502.3	0.07	4554.4	0.25
522.3	0.07	4556.4	0.25
542.3	0.07	4558.4	0.24
562.3	0.07	4560.4	0.24
582.3	0.08	4562.4	0.24
602.3	0.07	4564.4	0.24
622.3	0.08	4566.4	0.24
642.3	0.08	4568.4	0.24
662.3	0.08	4570.4	0.24
682.3	0.08	4572.4	0.23
702.3	0.09	4574.4	0.23
722.3	0.09	4576.4	0.22
742.3	0.1	4578.4	0.22
762.3	0.1	4580.4	0.23
782.3	0.1	4582.4	0.22
802.3	0.1	4584.4	0.22
822.3	0.11	4586.4	0.22
842.3	0.12	4588.4	0.22
862.2	0.12	4590.4	0.22
882.2	0.12	4610.5	0.2
902.2	0.12	4630.5	0.18
922.3	0.12	4650.6	0.17
942.2	0.12	4670.6	0.17
962.2	0.13	4690.5	0.16
982.2	0.13	4710.5	0.15
1060.3	0.13	4730.4	0.15
1120.3	0.13	4750.4	0.15
1180.3	0.13	4770.4	0.14
1240.2	0.14	4790.4	0.14
1300.3	0.14	4810.4	0.13
1360.3	0.14	4830.4	0.13
1420.3	0.14	4850.4	0.12
1480.2	0.15	4870.4	0.11
1540.2	0.16	4890.4	0.11
1631.2	0.16	4910.4	0.1
1691.2	0.16	4930.4	0.1
1751.4	0.17	4950.4	0.09
1811.3	0.17	4970.4	0.09
1871.3	0.17	4990.4	0.09
1931.3	0.17	5010.4	0.09
1991.3	0.17	5030.4	0.09
2051.3	0.17	5050.4	0.09
2111.3	0.18	5070.4	0.08
2171.3	0.18	5090.4	0.08
2231.3	0.19	5110.4	0.08
2291.3	0.2	5125.1	0.08

SOLUTION

Pumping Test
Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	1.294E+5	ft^2/day
S	3.596E-5	
1/B	4.715E-5	ft^{-1}
ß/r	2.533E-6	ft^{-1}
T2	4330.	ft^2/day
S2	0.00078	

K = T/b = 958.7 ft/day (0.3382 cm/sec)
Ss = S/b = 2.664E-7 1/ft
K'/b' = 1.998E-7 min^{-1}
K' = 0.01438 ft/day

APPENDIX C:
AQUIFER PERFORMANCE TEST 2

Table C-1. Discharge flow rates during aquifer performance test 2.

Time	Amount of Time for 10 Gallons of Pumped Discharge to Pass Through Flow Meter (seconds)	Rate (gpm)	Comments
10:36	30.70	19.54	Pump catching prime
	19.91	30.14	
	18.12	33.11	
	18.06	33.22	
	17.98	33.37	
	20.41	29.39	
	20.99	28.58	
	21.20	28.30	
	21.34	28.11	
	21.61	27.76	
	21.62	27.75	
	21.83	27.48	
10:42	21.76	27.57	
	22.31	26.89	
	22.70	26.43	
	21.94	27.34	
	22.03	27.23	
	22.18	27.05	
	21.79	27.53	
10:46	21.88	27.42	
10:51	22.46	26.69	
10:56	22.59	26.56	
10:58	22.55	26.10	
11:05	22.78	26.33	
11:11	22.77	26.35	
11:28	22.90	26.20	
	22.94	26.15	
11:35	22.99	26.09	
	22.98	26.01	
12:03	23.54	25.44	
	23.52	25.51	
12:33	23.77	25.24	
	23.81	25.20	
13:03	23.98	25.02	
	23.99	25.01	
13:28	24.24	24.75	
13:31	24.31	24.68	

gpm = gallons per minute.

Table C-2. Morikami Park aquifer performance test 2 manual water level depths and elevations (in feet).

Time	Depth to Water	Water Level Elevation
PW-1A (Measuring Point 19.76)		
09:50	4.530	15.230
11:25	4.485	15.275
12:29	4.520	15.240
13:27	4.520	15.240
14:58	4.470	15.290
D-1A (Measuring Point 19.47)		
09:51	4.180	15.290
11:23	4.165	15.305
12:20	4.210	15.260
13:25	4.200	15.270
14:57	4.160	15.310
D-2 (Measuring Point 19.49)		
09:45	4.200	15.220
11:20	4.195	15.295
12:28	4.210	15.280
13:23	4.220	15.270
14:51	4.170	15.320
S-1A (Measuring Point 19.70)		
09:52	4.130	15.570
11:22	4.510	15.190
12:31	4.520	15.180
13:24	4.550	15.150
14:56	4.190	15.510
S-2 (Measuring Point 19.55)		
09:47	4.000	15.550
11:19	4.275	15.275
12:27	4.290	15.260
13:22	4.320	15.230
14:52	4.050	15.500
S-3 (Measuring Point 19.72)		
09:40	4.160	15.560
11:17	4.240	15.480
12:25	4.260	15.460
13:20	4.290	15.430
14:49	4.230	15.490
S-1 (Measuring Point 19.34)		
09:48	3.780	15.560
14:54	3.835	15.515
M-1 (Measuring Point 19.04)		
--	No Measurements	

Table C-3. Aquifer performance test 2 transducer data (pumping rate = ±25 gallons per minute).

Time	Elapsed Time (min.)	PW-1A		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
10:35	0.000	0.00	4.53	0.00	4.13	0.00	4.18	0.00	4.00	0.00	4.20	0.00	4.16
10:35	0.017			0.00	4.13								
10:35	0.034			0.00	4.13								
10:35	0.050			0.00	4.13								
10:35	0.067			0.01	4.14								
10:35	0.084			0.01	4.14								
10:35	0.100			0.01	4.14								
10:35	0.117			0.01	4.14								
10:35	0.134			0.01	4.14								
10:35	0.150			0.01	4.14								
10:35	0.167			0.01	4.14								
10:35	0.257	0.01	4.54	0.03	4.16	0.01	4.19	0.03	4.03	0.03	4.23	0.04	4.20
10:35	0.340	0.00	4.53	0.07	4.20	0.01	4.19	0.05	4.05	0.03	4.23	0.05	4.21
10:35	0.424	0.01	4.54	0.10	4.23	0.01	4.19	0.08	4.08	0.03	4.23	0.05	4.21
10:35	0.507	0.00	4.53	0.14	4.27	0.01	4.19	0.10	4.10	0.03	4.23	0.06	4.22
10:35	0.590	0.00	4.53	0.16	4.29	0.01	4.19	0.12	4.12	0.03	4.23	0.06	4.22
10:35	0.674	0.01	4.54	0.18	4.31	0.01	4.19	0.13	4.13	0.03	4.23	0.06	4.22
10:35	0.757	0.01	4.54	0.19	4.32	0.01	4.19	0.14	4.14	0.03	4.23	0.07	4.23
10:35	0.840	0.01	4.54	0.21	4.34	0.01	4.19	0.15	4.15	0.04	4.24	0.07	4.23
10:35	0.924	0.01	4.54	0.22	4.35	0.01	4.19	0.16	4.16	0.04	4.24	0.08	4.24
10:36	1.007	0.01	4.54	0.23	4.36	0.01	4.19	0.17	4.17	0.03	4.23	0.08	4.24
10:36	1.394	0.01	4.54	0.26	4.39	0.01	4.19	0.20	4.20	0.04	4.24	0.09	4.25
10:36	1.727	0.00	4.53	0.28	4.41	0.01	4.19	0.21	4.21	0.04	4.24	0.07	4.23
10:37	2.060	0.00	4.53	0.29	4.42	0.00	4.18	0.20	4.20	0.02	4.22	0.04	4.20
10:37	2.394	0.00	4.53	0.29	4.42	0.01	4.19	0.19	4.19	0.01	4.21	0.03	4.19
10:37	2.727	0.01	4.54	0.31	4.44	0.01	4.19	0.21	4.21	0.02	4.22	0.05	4.21
10:38	3.060	0.01	4.54	0.32	4.45	0.01	4.19	0.23	4.23	0.03	4.23	0.08	4.24
10:38	3.394	0.01	4.54	0.33	4.46	0.01	4.19	0.24	4.24	0.04	4.24	0.08	4.24
10:38	3.727	0.01	4.54	0.34	4.47	0.02	4.18	0.25	4.25	0.05	4.25	0.09	4.25
10:39	4.060	0.00	4.53	0.34	4.47	0.01	4.19	0.23	4.23	0.03	4.23	0.08	4.24
10:39	4.394	0.00	4.53	0.34	4.47	0.01	4.19	0.23	4.23	0.02	4.22	0.05	4.21
10:39	4.727	0.00	4.53	0.34	4.47	0.01	4.19	0.24	4.24	0.03	4.23	0.06	4.22
10:40	5.060	0.01	4.54	0.34	4.47	0.01	4.19	0.25	4.25	0.03	4.23	0.06	4.22
10:40	5.394	0.01	4.54	0.35	4.48	0.01	4.19	0.24	4.24	0.03	4.23	0.06	4.22
10:40	5.727	0.00	4.53	0.35	4.48	0.01	4.19	0.25	4.25	0.03	4.23	0.07	4.23
10:41	6.060	0.01	4.54	0.35	4.48	0.01	4.19	0.25	4.25	0.03	4.23	0.07	4.23
10:41	6.394	0.00	4.53	0.36	4.49	0.01	4.19	0.26	4.26	0.03	4.23	0.07	4.23
10:41	6.727	0.00	4.53	0.36	4.49	0.01	4.19	0.25	4.25	0.03	4.23	0.07	4.23
10:42	7.060	0.00	4.53	0.35	4.48	0.00	4.18	0.24	4.24	0.01	4.21	0.04	4.20
10:42	7.394	0.00	4.53	0.35	4.48	0.00	4.18	0.23	4.23	0.01	4.21	0.03	4.19
10:42	7.727	0.00	4.53	0.35	4.48	0.00	4.18	0.22	4.22	-0.01	4.19	0.01	4.17
10:43	8.060	0.00	4.53	0.35	4.48	0.01	4.19	0.21	4.21	-0.01	4.19	-0.01	4.15
10:43	8.394	0.00	4.53	0.35	4.48	0.00	4.18	0.21	4.21	-0.01	4.19	-0.01	4.15

Time	Elapsed Time (min.)	PW-1A		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
10:43	8.727	0.00	4.53	0.34	4.47	0.01	4.19	0.21	4.21	-0.01	4.19	0.00	4.16
10:44	9.060	0.00	4.53	0.34	4.47	0.00	4.18	0.20	4.20	-0.01	4.19	-0.02	4.14
10:44	9.394	0.00	4.53	0.34	4.47	0.00	4.18	0.19	4.19	-0.01	4.19	-0.03	4.13
10:44	9.727	0.00	4.53	0.34	4.47	0.00	4.18	0.20	4.20	-0.01	4.19	-0.02	4.14
10:45	10.060	0.00	4.53	0.34	4.47	0.00	4.18	0.21	4.21	0.00	4.20	0.00	4.16
10:47	12.166	0.01	4.54	0.38	4.51	0.01	4.19	0.27	4.27	0.05	4.25	0.10	4.26
10:49	14.160	0.00	4.53	0.38	4.51	0.01	4.19	0.26	4.26	0.02	4.22	0.08	4.24
10:51	16.311	0.00	4.53	0.38	4.51	0.00	4.18	0.26	4.26	0.03	4.23	0.07	4.23
10:53	18.167	0.00	4.53	0.38	4.51	0.00	4.18	0.26	4.26	0.02	4.22	0.06	4.22
10:55	20.167	0.01	4.54	0.40	4.53	0.01	4.19	0.29	4.29	0.05	4.25	0.11	4.27
10:57	22.167	0.01	4.54	0.39	4.52	0.01	4.19	0.28	4.28	0.03	4.23	0.11	4.27
10:59	24.167	0.03	4.56	0.40	4.53	0.01	4.19	0.30	4.30	0.05	4.25	0.11	4.27
11:01	26.167	0.01	4.54	0.40	4.53	0.01	4.19	0.28	4.28	0.04	4.24	0.10	4.26
11:03	28.167	0.01	4.54	0.38	4.51	0.00	4.18	0.26	4.26	0.01	4.21	0.04	4.20
11:05	30.125	0.00	4.53	0.37	4.50	0.00	4.18	0.22	4.22	-0.02	4.18	-0.01	4.15
11:07	32.125	0.01	4.54	0.38	4.51	0.00	4.18	0.26	4.26	0.02	4.22	0.07	4.23
11:09	34.148	0.01	4.54	0.41	4.54	0.01	4.19	0.31	4.31	0.06	4.26	0.13	4.29
11:11	36.090	0.00	4.53	0.38	4.51	0.00	4.18	0.23	4.23	-0.02	4.18	0.00	4.16
11:13	38.090	0.00	4.53	0.38	4.51	0.00	4.18	0.26	4.26	0.01	4.21	0.05	4.21
11:15	40.090	0.01	4.54	0.39	4.52	0.00	4.18	0.28	4.28	0.02	4.22	0.08	4.24
11:17	42.090	0.03	4.56	0.41	4.54	0.01	4.19	0.32	4.32	0.06	4.26	0.16	4.32
11:19	44.090	0.01	4.54	0.41	4.54	0.00	4.18	0.31	4.31	0.04	4.24	0.15	4.31
11:21	46.090	0.00	4.53	0.40	4.53	0.01	4.19	0.28	4.28	0.01	4.21	0.08	4.24
11:23	48.090	0.01	4.54	0.41	4.54	0.00	4.18	0.29	4.29	0.02	4.22	0.08	4.24
11:25	50.090	0.01	4.54	0.41	4.54	0.01	4.19	0.30	4.30	0.03	4.23	0.11	4.27
11:27	52.090	0.00	4.53	0.37	4.50	0.00	4.18	0.25	4.25	-0.01	4.19	0.03	4.19
11:29	54.090	0.01	4.54	0.40	4.53	0.00	4.18	0.30	4.30	0.04	4.24	0.11	4.27
11:31	56.090	0.03	4.56	0.40	4.53	0.01	4.19	0.31	4.31	0.05	4.25	0.09	4.25
11:33	58.080	0.03	4.56	0.40	4.53	0.00	4.18	0.32	4.32	0.06	4.26	0.16	4.32
11:35	60.125	0.03	4.56	0.41	4.54	0.01	4.19	0.31	4.31	0.06	4.26	0.15	4.31
11:37	62.013	0.03	4.56	0.40	4.53	0.01	4.19	0.29	4.29	0.04	4.24	0.09	4.25
11:39	64.125	0.04	4.57	0.39	4.52	0.02	4.20	0.29	4.29	0.04	4.24	0.07	4.23
11:41	66.125	0.01	4.54	0.38	4.51	0.01	4.19	0.24	4.24	0.00	4.20	0.01	4.17
11:43	68.125	0.04	4.57	0.38	4.51	0.02	4.20	0.27	4.27	0.03	4.23	0.07	4.23
11:45	70.125	0.03	4.56	0.39	4.52	0.02	4.20	0.28	4.28	0.05	4.25	0.11	4.27
11:47	72.125	0.04	4.57	0.40	4.53	0.02	4.20	0.28	4.28	0.04	4.24	0.06	4.22
11:49	74.143	0.04	4.57	0.38	4.51	0.01	4.19	0.26	4.26	0.02	4.22	0.04	4.20
11:51	76.125	0.04	4.57	0.40	4.53	0.03	4.21	0.30	4.30	0.06	4.26	0.11	4.27
11:53	78.125	0.06	4.59	0.42	4.55	0.03	4.21	0.34	4.34	0.09	4.29	0.16	4.32
11:55	80.125	0.03	4.56	0.38	4.51	0.02	4.20	0.27	4.27	0.03	4.23	0.06	4.22
11:57	82.125	0.03	4.56	0.39	4.52	0.02	4.20	0.28	4.28	0.04	4.24	0.09	4.25
11:59	84.125	0.06	4.59	0.41	4.54	0.03	4.21	0.33	4.33	0.08	4.28	0.15	4.31
12:01	86.125	0.03	4.56	0.39	4.52	0.02	4.20	0.26	4.26	0.01	4.21	0.04	4.20
12:03	88.125	0.03	4.56	0.38	4.51	0.02	4.20	0.28	4.28	0.03	4.23	0.06	4.22
12:05	90.125	0.04	4.57	0.40	4.53	0.02	4.20	0.30	4.30	0.06	4.26	0.09	4.25

Time	Elapsed Time (min.)	PW-1A		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
12:07	92.125	0.04	4.57	0.42	4.55	0.03	4.21	0.34	4.34	0.09	4.29	0.17	4.33
12:09	94.125	0.04	4.57	0.41	4.54	0.03	4.21	0.33	4.33	0.08	4.28	0.16	4.32
12:11	96.125	0.03	4.56	0.38	4.51	0.01	4.19	0.26	4.26	0.02	4.22	0.04	4.2
12:13	98.125	0.03	4.56	0.37	4.50	0.01	4.19	0.24	4.24	0.00	4.20	0.00	4.16
12:15	100.130	0.06	4.59	0.40	4.53	0.03	4.21	0.33	4.33	0.08	4.28	0.15	4.31
12:35	120.290	0.03	4.56	0.39	4.52	0.01	4.19	0.29	4.29	0.03	4.23	0.08	4.24
12:55	140.290	0.07	5.00	0.42	4.55	0.03	4.21	0.36	4.36	0.08	4.28	0.15	4.31
13:15	160.290	0.01	4.54	0.38	4.51	0.00	4.18	0.26	4.26	-0.02	4.18	0.02	4.18
Recovery													
13:30	175.520	0.04	4.57	0.40	4.53	0.00	4.18	0.34	4.34	0.05	4.25	0.15	4.31
13:30	175.540			0.40	4.53								
13:30	175.550			0.39	4.52								
13:30	175.570			0.39	4.52								
13:30	175.590			0.38	4.51								
13:30	175.600			0.38	4.51								
13:30	175.620			0.37	4.50								
13:30	175.640			0.36	4.49								
13:30	175.650			0.36	4.49								
13:30	175.670			0.35	4.48								
13:30	175.690			0.35	4.48								
13:30	175.780	0.03	4.56	0.32	4.45	0.00	4.18	0.28	4.28	0.04	4.24	0.14	4.30
13:30	175.860	0.04	4.57	0.30	4.43	0.01	4.19	0.27	4.27	0.04	4.24	0.13	4.29
13:31	175.940	0.04	4.57	0.28	4.41	0.00	4.18	0.26	4.26	0.04	4.24	0.13	4.29
13:31	176.030	0.04	4.57	0.27	4.40	0.01	4.19	0.25	4.25	0.04	4.24	0.13	4.29
13:31	176.110	0.04	4.57	0.26	4.39	0.00	4.18	0.23	4.23	0.04	4.24	0.12	4.28
13:31	176.190	0.04	4.57	0.25	4.38	0.01	4.19	0.22	4.22	0.03	4.23	0.12	4.28
13:31	176.280	0.03	4.56	0.24	4.37	0.00	4.18	0.22	4.22	0.03	4.23	0.11	4.27
13:31	176.360	0.03	4.56	0.23	4.36	0.00	4.18	0.21	4.21	0.03	4.23	0.11	4.27
13:31	176.440	0.03	4.56	0.22	4.35	0.00	4.18	0.21	4.21	0.03	4.23	0.10	4.26
13:31	176.530	0.03	4.56	0.23	4.36	0.00	4.18	0.21	4.21	0.03	4.23	0.10	4.26
13:31	176.910	0.04	4.57	0.22	4.35	0.01	4.19	0.21	4.21	0.04	4.24	0.11	4.27
13:32	177.240	0.04	4.57	0.20	4.33	0.00	4.18	0.21	4.21	0.05	4.25	0.12	4.28
13:32	177.580	0.04	4.57	0.19	4.32	0.00	4.18	0.21	4.21	0.05	4.25	0.13	4.29
13:32	177.910	0.04	4.57	0.18	4.31	0.00	4.18	0.19	4.19	0.05	4.25	0.13	4.29
13:33	178.240	0.04	4.57	0.17	4.30	0.00	4.18	0.17	4.17	0.04	4.24	0.11	4.27
13:33	178.580	0.04	4.57	0.17	4.30	0.00	4.18	0.18	4.18	0.04	4.24	0.12	4.28
13:33	178.910	0.04	4.57	0.17	4.30	0.00	4.18	0.18	4.18	0.04	4.24	0.11	4.27
13:34	179.240	0.01	4.54	0.15	4.28	-0.01	4.17	0.14	4.14	0.02	4.22	0.07	4.23
13:34	179.580	0.03	4.56	0.13	4.26	-0.01	4.17	0.11	4.11	0.00	4.20	0.03	4.19
13:34	179.910	0.03	4.56	0.12	4.25	-0.01	4.17	0.14	4.14	-0.02	4.18	0.02	4.18
13:35	180.250	0.03	4.56	0.11	4.24	0.00	4.18	0.11	4.11	-0.01	4.19	0.01	4.17
13:35	180.580	0.03	4.56	0.12	4.25	-0.01	4.17	0.11	4.11	0.00	4.20	0.03	4.19
13:35	180.910	0.01	4.54	0.11	4.24	-0.01	4.17	0.11	4.11	0.00	4.20	0.04	4.20
13:36	181.250	0.03	4.56	0.11	4.24	-0.01	4.17	0.11	4.11	0.01	4.21	0.04	4.20
13:36	181.580	0.03	4.56	0.11	4.24	-0.01	4.17	0.12	4.12	0.02	4.22	0.05	4.21

Time	Elapsed Time (min.)	PW-1A		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
13:36	181.910	0.03	4.56	0.11	4.24	0.00	4.18	0.12	4.12	0.02	4.22	0.07	4.23
13:37	182.250	0.03	4.56	0.11	4.24	-0.01	4.17	0.12	4.12	0.03	4.23	0.08	4.24
13:37	182.580	0.03	4.56	0.10	4.23	-0.01	4.17	0.12	4.12	0.02	4.22	0.06	4.22
13:37	182.910	0.04	4.57	0.10	4.23	0.00	4.18	0.12	4.12	0.02	4.22	0.05	4.21
13:38	183.250	0.03	4.56	0.10	4.23	-0.01	4.17	0.12	4.12	0.02	4.22	0.05	4.21
13:38	183.580	0.03	4.56	0.09	4.22	-0.01	4.17	0.11	4.11	0.01	4.21	0.05	4.21
13:38	183.910	0.04	4.57	0.09	4.22	-0.01	4.17	0.11	4.11	0.02	4.22	0.05	4.21
13:39	184.250	0.03	4.56	0.09	4.22	-0.01	4.17	0.12	4.12	0.02	4.22	0.05	4.21
13:39	184.580	0.03	4.56	0.09	4.22	-0.01	4.17	0.12	4.12	0.03	4.23	0.05	4.21
13:39	184.910	0.04	4.57	0.09	4.22	0.00	4.18	0.11	4.11	0.02	4.22	0.06	4.22
13:40	185.250	0.03	4.56	0.09	4.22	0.00	4.18	0.11	4.11	0.02	4.22	0.06	4.22
13:40	185.580	0.03	4.56	0.09	4.22	-0.01	4.17	0.11	4.11	0.02	4.22	0.07	4.23
13:42	187.690	0.03	4.56	0.10	4.23	0.00	4.18	0.13	4.13	0.05	4.25	0.11	4.27
13:44	190.240	0.03	4.56	0.10	4.23	-0.01	4.17	0.13	4.13	0.05	4.25	0.09	4.25
13:46	191.690	0.03	4.56	0.08	4.21	-0.01	4.17	0.09	4.09	0.01	4.21	0.05	4.21
13:48	193.720	0.01	4.54	0.07	4.20	-0.01	4.17	0.09	4.09	0.02	4.22	0.04	4.2
13:50	195.720	0.04	4.57	0.10	4.23	0.01	4.19	0.15	4.15	0.08	4.28	0.16	4.32
13:52	197.720	0.03	4.56	0.08	4.21	0.00	4.18	0.12	4.12	0.05	4.25	0.10	4.26
13:54	199.720	0.03	4.56	0.08	4.21	0.00	4.18	0.12	4.12	0.05	4.25	0.11	4.27
13:56	201.720	0.04	4.57	0.08	4.21	0.01	4.19	0.11	4.11	0.05	4.25	0.08	4.24
13:58	203.720	0.04	4.57	0.08	4.21	0.01	4.19	0.13	4.13	0.07	4.27	0.14	4.30
14:00	205.720	0.06	4.59	0.06	4.19	0.01	4.19	0.10	4.10	0.05	4.25	0.05	4.21
14:02	207.720	0.04	4.57	0.08	4.21	0.01	4.19	0.12	4.12	0.07	4.27	0.14	4.3
14:04	209.720	0.01	4.54	0.04	4.17	-0.01	4.17	0.05	4.05	0.00	4.20	0.01	4.17
14:06	211.720	0.01	4.54	0.04	4.17	-0.01	4.17	0.07	4.07	0.02	4.22	0.03	4.19
14:08	213.720	0.03	4.56	0.03	4.16	0.00	4.18	0.05	4.05	0.01	4.21	0.01	4.17
14:11	216.060	0.04	4.57	0.05	4.18	0.00	4.18	0.08	4.08	0.04	4.24	0.07	4.23
14:12	217.750	0.04	4.57	0.06	4.19	0.00	4.18	0.11	4.11	0.06	4.26	0.11	4.27
14:14	219.750	0.06	4.59	0.08	4.21	-0.01	4.17	0.17	4.17	0.11	4.31	0.12	4.28
14:16	221.750	0.04	4.57	0.08	4.21	0.00	4.18	0.11	4.11	0.06	4.26	0.12	4.28
14:18	223.750	0.03	4.56	0.04	4.17	-0.01	4.17	0.06	4.06	0.01	4.21	0.05	4.21
14:20	225.750	0.01	4.54	0.03	4.16	-0.02	4.16	0.03	4.03	-0.01	4.19	0.02	4.18
14:22	227.750	0.03	4.56	0.03	4.16	-0.01	4.17	0.05	4.05	0.00	4.20	0.00	4.16
14:24	229.750	0.03	4.56	0.04	4.17	-0.01	4.17	0.06	4.06	0.01	4.21	0.03	4.19
14:26	231.750	0.03	4.56	0.04	4.17	-0.01	4.17	0.10	4.10	0.05	4.25	0.11	4.27
14:28	233.750	0.00	4.53	0.02	4.15	-0.02	4.16	0.03	4.03	-0.01	4.19	0.00	4.16
14:30	235.630	0.01	4.54	0.03	4.16	-0.02	4.16	0.06	4.06	0.02	4.22	0.03	4.19
14:32	237.630	0.01	4.54	0.04	4.17	-0.02	4.16	0.08	4.08	0.03	4.23	0.06	4.22
14:34	239.630	0.03	4.56	0.06	4.19	-0.01	4.17	0.12	4.12	0.07	4.27	0.15	4.31
14:36	241.630	0.01	4.54	0.03	4.16	-0.03	4.15	0.04	4.04	-0.02	4.18	0.01	4.17
14:38	243.630	0.00	4.53	0.02	4.15	-0.04	4.14	0.03	4.03	-0.03	4.17	0.00	4.16
14:40	245.630	0.00	4.53	0.03	4.16	-0.04	4.14	0.07	4.07	0.00	4.20	0.06	4.22
14:42	247.630	0.01	4.54	0.04	4.17	-0.04	4.14	0.07	4.07	0.00	4.20	0.07	4.23
14:44	249.630	0.01	4.54	0.07	4.20	-0.03	4.15	0.12	4.12	0.05	4.25	0.15	4.31
14:46	251.630	-0.01	4.52	0.03	4.16	-0.06	4.12	0.01	4.01	-0.06	4.14	-0.01	4.15

Time	Elapsed Time (min.)	PW-1A		S-1A		D-1A		S-2		D-2		S-3	
		Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW	Δ Level	DTW
14:48	253.630	-0.01	4.52	0.02	4.15	-0.06	4.12	0.02	4.02	-0.06	4.14	-0.04	4.12
14:50	255.630	-0.03	4.50	0.02	4.15	-0.06	4.12	0.04	4.04	-0.03	4.17	0.01	4.17
14:52	257.630	0.01	4.54	0.05	4.18	-0.05	4.13	0.10	4.10	0.03	4.23	0.10	4.26
14:54	259.630	-0.01	4.52	0.04	4.17	-0.06	4.12	0.05	4.05	-0.03	4.17	0.05	4.21
14:56	261.630	-0.01	4.52	0.02	4.15	-0.06	4.12	0.05	4.05	-0.03	4.17	0.04	4.20
14:58	263.630	-0.01	4.52	0.03	4.16	-0.06	4.12	0.05	4.05	-0.03	4.17	0.02	4.18

DTW = depth to water.
All values presented in feet.