Appendix E

Addendum to Water Supply Report

ADDENDUM

to

LOST LAKE WATER SUPPLY REPORT

LOST LAKE RESORT PROPERTY
Town of Forestburgh, Sullivan County, New York

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EXECUTIVE SUMMARY

Double Diamond Companies retained Tim Miller Associates, Inc. (TMA) and Advantage Engineers, LLC (Advantage) to develop sufficient potable water sources within the bedrock aquifer to support the proposed Lost Lake Resort development. This proposed resort encompasses 2,080 acres (3.25 square miles), and the preliminary development plan includes approximately 2,500 residential lots composed of house units, condominiums, and cabins, plus a golf course with restaurant and clubhouse. The Lost Lake Resort property is located within the Bush Kill watershed, which includes approximately 9 square miles of predominantly forested and sparsely populated land.

The anticipated average daily water use/peak day demand after full build out has been estimated for three (3) scenarios, as follows:

Water Demand Scenarios and Well Field Capacity

	Average Day	**Peak Day** 1.8 x Average Day
	MGD	MGD
Probable Demand: 172 gpd/connection	0.475 (330 gpm)	0.855 (594 gpm)
Conservatively High Demand 250 gpd/connection	0.683 (474 gpm)	1.23 (854 gpm)
EIS Review 330 gpd/connection	0.897 (623 gpm)	1.615 (1,121 gpm)
Well Field 24-Hour Maximum Production	1.731 (1,202 gpm)	

In addition to this water demand, the current daily groundwater pumping within the watershed is estimated at 0.023 MGD. The estimated drought year groundwater recharge to only the 3.25 mi^2 site is approximately 2.21 MGD, which should be sufficient to meet the current pumping, and the anticipated maximum groundwater pumping under the various water demand scenarios.

Hydrogeologic mapping, exploratory well drilling and aquifer testing was performed during the period from November 2009 through October 2010. Based on this work, the bedrock consists of mostly gray sandstone with interbeds of grayish and reddish siltstone and shale mapped as the Lower Walton Formation. The bedding ranges from horizontal to gentle dipping to the north, and the principal joint sets are oriented generally east to west and north to south, with dips steep to vertical. These joint sets, along with weathered bedding planes (both horizontal and dipping cross bed planes) serve as the secondary porosity openings, within which the groundwater flux in the bedrock occurs.

Based on the information obtained from drilling and aquifer testing, and from hydrogeologic mapping at the site, the successful supply wells withdraw groundwater from a set of deep, hydraulically connected fractures and/or enlarged bedding planes that occur at depths of approximately 400 feet to 800 feet below grade (bg), with a median depth of 660 feet amsl. This “deep aquifer” has horizontal hydraulic conductivity substantially greater than the vertical conductivity, which results in limited hydraulic interconnection with the shallow bedrock aquifer and the surface water. However, the segment of the Bush Kill, below the confluence with the tributary that crosses the site, is expected to be in hydraulic communication with the deep bedrock aquifer. Beginning at this area, the bedrock aquifer potentiometric surface is above the surface water, and indicates the presence of an upward, vertical gradient that is anticipated to have some discharge to the Bush Kill and possibly the associated wetlands, with the actual flux dependent on the hydraulic conductivity of the bedrock overburden materials.

Based on the recharge analysis, the well field production under any of the three (3) water use scenarios is supported by the estimated recharge. The Zone of Contribution that would develop under long term operation of the well field at the maximum estimated pumping rate of 623 gpm is estimated to be elliptical, with axis dimensions of 14,000 feet and 4,400 feet, and encompass 1.74 mi^2. The drought year recharge to this area would be approximately 1.183 MGD, which exceeds the maximum average day demand of 0.897 MGD by about 30%, and as such is considered to be sufficient to support the long term groundwater withdrawals from the site. The recharge area to a ZOC at the site could also theoretically include the hydraulically upgradient lands that lie within the Bush Kill watershed, which totals approximately 8.9 mi^2, and provide a net recharge volume of 6.052 MGD.

The water quality of the deep bedrock aquifer meets the NYSDOH applicable public water supply parameters, and should require no treatment beyond disinfection. In addition, the well locations will meet the applicable separation distances as required by NYDOH from possible sources of contamination (e.g., wastewater lines) as listed in Table 1 of Section 5-B.1 of the NYSDOH regulations (Statutory Authority Public Health Law 206(18)). Previous analysis of the potential for significant groundwater impact from the proposed development, with special focus on the golf course and other managed turf areas, indicated that there should be no unreasonable risk to the surface and groundwater quality of the area. In addition, the depth of the WBZs and confined nature of the aquifer should naturally provide a substantial barrier to any nearby surficial contaminant release.

The anticipated maximum impact to the nearest off-site domestic wells from the operation of the supply wells is approximately 8 feet of interference drawdown, which corresponds to a maximum 10% reduction to the water column; this impact should not result in a discernable reduction to the use or available groundwater at those locations. Overall, the operation of the site supply wells should not have any significant impact to any off-site wells.

The testing also showed that pumping the southernmost supply well (TW-5) resulted in a small decrease to the bedrock aquifer upward gradient beneath the nearby wetland. The actual change to the flux of groundwater through the low permeable soils at the wetlands due to the lowered head pressure is expected to be very small and not practicably measurable.

The aquifer response to the pumping tests was typical of a confined aquifer with vertical leakage. The aquifer transmissivity determined from observation well data, pumping well recovery data, and distance drawdown plots ranged from 956 gallons per day/foot (gpd/ft) to 4,800 gpd/ft. The storativity ranged between 0.000027 to 0.00012.

The testing demonstrated the maximum safe pumping rate for each well. Because most of the wells had additional available water column at the conclusion of testing, further analysis was performed to estimate a higher maximum safe pumping rate. A single test with all wells pumping concurrently was not completed due to the different times that wells were constructed, and the need to assess production capacity as the well drilling progressed. In lieu of such testing, an analysis of the anticipated well field production was performed which accounts for interference drawdown effects from other pumping wells at the site. Based on the testing results and the interference analysis, the following summarizes the individual maximum safe pumping rates, the possible individual maximum rate and the estimated total well field production capacity:

Summary of Lost Lake Resort Well Field Production

	Individual Well Maximum Safe Pumping Rate Proven from Testing	Individual Well <u>Estimated</u> Maximum Safe Pumping Rate	Well Field <u>Estimated</u> Maximum Safe Pumping Rate	Well Field 24-Hour Maximum <u>Estimated</u> Production
Well Designation	gpm	gpm	gpm	MGD
TW-5	365	500	365	0.526
TW-6	91	150	91	0.131
FFF	246	360	246	0.354
JJJ	126	126	100	0.144
HH	200	345	200	0.288
O	85	140	85	0.122
TW-3a	115	115	115	0.166
Total	na	na	1,202 gpm	1.731 MGD

Note: Well P with proven maximum safe yield of 18 gpm is not included due to low yield, but may used at some future time.

The estimated well field production exceeds each of the potential average day water demand scenarios for the site. The well field 24-hour maximum capacity with the largest well out of service is 1.205 MGD, and is sufficient to satisfy each of the peak demand water use scenarios, except for the high range estimate of 1.615 MGD. The difference of 0.410 MGD, which corresponds to a pumping rate of 285 gpm, may be covered by utilizing the additional capacity of the existing wells (which would require testing to confirm), and/or water system storage capacity.

1.0 INTRODUCTION

1.1 Project Summary

This document (Addendum I) describes additional aquifer tests conducted for a groundwater production well field developed at the Lost Lake Resort site. Tim Miller Associates, Inc. and Advantage Engineers, LLC (Advantage) performed this work on behalf of Double Diamond Companies, owners of the site. The work is part of the groundwater development project that was initiated in 2009 with the purpose of obtaining sufficient potable water sources to support the proposed resort development. The 2,080-acre (3.25 square miles) Lost Lake Resort property preliminary development plan includes approximately 2,500 residential lots composed of house units, condominiums, and cabins, plus a golf course with restaurant and clubhouse.

Previous well drilling and testing was described in the following document: *Lost Lake Resort Water Supply Report*, Lost Lake Resort Property, Town of Forestburgh, Sullivan County, New York, prepared by Tim Miller Associates, Inc. with SSEC, April 21, 2010 (referred to herein as the Report).

This Addendum I details the following:

1. Wells FFF and JJJ pumping tests during August 6 through 9, 2010, when the wells were pumped simultaneously for 72 hours at average rates of 246 gallons per minute (gpm) and 126 gpm, respectively.
2. Well TW-3a testing October 5 through 8, 2010 at a rate of 115 gpm.
3. Well TW-5 and TW-6 testing October 20 to 22, 2010, with average rates of 365 gpm for TW-5, and 62 gpm for TW-6.
4. Well TW-6 and Well O were re-tested October 26 through 28, 2010, at average rates of 91 and 85 gpm, respectively.

This Addendum also evaluates:

- interference drawdown between the all supply wells, and the nearest off-site wells
- recommended operation of the supply wells
- further estimation of the aquifer recharge rate and sustainability of the groundwater withdrawals.

The Report should be relied on for all information not otherwise provided or revised in this Addendum I.

1.2 Background

As of July 2010, sixteen (16) wells were constructed. As presented in the Report, a sustainable supply of 268 gpm was proven from tests of wells DD (200 gpm), P (18 gpm), and O (50 gpm) in November 2009. A test of well HH, which is a backup well constructed next to well DD, was conducted in December 2009, and showed a sustainable yield of 200 gpm with better hydraulics than DD. Since that time, well OO was constructed as an 8-inch diameter well next to well O in an effort to enable an additional 25 to 50 gpm withdrawal above the 50 gpm proven from well O.

During spring 2010, the 6-inch wells FF and JJ were constructed, and due to favorable well yields, were subsequently replaced with 8-inch diameter wells that were offset approximately 10 feet from the 6-inch wells. The 8-inch wells were designated as wells FFF and JJJ. Figure 1 in Attachment 1 is a topographic plan of the Lost Lake site that shows the well locations.

Additional wells were constructed at the site from August through October 2010. Seven (7) test wells designated as TW-1 through TW-7 were drilled, and three (3) of these wells were finished as supply wells. Details regarding the well construction and testing are provided in later sections.

1.3 Anticipated Water Demand

The initial anticipated average day water demand for the project was specified by NYSDOH as part of the EIS review at 330 gallons per day (gpd) per residential unit plus amenities, which totaled 0.897 million gallons per day (MGD). A peaking factor of 2.0 raised the total required source capacity to 1.794 MGD; these requirements correspond to source supply capacity of approximately 642 gpm to meet average day demand, and 1,243 gpm to meet peak demand. The applicant (Double Diamond Companies) requested that a lower projected water demand be considered, and NYSDOH agreed to consider a lower value that was based on actual per capita water use data from area water systems.

A revised projected water demand for the Lost Lake Resort site was estimated by Alfred Benesch & Company (Benesch), the water and wastewater system design engineer for the project. This data was summarized in a letter to NYSDOH dated September 10, 2010, and included the average daily use per residential connection from area water suppliers (see Attachment 2). The average for the residential connection usage was 155 gpd/connection, and the weighted average was 172 gpd/connection. The weighted average is very similar to the per connection average usage of 137 gpd to 181 gpd at the Eagle Rock Resort in Hazleton, PA, which is an existing residential resort community that is owned and operated by Double Diamond Companies (the Lost Lake Resort will be a similar development). The data supports using a per connection average day demand of 172 gpd, which corresponds to an average day demand of 0.475 MGD, and continuous source supply of 330 gpm; a peaking factor of 1.8 would require 0.855 MGD and source of 594 gpm. This scenario is considered to be the Probable Demand. Benesch proposed using 250 gpd and a peaking factor of 1.8, which would provide for a large factor of safety; this scenario is considered as a Conservatively High Demand. The 250 gpd rate corresponds to an average day demand of 0.683 MGD and continuous source supply of 475 gpm; a peaking factor of 1.8 increases this demand to 1.230 MGD and 854 gpm supply. These estimates were all considered when evaluating the capacity of the supply wells, which is described later in this Addendum.

1.4 Area Water Supply Wells and Groundwater Use

The Bush Kill watershed that includes the Lost Lake Resort property and upgradient lands encompasses approximately 9 square miles of predominantly forested and sparsely populated land. Within the watershed, sparse residential development is located along Cold Spring Road, and consists of approximately 13 homes, and the Melody Lake private community with approximately 75 homes is located across Cold Spring Road from the northeast corner of the Lost Lake Resort property. One farm property (Philwold) is located east of the Lost Lake Resort property, north of the intersection of St. Joseph and Cold Spring Roads. The nearest wells to the Lost Lake Resort supply wells consist of a group of five (5) residences located approximately 1,500 feet southeast of well FFF. The next nearest wells are the rental property at the former train station on St. Joseph Road, and the homes along Cold Spring Road (see Figure 1-2).

An estimate for total groundwater pumped and consumptively used within the watershed (i.e., not returned to the aquifer) is as follows:

<u>Cold Spring Road homes</u>:
Assuming that the average daily pumping totals about 250 gpd, the total daily groundwater withdrawal is estimated at 3,250 gpd (13 x 250 gpd/home). This is a conservatively high estimate, given that average daily water use per household is generally less than 200 gpd. The Cold Spring Road properties also use on-site septic systems, which results in approximately 90% recycling of all groundwater pumped from on-site wells via wastewater return flows (SRBC, Overview for the Development of Local Water Budgets). Thus, the net consumptive water use at each residential site is estimated to be 25 gallons per day (gpd), with a total consumptive use of 325 gpd (13 homes x 25 gpd).

Melody Lake:

This area is served by a community water system, and a WWTP that is believed to discharge to the Bush Kill. The daily groundwater withdrawal from the Melody Lake community is estimated at 18,750 gpd (75 homes x 250 gpd/home), with no return flows to the aquifer due to the surface water discharge.

Philwold:

No data is available for Philwold, which is known to house animals. In lieu of specific data, it was assumed that all potable water is sourced from a well(s), and wastewater is treated with an on-site septic system; a reasonable estimate for water use is 1,000 gpd, with 300 gpd consumptively used.

The total daily groundwater withdrawal is thus estimated at 23,000 gpd, with a net withdrawal from the aquifer of 19,375 gpd. In comparison to the total daily recharge to the site, as presented in Section 1.6, the off-site existing water use represents approximately 1% of the estimated daily recharge volume of 2.21 million gallons per day (MGD). On this basis the off-site water use is a negligible volume of the total available groundwater recharge.

1.5 Physiographic and Hydrogeologic Setting

Bedrock and Structure

The site is located within the Southern New York Section of the Appalachian Plateau Physiographic Province, which consists of a dissected plateau with somewhat gently sloping hillsides and broad flood plains; hilltop elevations range from approximately 1,200 feet to 2,000 feet. This region corresponds to the Glaciated Low Plateaus Section of northeast Pennsylvania) (Sevon, 2000). The site and surrounding area is underlain by Upper Devonian rocks (Soren, 1961) differentiated by NY State Geological Survey (NYSGS, GIS) into the Lower Walton Formation (Sonyea Group) and Upper Walton Formation (West Falls Group). Each of these formations is described as composed predominantly of shale, with some sandstone and conglomerate. The available mapping shows that most of the site is underlain by the Lower Walton Formation; only the extreme western side of the site is underlain by the Upper Walton Formation. Both formations have similar lithology, with bedding that ranges from horizontal to gentle dipping to the north. The well drilling at the site encountered mostly gray sandstone with interbeds of grayish and reddish siltstone and shale. Figure 3 shows the geologic mapping for the site.

Reconnaissance at the eastern portion of the site where the supply wells are constructed identified bedrock outcrops that were composed primarily of medium-gray, fine to medium grained sandstone, with occasional interbeds of rounded pebble conglomerate. Most strata were cross-bedded, and weathering commonly resulted in separation between individual cross beds. Bedding thickness ranged from medium (2 inches to 2 feet) to massive (>4 feet). The following table summarizes the bedrock outcrop strike and joint measurements that were made in the area of the well installations.

Table 1-1 – Bedrock Structure Measurements

Bedding	Major Joint	Minor Joint
N88E, dips 5N	N95E, dips 58N	N24E, dips 26ESE
N88E, dips 3N	N85E, nearly vertical	n/a
horizontal	N86E, dips 58N	n/a
N3W, dips 2E	N3W, nearly vertical	n/a
horizontal	N8E, nearly vertical	n/a
Horizontal	N89, nearly vertical	n/a
Horizontal	N78E, nearly vertical	n/a

The principal joint sets were oriented generally east to west and north to south, with dips steep to vertical. These joint sets, along with weathered bedding planes (both horizontal and dipping cross bed planes) serve as the secondary porosity openings, within which the groundwater flux within the bedrock occurs. The bedrock primary porosity is not anticipated to provide any significant groundwater flux.

Groundwater and Surface Water

With regards to the bedrock aquifer secondary porosity, the most productive supply wells withdraw groundwater from a set of deep, hydraulically connected fractures and/or enlarged bedding planes that occur at depths of approximately 400 feet to 800 feet below grade (bg), and correspond to elevations of approximately 440 to 840 feet above mean sea level (amsl), and a median depth of 660 feet amsl. The aquifer testing demonstrated that the horizontal hydraulic conductivity of this zone was substantially greater than vertical conductivity. This anisotropy is further discussed in later sections of this Addendum. For clarification in this Addendum, the bedrock aquifer is referred to as having a deep and shallow zone, which refers to the deep fractures between 600 and 700 feet amsl, and the WBZs at higher elevations, respectively.

Groundwater at the site is contained within both the bedrock aquifer, and saturated unconsolidated overburden materials that lie along flood plains and streams. The hydraulic interconnection between these is limited, based on the presence of low permeability soils that underlie the wetland areas and associated streams. The large wetland area (identified as ABC in the DEIS) and associated with the unnamed tributary to Bush Kill (BK-UNT) which flows from northwest to southeast across the site, is underlain by very poorly draining Carlisle Muck and Palms Muck soils, which should preclude significant flux of groundwater with the bedrock aquifer. The wetland hydrology is sourced from the BK-UNT and springs and overland flow from the adjacent steep-sloped uplands. Previous monitoring of the wetland areas during the fall 2009 pumping tests as described in the Report did not detect any apparent interconnection between the bedrock aquifer and surficial saturation.

Available information on the soils at the site, specifically the glacial deposits, indicates that the saturated overburden will probably not be an important source of potable water. Although buried gravel fill areas that were deposited by glaciers can produce substantial quantities of groundwater, the existing deposits, which are located along the stream channels and flood plains, are not anticipated to exist in sufficient quantity. Therefore, at this time the bedrock aquifer is the sole source of groundwater.

The groundwater elevation in the bedrock aquifer at the eastern portion of the site was determined by subtracting the static water level (SWL) measurements from the existing wells (on July 14 and October 29, 2010), from the surveyed top of casing (TOC) elevations. Tables 2a and 2b lists the measurements, and Figure 1-4a shows the inferred groundwater surface elevation contour lines from this data. For consistency, only the wells that intersected deep water bearing zones (WBZs) were used for the mapping (wells II and N were not used, see Table 2). The groundwater elevation data indicates that the direction of the horizontal hydraulic gradient decline, and presumed groundwater flow direction, is towards the south. The elevation data showed a sharp decline of the horizontal hydraulic gradients between the northern and southern portions of the site. The horizontal gradients determined from the data were one (1) order of magnitude lower in the southern area, roughly beginning from the area between wells M and F. Using the available elevation date, the area from well A and south to well M and F, the gradient is 0.014. South of this area, from well M and F to well FFF, the gradient declines to 0.0031, and to 0.002 between FFF and TW-5. The higher gradient area was interpreted as reflecting a zone of the bedrock aquifer with lower conductivity, with poorly developed secondary porosity, especially the deeper, productive aquifer. This condition was reflected by the low yield of all of the wells in the northern area. Conversely, the area of lower gradients is inferred to be a zone of greater hydraulic conductivity in the bedrock, and is the area of the site where the most productive wells are located. The surface water gradient along the BK-UNT is approximately 0.0026, based on the decline of the surface water elevation from 1,365 feet amsl near well M, to 1,350 feet amsl near well FFF, which is moderately lower than the bedrock aquifer groundwater gradient along that stream segment.

The groundwater elevation data also indicates Lost Lake is perched above the bedrock aquifer saturation. The pool elevation is +/- 1,462 feet amsl, compared to the bedrock aquifer groundwater surface beneath Lost Lake, which declines from about 1,440 feet amsl to 1,410 feet amsl. The stream which discharges from Lost Lake is likewise perched above the bedrock aquifer saturation for the segment that lies on the property.

Table 1-2a –July 2010 Groundwater Elevations

Well	TOC, Feet amsl	Depth To Water, feet BTOC	GW Elevation, Feet amsl
		7/14/2010	
A (470, 770)	1,439.92	0.25	1,439.67
C (780)	1,459.63	49.85	1,409.78
D (na)	1,473.66	lid rusted	n/a
F (300, 750)	1,432.74	69.57	1,363.17
M (600)	1,388.34	21.25	1,367.09
O (140, 750, 880)	1,376.72	18.73	1,357.99
OO (165, 740)	1,377.86	19.78	1,358.08
N (85)	1,426.33	40.60	1,385.73
P (376)	1,424.42	64.92	1,359.50
BB (320, 780)	1,396.13	39.05	1,357.08
DD (110 to 715)	1,372.10	17.27	1,354.83
EE (835, 965)	1,414.36	59.87	1,354.49
FF (175 to 700)	1,360.75	9.69	1,351.06
FFF (500, 697)	1,360.28	9.42	1,350.86
HH (90 to 535)	1,372.85	17.58	1,355.27
II (158)	1,465.60	62.12	1,403.48
JJ (692)	1,384.14	29.30	1,354.84
JJJ (690, 710)	1,384.34	32.17	1,352.17

Table 1-2b –October 2010 Groundwater Elevations

Well	TOC, Feet amsl	Depth To Water, feet BTOC	GW Elevation, Feet amsl
		10/29/2010	
O (140, 750, 880)	1,376.72	21.07	1,355.65
P (376)	1,424.42	67.22	1,357.20
BB (320, 780)	1,396.13	39.54	1,356.59
EE (835, 965)	1,414.36	60.15	1,354.21
FFF (500, 697)	1,360.28	10.90	1,349.38
HH (90 to 535)	1,372.85	19.13	1,353.72
JJJ (690, 710)	1,384.34	32.40	1,351.94
TW-3a (29, 78-175)	1,365.62	3.75	1,361.87
TW-2 (138, 300 to 518)	1,373.18	16.55	1,356.63
TW-1 (52, 1048, 1110)	1,367.43	10.28	1,357.15
TW-6 (747)	1,365.41	9.65	1,355.76
TW-4 (217, 347)	1,350.52	1.38	1,349.14
TW-5 (132, 792, 798)	1,354.87	6.80	1,348.07
TW-7 (148, 182-440)	1,366.29	21.10	1,345.19

(470, 770) - number in parenthesis is the WBZ depth(s) or range of depths
Shading indicates that a line level was used to determine the TOC elevation from a nearby, surveyed well elevation.

The BK-UNT is expected to be the discharge point for the shallow groundwater, which is believed to be sourced from the unconsolidated glacial deposits and residual soils that overlie the bedrock. As shown on Figure 1-4a, the elevation of the bedrock aquifer groundwater is below the BK UNT surface until the area where the BK-UNT discharges to the Bush Kill (i.e., approximately 1,350 feet amsl), at which point the vertical separation between the bedrock aquifer and surface water dissipates, and the bedrock aquifer is probably in hydraulic communication with the surface water. Below this point the bedrock groundwater surface is above the Bush Kill surface, which indicates that there is a vertical gradient oriented upwards. This condition is supported by the groundwater elevation at TW-4 that rises above the ground surface, and is several feet above the Bush Kill surface. The groundwater elevation at TW-5 is 1,348 feet amsl, and very near to the ground surface; the Bush Kill surface at its nearest approach to TW-5 is shown at approximately 1,340 feet amsl (on sheet S-16, Brinkash Associates, Inc. wetlands mapping). Thus, the bedrock aquifer potentiometric surface beginning in the area of the BK-UNT discharge is above the surface water, and indicates the presence of an upward, vertical gradient that is anticipated to have some discharge to the Bush Kill and possibly the associated wetlands, with the actual flux dependent on the hydraulic conductivity of the bedrock overburden materials. The source of the hydraulic head in the bedrock aquifer is expected to be the upland areas within the mostly forested recharge area that contains the site.

The deeper groundwater system is probably influenced mostly by regional controls. The deep system is anticipated to ultimately discharge to the Neversink and Delaware Rivers that are located to the south and southwest.

1.6 Groundwater Recharge

The average annual groundwater recharge for the site was estimated from available data for the Upper Devonian-aged Catskill Formation, which is very similar to the bedrock beneath the site in regards to both lithology and structure. The Delaware River Basin Commission (DRBC, 1982) reports the average and drought year (i.e., the 10% probability drought) groundwater recharge rates at 940,000 gallons per day per square mile (gpd/mi^2) and 680,000 gpd/ mi^2, respectively. Long-term groundwater budgets should rely on drought year recharge only; therefore, a general estimate of total groundwater recharge (within only the property boundary) for planning purposes is approximately 2.21 million gallons per day (MGD) (3.25 mi^2 x 680,000 gpd/ mi^2). As described in the aquifer testing results, the pumping zone of influence/groundwater Zone of Contribution (ZOC), and the resulting recharge area, extends beyond the site boundaries, as the fractured bedrock aquifer, and especially the productive deeper zone, sources water from well beyond the property limits. Therefore, the actual drought year available groundwater is substantially greater. This total recharge volume is not fully available for withdrawal by water supply wells at the site, because a portion of this provides the baseflow for the surface streams at the site and nearby areas.

1.7 Hydrogeologic Boundaries

The horizontal bedding and similar bedrock lithology of sandstone, siltstone, and shale that exists at the site and surrounding area does not contain any apparent barrier boundary condition. The northern portion of the site, where the bedrock conductivity appears to be lower, would be expected to limit the groundwater flux through the aquifer from this direction. A cone of depression that intersects this area may manifest as a moderately steepening drawdown slope.

Recharge boundaries may be encountered, given the presence of the Bush Kill and tributaries, and possibly several lakes in the area (but probably not Lost Lake). Also, the areas where the gravel and boulder deposits thicken and lie below the water table may also serve as a recharge boundary.

2.0 CONSTRUCTION AND TESTING OF WELLS FFF AND JJJ

2.1 Well Construction

Boyd Artesian Well Co., Inc. performed the drilling and construction of both wells. Copies of the well logs are provided in Attachment 3, and indicate that both wells intersected alternating beds of gray and red sandstone. The construction details are summarized in Table 2-1:

Table 2-1 – Summary of Well FFF and JJJ Construction

Well	Total Depth Feet, bg	Casing	TOC Elevation ft, amsl	Depth to Bedrock Feet, bg	SWL ft, BTOC (8/6/10)	Water Bearing Zones	Blown Yield
FFF	699 ft	51 feet 8-in. diameter, grouted from 51 to 10 ft	1,360.58	17 ft	10.54 ft	85 ft – 3 gpm 500 ft – 5 gpm 697 ft – 300 gpm	300 gpm
JJJ	750 ft	51 feet 8-in. diameter, grouted from 50 to 15 ft	1,384.34	40 ft	33.25 ft	690 ft – 200 gpm 710 ft – 25 gpm	200+ gpm

SWL – static water level
BTOC – below top of casing
WBZ – Water Bearing Zone

The principal water bearing zones (WBZs) for each well are very deep and tap the deep bedrock aquifer, and provide an available water column of approximately 680 feet at well FFF, and 650 feet at well JJJ. The principal WBZs appear to be bedding plane related, because they occurred at the approximate same depth as their corresponding 6-inch wells, which are located within 10 feet, and the bedrock is generally horizontally-bedded but joints are steeply inclined. The elevations of the principal WBZs are approximately 662 feet at well FFF, and 693 feet at JJJ.

2.2 WELL FFF AND JJJ AQUIFER TESTING

Aquifer testing was completed for both wells in order to estimate the well yield, aquifer characteristics, drawdown interference, and evaluate surface water impact. The testing followed the protocol prepared by Tim Miller Associates, Inc. and submitted to NYDEC in fall 2009. The testing included a 72-hour constant rate pumping test, followed by sample collection for NYSDOH Subpart 5.1 parameters and a Microscopic Particulate Analysis (MPA). A step drawdown test was also conducted for well FFF. The testing schedule and summary of results for both wells is provided in Table 2-2.

A Grundfos Model 230S500-15 50-hp submersible pump was installed in well FFF with the intake at 660 feet, and was rated to produce 237 gpm with the PWL at the intake.

At well JJJ, a Franklin pump model 375ST6 60-hp pump was installed with the intake at 685 feet, and was rated to produce 190 gpm with the PWL at the intake. Both pumps were installed on 4-inch diameter galvanized riser pipe, with a totalizer meter, flow control valving, and sampling port. Electronic data loggers with manual back-up measurements were used to record the water level in the pumping wells.

Table 2-2 – Summary of Well FFF and JJJ Pumping Tests

Test Name	Step Test	Constant Rate Test	Initial SWL and Final PWL (feet, BTOC)	Net Drawdown (feet)	Total Gallons Pumped	Average Rate for 72 Hours (gpm)	24-Hr and End of Test Specific Capacity gpm/foot drawdown
Well JJJ	n/a	Aug. 6th, 09:20 thru Aug. 9th, 9:20	32.51 – 680.88	648.37	545,740	126.3	0.20 and 0.19
Well FFF	Aug, 5th, 8:10 to 9:50		10.54 – 501	490.46	1,061,840	245.8	0.51 and 0.48

2.3 Monitoring

Figure 1-5 shows the locations of the groundwater and surface water monitoring points, and Table 2-3 summarizes the pertinent information. Most of the on-site wells were used for observation, but no off-site wells were monitored because permission was not granted by the property owners.

The surface water monitoring consisted of a wetland piezometer and a stream level point in the UNT-BK. A nested piezometer was not installed in the wetland because there was no ponded water or saturation within 2 feet of the surface, and the base of the piezometer could not be extended more than 2.6-foot below grade due to the presence of boulders and cobbles that precluded further hand-augering. The piezometer boring intersected vegetation/organic debris from 0 to 0.5 foot, black organic soil to 2.6 feet, and cobbles/boulders at 2.6 feet, which was the maximum extent that any of the several wetland borings achieved. Electronic dataloggers were used at all of the monitoring points, and programmed to record at a 10-minute frequency. These files are available upon request for this and all other aquifer tests.

Table 2-3 – Monitoring Summary for Wells FFF and JJJ

Observation Point	Distance Relative to Pumping Wells (1) (feet)	Net Drawdown Interference after Pumping Well Stabilization (feet)
Well EE	510-	93
Well HH	1,260	37.6
Well P	1,930	11.0
Well OO	2,330	20.0
Well BB	2,520	2.6
Well F	3,340	4.6
Well M	4,800	0.7
Wetland Piezometer	355	None discernable
BK-UNT	320	None discernable

(1) Distance to the midpoint between wells JJJ and FFF
(2) After stabilization

Chemistry monitoring for several parameters was performed during the constant rate testing at the pumping wells on a minimum 2 to 4 hour schedule during daytime and evening. The surface water was monitored prior to each test, at least once per day during the pumping phase, and then during the recovery period. Portable meters were used to monitor the pH, temperature (°Celsius), and specific conductance (microsiemens/cm [uS/cm]). The meters were calibrated or compared to standard solutions on a daily basis during the testing period to ensure accuracy.

2.4 Discharge

The discharge water from well JJJ was conveyed approximately 400 feet east, where it flowed through an existing swale and into the wetland next to Bush Kill and eventual flow into the Bush Kill. The discharge from well FFF was conveyed approximately 250 feet to the southeast, where it was permitted to discharge next to the BK UNT, where it also flowed into the surface water. These locations are downgradient of the surface water monitoring points, and precluded any recirculation to the pumping wells.

2.5 Precipitation and Effects on Surface Water and Bedrock Aquifer During Testing

The period prior to the pumping test was dry, except for two (2) thunderstorm events that occurred during the early morning and late evening of August 5th, with approximately 0.2 inch of precipitation from each event. Monitoring at each of the observation wells showed that there was some aquifer recharge due to the precipitation, but that the groundwater levels were steady to declining prior to the start of the test. Figures 2-1 through 2-10 are hydrographs for the pumping and observation wells and surface water, and show the aquifer response to the precipitation.

The surface water monitoring record was 12 hours or less prior to the test. The available record showed an increase of more than 0.1-foot in the wetland piezometer level, which began to recede several hours after the start of the test (Figure 2-8). The Bush Kill-UNT hydrograph (Figure 2-9) showed a steady recession throughout the testing period.

Figure 2-10 is a hydrograph for wells FFF and JJJ for the period of record prior to the test. Both wells were operated on August 5, but fully recovered and had flat (unchanging) water levels prior to the start of pumping on August 6.

2.6 Pumping Tests

Table 2-2 lists the start and stop times for the 72 hours of pumping at both wells, along with the net drawdown and specific capacities. Tables 2-5 and 2-6 (Attachment 4) summarize the rate and discharge water chemistry measurements that were performed during the pumping phase of the tests. During the 3-day pumping phase, a combined total of 1.608 million gallons (MG) of water was pumped from both wells.

Well FFF Step Drawdown Test

A step drawdown test is useful to assess the well yield and select an appropriate pumping rate for a constant rate test, and to estimate the turbulent flow and well efficiency which aids in distance drawdown analysis. A step drawdown test was completed at Well FFF, but was not feasible for well JJJ, because rates lower than approximately 100 gpm resulted in excessive line pressure (i.e., >300 psi), which was considered too high for the pump set-up. The well FFF test pumping rates (i.e., steps) and drawdown are summarized below in Table 2-4; Figures 2-11 and 2-12 are the semilog plot of the time-drawdown data and turbulent flow analysis.

Table 2-4 –Well FFF Step Drawdown Test

Step	Q	Initial Water Level	Final Water Level	Net Drawdown	Q/S_w	$S_{w/Q}$
	gpm	feet, BTOC	feet, BTOC	feet	gpm/ft drawdown	ft drawdown/ gpm
1	158.3	9.89	90.41	80.52	1.97	0.51
2	247.3	90.41	214.30	204.41	1.21	0.83
3	281.2	214.30	354.47	344.58	0.82	1.23

The Well FFF step-drawdown results indicated that (on a preliminary basis) the sustainable pumping rate, without interference from another pumping well, was at least 281 gpm, which would prevent the pumping water level (PWL) from declining below the principal WBZ at 697 feet below grade. The turbulent flow was analyzed from the time-drawdown and yield data using the method described by Bruin and Hudson (1955); the efficiency analysis estimates the portion of the total drawdown observed in the pumping well that is attributable to turbulent flow head loss. In this instance, the pumping rate of 245 gpm was evaluated, and indicated that most of the drawdown (i.e. 87%) is attributed to turbulent flow head losses, and only a minor percentage is due to aquifer drawdown. This is the typical condition for a fractured bedrock aquifer with deep water bearing zones. The result for this and other turbulent flow analyses described in this Addendum should be considered as approximate. This is because when the turbulent flow is high, the constants in the analyses shown on Figure 2-12 may become variables (as shown by the poor best fit line to some of the data from higher pumping rates).

2.7 Well JJJ Performance

Figure 2-13 is a time drawdown semilog plot for well JJJ, which shows rapid, early drawdown from the SWL of 32.51 feet btoc to a pumping water level (PWL) of approximately 600 feet below top of casing (BTOC) after 70 minutes. During this period the pumping rate declined from a maximum of 190 gpm to 145 gpm due to increased elevation head. The early rate could not be lowered further due to excessive discharge line pressures (greater than 300 psi). After about 70 minutes the drawdown transitioned to a much lower slope, when hydraulic communication between the borehole and the bedrock aquifer became sufficiently established. The plot uses manual water level measurements for the period from about 70 minutes to 120 minutes because the datalogger became exposed during the rapid early drawdown, and was lowered further. After about 600 minutes pumping, there was a moderate recovery that was attributed to some development; this was followed by steady rate drawdown, and then steady state pumping, with a PWL at approximately 681 feet btoc, and drawdown of approximately 648 feet. This PWL remains approximately 11 feet above the principal water bearing zone (WBZ) at 690 feet below grade (or approximately 692 feet btoc). The PWL reached stabilization after 1,340 minutes in accordance with NYDEC *Recommended Pump Test Procedures for Water Supply Applications* (August 31, 2005), which is “a water level that has not fluctuated by more than plus or minus 0.5 feet for each

100 feet of water in the well (i.e., static water level (SWL) to bottom of well) over at least a six hour period of constant pumping flow rate." Based on a total water column of 717 feet, the allowable fluctuation is 3.6 feet (0.5 foot per 100 feet of water column). Thus, the well was in a stabilized PWL condition for the last 49 hours of the pumping test. This is evident by the 24-hour and 72-hour specific capacities, which were nearly the same.

The average pumping rate for the test was 126.3 gpm (rounded to 126 gpm), based on a total of 545,739 gallons pumped over 4,320 minutes. This rate was maintained within +/- 5% from 280 minutes to the end of the pumping phase.

The well response is indicative of a leaky, semi-confined aquifer, when pumping induces flow from upper zones of the aquifer, and results in a steady state to nearly steady state condition. In this instance, the leakage is believed to occur from the nearly 700 saturated feet of the fractured bedrock aquifer within the pumping zone of influence.

At approximately 4,200 minutes pumping, water quality samples were collected from both Well JJJ and FFF for NYSDOH Subpart 5.1 parameters for public water supplies. The samples were placed into laboratory-supplied containers with appropriate preservative, and picked up by the laboratory shortly thereafter. In addition, a Microscopic Particulate Analysis MPA) sample was also collected. A copy of the Enviro Laboratories, Inc. analytical report is included in Attachment 5.

After continuous pumping for 4,320 minutes, the pump was shut off and the well permitted to recover. Figure 2-14 is a Theis recovery plot (Theis, 1935), with residual drawdown on the y-axis (arithmetic), and the ratio of the time since pumping started (referred to as t) to the time since pumping stopped (referred to as t') on the x-axis (logarithmic). The well recovered 50% (324 feet) from the maximum drawdown of 681 feet after 19 minutes, and 90% (64.8 feet residual drawdown) after 90 minutes. The response of very rapid filling of the borehole shows that much of the observed drawdown in the borehole was due to turbulent flow head loss, and not drawdown in the aquifer outside of the borehole. Projection of the recovery plot indicates full recovery above the origin.

Following industry-standard analyses, the straight line portion of the later recovery beginning at t/t' = 30, was used to calculate the aquifer transmissivity. This portion of the recovery was assumed to mostly reflect the aquifer response, and after rounding to three (3) significant figures yielded a transmissivity of 1,850 gallons per day/foot (gpd/ft), which converts to 247 feet^2/day (ft^2/d).

2.8 Well FFF Performance

The initial pumping rate was 300 gpm, which declined to 268 gpm after 85 minutes pumping. As with Well JJJ, the early pumping rate was higher than desired due to excessive line pressures. The average pumping rate over the 72-hour pumping phase was 245.8 gpm (rounded to 246 gpm), based on a total of 1,061,840 gallons, and was maintained within 5% for the duration of pumping after 213 minutes. Figure 2-15 is a time drawdown semilog plot for well FFF, and as compared to Well JJJ shows a less steep PWL decline during the early portion of the test, and a longer period required to reach stabilization (3,370 minutes). This was determined from the total water column of 689 feet, and allowable fluctuation of 3.4 feet. The stabilized PWL condition was achieved for the last approximately 16 hours of the test.

The plot contains manual measurements after only 55 minutes of pumping, because the electronic datalogger could not communicate with the computer after this time. After the test the logger was sent to the manufacturer (In Situ) in an effort to recover data, but the data after this period was corrupted and unusable. The maximum PWL was 508 feet btoc, which corresponds to drawdown of approximately 498 feet. The 24-hour (0.51 gpm/ft) and 72-hour (0.48 gpm/ft) specific capacities were nearly the same, and reflect the stabilized PWL condition. The stabilized PWL was almost 200 feet above the principal WBZ at 697 feet bg (699 feet btoc).

Figure 2-16 is the Well FFF recovery plot, with the available manual recovery data. Only the later recovery data after approximately 6 hours is available, which plots along a straight line, similar to the Well JJJ recovery. The calculated transmissivity was 3,090 gpd/ft (413 ft^2/d). The greater aquifer transmissivity as compared to Well JJJ is consistent with the greater productivity at Well FFF. As with Well JJJ, the recovery was very rapid, which is due to most of the drawdown caused by turbulent flow head loss; the actual aquifer drawdown was substantially less than the 498 feet that occurred within the borehole.

2.9 Field Chemistry Monitoring

Field monitoring for pH, temperature, and specific conductance was performed on the well discharge water during the constant rate testing using portable field meters. The meters were calibrated prior to use, and at least once per day during the test. Tables 2-5 and 2-6 (Attachment 4) list the data collected from each discharge. The data showed that the discharge water from both wells had similar chemistry, with the minor differences probably due to the use of different field chemistry meters. The temperatures showed the most fluctuation during the test, which is attributed to the daily ambient air temperature change that affected the sampling port. The pH was slightly above neutral, with median values of 7.7 for Well FFF and 7.9 for Well FFF. The median specific conductance was 190 microSiemens/cm (uS/cm) at Well FFF, and 158 at Well JJJ.

2.10 Effects at Surface Water

Figures 2-8 and 2-9 are hydrographs for the Wetland Piezometer and Bush Kill UNT stilling well, respectively. The levels plotted are the depth of water above the datalogger, and are directly related to the height of saturation at the wetland, and the stream stage at the stilling well. The precipitation prior to the test caused a substantial increase to the wetland level, which then receded throughout the test. However, after pumping stopped the recession trend continued the same pattern, with no indication that the groundwater pumping had any effect. The Bush Kill UNT showed a recession trend throughout the pumping phase, which also continued after pumping stopped, with no indication of any effects related to the groundwater withdrawals. These observations indicate that the groundwater pumping from Wells FFF and JJJ had no apparent effect on the nearby wetlands and surface water flows at the monitoring points.

The surface water at the stilling well was also monitored for temperature, pH, and specific conductance prior to, during, and after the test, and these values are listed on Table 2-7. The purpose of the monitoring was to determine whether the groundwater had similar chemistry, and if any significant changes to the surface water chemistry occurred. The surface water monitoring showed that it is dissimilar to the Well FFF and JJJ groundwater, especially the specific conductance. The specific conductance is one order of magnitude lower than the groundwater, which indicates substantially lower dissolved ion content. Since the dissolved ion content typically increases with depth of subsurface water circulation, the surface water baseflow is apparently sourced from a shallower horizon with a much shorter circulation period than the groundwater. The temperature was much higher than the groundwater, but it is not an especially useful parameter, since the surface water is more affected by ambient air temperature. The pH was moderately lower than the groundwater.

Overall, the surface water chemistry is dissimilar to the groundwater chemistry. There was no indication during the pumping test that there was any change to either the surface or groundwater chemistry to indicate any water exchange between the surface water or groundwater.

2.11 Effects at Observation Wells

Table 2-3 lists the maximum aquifer drawdown that was observed at the observation wells. The aquifer drawdown response occurred very near to the start of pumping, which is characteristic of a confined aquifer response. The greatest drawdown was 93 feet, observed at Well EE, which intersects a set of deep fractures at 835 feet and 965 feet bg. The large response was interpreted as indicating that the pumping wells and Well EE intersect a common fracture set with very effective hydraulic communication. When compared to the responses of the other wells, the drawdown at Well EE is atypical and reflects the anisotropy within the fractured bedrock aquifer.

The nearest off-site wells are the domestic wells located along Cold Spring Road, approximately 1,800 feet at the closest distance to wells FFF and JJJ (see Figure 1-2). The effects to these wells from supply well pumping at the Lost Lake Resort site are evaluated in Section 4 of this report.

2.12 Aquifer Parameters

The aquifer analysis program *AQTESOLV®* v.4.02 (HydroSOLV, Inc., by Glenn Duffield, 1996-2006) was used to analyze the data from the observation wells. The Hantush and Jacob solution (Hantush and Jacob, 1955) for a leaky confined aquifer was applied to the data, and a manual curve match performed using the software. The solution type curve uses a leaky artesian well function, and the data is matched to the plotted type curve. Attachment 6 includes the *AQTESOLV* output graphs that show the observed data and type curve, and the solutions for aquifer transmissivity (T) and storativity (S) for the observation wells where there was drawdown. Table 2-8 summarizes these results.

Table 2-8 –Summary of Aquifer Parameters

	Transmissivity (gpd/ft)	Storativity
Pumping Wells:		
FFF	3,090	n/a
JJJ	1,230	n/a
Observation Wells:		
EE	956	0.000027
HH	3,075	0.000038
OO	4,501	0.000035
P	6,029	0.000059
M	4,265	0.00012
BB	26,820	0.00066
F	24,150	0.00017
Geometric Mean:		
all	4,600	0.000084
excluding BB and F	2,800	0.000048

The calculated transmissivity values are in reasonable agreement, except for wells BB and F, where the values were one (1) order of magnitude greater. The variation at wells BB and F is partly due to a poor curve match to the drawdown data, and also due to the large distance from the pumping wells. These wells also did not exhibit a delayed leakage response, unlike all of the other observation wells. As shown on the Aqtesolv® plots, the leakage response was evident as early as 100 minutes (Well EE), and as late as 800 minutes (Well M).

The storativity values were mostly consistent. All of the values are in the range for a confined aquifer.

It should be noted that any solution for a fractured bedrock aquifer, especially one with observed anisotropy, is subject to uncertainty due to variance from the method assumptions. Thus, the calculated parameters for the bedrock aquifer are considered to be approximate, but representative of the conditions at the site.

2.13 Dependable Yield and Recommended Operation

Well FFF

The maximum safe pumping rate (i.e., dependable pumping rate or sustainable yield) of Well FFF was estimated from the projection of the constant rate test drawdown to 180 days (259,200 minutes) to simulate prolonged pumping without recharge (Figure 2-15). A sustainable rate should maintain the PWL above the principal WBZ which helps to ensure the long-term well production. Figure 2-15 shows that the long-term projection of the PWL straight line segment would decline to about 530 feet btoc, and approximately 170 feet above the bottom of the well and principal WBZ. Thus, the test average rate of 246 gpm is considered to be a sustainable pumping rate, and is conservative since it includes the well JJJ interference effects.

The maximum safe pumping rate is greater, given that an additional 170 feet of water column is available. The theoretical maximum pumping rate was estimated from the step drawdown test results. The highest well FFF pumping rate was 281 gpm, and projection of this drawdown to stabilization yields a PWL of about 450 feet btoc (440 feet drawdown), and a specific capacity of 0.64 gpm/ft, and 250 feet of remaining available drawdown. The theoretical maximum pumping rate was estimated by multiplying the specific capacity (0.64 gpm/ft) by the remaining available drawdown (250 feet), and reducing the product by 50% to account for increased turbulent flow head loss and uncertainty. This yields a theoretical maximum pumping rate of +/- 360 gpm (281 gpm + 81 gpm), assuming no significant interference effects.

Based on the stabilized PWL, rapid recovery, and ample available drawdown at the test pumping rate, it was demonstrated that Well FFF can be continuously operated at 246 gpm while JJJ is pumping at 126 gpm without any adverse effects. Thus, Well FFF can be relied on to produce 0.354 MGD (1,440 minutes x 246 gpm) for an extended period of time, if necessary, to meet peak demand. For normal operation, it is recommended that daily operation be limited to a 12-hour pumping cycle which will enable a 12-hour daily recovery period, which would produce about 0.177 MGD. The pump intake setting should be no lower than approximately 685 feet, which will maintain the PWL above the principal WBZ. In order to account for a potentially higher pumping rate, the pump should be sized such that the discharge rate against an elevation head pressure of 685 feet would not exceed 360 gpm, inclusive of any other system operating pressures. The sizing of the submersible pump to the theoretical maximum safe pumping rate will allow for future testing that will be necessary in support of any rate increase above 246 gpm.

Well JJJ

Figure 2-13 shows the 180-day PWL projection of Well JJJ to be approximately 681 feet btoc, which is 9 feet above the principal WBZ at 690 feet, and 69 feet above the bottom of the well. Based on this projection, the test average rate of 126 gpm is also considered to be the maximum safe pumping rate.

Given the steady state PWL condition at a pumping rate of 126 gpm, Well JJJ should be able to produce approximately 0.179 MGD (1,440 minutes x 126 gpm) for a week or more in order to meet peak demand. However, normal operation is recommended at 12 hours per day, which would produce 0.089 MGD. The pump intake setting should be no lower than approximately 680 feet, which will maintain the PWL above the principal WBZ. Furthermore, the pump should be sized such that the discharge rate against an elevation head pressure of 680 feet would not exceed 126 gpm, inclusive of any other system operating pressures. A higher individual rate of at least 150 gpm is feasible, and would require some further testing.

2.14 Water Quality

In accordance with NYDOH requirements for a public water supply, groundwater samples collected after approximately 70 hours of pumping were analyzed for the Subpart 5.1 parameters; the laboratory reports are contained in Attachment 5. These parameters include an extensive list of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, radionuclides, bacteria, and inorganic water chemistry analyses. A Microscopic Particulate Analysis (MPA) was also performed in order to evaluate for surface water influence. Many of the analytical parameters have a Maximum Contaminant Level (MCL), which is the maximum permissible level of that contaminant in water which is delivered to a public water system.

The water quality of both wells was very similar with a few minor differences. The analyses showed that the water from both wells is of good quality and meets all of the applicable standards. The following summarizes the results for both wells:

- There were no detected VOCs, SVOCs, pesticides, herbicides, or PCBs.
- Trace to low concentrations of several metals were detected as follows: arsenic at 2.6 micrograms per liter (ug/L) in Well JJJ, but not detected (ND) in Well FFF; barium at 12 and 40 micrograms per liter (ug/L); chromium at 1.6 and 1.9 ug/L; copper at 1.6 ug/L but ND in Well JJJ; nickel at 0.8 and 0.74 ug/L; antimony at 1.2 ug/L in Well JJJ but ND at Well FFF; and, zinc at 110 and 28 ug/L. All of the detected concentrations are below any applicable MCL.

- The secondary parameters of iron and manganese were not detected. These metals are commonly present in sedimentary bedrock aquifers.
- The dissolved ion content of the water was low, as reflected by the low sulfate (7.9 milligrams per liter (mg/L) and 8.9 mg/L). Trace nitrate was detected at 0.04 mg/L in both wells, but nitrite was not detected. Trace chloride (1.6 mg/L) was reported for Well FFF, but was ND at Well JJJ.
- The Apparent Color was low (2.5 color units at each well). The turbidity as reported in Nephalometric Turbidity Units (NTUs) was also low (0.14 at FFF and 0.26 at JJJ 0.26).
- Regarding radionuclides, no Gross Alpha, Gross Beta, Radium 226 and 228, and uranium were detected. Radon was present in Well FFF at 1,020 and Well JJJ at 890 PicoCuries/L (uncertainty +/-30). Radon does not have a MCL.
- The microbiological analysis did not detect any Total Coliform, *E. coli,* or Fecal Coliform bacteria in either sample.
- The MPA samples did not contain any bio-indicators (particulate, protozoans and organisms, algae), and the groundwater is characterized as "Low Risk For Surface Water Influence". These results along with no bacteria, the well construction with deep casing, and confined nature of the aquifer, indicate that the groundwater is not at risk for surface water influence.

In summary, the water quality analyses indicate that the groundwater from both Well FFF and JJJ meets all NYSDOH public water system drinking water standards, and should only require standard chlorine disinfection for treatment.

3.0 ADDITIONAL WELL CONSTRUCTION AND TESTING

Immediately following the well FFF and JJJ testing, additional well construction and testing was performed. Seven (7) test wells designated as TW-1 through TW-7 were constructed as open borehole bedrock wells, and new supply wells were constructed at three (3) of these locations. These locations are shown on Figure 1-1. A brief summary of each well that was not tested for supply is below:

- TW-1 – total depth 1,122 ft, blown yield 39 gpm, WBZs at 52, 350, 711, 1048, and 1,110 feet
- TW-2 - total depth 740 ft, blown yield 43 gpm, WBZs at 138, 380, 520, and 725 feet
- TW-4 - total depth 1,100 ft, blown yield 60 gpm, WBZs at 217 and 350 feet
- TW-7 - total depth 500 ft, blown yield 20 gpm, WBZs at 60 and 140 feet

3.1 Wells OO AND TW-3A Construction

Boyd Artesian Well Co., Inc. performed the drilling and construction of Well OO. This was an 8-inch diameter open borehole well installed near well O, with the goal of enabling a larger submersible pump to be installed, and a greater pumping rate than the 50 gpm yield that was previously proven for the 6-inch well O.

Talon Well Drilling constructed well TW-3a, which was a shallower well constructed within the upper portion of the bedrock aquifer, where a highly fractured and transmissive zone was encountered. Well TW-3a was offset about 15 feet from well TW-3, which was a reconstructed test well that could not be used after grouting, because the grouting process apparently sealed off the WBZs that were encountered at depth in the 6-inch test well. Copies of the well logs reports are provided in Attachment 3, and indicate that both wells intersected alternating beds of gray and red sandstone. The construction details are summarized below:

Table 3-1 – Summary of Well TW-3a and OO Construction

Well	Total Depth Feet, bg	Casing	TOC Elevation ft, amsl	Depth to Bedrock Feet, bg	SWL ft, BTOC (10/4/10)	Water Bearing Zones	Blown Yield
OO	955 ft	51 feet 8-in. diameter, grouted from 51 to 15 ft	1,377.86	14 ft	21.03 ft	165 ft – 50 gpm 740 ft – 30 gpm	85 to 100 gpm
TW-3a	200 ft	16 feet 10-in. diameter, 36.5 ft 6-in diameter, slotted from 36.5 to 21.5 ft	1,384.34	9 ft	3.82 ft	29 - 34 ft – 150+ gpm 78 ft – 5 gpm 91 ft, 97 ft, 110 ft, 133 ft, 154 ft, 175 ft – combined 20 gpm	150+ gpm

The principal water bearing zones (WBZs) at Well OO were intersected in both the shallow and deep zones of the bedrock aquifer. Well TW-3a relies solely on the shallow bedrock aquifer.

3.2 WELL OO AND TW-3a AQUIFER TESTING

Step drawdown testing followed by simultaneous 72-hour pumping tests were planned for the wells. A Grundfos Model 230S400-13 40-hp, 6-inch submersible pump was installed in well OO on 3-inch diameter pipe with the intake at 726 feet, and was rated to produce approximately 100 gpm with the PWL at with the intake. A Grundfos model 150S150-8 15 hp, 6-inch submersible pump was installed in well TW-3a on 2-inch diameter pipe with the intake set at approximately 155 feet btoc, and was rated to produce 200 gpm at a total dynamic head of 180 feet. Both set ups included a totalizer meter, flow control valving, and sampling port. Electronic data loggers with manual back-up measurements were used to record the water level in the pumping wells.

A step drawdown test was conducted at well OO on September 27 starting at 12:50 PM. The test resulted in the PWL being lowered to the pump intake at 726 feet btoc within less than 2 hours of pumping, when the last rate of the test was less than 80 gpm. A second step test was conducted the following day, with a similar result. Concurrent monitoring at nearby well O during this period showed that the well O water level declined to approximately 160 feet btoc, and then stabilized, even though the PWL at well OO was below 700 feet btoc. This response showed that the wells did not share all of the same WBZs, and indicated that most of the water at well OO sourced from shallower zones of the bedrock aquifer. The construction log for well OO noted a 50 gpm WBZ at 165 feet bg, along with a 35 gpm WBZ at 740 feet bg. Based on this response, it was apparent that a 72-hour test at the target rate of 80 to 100 gpm was not feasible, and no further testing of well OO was performed.

The testing schedule and summary of results for both wells is provided in Table 3-2.

Table 3-2 – Summary of Well OO and TW-3a Pumping Tests

Test Name	Step Test	Constant Rate Test	Initial SWL and Final PWL (feet, BTOC)	Net Drawdown (feet)	Total Gallons Pumped	Average Rate for 72 Hours (gpm)	24-Hr and End of Test Specific Capacity gpm/foot drawdown
Well OO	9/27/10	Not performed	na	na	na	na	na
Well TW-3a	9/28 13:20 to 17:00	10/5, 15:00 to 10/8, 15:00	3.76 – 21.84	18.08	494,975	114.6	8.7 and 6.3

3.3 Monitoring

Electronic dataloggers were used to record water levels in the pumping well on a 1-minute frequency. Wells O and TW-2, and two (2) surface water locations were also monitored with dataloggers programmed at a 10-minute frequency.

The surface water monitoring consisted of a wetland piezometer installed west of well OO and designated PZ-2, and a nearby stilling well in the UNT-BK. The wetland piezometer boring intersected from grade to 0.4 feet a mossy mat of organic debris (roots, grass, moss), followed by black, wet, sandy silt and silty sand with organic debris and an organic odor from 0.4 foot to 2.0 feet. Hand auger refusal occurred at 2.0 feet bg on a gray sandstone boulder. The PZ-2 and Stilling Well were constructed and activated on September 24, 2010.

Table 3-3 – Monitoring Summary for Well TW-3a

Observation Point	Distance Relative to TW-3a (feet)	Net Drawdown Interference (2) (feet)
Well O	405-	None discernable
Well TW-2	630	None discernable
Wetland Piezometer	approx. 530	None discernable
BK-UNT	approx. 520	None discernable

Chemistry monitoring for pH, temperature (°Celsius), and specific conductance (microsiemens/cm [uS/cm]) was conducted on the well TW-3a discharge, and daily measurements of the surface water was also performed.

3.4 Discharge

The discharge water was conveyed approximately 700 feet southeast and across the wetlands and permitted to discharge into the BK-UNT. The discharge was at a point downstream of the wetland piezometer and stilling well in order to avoid any possible impact to the surface water monitoring.

3.5 Precipitation and Effects on Surface Water and Bedrock Aquifer During Testing

Precipitation events the week of September 26th required the TW-3a constant rate test to be postponed. A second rain event during the week of October 4th caused a 1-day delay. The rain events were as follows:

9/30:	1.1 inches rainfall
10/1 to 10/2:	1.8 inches rainfall
10/4:	late PM and evening showers, 0.035-inch rainfall

Figure 3-1 is a hydrograph for well TW-3a for the 1-week period preceding the constant rate test. The graph shows the drawdown from the step drawdown test on September 28, a 3-hour period of preliminary pumping on September 30, and the first start of the constant rate test on October 4, which was stopped after less than 1 hour due to the onset of rain. The hydrograph reflects a period of aquifer recharge from September 30 through October 1, but no effect from the rainfall on October 4. Figures 3-2 and 3-3 are the hydrographs for wells O and TW-2, which also show the aquifer recharge period, and that the recharge was essentially stopped by October 4. After this time, these observation wells were affected by the continued well drilling at the site at wells TW-5 and TW-6.

The stage of the surface water at PZ-2 and the Stilling Well are shown on Figure 3-4. This hydrograph shows a steadily declining trend at PZ-2, with a slight upward inflection caused by the October 4 rain event, but an overall declining trend prior to and during the constant rate test. The Stilling Well record is less clear, due to a very pronounced but irregular diurnal cycling of the water level, with the low reached during the early afternoon hours. This cycling is possibly the result of evapotranspiration and vegetative pumping of shallow subsurface water, and/or lunar effects.

3.6 TW-3a Pumping Test

Table 3-2 lists the start and stop times for the 72 hours of pumping at TW-3a, along with the net drawdown and specific capacities. Table 3-4 (Attachment 4) summarizes the rate and discharge water chemistry measurements that were performed during the pumping phase of the tests.

Step Drawdown Test

A step drawdown test was conducted on September 28, and is summarized below:

Table 3-5 –Well TW-3a Step Drawdown Test

Step	Q	Initial Water Level	Final Water Level	Net Drawdown	Q/S_w	$S_{w/Q}$
	gpm	feet, BTOC	feet, BTOC	feet	gpm/ft drawdown	ft drawdown/ gpm
1	58.0	3.18	7.05	3.87	15.0	0.07
2	126.5	7.05	13.50	10.32	12.3	0.08
3	168.3	13.50	18.24	15.06	11.2	0.09
3	198.5	18.24	21.86	18.68	10.6	0.09

Figures 3-5 and 3-6 are the semilog plot of the time-drawdown data and turbulent flow analysis. The trend of the drawdown was difficult to plot, except for the last rate, due to fluctuation of the water level. This fluctuation was attributed to the turbulence that occurred as groundwater entered the slotted casing. The step-drawdown results showed that the step 3 and 4 rates of 168 gpm and 198 gpm, respectively, were probably not sustainable. The turbulent flow analyses showed that most of the drawdown observed in the borehole (i.e., 71%) was attributable to aquifer drawdown.

Some additional short-term pumping (186 minutes) at a rate of 136 gpm was conducted on September 30 to evaluate a rate of 120 to 130 gpm for a constant rate test. Based on that pumping, a rate of 110 to 120 gpm was selected for the constant rate test.

3.7. Well TW-3a Performance

Figure 3-7 is a time drawdown semilog plot for well TW-3a, which shows gradual, steady-rate drawdown from the SWL of 3.76 feet btoc to a pumping water level (PWL) of approximately 19 feet btoc during the first 2,000 minutes of pumping. There was a slope increase at 2,000 minutes, from Δs = 3 feet to Δs = 10 feet, followed by a second period of steady rate drawdown through the end of pumping. The slope inflection was attributed to a boundary condition where the expanding ZOC encountered a region of the bedrock aquifer with lower transmissivity (based on the hydrogeologic mapping, this occurrs towards the north and northeast). The PWL reached stabilization after approximately 4,000 minutes, i.e., there was less than +/- 1.0-foot of variation (0.5 foot x 200 feet water column). The average pumping rate for the test was 114.6 gpm (rounded to 115 gpm), based on a total of 494,975 gallons pumped over 4,320 minutes; Table 3-4 lists the rate measurements. This rate was maintained within +/- 5% for the duration of the test. The transmissivity calculated from the later period of pumping was 3,030 gpd/ft.

After continuous pumping for 4,320 minutes, the pump was shut off and the well permitted to recover. Figure 3-8 is a Theis recovery plot (Theis, 1935), which shows that 90% (1.8 feet residual drawdown remaining) was achieved after 538 minutes. The straight line portion of the later recovery beginning at t/t' = 80, was used to calculate the aquifer transmissivity, and yielded a transmissivity of 3,220 gpd/ft, which converts to 430 ft^2/d, and in good agreement with the value determined from the pumping phase of the test.

3.8 Field Chemistry Monitoring

The field monitoring for pH, temperature, and specific conductance is summarized in Table 3-4. The data showed little variation during the course of the test, with median values of 10.9° C for temperature, 6.1 for pH, and specific conductance of 81 uS/cm. The mostly uniform chemistry indicates that the source of the groundwater remained unchanged during the test. The specific conductance is lower than groundwater from other supply wells, which at FFF and JJJ was 158 uS/cm and 190 uS/cm, respectively, and is attributed to the difference between the shallow and deep portions of the bedrock aquifer. The groundwater residence is shorter in the shallow portion, and thus there is less time for dissolution of minerals from the bedrock aquifer.

3.9 Effects at Surface Water

Figure 3-4 is the hydrograph for the Wetland Piezometer and Bush Kill UNT stilling well. There is no inflection to either level that would indicate any impact from groundwater pumping from TW-3a. The field chemistry monitoring of the BK-UNT surface water at the stilling well is listed on Table 3-6. This data shows dissimilar pH and specific conductance as compared to the TW-3a groundwater, and provides some further confirmation that there was no impact to the flows of the BK-UNT or wetland hydrology as a result of the groundwater withdrawals.

3.10 Effects at Observation Wells

No interference drawdown was observed at wells O and TW-2, which are the nearest wells. The concurrent groundwater pumping from the deep aquifer during the drilling of wells TW-5 and 6 introduces uncertainty with determining whether well TW-3a pumping caused any effects to other wells. However, the following observations were relied on to support the conclusion of no effects to these wells, which were assumed to reflect the deep aquifer response:

- Well O and TW-2 showed nearly immediate responses to well OO step test pumping, but no effect from the TW-3a step drawdown start or stop.
- Well O and TW-2 hydrographs showed no discernable response to the 3-hours of preliminary pumping at TW-3a on September 30th.
- Well O and TW-2 hydrographs showed no discernable response to the end of pumping on October 8.
- As described later in this report, groundwater pumping from the deep aquifer has little to no effect on the shallow bedrock aquifer.

Overall, the well TW-3a pumping had no discernable effect to the deep bedrock aquifer.

3.11 Aquifer Parameters

No drawdown was observed at observation wells, so no further analysis beyond the pumping well drawdown and recovery data is available.

3.12 Dependable Yield and Recommended Operation

The safe pumping rate (i.e., dependable pumping rate) of well TW-3a is recommended at the constant rate test pumping rate of 115 gpm. This rate is supported by the stabilized PWL that occurred, and the rapid recovery to 90% within 9 hours. However, continuous pumping for more than approximately 20,000 minutes (~14 days) is probably not sustainable, based on the projection of the drawdown plot which shows that the PWL would encounter the principal WBZ at 29 feet. Also, because the portion of the aquifer that provides water to well TW-3a is shallow, the ZOC is not likely to expand to the extent that occurs when the deep aquifer is pumped, which introduces a limiting condition to the available groundwater recharge to TW-3a. Given the other available wells at the site, Advantage recommends that TW-3a be relied on for meeting peak demand, which is likely to be a maximum of one (1) day or less. The TW-3a testing has demonstrated that it can safely provide 0.165 MGD for at least 3 continuous days.

For normal operation, it is recommended that daily operation be limited to a 12-hour pumping cycle, which would produce about 0.055 MGD, and provide for an ample daily recovery period. The pump intake setting should be shallow to maintain the PWL above the principal WBZ at 29 feet bg. The pump should be sized such that the discharge rate against an elevation head pressure of approximately 25 feet would not exceed 110 gpm, inclusive of any other system operating pressures.

3.13 Water Quality

A water quality sample was not collected from well TW-3a. If the well is needed in the future, a sample should be collected and analyzed for the NYDOH requirements for a public water supply in order to determine what, if any treatment is necessary to meet drinking water standards.

3.14 Zone of Contribution and Recharge Area

There was no discernable effect at any of the observation wells; therefore, no numerical estimate was performed. Given the shallow source zone for the groundwater, it is likely that the immediate upland area towards the east serves as the principal recharge zone.

4.0 WELLS TW-5, TW-6, AND O

4.1 Well Construction

Table 4-1 (next page) summarizes the well construction of the three (3) wells. Talon Well Drilling constructed well TW-5 as a 10-inch diameter open borehole bedrock well; the well was initially drilled as a 6-inch diameter test well by Negleys Well Drilling of Newville, PA. The test well intersected a large fracture zone at 796 feet with a blown yield of approximately 125 gpm. Reconstruction involved removal of the temporary 6-inch casing, and installation of a K-packer to a depth of 65 feet to seal the lower portions of the borehole followed by placement of bentonite and drill cuttings. The tophole consisted of 14-inch casing to 7.5 feet bg, a 14-inch borehole to 45 feet, placement of 10-inch casing with driveshoe to 45 feet bg, and pressure grouting the 10-inch casing annular space from the bottom of the casing to grade with cement grout pumped through a tremie pipe. The borehole was then reamed to 10-inch diameter to a total depth of 840 feet btoc. The final blown yield was conservatively estimated at +/-420 gpm.

Negleys drilled a 6-inch test well at TW-6 to a total depth of 850 feet bg, with 26 feet of 10-inch diameter casing with driveshoe required to maintain the borehole through the overburden and upper zone of fractured and unstable bedrock. The test well intersected a single WBZ at 747 feet bg with a blown yield of 30 gpm. The well was reconstructed as an 8-inch diameter open borehole bedrock well by installing a K-packer to 65 feet, sealing the zone above, and drilling a 10-inch diameter borehole to 50 feet bg; 8-inch diameter casing was installed to 50 feet bg and the annular space pressure grouted from the bottom of the casing with a tremie pipe. The borehole was reamed to 8-inches diameter to a final depth of 850 feet bg, with a final blown yield of 55 gpm. Copies of the well logs are provided in Attachment 3, and show that both wells intersected alternating beds of gray and red sandstone. The construction details are summarized below, and include well O which was installed by Boyd Artesian Well Co., Inc.:

Table 4-1 – Summary of Well TW-5, TW-6, and O Construction

Well	Total Depth Feet, bg	Casing	TOC Elevation ft, amsl	Depth to Bedrock Feet, bg	SWL ft, BTOC (10/19/10)	Water Bearing Zones	Blown Yield
TW-6	850 ft	52 feet 8-in. diameter, grouted from 50 feet bg to grade	1,365.41	6 ft	8.04 ft	747 ft –30 gpm	55 gpm
TW-5	840 ft	7.5 feet 14-in. diameter, 47 ft 10-in diameter	1,354.87	21 ft	4.22ft	132 ft – 10 gpm 475 ft – 2 gpm 792 and 798 ft, est. +/- 400 gpm	>420 gpm
O	1,055	6-inch	1,376.72	12 ft	18.22	140 ft – 3 gpm 750 ft – 12 gpm 880 ft – 15 gpm	30 gpm

SWL – static water level
BTOC – below top of casing

The principal water bearing zones (WBZs) intersected by all three (3) wells were in the deep bedrock aquifer.

4.2 WELL TW-5, TW-6, and O AQUIFER TESTING

A Franklin Model 375ST 60-hp, 6-inch submersible pump was installed in well TW-5 on 4-inch diameter pipe with the intake at 606 feet, and was rated to produce approximately 300 gpm with the PWL at 560 feet btoc. A Grundfos model 150S300-8 30 hp, 6-inch submersible pump was installed in well TW-6 on 2-inch diameter pipe with the intake set at approximately 502 feet btoc, and was rated to produce 170 gpm with the PWL at with the intake. Both set ups included a totalizer meter, flow control valving, and sampling port. Electronic data loggers with manual back-up measurements were used to record the water level in the pumping wells.

The testing of these wells was intended to be 72-hour simultaneous tests that began on October 20, with the start of the tests offset by several hours to enable a more clear determination of individual pumping effects. However, the TW-6 generator failed after only 72 minutes pumping due to a failed circuit board. A replacement generator was obtained, and the test was re-started on October 21; this is referred to as the 1st TW-6 test. The data from the 1st TW-6 test was somewhat erratic, with periods of recovery and fluctuating PWL. Although this data was probably sufficient to support that test pumping rate of 62 gpm, a 2nd TW-6 test was conducted the week of October 24. The 2nd test was 48 hours, and conducted at a higher rate based on the 1st test result, and was also sufficient to evaluate effects to surface water and the aquifer.

At TW-5, the generator failed after 50 hours of pumping due to a blown head gasket. Although a 72-hour test was intended, the 50 hours of available data was sufficient to evaluate the well performance and pumping effects to surface water and the aquifer.

Well O was re-tested to evaluate whether a higher sustainable yield was feasible. A 5-inch diameter pump with 3-inch diameter discharge pipe was installed with the intake set at 422 feet btoc. Initially, well O was to be tested the week after the TW-5 and TW-6 testing, but was tested simultaneously with the 2nd TW-6 test.

The testing schedule and summary of results for both wells is provided in Table 4-2.

Table 4-2 – Summary of Well TW-5, TW-6 and O Pumping Tests

Test Name	Step Test	Constant Rate Test	Initial SWL and Final PWL (feet, BTOC)	Net Drawdown (feet)	Total Gallons Pumped	Average Rate for Test (gpm)	24-Hr and End of Test Specific Capacity gpm/foot drawdown
Well TW-5	10/19, 16:20 to 19:56	10/20, 10:30 to 10/22, 12:34	4.82 to 438.34	433.52	1,097,490	365.3	0.85 and 0.83
Well TW-6	10/18, 15:00 to 19:35	**1st**: 10/21, 12:30 to 10/23, 12:30	8.99 to 167.43	158.44	179,130	62.2	0.53 and 0.39
		2nd : 10/26, 13:00 to 10/28, 13:00	8.70 to 421.94	413.24	261,733	90.9	0.22 and 0.22
Well O	none	10/26, 14:40 to 10/28, 14:40	20.86 to 321.42	300.56	244,418	84.9	0.29 and 0.28

4.3 Monitoring

Electronic dataloggers were used to record water levels in the pumping wells on a 1-minute frequency. Selected observation wells were also monitored with dataloggers programmed at a 10-minute frequency. Other existing site wells were manually monitored, and Table 4-3 summarizes all of the points.

The surface water monitoring consisted of one (1) wetland piezometer installed south of TW-5 and one (1) north of TW-6, and a stilling well in the Bush Kill to the southeast of TW-5. The wetland piezometer borings each intersected mossy organic debris (roots, grass, moss) to approximately 1 foot bg, followed by wet, sandy silt and silty sand with organic debris to hand auger refusal on boulders, which occurred at 1.9 to 2.3 feet bg. Electronic dataloggers were used at each of the surface water points. No additional surface water monitoring was performed for the Well O test, as the previous testing showed that there was no surface water interference.

In addition, two (2) of the nearest off-site domestic wells were monitored after further attempts to contact the owners. The Feller (1506 Cold Spring Road) and Stawarz (1516 Cold Spring Road) wells were fitted with electronic dataloggers that recorded on a 10-minute frequency. Neither owner had a well log, but based on the depths that the loggers were placed, the Feller well is at least 120 feet deep with an 80-foot water column, and the Stawarz well at least 185 feet deep with a 166 foot water column.

Table 4-5 – Monitoring Locations for Wells TW-5 and TW-6

Observation Point	Method	Distance Relative to TW-5 (feet)	Distance Relative to TW-6 (feet)
TW-7	Manual	540 feet NE	1,100 S
TW-4	10-minute	900 NE	860 SE
TW-1	Manual	2,200 N	620 N
TW-2	10-minute	3,500 NNW	2,100 NNW
Well O	10-minute	3,900 NNW	2,400 NNW
Well HH	10-minute	2,700 NNW	1,200 NNW
Well FFF	10-minute	1,600 NNE	370 NE
Well EE	Manual	2,200 N	2,300 N
Well P	Manual	3,700 N	2,300 N
Well BB	10-minute	4,400 N	3,100 NE
Feller	10-minute	1,200 E	1,900 SE
Stawarz	10-minute	900 E	1,700 SE
TW-5 Wetland PZ	10-minute	170 SE	na
Bush Kill Stilling Well	10-minute	190 SE	na
TW-6 Wetland PZ	10-minute	na	130 E

Chemistry monitoring for pH, temperature (°Celsius), and specific conductance (microsiemens/cm [uS/cm]) was conducted on the pumping well discharge water, and representative measurements of the surface water and domestic well water was also performed.

4.4 Discharge

The TW-6 discharge water was conveyed into the BK-UNT, downstream of the wetland PZ. The flow of the BK-UNT was estimated at 3,000 to 5,000 gpm, and the Bush Kill near TW-5 at >10,000 gpm during the testing period. The additional 60 to 90 gpm from TW-6 was considered to be an insignificant increase and not discernable at the Bush Kill stilling well near TW-5.

The TW-5 discharge was conveyed approximately 350 feet southeast and into the Bush Kill. The discharge was approximately 150 feet downstream of the wetland piezometer and stilling well in order to avoid any possible impact to the surface water monitoring.

The well O discharge was conveyed 300 feet northeast and permitted to discharge onto the ground surface for eventual discharge to the wetland area.

4.5 Precipitation and Effects on Surface Water and Bedrock Aquifer During Testing

There were no precipitation events from October 17 through 25. Light showers occurred on October 26, and a significant rainfall of 0.75-inch occurred during the early hours of October 27. Figures 4-1a through 4-6 are hydrographs for the observations wells with dataloggers for the testing period, and do not show any significant effects from the rainfall.

Figures 4-6 to 4-8 are the hydrographs for the surface water monitoring points. Both wetland piezometers show a sharp water level increase in response to the October 27 rain event; the stilling well at TW-5 was de-activated prior to that rainfall. All three (3) of the hydrographs show diurnal cycling to some extent.

4.6 TW-5 Pumping Test

Table 4-2 lists the start and stop times for the pumping, along with the net drawdown and specific capacities. Table 4-4 (Attachment 4) summarizes the rate and discharge water chemistry measurements that were performed during the pumping phase. Because the generator failed (blown head gasket) during the TW-5 test, the pumping phase was 3,004 minutes (50 hours) instead of the planned 72-hour test.

4.6a Step Drawdown Test

A step drawdown test was conducted on October 19, and is summarized below:

Table 4-5 –Well TW-5 Step Drawdown Test

Step	Q	Initial Water Level	Final Water Level	Net Drawdown	Q/S_w	$S_{w/Q}$
	gpm	feet, BTOC	feet, BTOC	feet	gpm/ft drawdown	ft drawdown/ gpm
1	173.4	4.95	62.95	58.00	3.0	0.33
2	252.1	62.95	122.66	117.71	2.1	0.47
3	341.2	122.66	234.31	229.36	1.5	0.67
4	393.6	234.31	359.52	354.57	1.1	0.90

Figures 4-10 and 4-11 are the semilog plot of the time-drawdown data and turbulent flow analysis. The last rate of 393.4 gpm was the maximum output of the pump, and a projection trend showed that the PWL should stabilize at approximately 520 feet btoc (515 feet drawdown), with a specific capacity of 0.76 gpm/ft. This data was used to estimate a maximum sustainable pumping rate, absent any interference drawdown from another well. Multiplying the remaining available drawdown of approximately 270 feet above the principal WBZ by the specific capacity (0.76 gpm/ft), and decreasing by 50% to account for additional turbulent flow head loss and uncertainty, yields a rate of 103 gpm. Adding this rate to the 393 gpm rate of step 4 yields an estimated maximum rate of 496 gpm; thus, a higher sustainable pumping rate in the 500 gpm range is considered feasible for TW-5.

The turbulent flow analyses showed that 91% of the drawdown observed in the borehole was attributable to turbulent flow head losses. This is a high value, but characteristic for a deep well with a deep WBZ.

4.6b. Well TW-5 Constant Rate Test and Performance

A target rate of approximately 380 gpm was selected for the constant rate test. Due to the several hundred feet of drawdown that occurs prior to stabilization, numerous rate adjustments were performed during the initial 400 minutes of pumping in order to maintain the rate within +/- 5%. During this period the target rate was lowered to +/- 360 gpm due to limitations of the pump. Figure 4-12 is a time drawdown semilog plot for well TW-5, which shows an inflection when a final rate adjustment (wide open valve) was made at 421 minutes; at this time the PWL was reaching stabilization after approximately 250 minutes of pumping, but there was some remaining back pressure and available pump capacity. Within

100 minutes the PWL again was approaching stabilization and steady rate drawdown. A second inflection occurred at 1,560 minutes when pumping was started at well TW-6 for the 1st test. This resulted in a decline of the PWL from 426 feet to 430 feet over the next 60 minutes, followed by steady rate drawdown to the end of pumping when the PWL reached 438 feet btoc. The steady rate drawdown is characteristic of an expanding capture zone through uniform aquifer conditions, as there was no inflection and change of slope that would indicate contact with a boundary condition. Stabilization of the PWL (+/-4.2 ft for the 835-feet water column) occurred prior to 2,000 minutes, and was followed by an additional 16 hours of pumping prior to the generator failure. The aquifer response is consistent with vertical leakage that has not yet reached equilibrium. The 180-day projection of the PWL indicates that it would reach approximately 460 feet btoc; this projection includes approximately 4 feet of interference drawdown from TW-6 pumping at 62 gpm. The average pumping rate for the test was 365.3 gpm (rounded to 365 gpm), based on a total of 1,097,490 gallons pumped over 3,004 minutes.

Figure 4-12 is a Theis recovery plot (Theis, 1935), with a brief interruption after 19 minutes when the generator was re-started for 4 minutes. The plot shows a very rapid recovery, with 90% (43.8 feet residual drawdown remaining) achieved after 96 minutes. The straight line portion of the later recovery beginning at t/t' = 20, was used to calculate the aquifer transmissivity, and yielded a transmissivity of 3,850 gpd/ft, which converts to 515 ft^2/d. This value is in good agreement with the values determined from the previous pumping tests of other wells at the site.

4.7 TW-6 Pumping Test

4.7a Step Drawdown Test

A step drawdown test was conducted on October 18, and is summarized below:

Table 4-6 –Well TW-6 Step Drawdown Test

Step	Q	Initial Water Level	Final Water Level	Net Drawdown	Q/S_w	$S_{w/Q}$
	gpm	feet, BTOC	feet, BTOC	feet	gpm/ft drawdown	ft drawdown/ gpm
1	20.0	8.09	13.67	5.58	3.6	0.28
2	37.4	13.67	21.86	13.77	2.7	0.37
3	61.0	21.42	67.14	59.05	1.0	0.97
4	89.6	67.9	224.5	216.41	0.4	2.42

Figures 4-13 and 4-14 are the semilog plot of the time-drawdown data and turbulent flow analysis. The testing showed that last rate of 89.6 gpm resulted in substantially greater drawdown as compared to the previous rates, probably due to disproportionally higher turbulent flow head loss. The test also showed that the well should be able to produce 90 gpm since the PWL appeared to be approaching stabilization above 300 feet btoc, absent any other interference drawdown. The turbulent flow analyses showed that 89% of the drawdown observed in the borehole was attributable to turbulent flow head losses, which is similar to the TW-5 result, and due to the condition of a deep well with a deep WBZ.

Following the method described in Section 4.6a, a maximum sustainable pumping rate in the range of 150 gpm was estimated for TW-6. This estimate is based on a projected stabilized PWL at 315 feet btoc (305 feet drawdown), a stabilized specific capacity of 0.29 at 90 gpm, and additional available drawdown of 435 feet above the principal WBZ at about 747 feet.

4.7b Well TW-6 Constant Rate Test and Performance

The 1st test indicated that some development of the WBZ in TW-6 occurred during pumping, based on periods of fluctuation and recovery during the test. That test was conducted at 62 gpm, with an end of test PWL of 167 feet btoc.

The target rate for the 2nd test was 90 gpm. The initial rate was 120 gpm due to high line pressure, and was adjusted to 94.5 gpm after 240 minutes (see Table 4-7 for rate measurements). Figure 4-15 is the semilog plot, and shows that the PWL was beginning to stabilize at nearly 400 feet after 100 minutes of pumping, and reached stabilization after approximately 1,100 minutes (+/- 4.2 feet fluctuation), and was followed by an additional 29 hours of pumping. The plot of the drawdown after 100 minutes still contained fluctuations, and two (2) distinct recovery periods at about 1,900 minutes and 2,700 minutes. The pumping period from approximately 100 minutes until 1,900 minutes was interpreted as a period of steady rate drawdown, followed by a recovery of about 2 feet, with further steady rate drawdown at a lower slope. The 180-day projection of the latter slope is to 455 feet, which remains 290 feet above the WBZ and 395 feet above the bottom of the well.

A second period of recovery began near the end of pumping at 2,720 minutes, when the PWL declined from nearly 435 feet to 421 feet at the conclusion of pumping at 2,880 minutes. The recovery periods and decreased slope was attributed to further development and increased conductivity within the WBZ at 747 feet. The average pumping rate for the test was 90.8 gpm (rounded to 91 gpm), based on a total of 261,733 gallons pumped over 2,880 minutes.

Figure 4-16 also shows the very rapid recovery to about 50 feet, which reflects the amount of turbulent flow head loss. Figure 4-16 is a Theis recovery plot (Theis, 1935), with 90% (41.3 feet residual drawdown remaining) was achieved after only 15 minutes. The straight line portion of the later recovery beginning at t/t' = 200, was used to calculate the aquifer transmissivity, and yielded a transmissivity of 4,800 gpd/ft, which converts to 642 ft^2/d. This value is in good agreement with the values determined from the previous pumping tests of other wells at the site, and suggests that deep aquifer conductivity at this location may be the highest as compared to the other well locations.

4.8 Well O Re-Test

A step-drawdown test was not performed at Well O. For the constant rate test a target rate of approximately 100 gpm was selected, but was reduced to a lower rate after the start of the test because the PWL was projected to intersect the pump intake prior to 48 hours. The rate was permitted to drift downward with the increased elevation head pressure, and the PWL reached stabilization (+/- 4.9 feet fluctuation) after approximately 1,200 minutes and the rate was approximately 85 gpm. Table 4-8 summarizes the rate measurements during the test. The PWL reached steady rate at approximately 900 minutes, and projected to 345 feet btoc after 180 days of pumping. This PWL remains 405 feet above the principal WBZ at 750 feet, and 660 feet above the bottom of the well, and shows that a higher sustainable pumping rate is supported by the well hydraulics. As with other supply wells that have been tested, the drawdown reached a steady rate with low slope value, and is characteristic of an expanding capture zone through uniform aquifer conditions, as there was no inflection and change of slope that would indicate contact with a boundary condition. The average pumping rate for the test was 84.9 gpm (rounded to 85 gpm), based on a total of 244,418 gallons pumped over 2,880 minutes.

The semilog plot also shows the very rapid recovery to about 75 feet, which indicates that there was significant turbulent flow head loss. Figure 4-18 is a Theis recovery plot (Theis, 1935), with 90% (30.1 feet residual drawdown remaining) was achieved after only 12 minutes. The straight line portion of the later recovery beginning at t/t' = 200, was used to calculate the aquifer transmissivity, and yielded a transmissivity of 1,730 gpd/ft, which converts to 230 ft^2/d. This value is within the lower range of transmissivity values as compared with other results, and considered to be representative of the range for transmissivity of the deep aquifer at the site.

4.9 Effects at Surface Water

Figure 4-6 through 4-8 are the hydrographs for the TW-5 Wetland Piezometer, Bush Kill stilling well, and TW-6 wetland Piezometer. The TW-5 Wetland Piezometer record shows that the TW-5 groundwater pumping had a discernable lowering effect of between 0.05 and 0.10 foot. This response was interpreted as a decline in upward head from the bedrock aquifer into the overlying overburden and wetland area. The previously described groundwater and surface water elevation mapping indicated that the Bush Kill is in hydraulic communication with the bedrock aquifer beginning in the area where the BK-UNT discharges into the Bush Kill. This condition is supported by the artesian water level at TW-4, where the SWL is 1 to 1-1/2 feet above grade, and at TW-5 where the SWL is within 1 to 2 feet of grade. It should be noted that the response at the piezometer represents a very small decline to an upward head pressure, and that there is no indication of any gradient reversal to downward leakage. The actual change to the flux of groundwater through the low permeable soils at the wetlands due to the lowered head pressure is expected to be very small and not practicably measurable. The normal seasonal variation to the vertical gradient is likely to be several feet, and thus one order of magnitude greater than what was induced by the groundwater pumping. This could potentially change if TW-5 is <u>continuously</u> pumped for a week or more on a regular basis. However, providing that the normal operation is approximately 12 hours per day, the resulting slight head decline would likely return to the pre-pumping condition during the subsequent recovery period, given that the hydrograph shows an equally fast response to the start and stop of TW-5 pumping.

Figure 4-8 shows that there is no inflection to the Stilling Well level that would indicate any impact from groundwater pumping from TW-5. Given the response at the piezometer and its proximity to the Bush Kill, it is likely that there was a similar change in the upward gradient beneath the Bush Kill. Again, the change is very slight, and should not have any measurable effect to the Bush Kill flow. The field chemistry monitoring of the Bush Kill water at the stilling well (see Table 4-8) showed dissimilar pH and specific conductance as compared to the TW-5 groundwater, and provides some further confirmation that there was <u>no</u> fluid exchange between the groundwater and surface water.

The TW-6 wetland Piezometer (Figure 4-6) showed no indication that there was any effect due to the pumping during the 1st TW-6 test. A rain event prior to and during the 2nd TW-6 test caused the level to rise, so the monitoring point was of no use for the 2nd TW-6 test.

4.10 Field Chemistry Monitoring

The field monitoring for pH, temperature, and specific conductance for all three (3) wells is summarized in Tables 4-4, 4-7, and 4-8, and showed that during the course of pumping the parameters did not significantly vary. In addition, the groundwater chemistry for each well is very similar. These conditions together indicate that the source zones for each well remained consistent, which reflects in part the common source zone. For the 3 wells (TW-5, TW-6, and O), the median pH was either 7.7 or 7.8; and, the median conductivity ranged from 172 to 179 uS/cm, a variance of less than 5%. The temperature variance was greater, at 10.7 to 12.0° C, and is attributed in part to daily ambient air temperature fluctuation. These values differ significantly from the Bush Kill and BK-UNT chemistry (Table 4-9), as the surface water had dissimilar pH and conductivity. These results are consistent with previous test results, and provide further support of the conclusion that there was no induced flow from the surface water to the bedrock aquifer.

The groundwater from each domestic well was also measured from an outside spigot for a comparison to the deep aquifer groundwater. The Feller (pH - 5.77, conductivity – 283 uS/cm) and Stawarz (pH - 6.02, conductivity – 391 uS/cm) data is dissimilar to the deep aquifer, with lower pH and higher conductivity. Viewed along with the aquifer responses, the data further supports the conclusion that the deep aquifer at the site is in poor hydraulic communication with the shallow aquifer.

4.11 Effects at Observation Wells

Tables 4-10a and 4-10b summarize the end of test aquifer drawdown response at each observation well, in order from the nearest to farthest observation well. Figures 4-1a through 4-6 are hydrographs that illustrate the drawdown effects, and include notations that further explain the responses. Since the testing period included periods when each well was pumped individually and simultaneously, those effects could be evaluated, and it was found that the combined pumping drawdown response was typically greater than the sum of the individual pumping responses for wells closer together (+/- 400 feet). Where this occurred, the greater drawdown response was used in the overall evaluation in order to provide some conservative factor.

Table 4-10a – Summary of TW-5 and TW-6 Aquifer Drawdown Effects

Observation Well	**Distance from TW-5 feet**	**Pre-Pumping SWL Feet, btoc**	**End of Test Maximum SWL Feet, btoc**	**Net Aquifer Response Feet below SWL**
TW-4	900	0.23	8.73	**8.5**
Stawarz	900	19.22	27.58	**8.4**
Feller	1,250	40.21	48.30	**8.1**
FFF	1,600	9.86	82.27	TW-5 – 38.8 TW-6 – 33.6 **Total – 72.4**
JJ	2,000	31.57	75.18	TW-5 – 24.2 TW-6 – 19.4 **Total – 43.6**
TW-1	2,200	9.52	21.5	TW-5 – 6.6 TW-6 – 5.4 **Total – 12.0**
HH	2,700	17.73	40.32	**22.6**
EE	2,200	58.76	81.10	**22.3**
P	3,700	64.95	71.00	**6.1**
O	4,400	18.22	29.85	**11.6**
BB	4,400	38.64	39.76	**1.1**

Table 4-10b – Summary of TW-6 and Well O Aquifer Drawdown Effects

Observation Well	**Distance from TW-6 feet**	**Pre-Pumping SWL Feet, btoc**	**End of Test Maximum SWL Feet, btoc**	**Net Aquifer Response Feet below SWL**
FFF	420	10.27	31.76	**21.5**
JJ	470	31.6	44.84	**13.2**
TW-1	620	12.85	14.75	**1.9**
TW-4	860	0.51	2.64	**2.11**
EE	860	64.98	68.21	**3.2**
HH	1,200	18.16	32.96	**14.8**
TW-5	1,460	5.03	13.30	**8.27**
Feller	1,700	40.57	42.06	**1.49**
Stawarz	1,900	19.60	21.13	**1.53**
P	2,300	67.55	71.43	**3.9**
BB	3,100	38.95	40.24	**1.3**

The data shows the nearer wells had disproportionately less drawdown than wells that are substantially further away. These nearer wells (TW-4, Stawarz, and Feller) do not intersect WBZs of the deep aquifer, and thus do not have the same degree of hydraulic communication as the wells that do intersect the deep aquifer. These results demonstrate the anisotropic aquifer response, i.e., the greater horizontal conductivity as compared to the vertical conductivity.

Of note is the response at the Stawarz and Feller domestic wells. The combined pumping at TW-5 and TW-6 totals 427 gpm, and was the largest rate of pumping from the aquifer during any testing at the site. These wells are also the nearest to any off-site wells, so the aquifer drawdown response at the off-site domestic wells can be considered as the maximum impact in response to any of the testing to date. Those impacts were approximately 8 feet at the end of the TW-5 test, which represents a maximum 10% water column reduction at the Feller well, and 5% at the Stawarz well. Such an effect should not result in any discernable change to the operation and production of either well, given that the normal drawdown during domestic pumping ranges from 4 to 8 feet. In addition, normal supply well operation should be about 12 hours/day, which leaves ample time for aquifer recovery and dissipation of interference drawdown at the off-site wells.

The drawdown at other production wells at the site (JJJ, FFF, HH, and O) ranged from a maximum of 72 feet at FFF, to almost 12 feet at well O. Several of the hydrographs are presented with small and large scales. The large scale provides a detailed view of pumping effects, and the small scale an overall perspective of the impact to the water column. Section 6.0 evaluates these interference effects to determine whether they would cause a significant reduction to the production capacity of the production wells at the site.

4.12 Aquifer Parameters

Based on the existing data for the aquifer parameters, which shows generally uniform conditions, no additional analyses was performed for the observation well data.

4.13 Water Quality

Water quality samples were not collected from any of the 3 wells. Previous water quality analyses showed that the groundwater from the deep aquifer is of good quality and should require no treatment beyond simple disinfection. However, a groundwater sample must be collected and analyzed for the NYSDOH public water supply parameters prior to being considered for permitting as a public water supply.

4.14 Dependable Yield and Recommended Operation

4.14a TW-5

The dependable pumping rate of well TW-5 is recommended at the constant rate test pumping rate of 365 gpm. This rate is supported by the stabilized PWL that occurred, the 180-day PWL projection that remains 460 feet above the principal WBZ, and the rapid recovery to 90% within 9 hours. A higher dependable pumping rate is clearly feasible, and is estimated to be in the range of 500 gpm. This estimate does not account for other interference drawdown or the possibility of a barrier aquifer boundary to develop over the long-term, and requires additional testing to prove as sustainable.

Based on the testing, continuous pumping of TW-5 is feasible, which would produce 0.526 MGD. Advantage does not recommend continuous pumping unless a peak demand period requires such, and under normal conditions a 12-hour duty cycle is recommended, which would easily produce 0.263 MGD.

The pump intake setting should be no deeper than 780 feet bg which would preclude lowering the PWL below the principal WBZ. The pump should be sized such that the discharge rate against an elevation head pressure of approximately 780 feet would not exceed 500 gpm, inclusive of any other system operating pressures.

4.14b TW-6

For the same reasons as with TW-5, the 2nd TW-6 constant rate test average of 91 gpm is recommended for the dependable pumping rate. A higher dependable rate in the range of 150 gpm (or more) is likely to be feasible.

Based on the testing, continuous pumping of TW-6 is feasible, which would produce 0.131 MGD, and could be relied on to meet peak demand. The recommended normal pumping schedule of 12 hours per day would easily produce 0.066 MGD.

The pump intake setting should be no deeper than 735 feet bg, and sized such that the discharge rate against an elevation head pressure of approximately 735 feet would not exceed 150 gpm, inclusive of any other system operating pressures.

4.14c Well O

As with TW-5 and TW-6, constant rate test average of 85 gpm is recommended for the dependable pumping rate. A higher dependable rate in the range of 140 gpm is likely to be feasible based on analysis of the constant rate test result, which was used in lieu of step drawdown testing. This estimate was determined by multiplying the end of test specific capacity (0.28 gpm/ft) by the available drawdown above the principal WBZ after 180 days (405 feet), and reducing the result by 50% to be conservative and account for uncertainty (85 gpm plus: 405 feet x 0.28 gpm/ft x 50%). This estimate does not account for interference drawdown from another supply well. Further testing is necessary to prove any additional production from the well.

Based on the testing, continuous pumping of well O is feasible, which would produce 0.122 MGD, and could be relied on to meet peak demand. The recommended normal pumping schedule of 12 hours per day would easily produce 0.061 MGD.

The pump intake setting should be no deeper than 740 feet bg. The pump should be sized such that the discharge rate against an elevation head pressure of approximately 740 feet would not exceed 140 gpm, inclusive of any other system operating pressures.

5.0 WELL FIELD EVALUATION

5.1 Current Proven and Estimated Production Capacity

The testing results to date involved either concurrently pumping two (2) wells, or individual pumping tests. A single test with all wells pumping concurrently was not completed due to the different times that wells were constructed, and the need to assess production capacity as the well drilling progressed. In lieu of such testing, an analysis of the anticipated well field production was performed which accounts for interference drawdown effects from other pumping wells at the site. The analysis relied on the following assumptions and simplifications:

1. Drawdown is directly proportional to the pumping rate (Driscoll, 2003). Thus, when the interference drawdown at a particular pumping rate is determined, the theoretical drawdown caused by a different rate can be estimated by multiplying the observed drawdown by the ratio of pumping rates.

2. The interference effect between wells is reciprocal, i.e., if well A causes 10 feet of drawdown at well B, then the opposite will occur providing the pumping rates are equal. For a different pumping rate, the interference drawdown can be estimated by multiplying by the ratio of pumping rates.

3. Interference drawdown effects are additive (Driscoll, 2003), and the total effect in any one well is the sum of the effects caused by others in the well field.

4. The likelihood that all wells will operate simultaneously is very low, based on the water demand projections for the site. If simultaneous operation is required, it was assumed to be limited to a 24-hour period, which is considered an extremely improbable event.

5. Well TW-3a does not affect the analysis, because there is no interference drawdown effects between this well and all other wells.

The above assumptions enable reasonably accurate prediction of the net interference drawdown effects, unless pumping wells are too close together and have exceptional hydraulic communication between WBZs. This condition occurred at wells FFF and JJJ, but is accounted for by using the observed drawdown from that test, rather than adding together the individual interference drawdown between wells FFF and JJJ when each was pumped by itself.

Interference drawdown between the wells is of concern if it decreases the individual well water column such that the proven maximum pumping rate can no longer be achieved.

The evaluation of the drawdown interference effects to the well field was determined by the following procedure:

1. The interference effects were estimated from the various pumping tests completed to date, using the above assumptions and simplifications.

2. The available water column in each supply well after it had reached stabilization was estimated. The total height was the difference between the stabilized PWL at the proven maximum safe pumping rate and the principal WBZ in the well. This provides for a more conservative approach (i.e., lower water column) than using the bottom of the well.

3. If the remaining water column exceeded the sum of the interference drawdown effects, the proven maximum safe pumping rate was considered to remain feasible for meeting a peak demand period. Otherwise, a reduced pumping rate would be necessary for that particular well under the scenario of all wells operating simultaneously.

Table 5-1 (following page) summarizes this data and evaluation. The table includes notations that explain the source for the interference drawdown effects. For all of the wells, except JJJ, the remaining water column is ample to account for all of the interference effects from the other wells. The remaining water column height ranges between a minimum of 108 feet, to a maximum of 350 feet.

At JJJ, the evaluation shows that the proven rate of 126 gpm could not be sustained if all other wells were simultaneously pumping. The PWL of 680 feet would be lowered an additional 62 feet from interference, and the 9 feet of water column is insufficient. An estimate for a lower rate that could be achieved was performed using the ratio of slopes method (Driscoll, 2003). This method relies on the assumption that drawdown is proportional to pumping rate. To estimate the lower rate at JJJ, a theoretical drawdown plot with a slope that is 62 feet less than the actual plot at 126 gpm was drawn (see Figure 2-13). The test rate of 126 gpm was multiplied by the ratio of slopes, and yields a value of 103 (rounded to 100 gpm). Based on this estimate, a lower rate of 100 gpm was assumed as feasible for JJJ if all other wells were pumping.

Based on the above analysis, the well field production is summarized in Table 5-2 (following page). This table also includes the individual well <u>estimated</u> maximum safe pumping rate as determined from the available water column after PWL stabilization and the well hydraulics. These values are included to provide a general idea of the maximum well pumping rate, and indicate that the well field production potential is higher than what is

Table 5-1 - Summary of Well Field Interference

Pumping Well	Rate	Estimated Interference Effects to Stabilized PWLs (feet below existing water level)							Data Source
	gpm	TW-5	TW-6	FFF	JJJ	HH	O	TW-3a	
TW-5	365		43	40	24	16	7	0	A
TW-6	91	9		22	13	10	7	0	B
FFF	246	27	88			25	13	0	C
JJJ	126	8	26			13	7	0	C
HH	200	8	32	20	20		21	0	D
O	85	2	4	5	5	9		0	E
TW-3a	115	0	0	0	0	0	0		
Sum of Interference (feet)		54	193	87	62	73	55	0	
Available Water Column Below Stabilized PWL (feet)		360	315	195	9	370	405	7	F
Net Remaining Water Column (feet)		**306**	**122**	**108**	**53**	**297**	**350**	**7**	

Data Source Explanations:

A observed drawdown after approximately 24 hours pumping TW-5 at 365 gpm

B observed drawdown after approximately 48 hours pumping TW-6 at 62 gpm, multiplied by ratio of rates (91/62 = 1.5)

C for TW-5 and TW-6 assumed reciprocal drawdown from those individual tests multiplied by ratio of rates;
for **HH** and O, used the observed drawdown from the **FFF**/JJJ test multiplied by ratio of rates

D for TW-5 and TW-6 assumed reciprocal drawdown from those individual tests multiplied by ratio of rates;
for JJJ and **FFF**, assumed reciprocal drawdown from the **FFF**/JJJ test multiplied by ratio of rates;
for O, used the reported drawdown from the **HH** test in december 2009

E same as d for TW-5, TW-6, **FFF**, and JJJ;
for **HH**, used the reported drawdown from the **HH** test in December 2009 multiplied by ratio of rates

F the approximate water column remaining above the principal WBZ after the PWL reached stabilization as determined from pumping tests listed in Table 5-2. The maximum safe pumping rates for the project will be tested and demonstrated in the applicant's water supply applications.

Table 5-2 – Summary of Well Field Production

	Individual Well Maximum Safe Pumping Rate Proven from Testing	Individual Well Estimated Maximum Safe Pumping Rate	Well Field Estimated Maximum Safe Pumping Rate	Well Field 24-Hour Maximum Estimated Production
	gpm	gpm	gpm	MGD
TW-5	365	500	365	0.526
TW-6	91	150	91	0.131
FFF	246	360	246	0.354
JJJ	126	126	100	0.144
HH	200	345	200	0.288
O	85	140	85	0.122
TW-3a	115	115	115	0.166
Total	na	na	1,202 gpm	1.731 MGD

Note: Well P with maximum safe yield of 18 gpm is not included due to low yield, but may used at some future time.

Well HH is listed as having a possible yield of 345 gpm. This is based on the end of test specific capacity of 0.79 gpm/ft, and available water column of 370 from the 12/09 test (see Report).

5.2 Well Field Production and Estimated Water Demand

The estimated water demand was described in Section 1.3 of this Addendum. To date, the final water demand as required by reviewing authorities has not been determined. The following summarizes the well field capacity with the various water demand scenarios.

Table 5-3 –Water Demand Scenarios and Well Field Capacity

	Average Day	**Peak Day** 1.8 x Average Day
	MGD	MGD
Probable Demand: 172 gpd/connection	0.475 (330 gpm)	0.855 (594 gpm)
Conservatively High Demand 250 gpd/connection	0.683 (474 gpm)	1.23 (854 gpm)
Initial DEIS Review 330 gpd/connection	0.897 (623 gpm)	1.615 (1,121 gpm)
Well Field 24-Hour Maximum Production	1.731 (1,202 gpm)	

The estimated well field production exceeds each of the potential average day water demand scenarios for the site.

A last consideration is the requirement to satisfy peak demand with the largest well out of service. Removing the TW-5 production would lower the well field 24-hour maximum production to 1.205 MGD. Under this condition, the Probable Demand peak day would be met, and would satisfy 98% of the Conservatively High Demand scenario. Under the initial DEIS scenario, there would be a difference of 0.410 MGD, which corresponds to a pumping rate of 285 gpm. This difference may possibly be covered by utilizing the additional capacity of the existing wells as listed in table 5-2 (which would require testing to confirm), and/or water system storage capacity. However, in light of the overly conservative assumptions used to support the peak day demand of 1.615 MGD, development of additional source capacity above what has already been proven to satisfy the theoretical demand does not appear to be necessary, as the current developed sources are considered to be more than adequate to meet the full build out water demand.

6.0 ZONE OF CONTRIBUTION AND GROUNDWATER RECHARGE

The recharge area was determined by estimating the Zone of Contribution (ZOC) from a theoretical distance-drawdown plot of the observation well data from the various pumping tests, and using the Uniform Flow Equation method described by Todd (Todd, 1980). The distance drawdown analysis mostly relied on the end of test observation well responses, when the aquifer drawdown at the most distant observation wells was not yet stabilized. Thus, the ZOC estimate is considered to be approximate, and may be smaller than what would develop under long term pumping. The following figures portray the aquifer responses at the observation wells:

Figure 6-1: This portrays the end of test observation well drawdown for the well FFF and JJJ test, which approximates the steady-state aquifer response to a total groundwater withdrawal of approximately 372 gpm (combined pumping rates of Wells FFF and JJJ). The plot is a simplification in that there are two (2) pumping wells, and the distances are approximated from the midpoint between Wells FFF and JJJ. The drawdown responses indicate that there is preferential drawdown in the direction of Wells HH, OO, F, and M, which was interpreted as reflecting a zone of greater transmissivity, and which was reflected by the groundwater surface contour mapping. Thus, the aquifer drawdown towards the northwest, and possibly the southeast also, can be expected to extend almost 5,000 feet. Towards the north in the direction of Wells BB and P, where the bedrock transmissivity is assumed to be lower, the drawdown response appears to extend a maximum of approximately 2,500 feet. Well EE falls below both of the drawdown plots due to the high degree of hydraulic communication with Well JJJ.

Figure 6-2: This portrays the approximately 24-hour aquifer response from pumping 365 gpm from well TW-5. The aquifer response is not at a steady state condition, but it does include the majority of drawdown that occurred, and is a reasonable approximation for the steady state condition. Of note is the difference between the drawdown of wells constructed within the shallow and deep portions of the bedrock aquifer. The shallow aquifer response extends a maximum of approximately 1,500 feet, and the deep aquifer response extends approximately 4,500 feet.

Figure 6-3: This figure portrays the aquifer response to a combined withdrawal of 427 gpm, which was the maximum aquifer stress that occurred during any of the tests. The observation well data plots in similar fashion as Figure 6-2, in that there is a distinctly different response between the shallow and deep bedrock aquifer. The projected extent for pumping influence is approximately 1,800 feet for the shallow, and 4,800 feet for the deep.

Figure 6-4: This plot shows the effects after approximately 48 hours of pumping well TW-6 at 62 gpm. Compared to the previous distance drawdown plots, the y-scale was enlarged by a factor of 2 in order to show sufficient detail. Again, the same distinct pattern between shallow and deep aquifer responses was present, and totaled approximately 1,500 feet for the shallow, and 4,200 feet for the deep. The response approximates the steady state condition.

All of the plots yielded similar values for the maximum extent of the pumping zone of influence, i.e., aquifer drawdown effects extend to a maximum distance of nearly 5,000 feet for the deeper portion of the aquifer, and 2,000 feet for the shallow bedrock aquifer. This response was assumed to approximate continuous pumping at a rate of 427 gpm, which was the combined rate for TW-5 and TW-6.

The Zone of Contribution (ZOC) for the deep aquifer (i.e., zone where groundwater is diverted to pumping wells) that would develop under this condition was estimated using the Uniform Flow Equation method. This method estimates the distance to the lateral extent of a ZOC, and the downgradient distance to the null point, i.e. where groundwater in the downgradient direction is diverted back to the pumping well. The input used an aquifer thickness of 700 feet, which approximates the saturated thickness of the bedrock aquifer, and the average horizontal hydraulic gradient for the higher transmissivity zone (0.003) of the site, where the supply wells are constructed. The hydraulic conductivity is variable due to the fractured bedrock aquifer setting; simply using the conductivity of 0.9 ft/d (obtained by dividing the median transmissivity from Table 2-8 of 615 ft^2/d by the aquifer thickness of 700 feet) results in unrealistically large dimensions for the ZOC. A more realistic value for the conductivity was estimated by assuming that the lateral distance of the ZOC is equal to the distance drawdown value of 4,800 feet, and solving the appropriate equation for the conductivity; this yielded a value of 4.1 ft/d, which is considered as the effective hydraulic conductivity for the deep bedrock aquifer in terms of how it was observed on a large scale to respond to pumping. This value was then used in the equation for the downgradient null point, and yielded a distance of 1,500 feet for the scenario of pumping at 427 gpm. Table 6-1 summarizes the equation input and results.

Thus, a reasonable approximation for the ZOC for the deep bedrock aquifer under the TW-5 and TW-6 pumping scenario is an ellipse centered over those wells, with a major axis of 9,600 feet (2 x 4,800 feet), and minor axis of 3,000 feet (2 x 1,500 feet).

The table also includes the pumping rates for the three (3) average day water use scenarios that were discussed in Section 5 in order to provide an estimate of how the ZOC may change in response to changes in water use. Based on the methodology, the maximum ZOC dimension develops from continuously pumping at 623 gpm, and would have a major axis of 14,000 feet (2 x 7,000 feet), and minor axis of 4,400 feet (2 x 2,200 feet).

Table 6-1 Zone of Contribution (ZOC) Estimate

Lateral Dimensions

Distance to lateral null point:	Continuous Pumping Rate	Discharge	Equation Constant	Hydraulic Conductivity	Aquifer Thickness	Hydraulic Gradient
y_{lat} (**1**)		Q	2	K	b	i
feet	gpm	cubic feet/day	-	feet/day	feet	-
4,774	**427**	82,203	2	4.1	700	0.003
3,689	**330**	63,529	2	4.1	700	0.003
5,299	**474**	91,251	2	4.1	700	0.003
6,965	**623**	119,936	2	4.1	700	0.003

(1) Y_{lat} = Q /(2 x K x b x i)

Distance to Downgradient Null Point

Distance to downgradient null point	Continuous Pumping Rate	Discharge	Equation Constant	Hydraulic Conductivity	Aquifer Thickness	Hydraulic Gradient
x (**2**)		Q	2 x π	K	b	i
feet	gpm	cubic feet/day	-	feet/day	feet	-
1,520	**427**	82,203	6.28	4.1	700	0.003
1,175	**330**	63,529	6.28	4.1	700	0.003
1,688	**474**	91,251	6.28	4.1	700	0.003
2,218	**623**	119,936	6.28	4.1	700	0.003

(2) x = -Q / (2 x π x K x b x i)

This generalized ZOC is depicted on Figure 1-4b and corresponds to an area of approximately 1,110 acres, or 1.74 mi^2. The ZOC with these dimensions is approximately centered over the well field and oriented from northwest to southeast, which approximates the observed aquifer response to pumping as observed during the well FFF/JJJ test. This ZOC is assumed to represent the general ZOC that would develop in response to operation of the well field. Because of the low hydraulic gradient of the bedrock aquifer, the minor axis of the ZOC is probably wider than what is shown. The ZOC should be considered as approximate, due to the uncertainties associated with the nature of the fractured bedrock aquifer and anisotropic conditions.

Based only on the ZOC size of 1.74 mi^2, the drought year recharge would approximately 1.183 MGD (1.74 mi^2 x 0.680 MGD/mi^2). This volume exceeds the highest average day demand scenario of 0.897 MGD (Table 5-3) by about 30%, and as such is considered to be sufficient to support the long term groundwater withdrawals from the well field.

The recharge area to a ZOC at the site could also theoretically include the hydraulically upgradient lands that lie within the Bush Kill watershed. This area totals approximately 8.9 square miles (mi^2). Based on the drought year aquifer recharge value of 0.680 MGD/mi^2, the recharge volume would be 6.052 MGD. Both the ZOC ellipse and total theoretical recharge area are shown on Figure 1-4b. This analysis shows that the recharge area that would develop in response to long term pumping at the site is sufficient to support the long term operation of the well field.

Aquifer Characteristics from Distance Drawdown Plots

Some further analysis of the distance drawdown plots was performed for the aquifer transmissivity and storativity using the best fit line for the deep aquifer response. The values ranged from 1,920 gpd/ft to 3,000 gpd/ft, with a median of 2,300 gpd/ft. The storativity ranged from 0.000034 to 0.00012, with a median of 0.000033. These values are consistent with other determinations of the deep bedrock aquifer transmissivity and storativity that used the time drawdown data. The time-drawdown and distance-drawdown methods are independent of each other, and thus provide a reasonably accurate estimate of the deep bedrock aquifer characteristics.

7.0 WELLHEAD PROTECTION

The recharge area for the wells encompasses a large area. Currently this area is mostly forested land with sparse residential development, with no high-risk conditions for groundwater contamination, such as industrial development or fuel underground storage tanks. After development of the property, the more immediate recharge areas with respect to the wells will be residential. Previous analysis of the potential for significant groundwater impact from the proposed development, with special focus on the golf course and other managed turf areas, indicated that there should be no unreasonable risk to the surface and groundwater quality of the area. In addition, the supply wells are located on the southern portion of the property, while the golf course and managed turf areas are mostly on the north side. Any public water supply well at the site will maintain a 100-feet radial protection area where no development will occur, and all wells will meet the applicable separation distances as required by NYDOH from possible sources of contamination (e.g., wastewater lines) as listed in Table 1 of Section 5-B.1 of the NYSDOH regulations (Statutory Authority Public Health Law 206(18)). Finally, the supply wells (except for TW-3a) withdraw groundwater from deep fractures with limited hydraulic communication to the upper zone of saturation in the bedrock aquifer. The depth of the WBZs and confined nature of the aquifer should naturally provide a substantial barrier to any nearby surficial contaminant release.

8.0 CONCLUSIONS

Based on the results of the well construction and testing at the Lost Lake Resort site, Advantage offers the following conclusions:

1. A well field that consists of seven (7) public water supply wells was constructed at the southern portion of the Lost Lake Resort site in support of the future development. Six (6) of the wells are deep, open borehole bedrock wells, and one (1) well is a shallow well constructed within a highly permeable zone of the shallow bedrock aquifer. The maximum safe yield of the wells, as determined from aquifer testing, ranges from 85 gpm to 365 gpm. The estimated maximum safe pumping rate for all wells pumping simultaneously is 1,202 gpm, which would produce 1.731 MGD for a maximum period of 24 hours.

2. Based on the information obtained from drilling and aquifer testing, and from hydrogeologic mapping at the site, the successful supply wells withdraw groundwater from a set of deep, hydraulically connected fractures and/or enlarged bedding planes that occur at depths of approximately 400 feet to 800 feet below grade (bg), with a median depth of 660 feet amsl. This "deep aquifer" has horizontal hydraulic conductivity substantially greater than the vertical conductivity, which results in limited hydraulic interconnection with the shallow bedrock aquifer and the surface water.

3. The initial anticipated average day water demand for the project after full build out was specified by NYSDOH as part of the EIS review at 330 gallons per day (gpd) per residential unit plus amenities, which totaled 0.897 million gallons per day (MGD) for the average day, and peak day (2.0 factor) of 1.794 MGD; these requirements correspond to source supply capacity of approximately 642 gpm to meet average day demand, and 1,243 gpm to meet peak demand.

4. A request to reduce the anticipated full build out water demand was submitted to NYSDOH using actual water use data from area public water systems. Based on current water use in the area, a Probable Demand scenario is 0.475 MG (330 gpm) for the average day, and 0.855 MGD (594 gpm) for the peak day (1.8 factor). A Conservatively High Demand scenario based on the data is 0.683 MGD and 1.230 for the average and peak day, respectively.

5. The estimated well field production exceeds each of the potential average day and peak day water demand scenarios for the site. The well field 24-hour maximum capacity with the largest well out of service is 1.205 MGD, and is sufficient to satisfy each of the peak demand water use scenarios, except for the high range estimate of 1.615 MGD. The difference of 0.410 MGD, which corresponds to a pumping rate of 285 gpm, may possibly be covered by utilizing the additional capacity of the existing wells (which would require testing to confirm), and/or water system storage capacity.

6. The water quality of the deep bedrock aquifer meets the NYSDOH applicable public water supply parameters, and should require no treatment beyond disinfection.

7. The segment of the Bush Kill, below the confluence with the tributary that crosses the site, is expected to be in hydraulic communication with the deep bedrock aquifer. The bedrock aquifer below the tributary confluence has an upward, vertical gradient that is anticipated to have some discharge to the Bush Kill and possibly the associated wetlands, with the actual flux dependent on the hydraulic conductivity of the bedrock overburden materials. The surface water (streams and wetlands) upstream from this point are not anticipated to be in hydraulic communication and do not source water from the deep bedrock aquifer.

8. Overall, the operation of the well field should not have any significant impact to any off-site wells. The anticipated maximum impact to the nearest off-site domestic wells from the operation of the supply wells is approximately 8 feet of interference drawdown, which corresponds to a maximum 10% reduction to the water column; this impact should not result in a discernable reduction to the use of those wells or available groundwater at those locations.

9. There were no significant impacts to the wetlands or surface water that occurred from pumping the supply wells. Pumping the southernmost supply well (TW-5) resulted in a small decrease to the bedrock aquifer upward gradient beneath the nearby wetland. The actual change to the flux of groundwater through the low permeable soils at the wetlands due to the lowered head pressure is expected to be very small and not practicably measurable.

10. The aquifer response to the pumping tests was typical of a confined aquifer with vertical leakage. The aquifer transmissivity determined from observation well data, pumping well recovery data, and distance drawdown plots ranged from 956 gallons per day/foot (gpd/ft) to 4,800 gpd/ft. The storativity ranged between 0.000027 to 0.00012.

11. Based on the recharge analysis, the well field production under any of the three (3) water use scenarios is supported by the estimated recharge. The Zone of Contribution that would develop under long term operation of the well field at the maximum estimated pumping rate of 623 gpm is estimated to be elliptical, with axis dimensions of 14,000 feet and 4,400 feet, and encompass 1.74 mi2. The drought year recharge for this area would be approximately 1.183 MGD, which exceeds the maximum average day demand of 0.897 MGD by about 30%, and as such is considered to be sufficient to support the long term groundwater withdrawals from the site. The recharge area to a ZOC at the site could also theoretically include the hydraulically upgradient lands that lie within the Bush Kill watershed, which totals approximately 8.9 mi^2, and provide a net recharge volume of 6.052 MGD.

12. The well locations will meet the applicable separation distances as required by NYDOH from possible sources of contamination (e.g., wastewater lines) as listed in Table 1 of Section 5-B.1 of the NYSDOH regulations (Statutory Authority Public Health Law 206(18)). Previous analysis of the potential for significant groundwater impact from the proposed development, with special focus on the golf course and other managed turf areas, indicated that there should be no unreasonable risk to the surface and groundwater quality of the area. In addition, the depth of the WBZs and confined nature of the aquifer should naturally provide a substantial barrier to any nearby surficial contaminant release.

9.0 REFERENCES

Cooper, H. and Jacob, C., 1946, A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well-Field History, Transactions of the American Geophysical Union, Vol. 27, pp. 526-534.

Driscoll, F., Groundwater and Wells, Johnson Screens, St. Paul, Minnesota, 2003.

Hantush, M.S. and C.E. Jacob, 1955. Non-steady radial flow in an infinite leaky aquifer, Am. Geophys. Union Trans., vol. 36, pp. 95-100.

New York State Geological Survey, GIS Bedrock Attributes

R.E. Wright and Associates, 1982, "Special Groundwater Study of the Upper Delaware River Basin – Study Area III", Delaware River Basin Commission.

Soren, J., The Ground-Water Resources of Sullivan County, New York, U.S. Geological Survey in cooperation with the New York State Water resources Commission, Bulletin GW-46, Albany, N.Y., 1961.

Theis, C.V., 1935, The Lowering of the Piezometric Surface and the Rate and Discharge of a Well Using Groundwater Storage, Transactions of the American Geophysical Union, Vol. 16, pp. 519-524.

Todd, D.K., 1980, Groundwater Hydrology, 2nd Edition, John Wiley and Sons, New York.

ATTACHMENT 1

Figures

Figure 1-1 - Topographic Map

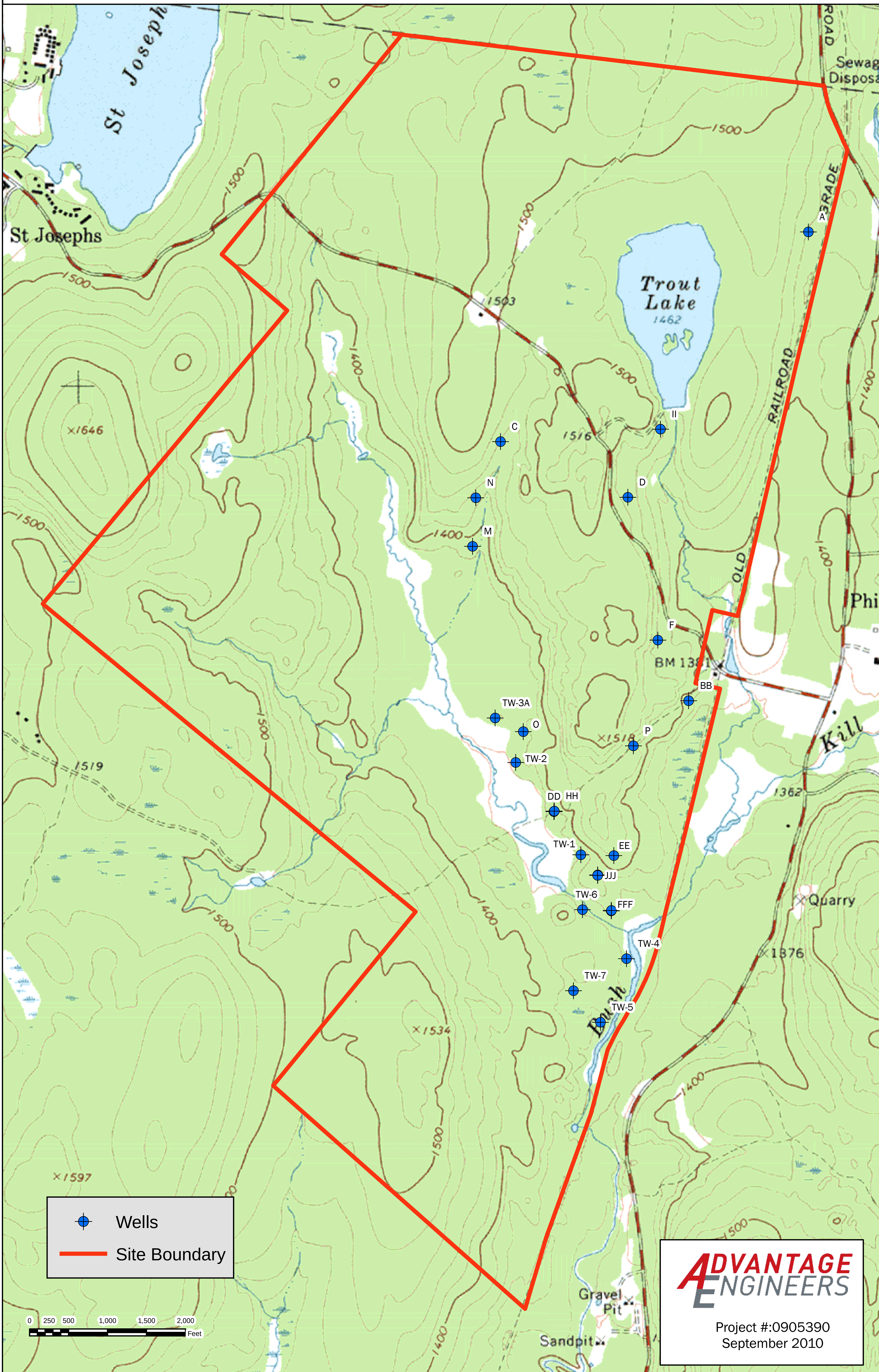

Figure 1-2 - Aerial Photograph

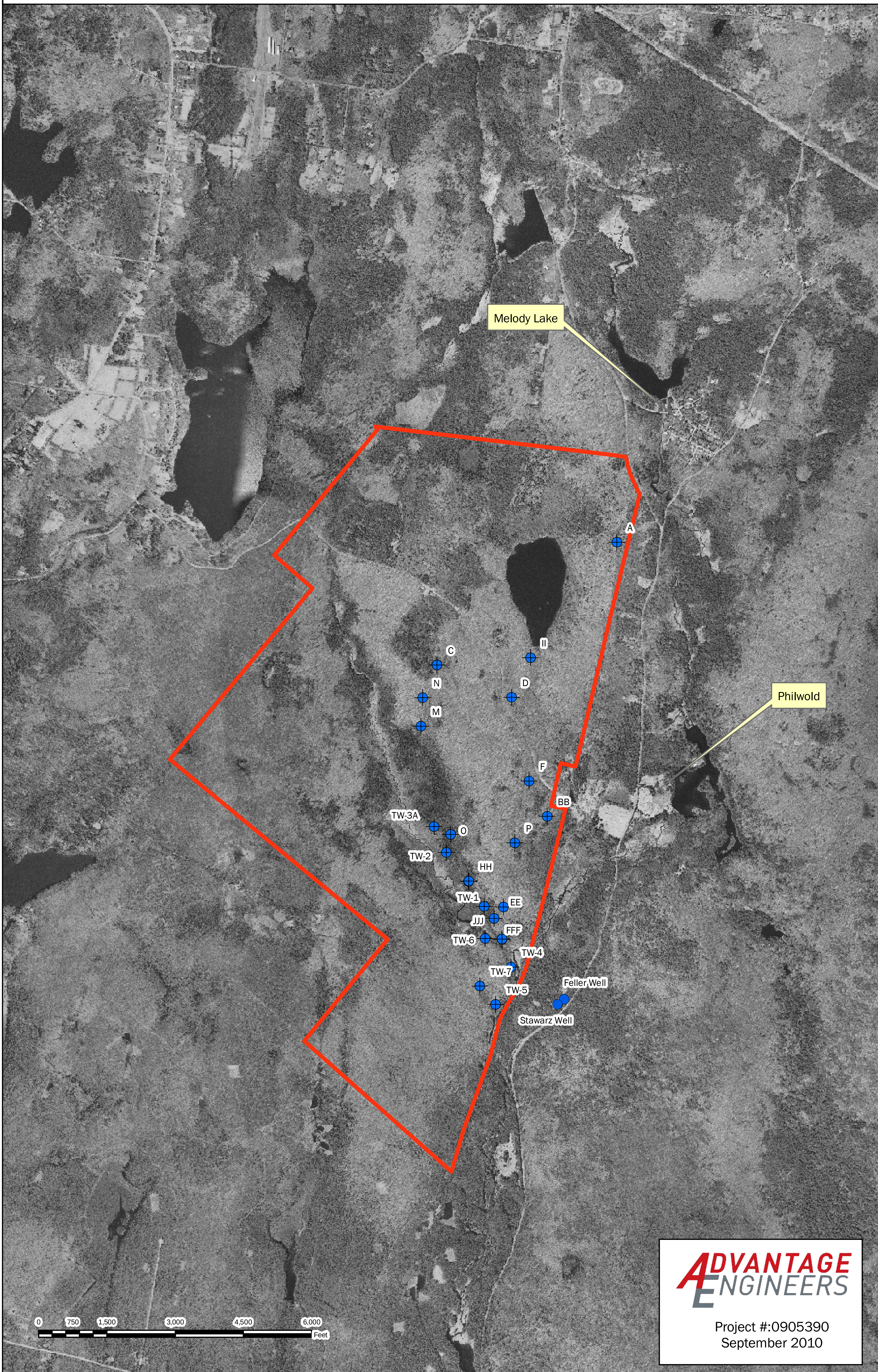

Figure 1- 3 - Geologic Map

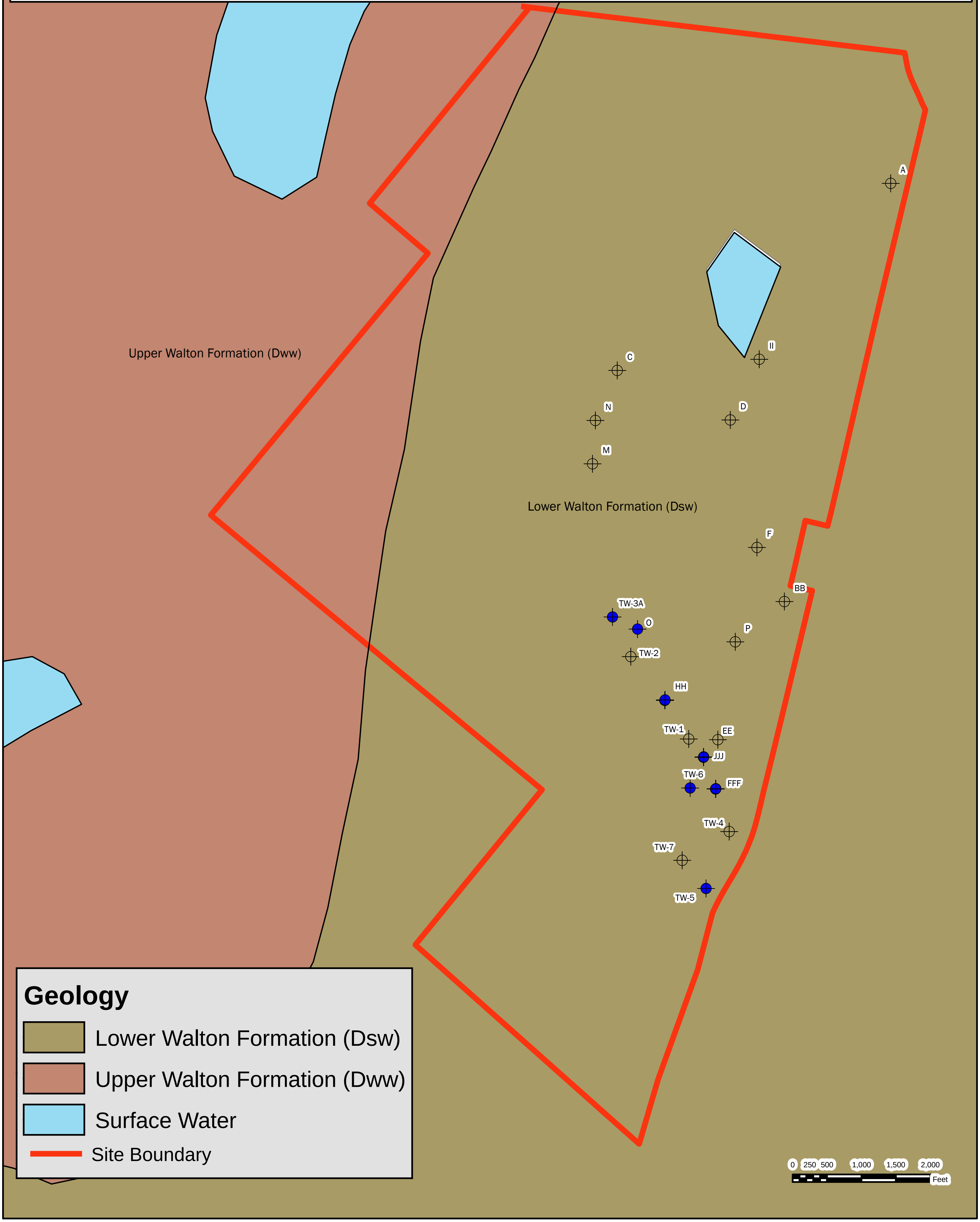

Figure 1-4a - Hydrogeologic Map

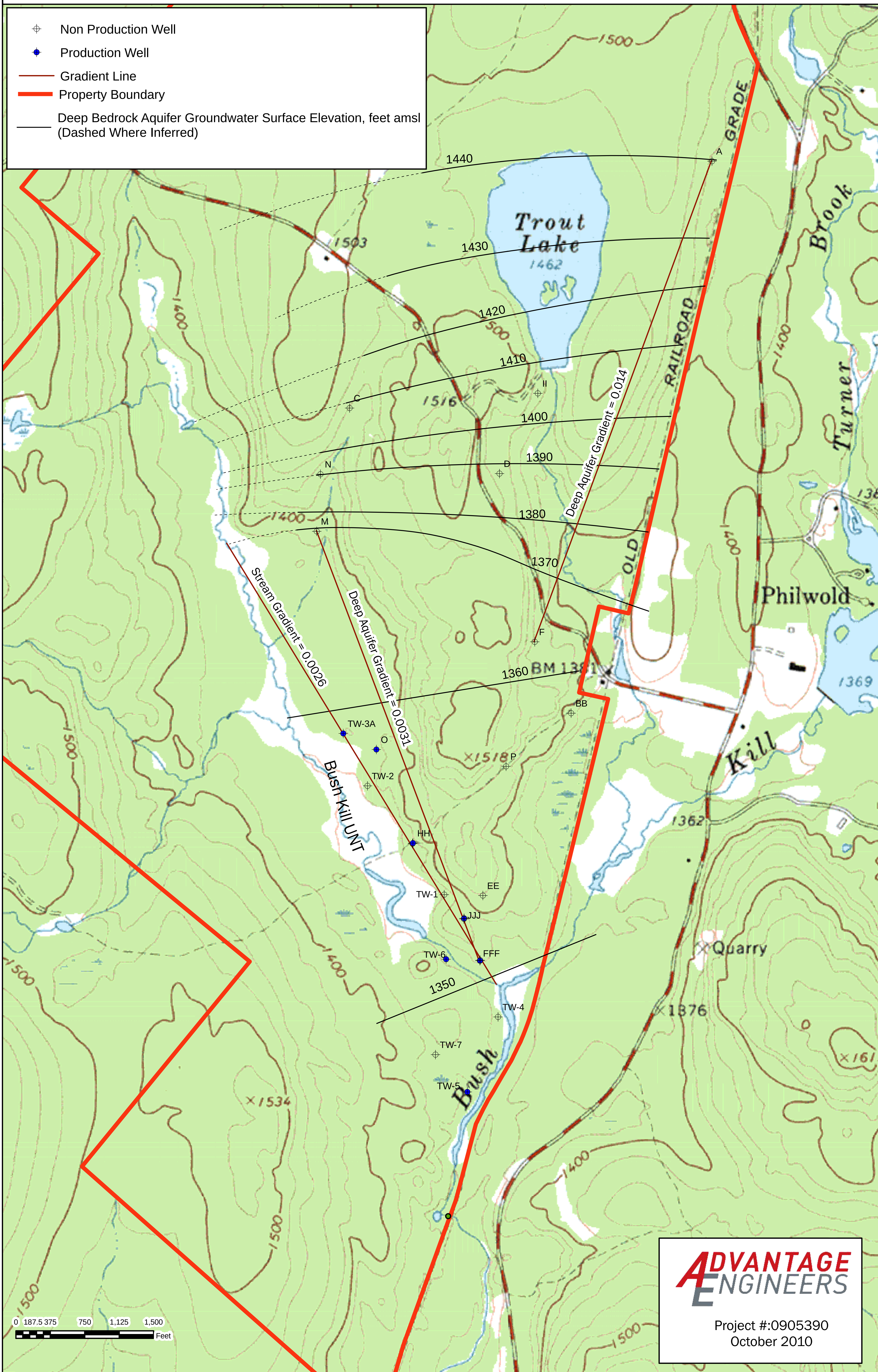

Figure 1-4b - Hydrogeologic Map with Recharge Area

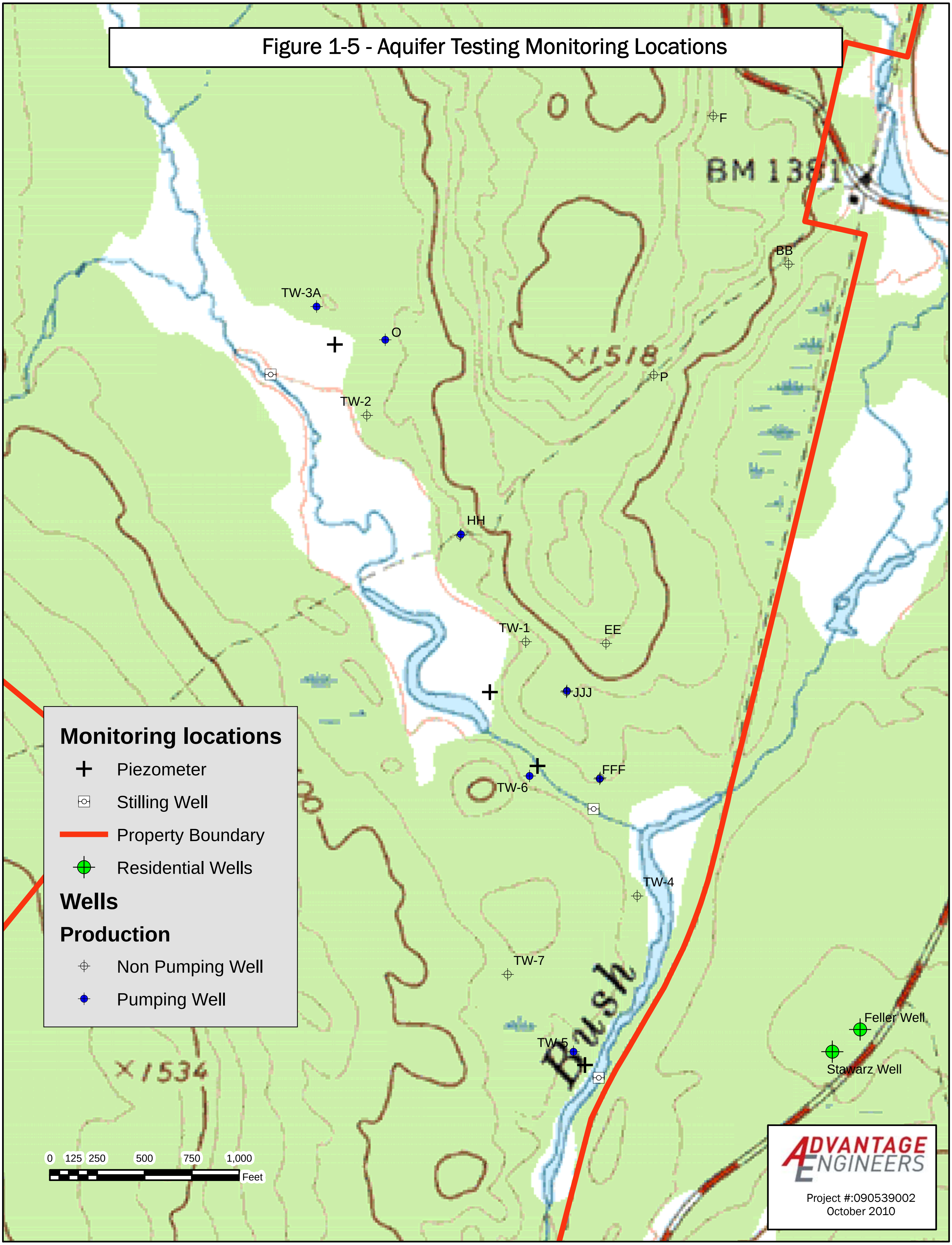

Figure 1-5 - Aquifer Testing Monitoring Locations
F
BM 1381
BB
TW-3A
O
X1518
P
TW-2
HH
TW-1
EE
JJJ
FFF
TW-6
TW-4
TW-7
Bush
TW-5
Feller Well
Stawarz Well
X1534
Monitoring locations
Piezometer
Stilling Well
Property Boundary
Residential Wells
Wells
Production
Non Pumping Well
Pumping Well
0 125 250 500 750 1,000
Feet
ADVANTAGE ENGINEERS
Project #:090539002
October 2010

Figure 2-1

Observation Well EE Hydrograph
Well FFF and JJJ 72-Hour Test
August 6 thru 9, 2010

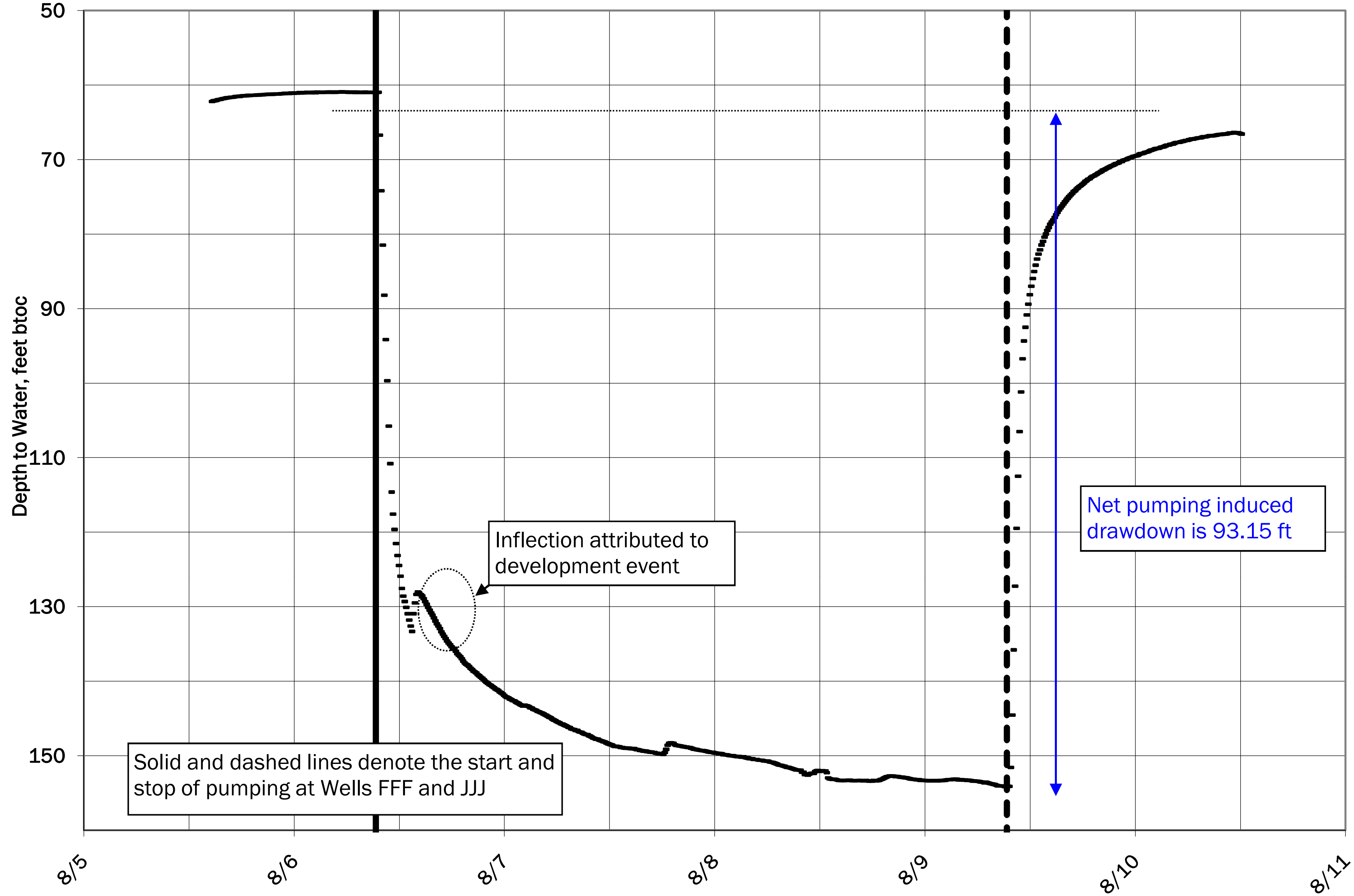

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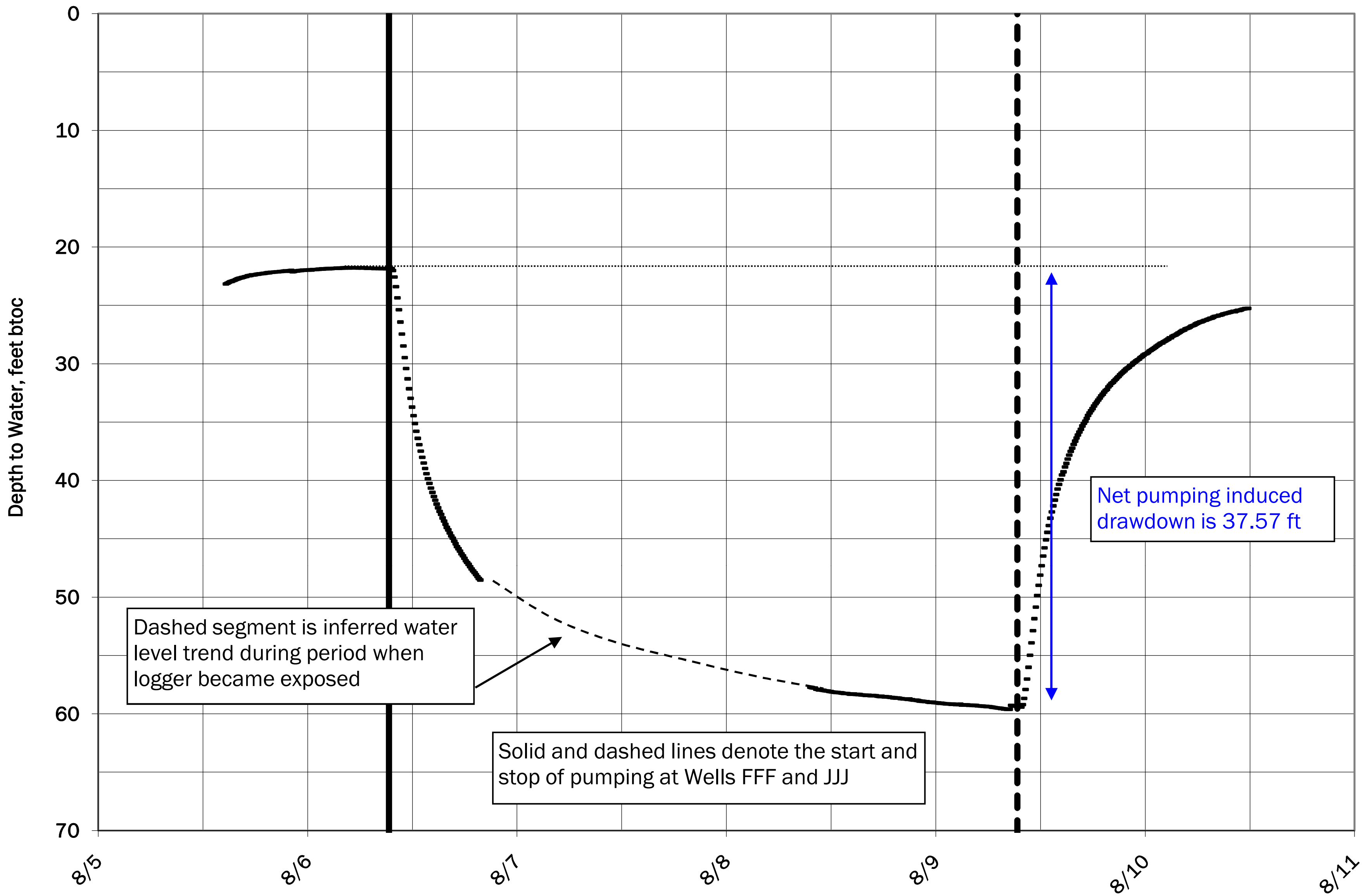
Figure 2-2

Observation Well HH Hydrograph
Well FFF and JJJ 72-Hour Test
August 6 thru 9, 2010



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Advantage Engineers Project 090539

Figure 2-3

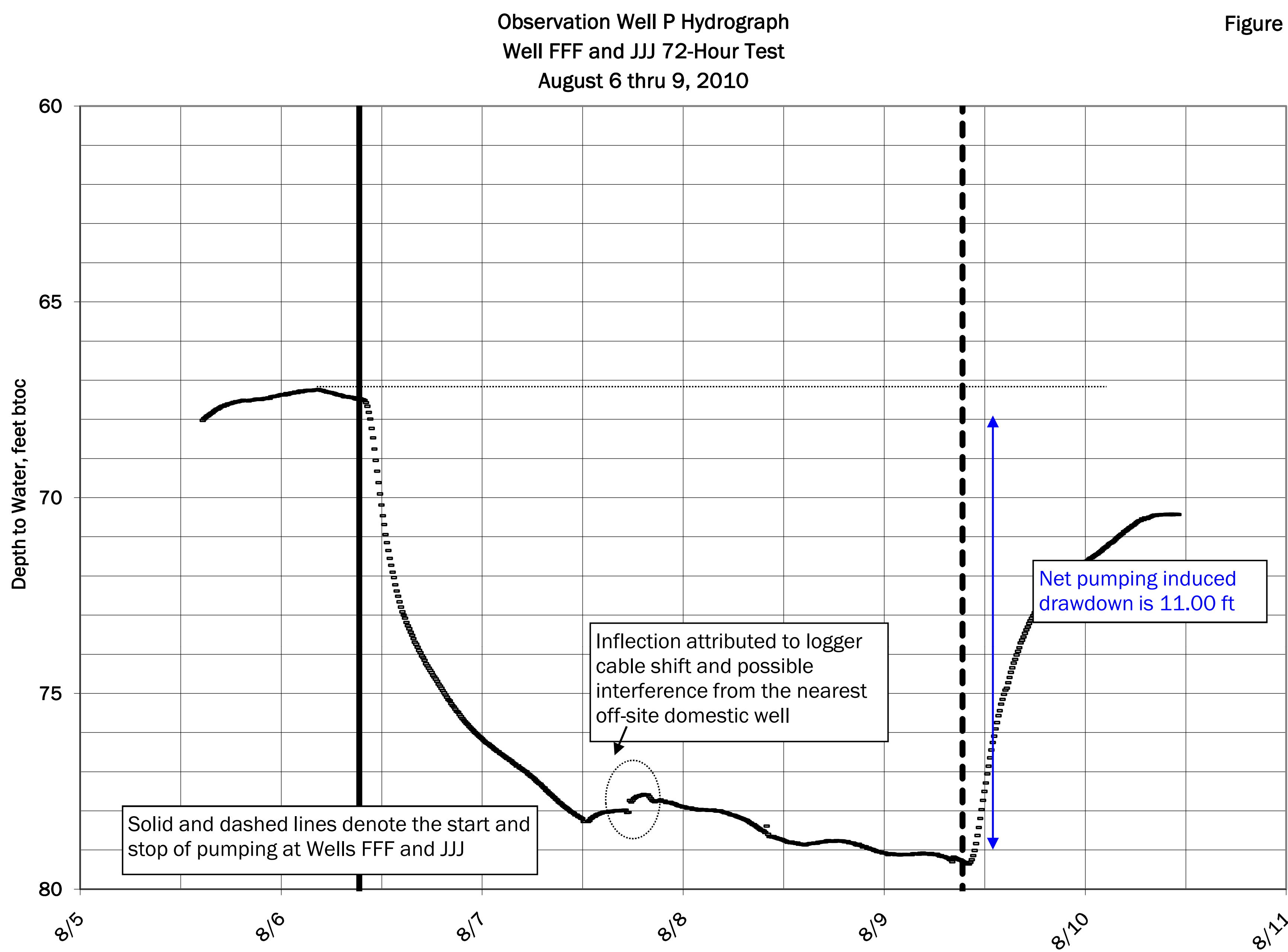

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Figure 2-4

Observation Well OO Hydrograph
Well FFF and JJJ 72-Hour Test
August 6 thru 9, 2010

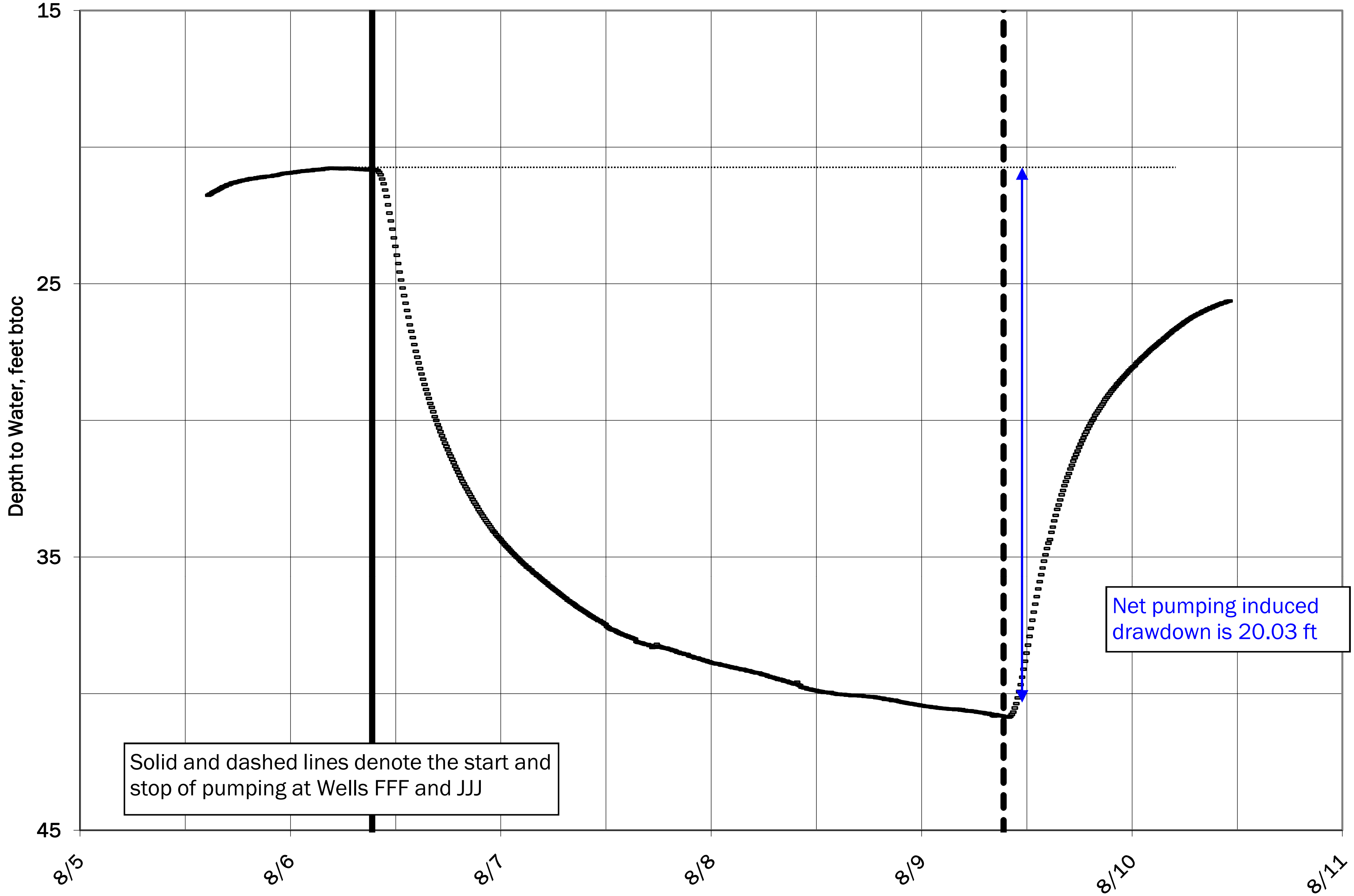

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Figure 2-5

Observation Well BB Hydrograph
Well FFF and JJJ 72-Hour Test
August 6 thru 9, 2010

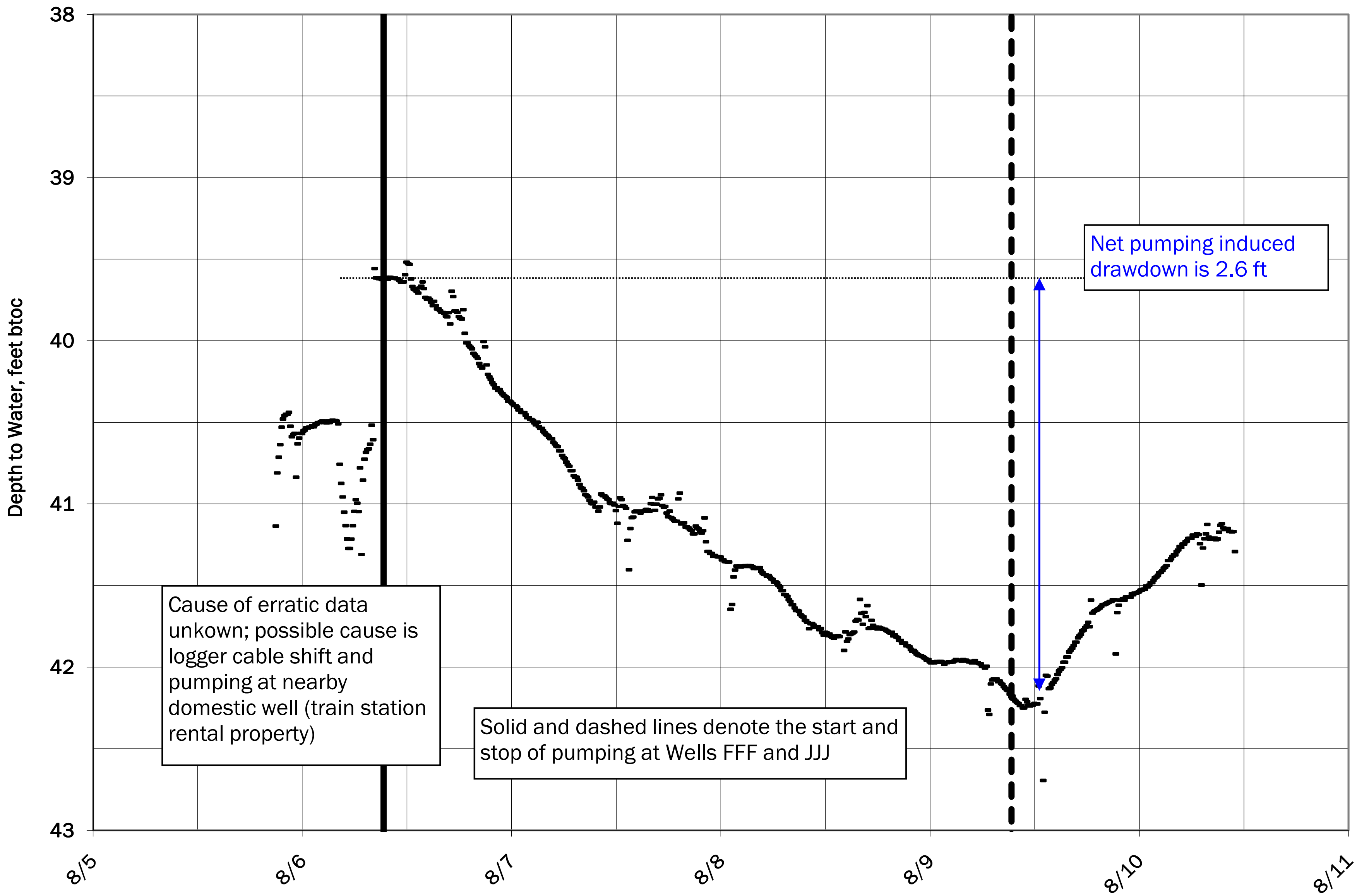

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Figure 2-6

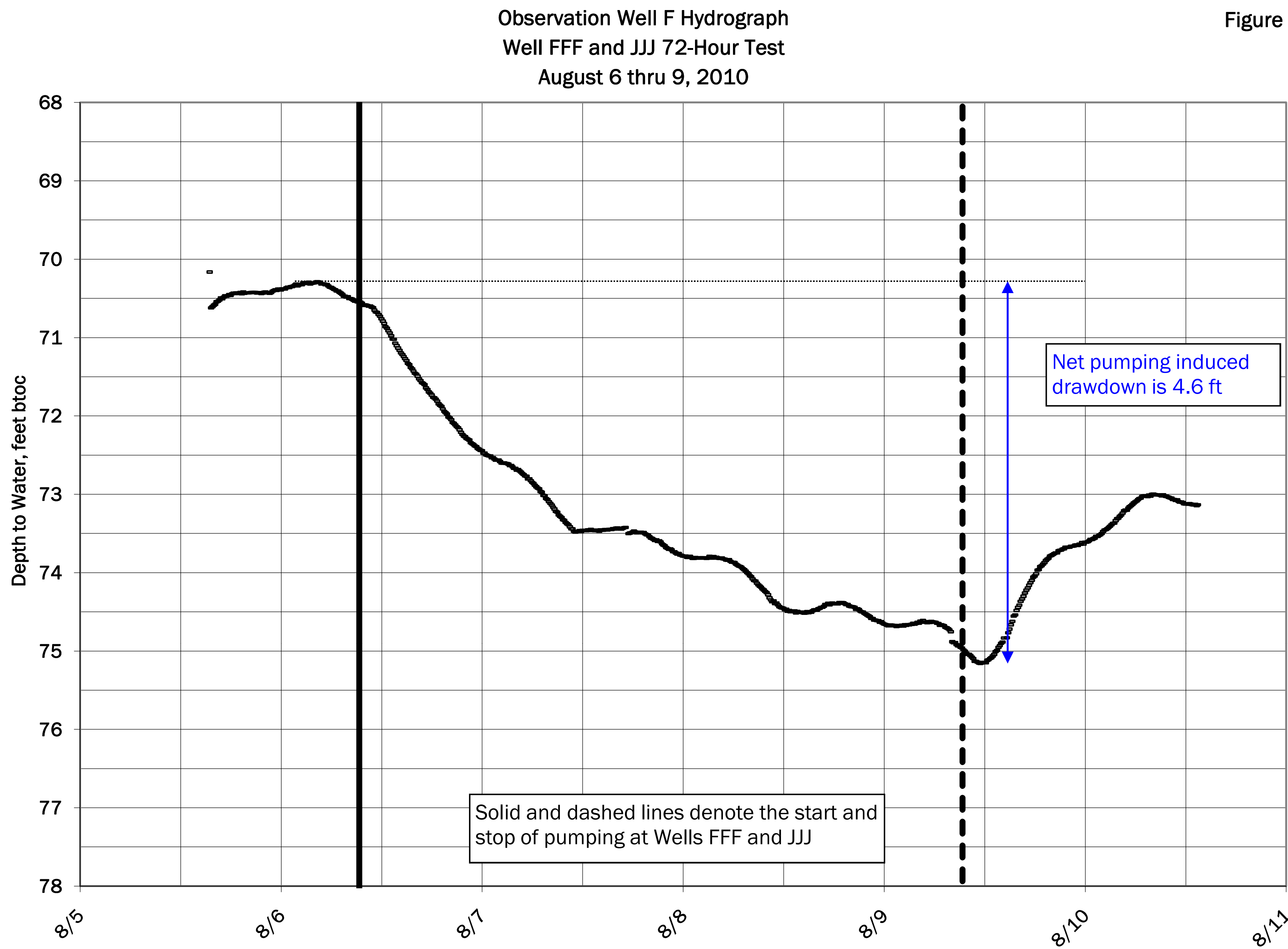

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Figure 2-7

Observation Well M Hydrograph
Well FFF and JJJ 72-Hour Test
August 6 thru 10, 2010

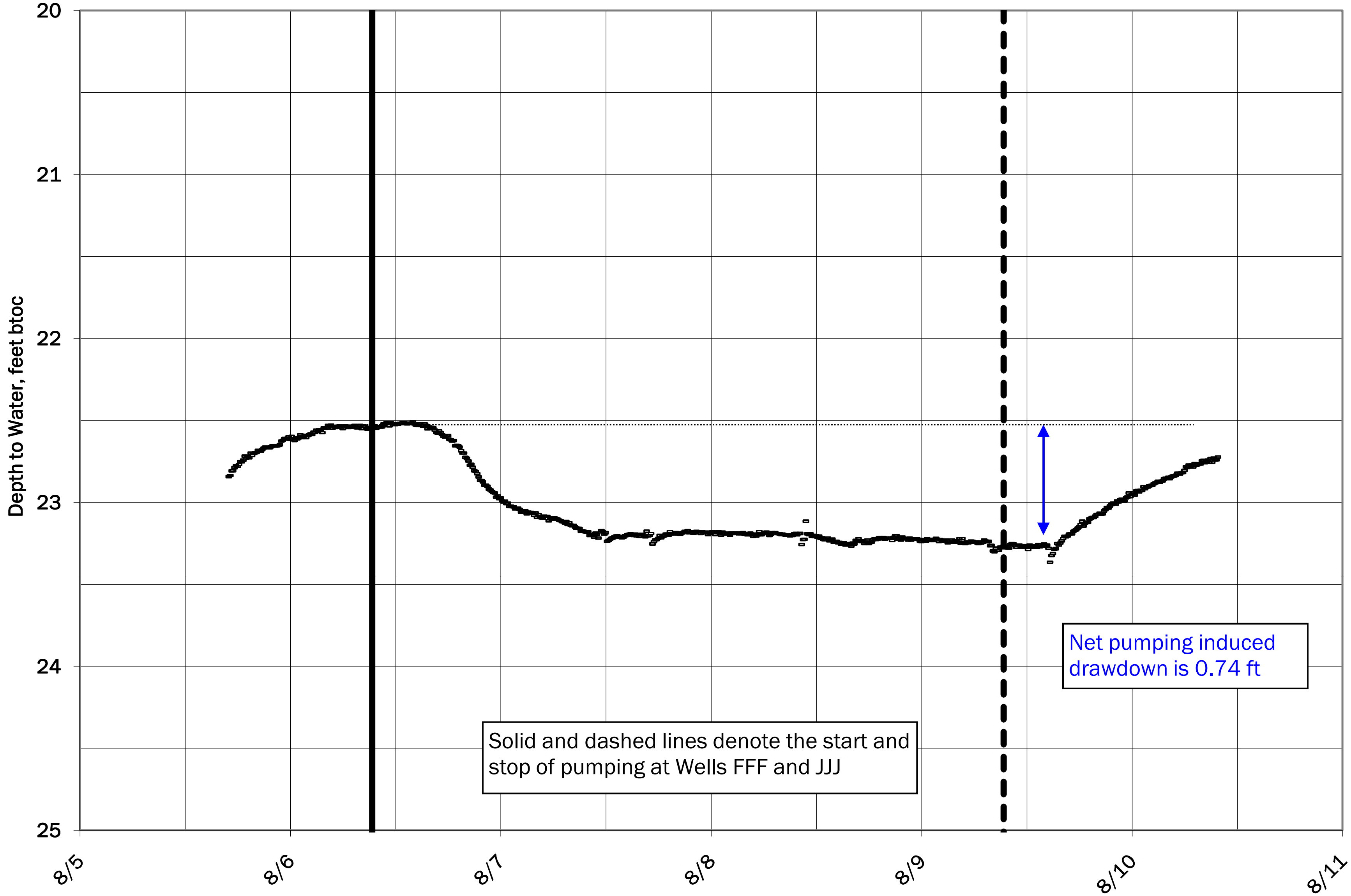

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Figure 2-8

Wetland Piezometer Hydrograph
August 6 thru 12, 2010

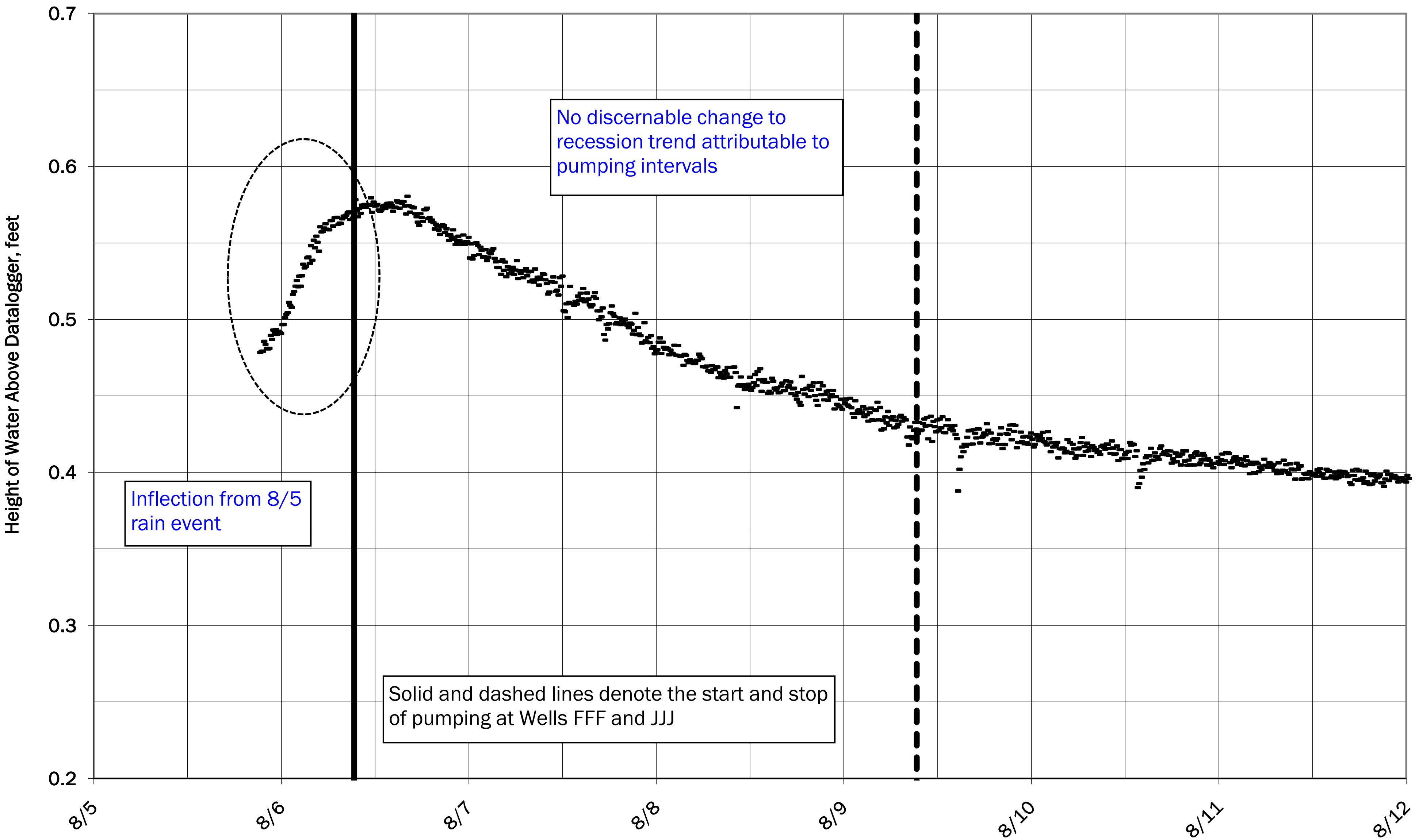

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Figure 2-9

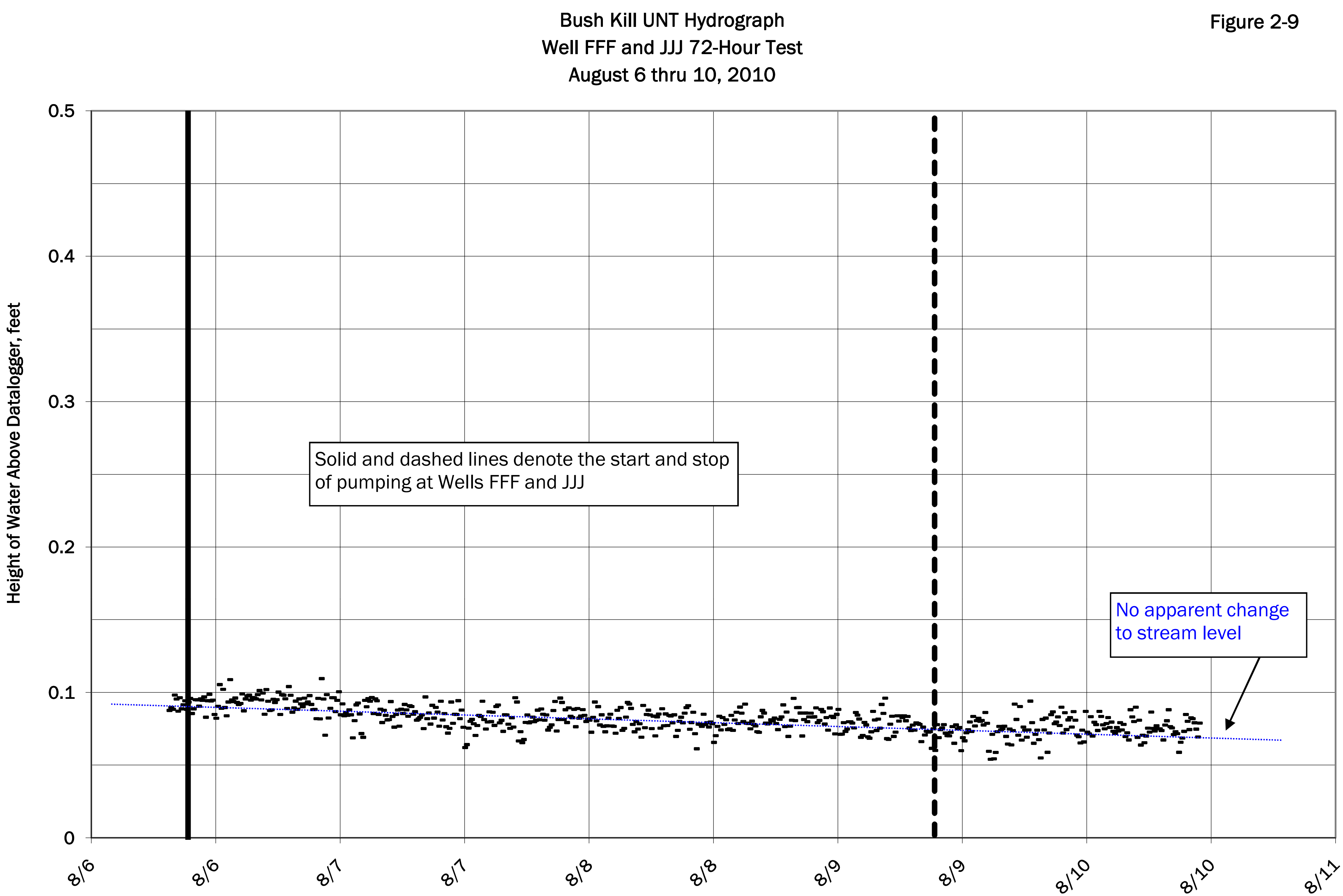

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Figure 2-10

Well FFF and JJJ Hydrograph
August 5 to 6, 2010

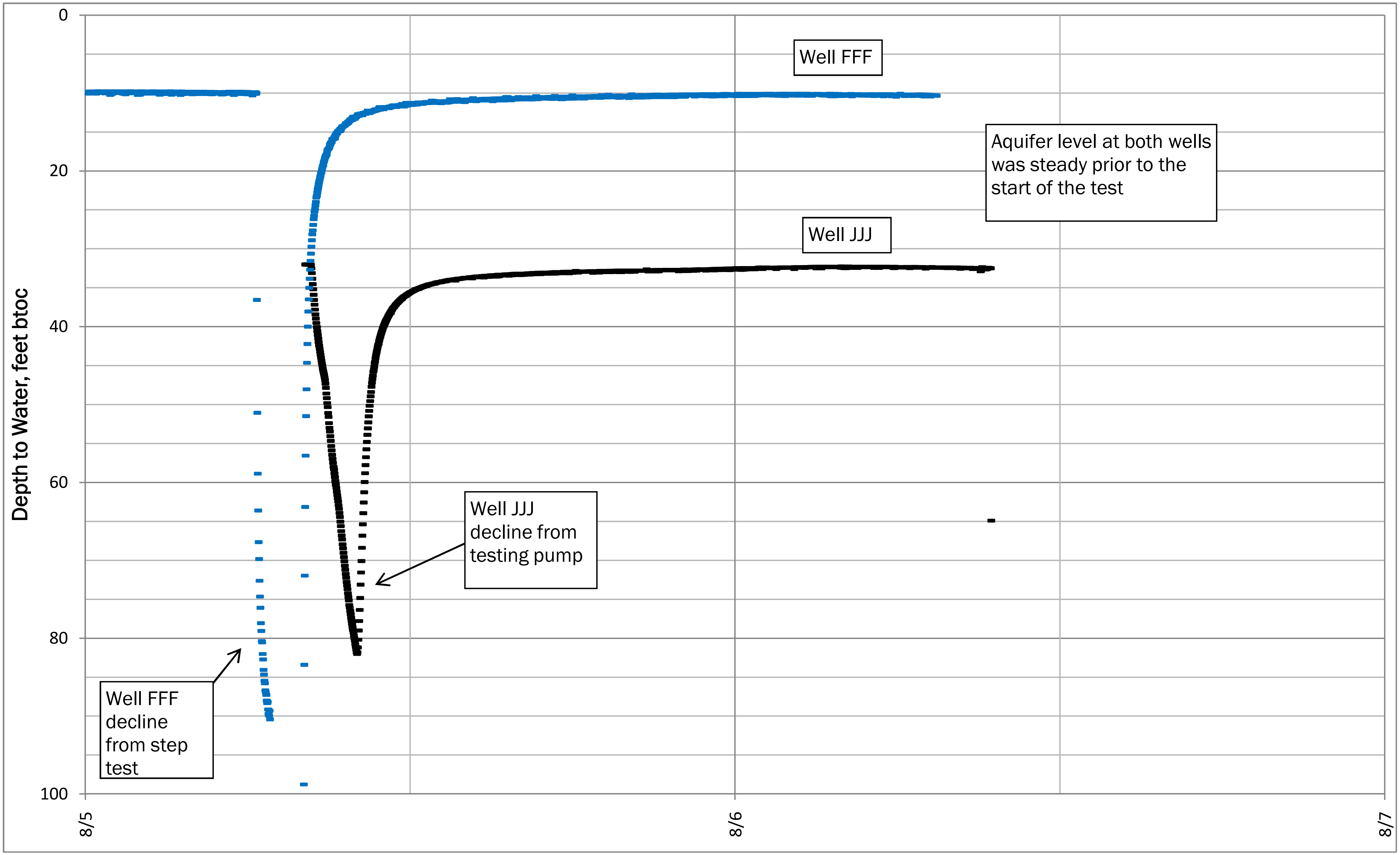

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Figure 2-11

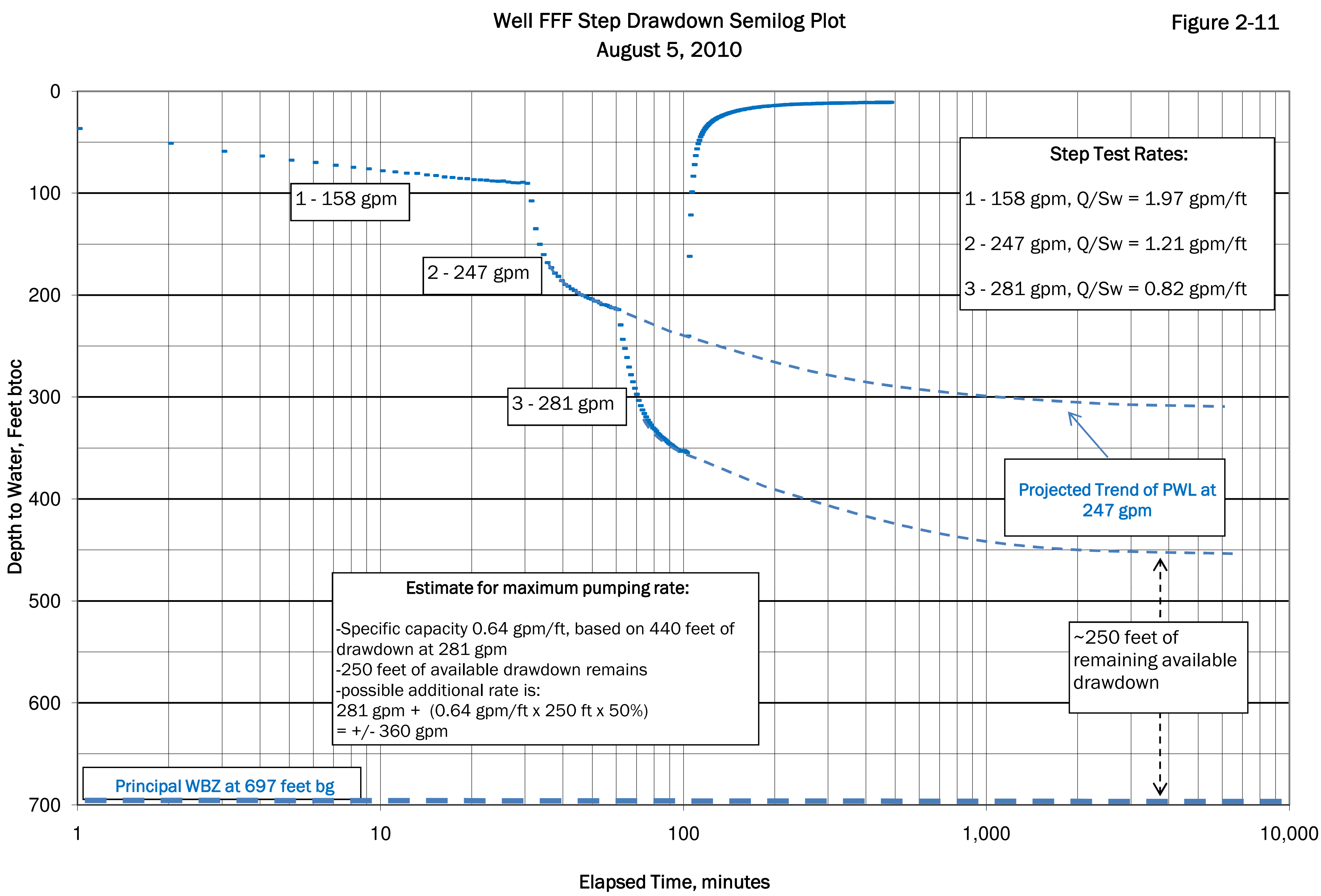

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Figure 2-12

Well FFF Turbulent Flow Analysis

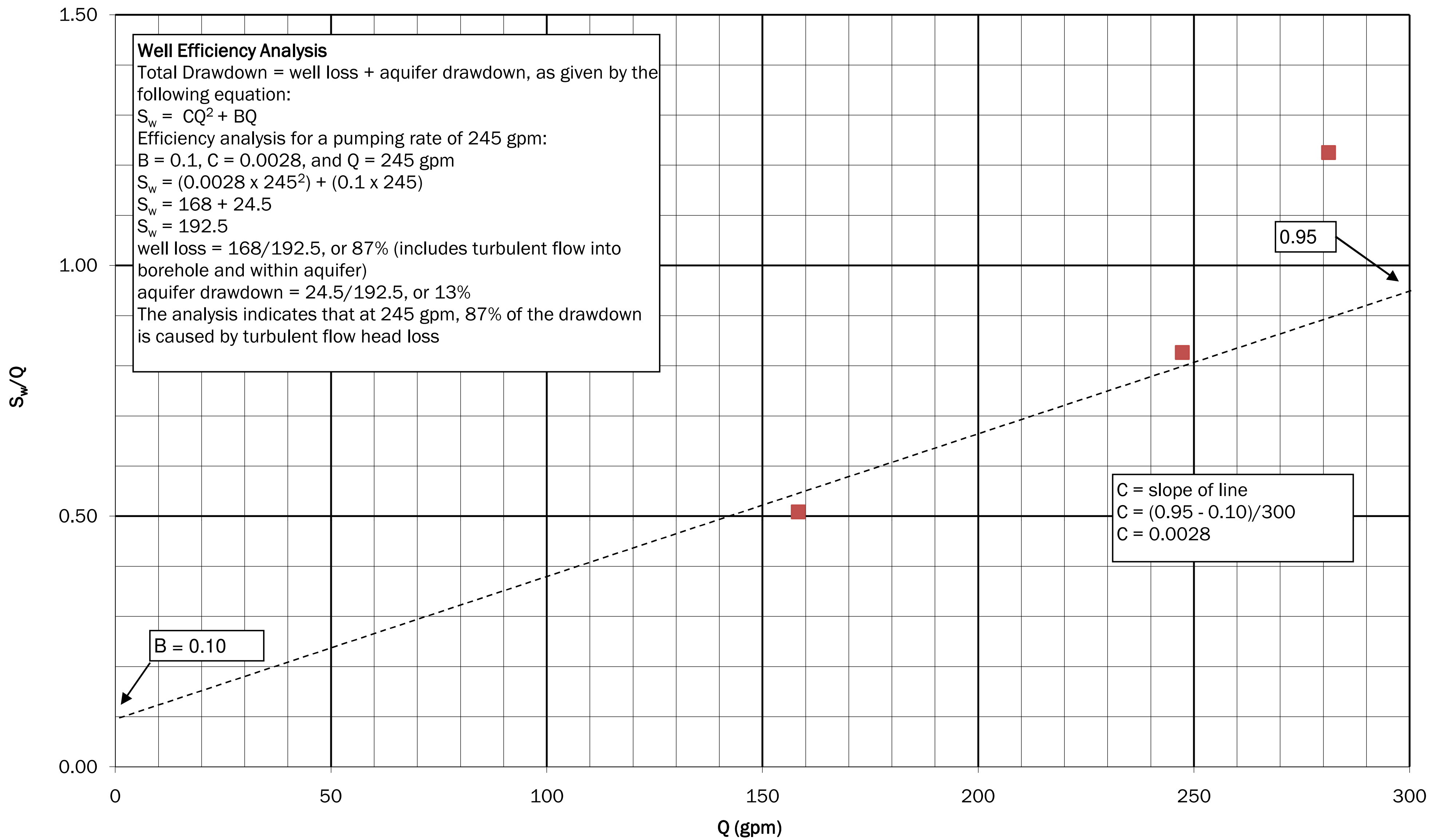

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Figure 2-13

Pumping Well JJJ 72-Hour Test
August 6 - 9, 2010

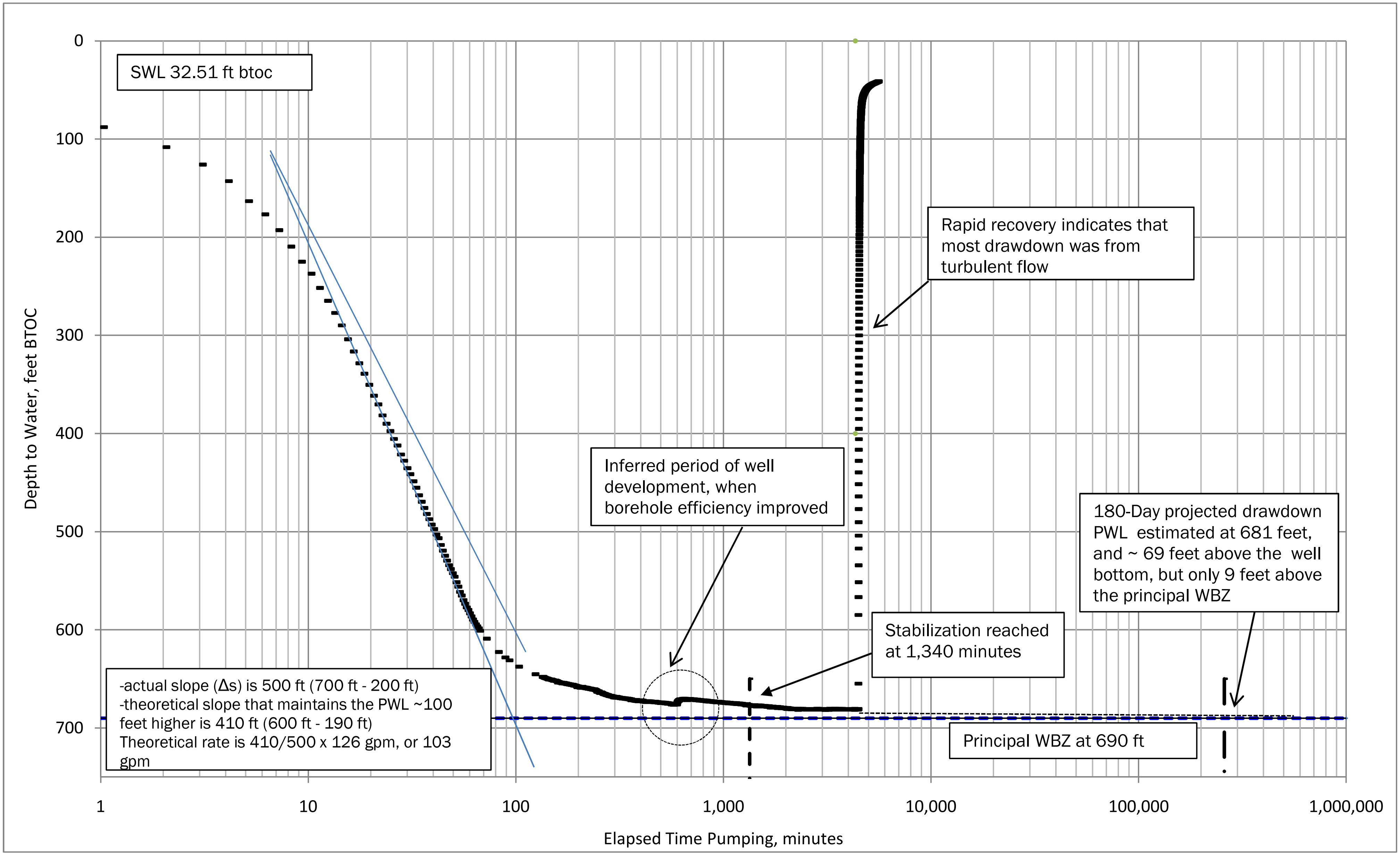

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Figure 2-14

Well JJJ Residual Drawdown Plot
August 9 - 13, 2010

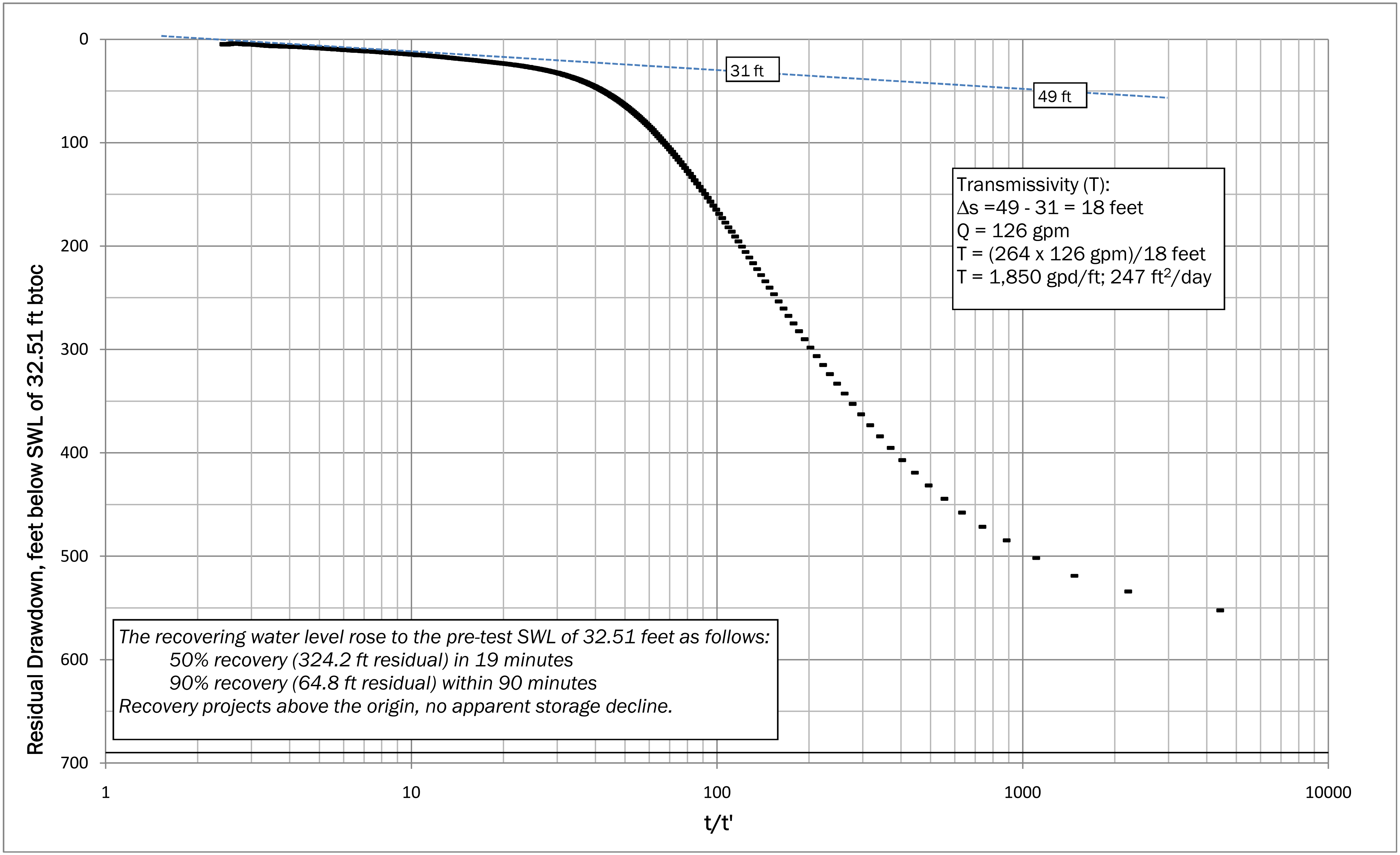

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Figure 2-15

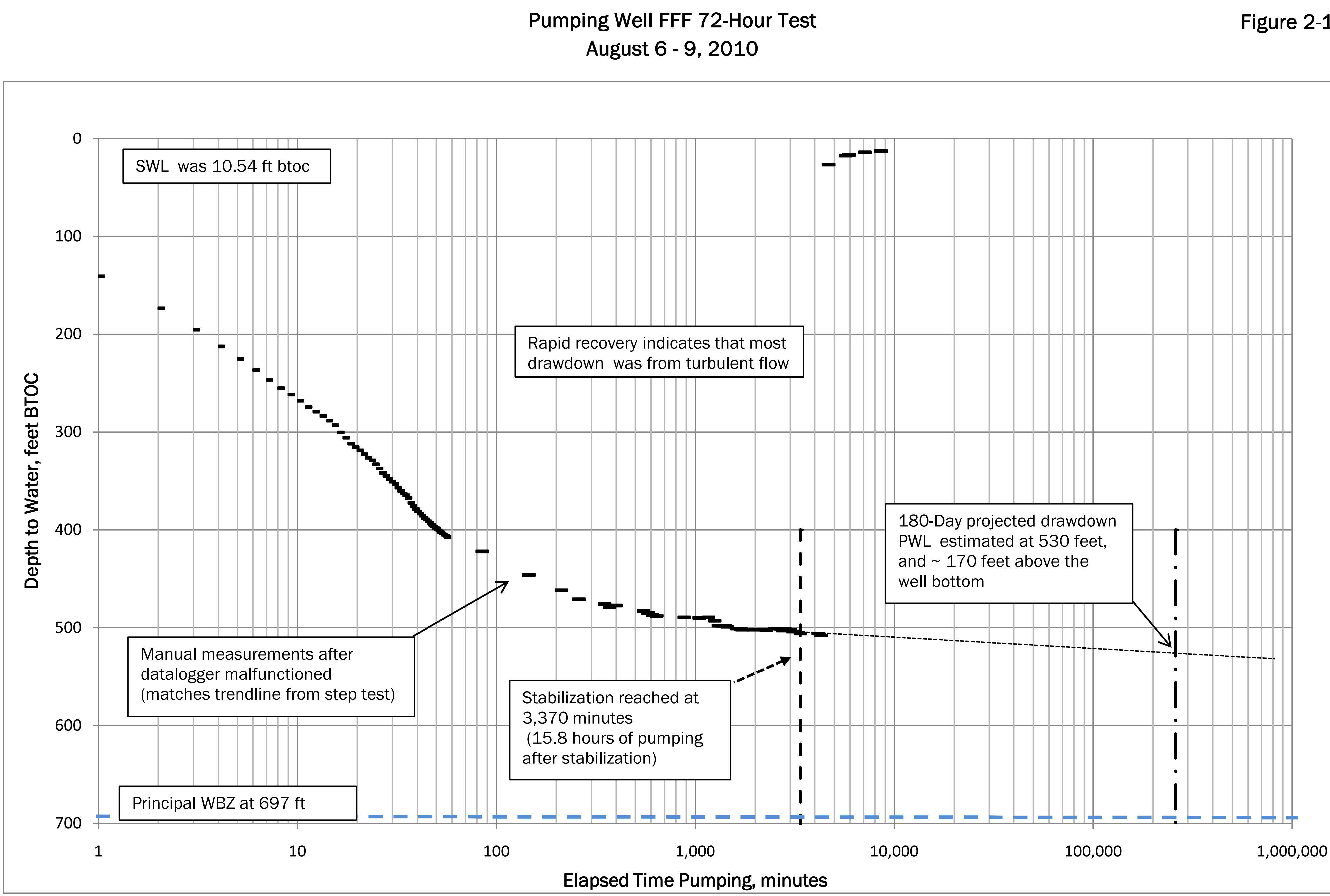

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Figure 2-16

Well FFF Residual Drawdown Plot
August 9 - 13, 2010

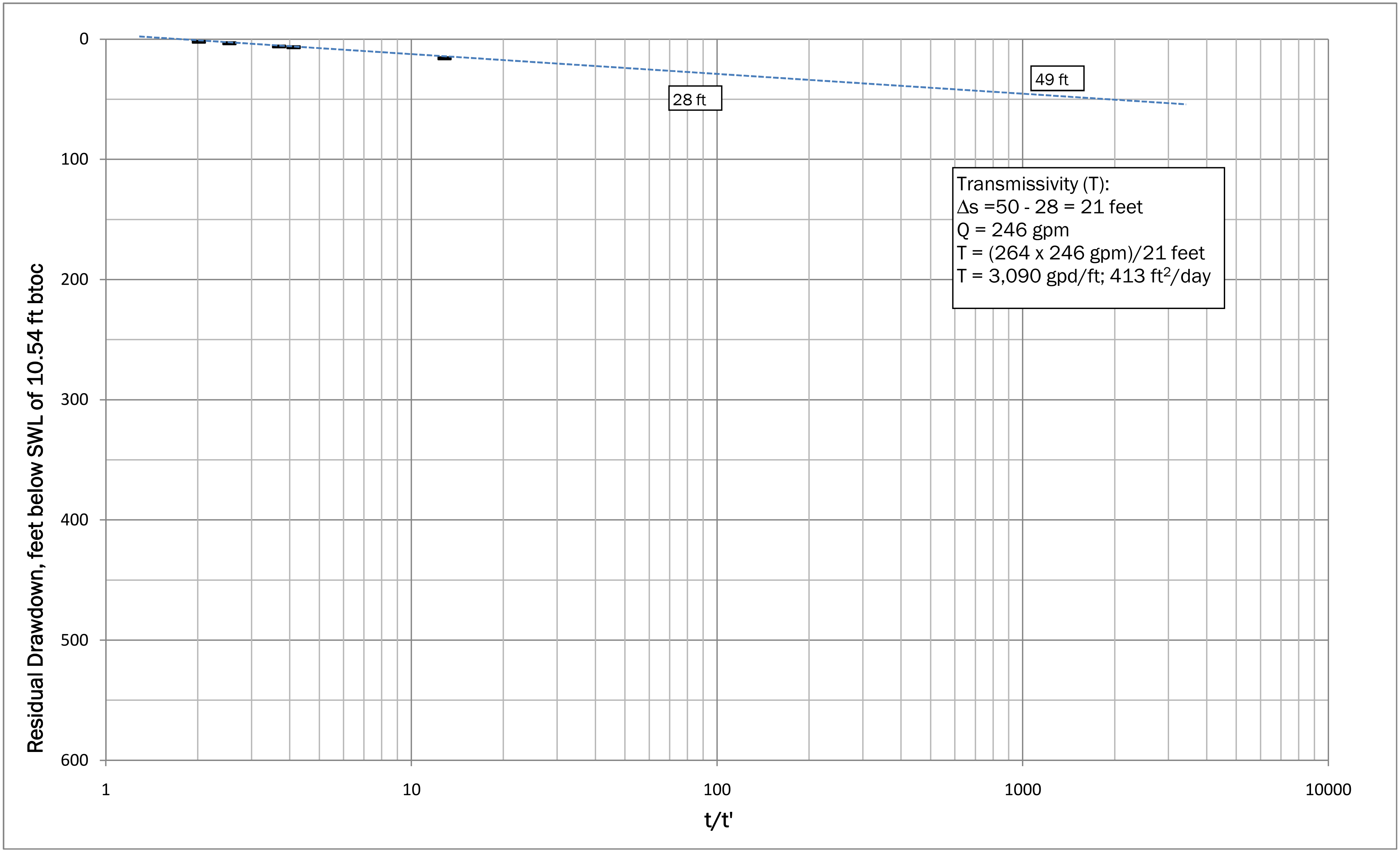

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Figure 3-1

Well TW-3a Hydrograph
September 28 to October 5, 2010

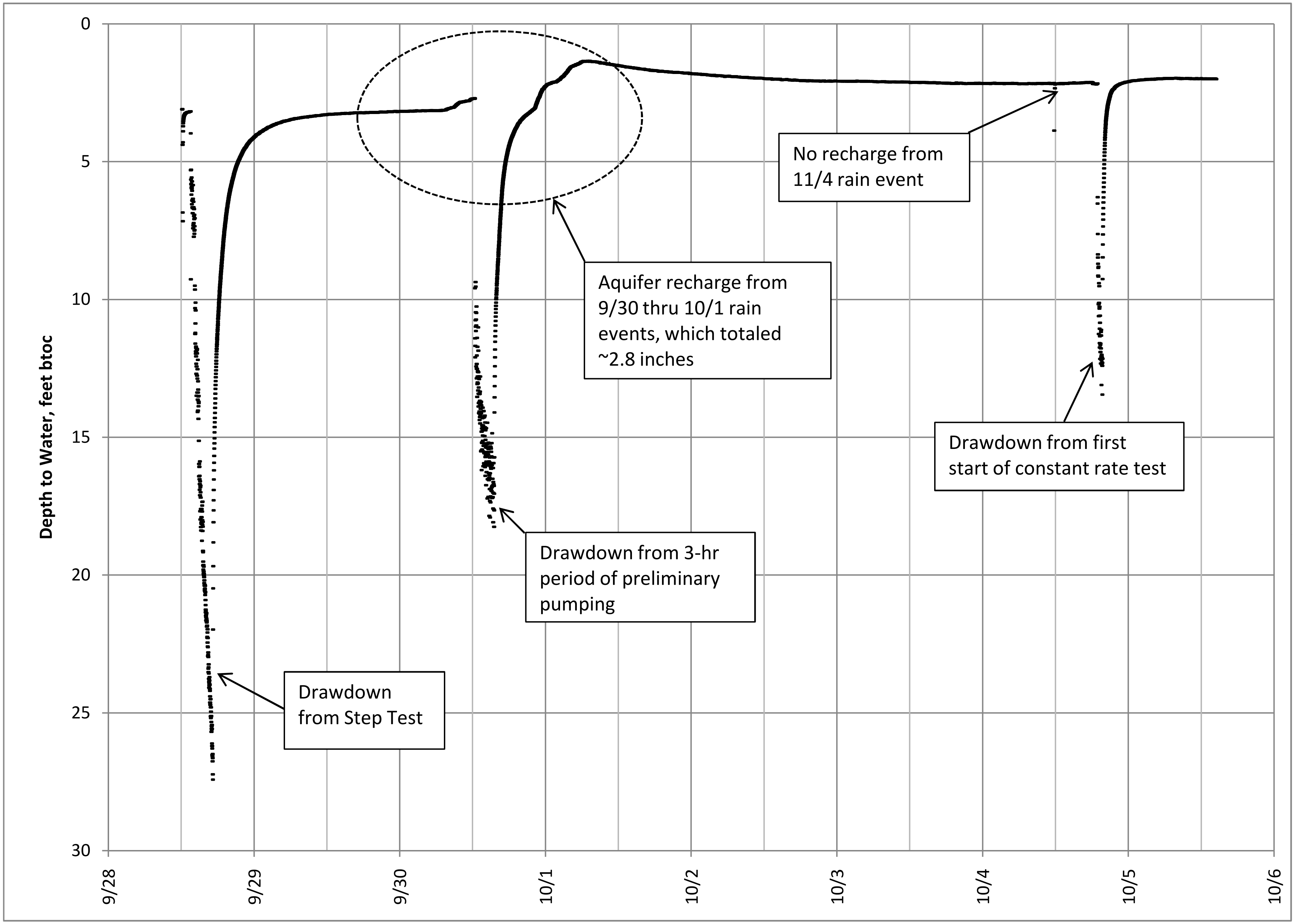

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Figure 3-2

Observation Well O Hydrograph
September 24 through October 18, 2010

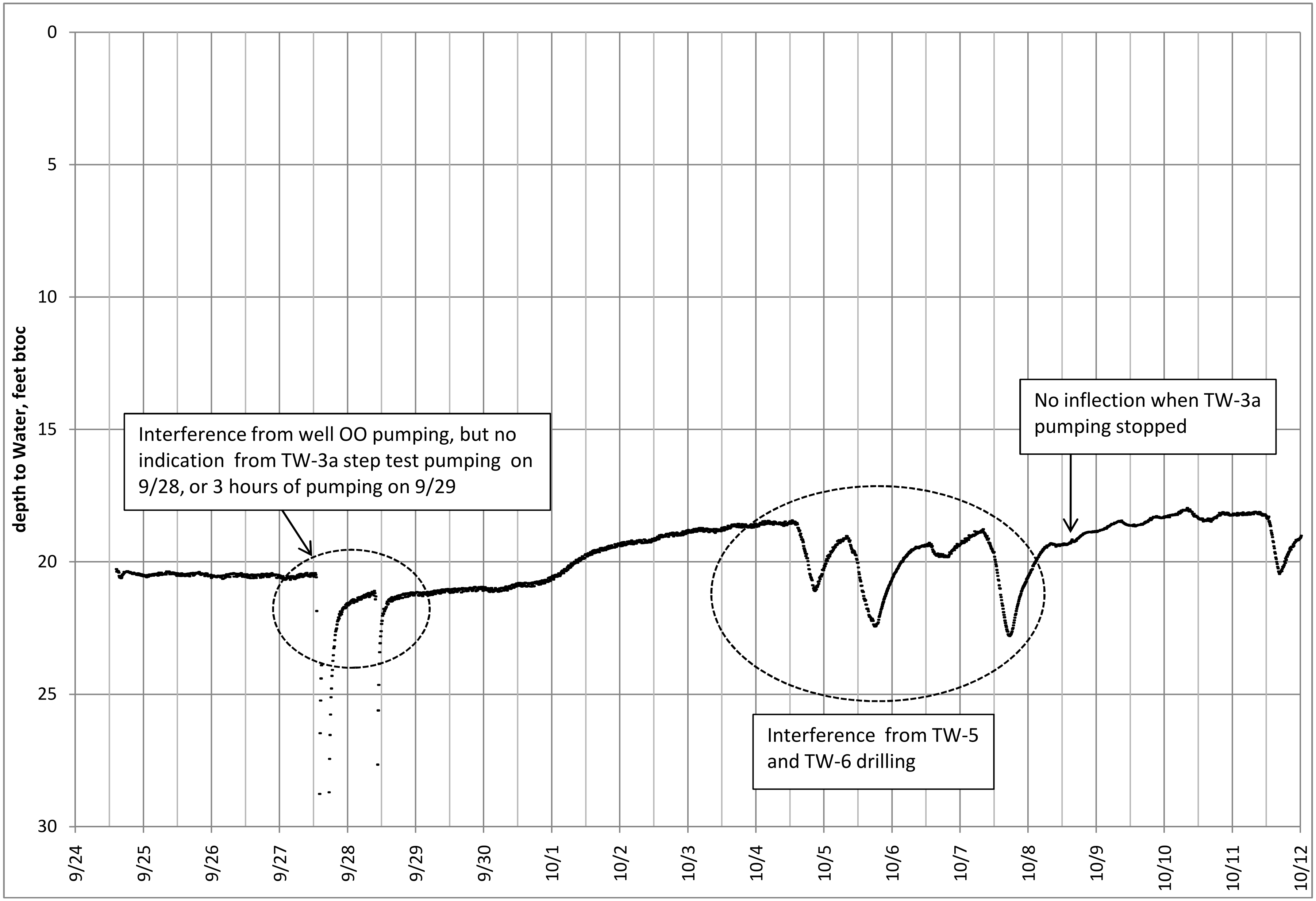

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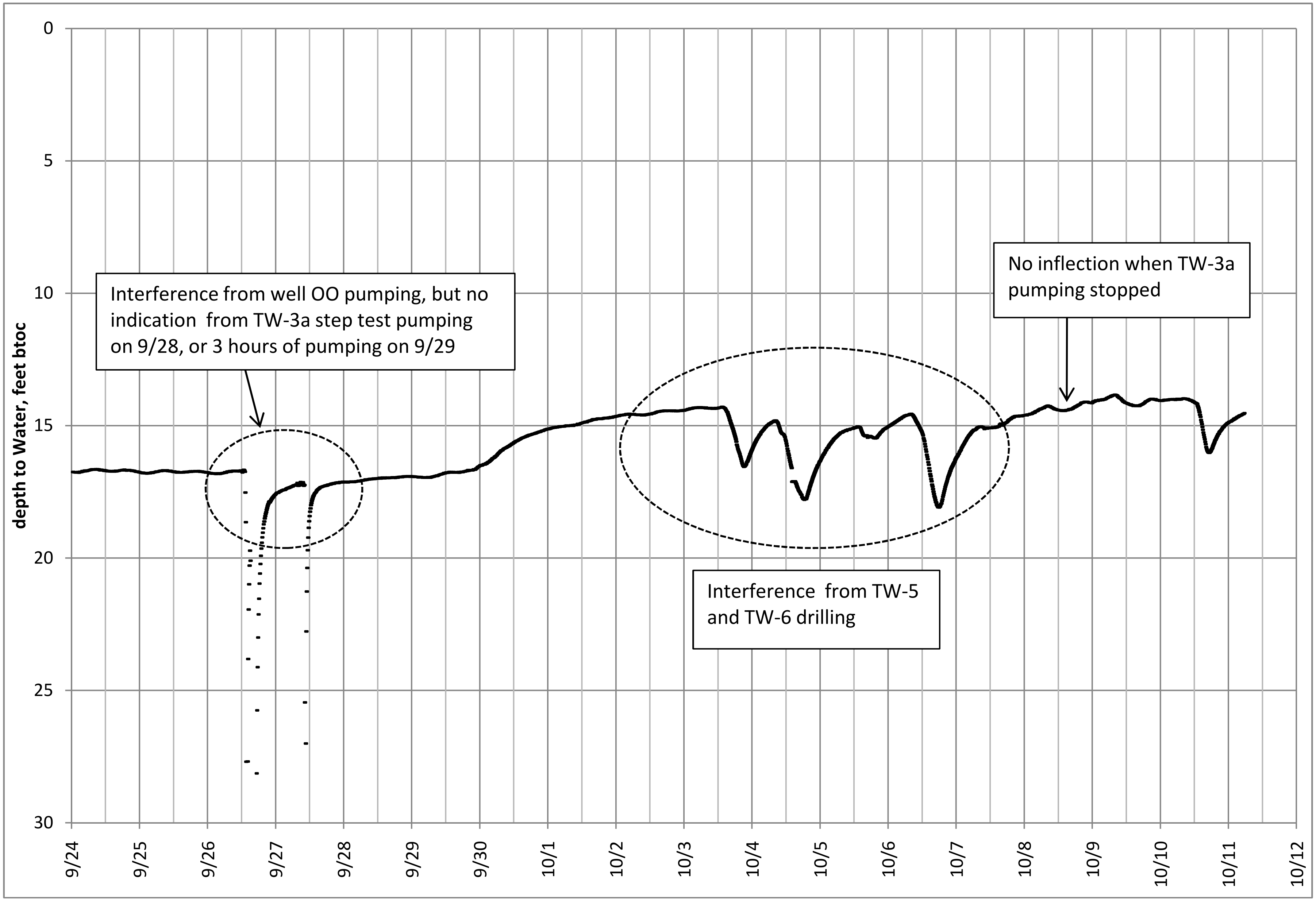
Figure 3-3

Observation Well TW-2 Hydrograph
September 24 through October 18, 2010



Stilling Well and Wetland Piezometer PZ-2 for TW-3a Test
October 4 - 12, 2010

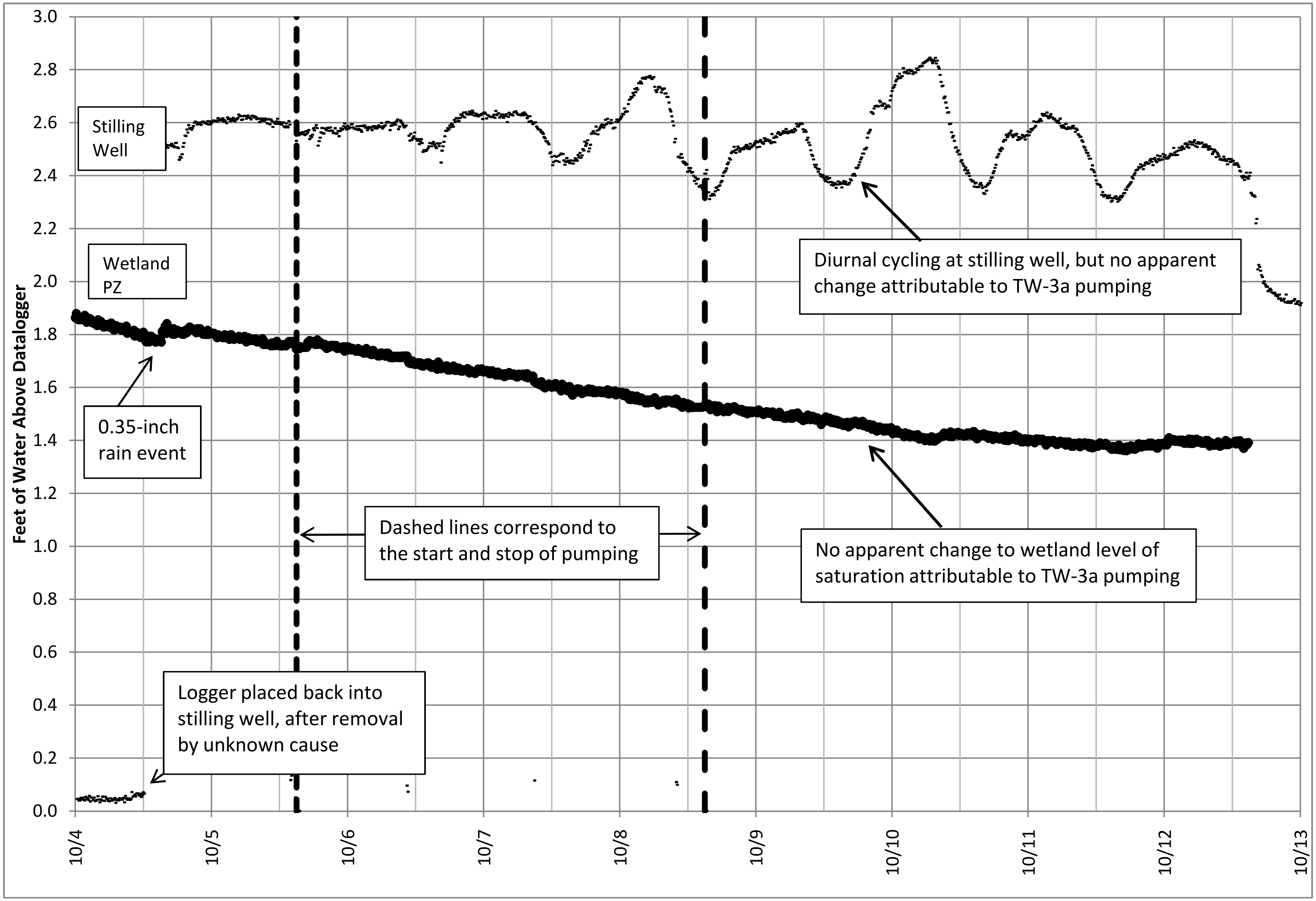


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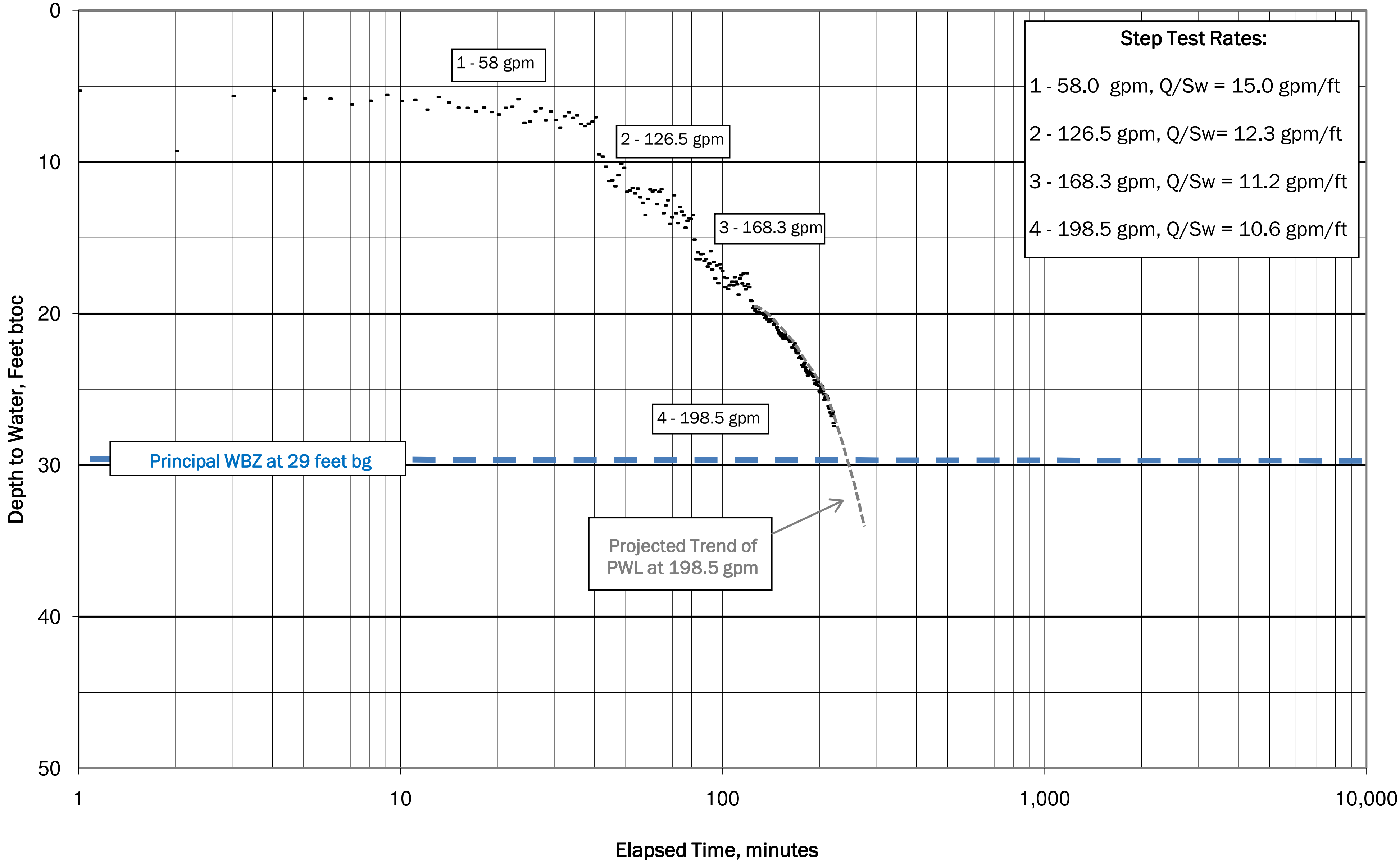
Figure 3-5

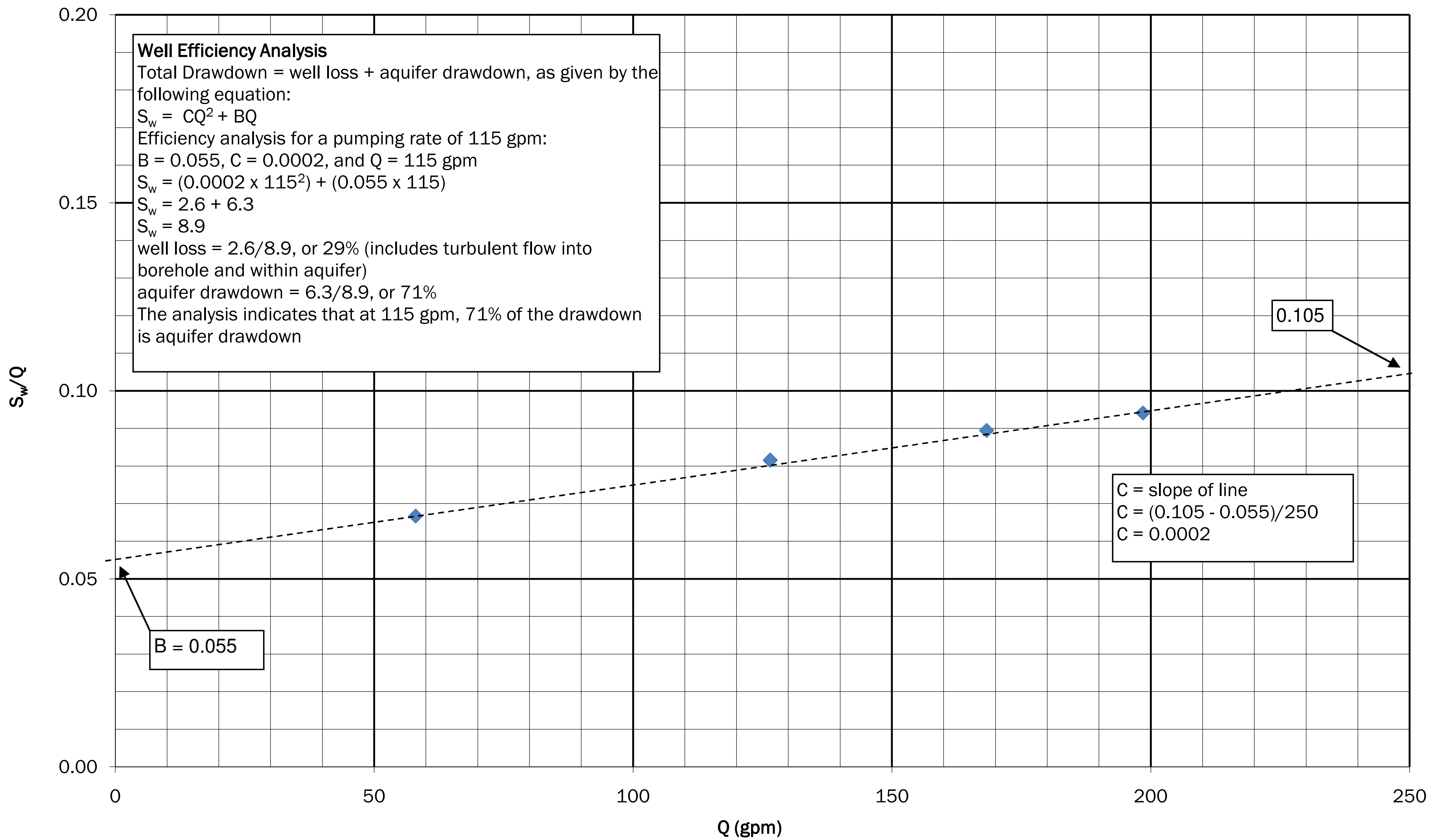
Well TW-3a Step Drawdown Semilog Plot
September 28, 2010



Double Diamond Compamies - Lost Lake Resort
Advantage Engineers Project 090539

Figure 3-6

Well TW-3a Turbulent Flow Analysis



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Advantage Engineers Project 090539

Figure 3-7

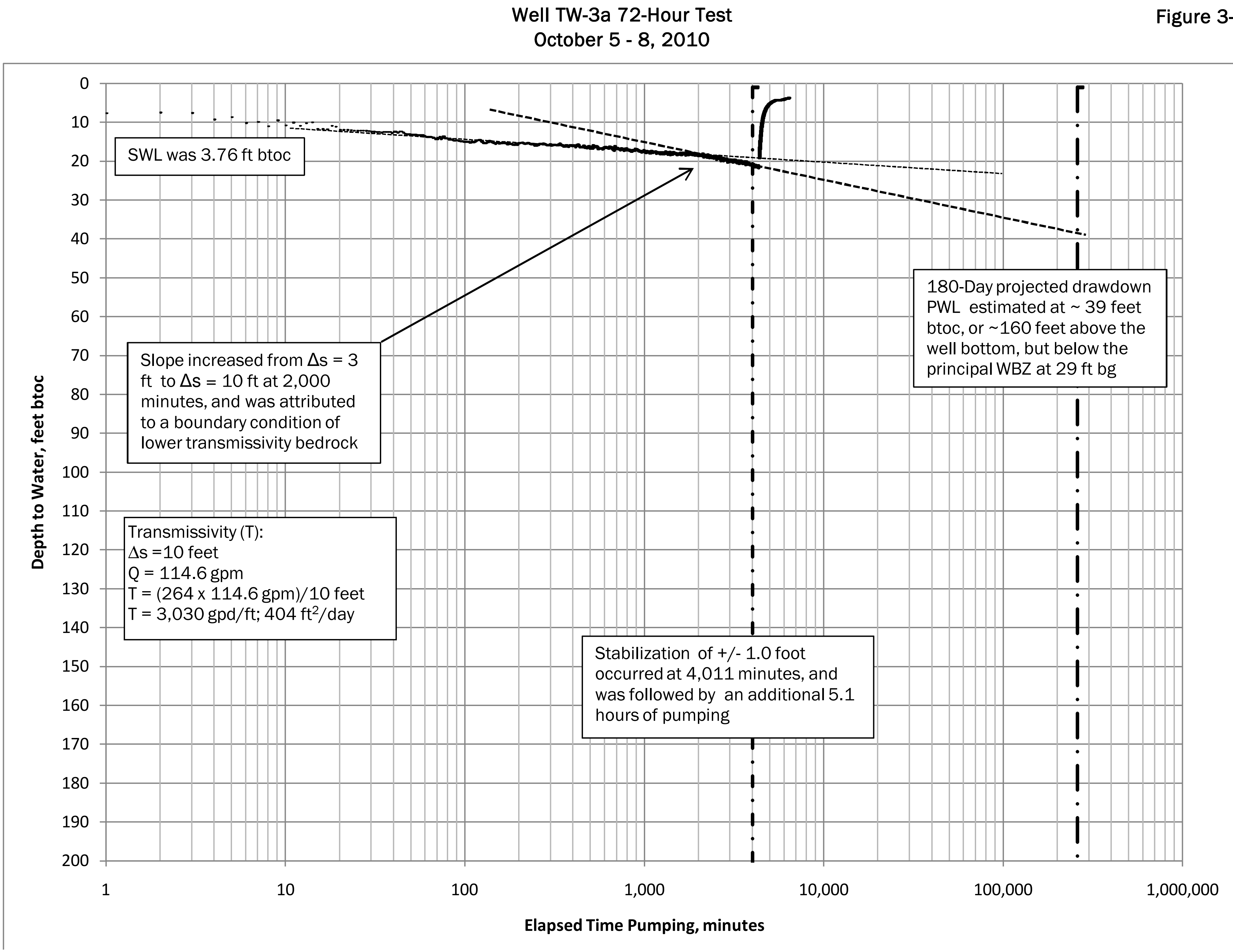

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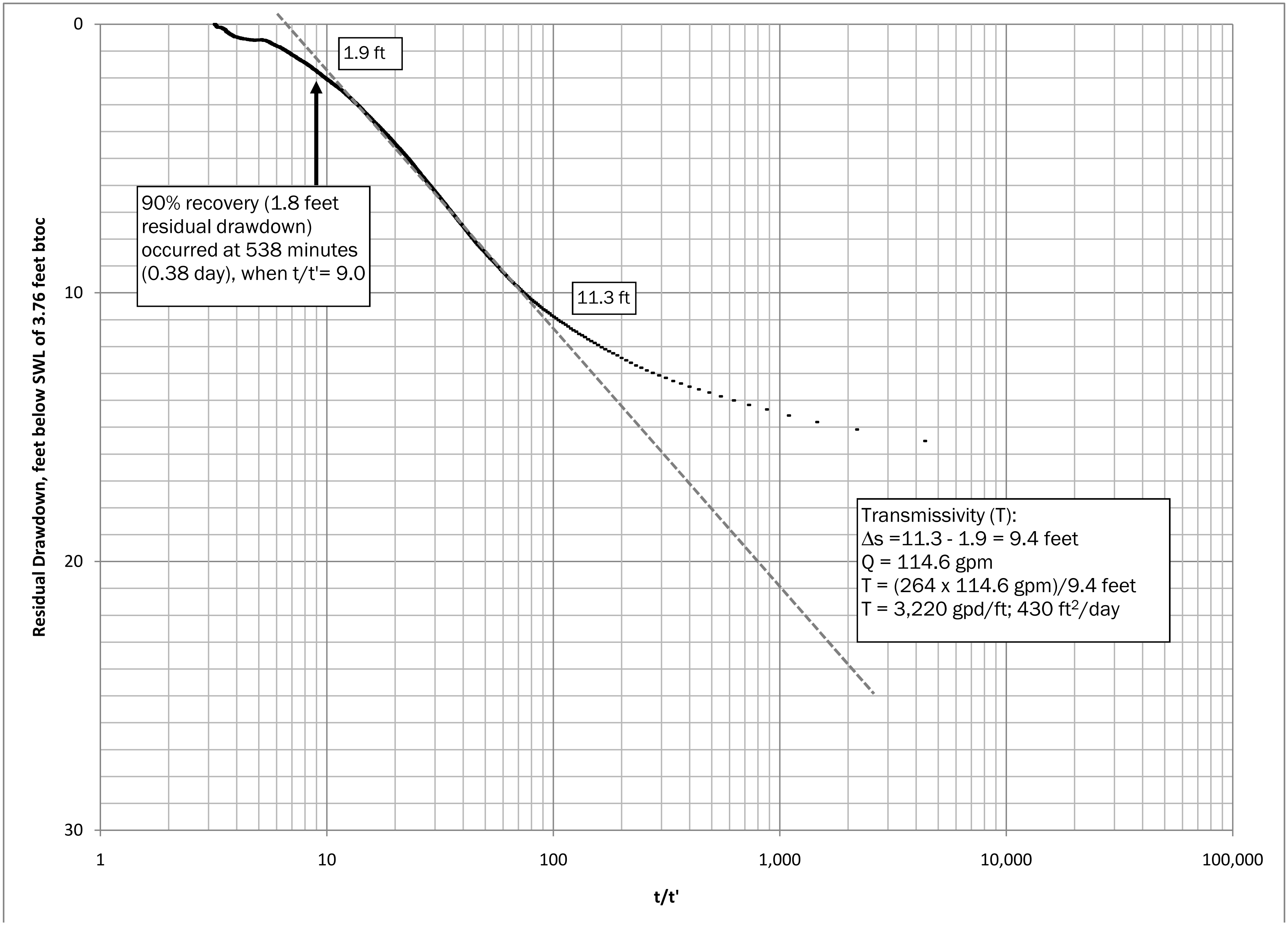
Figure 3-8

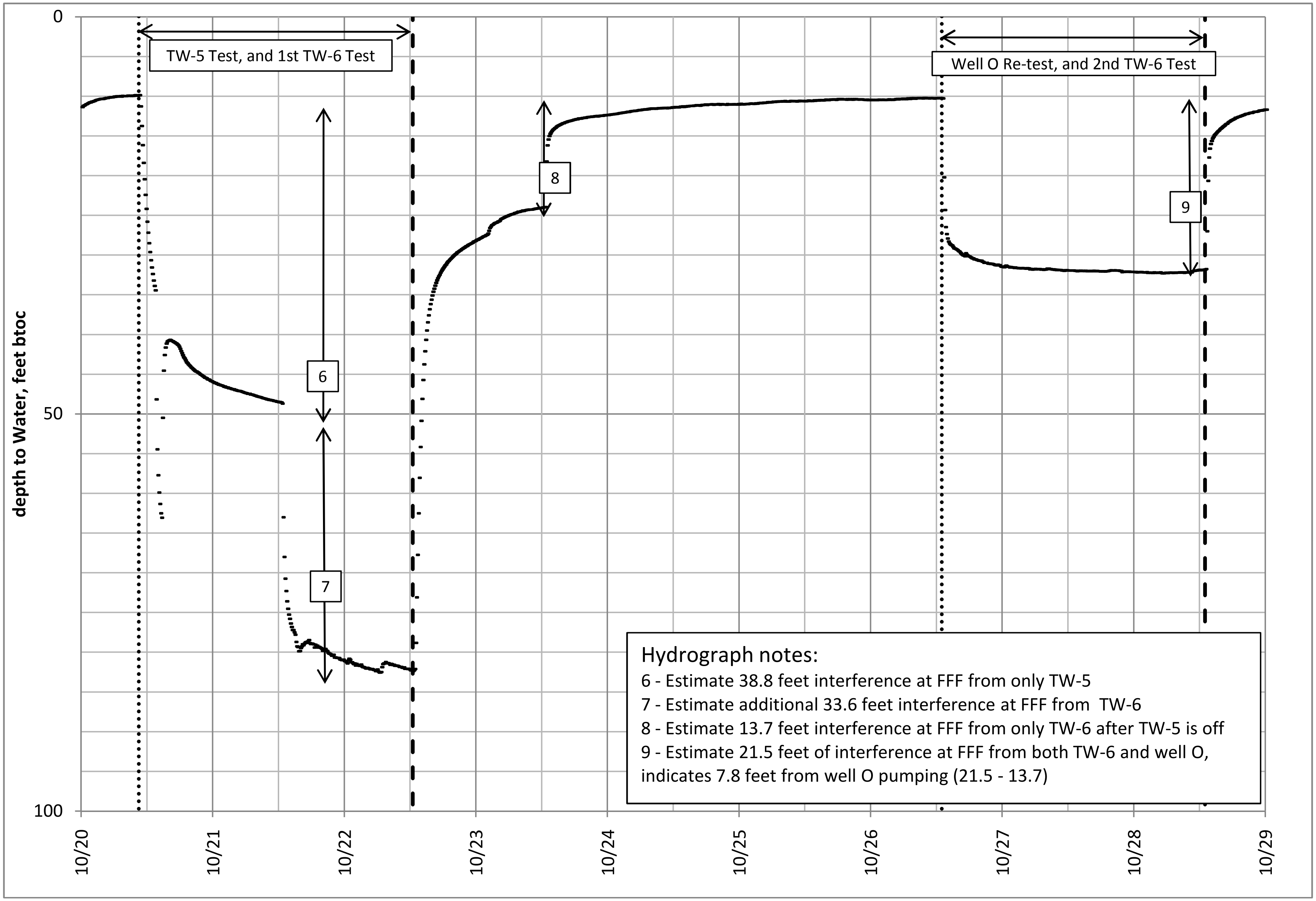
Well TW-3a Residual Drawdown Plot
October 8 - 10, 2010



Double Diamond Companies - Lost Lake Resort Site
Advantage Engineers Project No. 090539

Figure 4-1a

Observation Well FFF Large Scale Hydrograph
October 18 thru 29, 2010



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Advantage Engineers project 090539

Figure 4-1b

Observation Well FFF Small Scale Hydrograph
October 18 thru 29, 2010

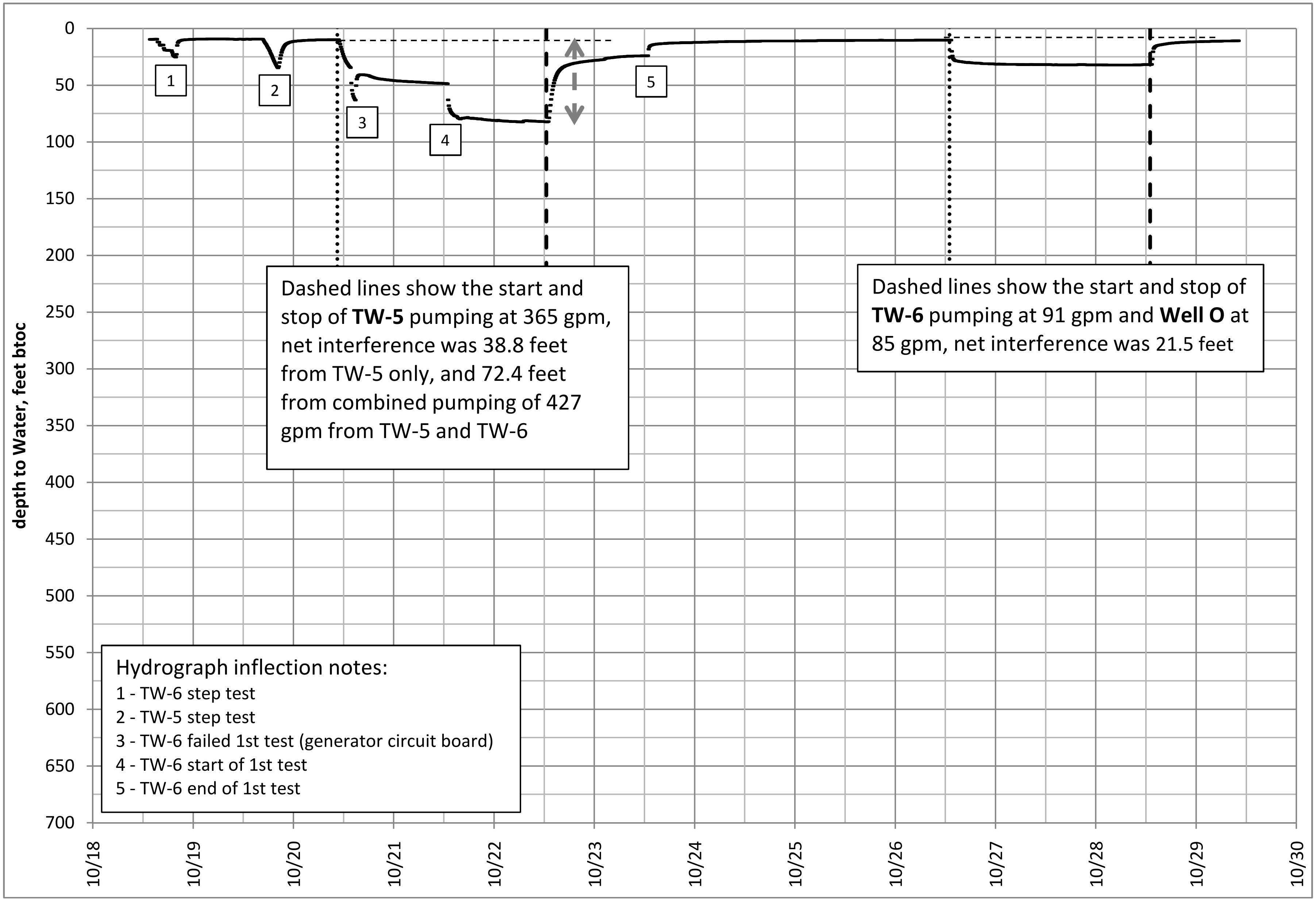

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Figure 4-2a

Observation Well HH Large Scale Hydrograph
October 19 thru 29, 2010

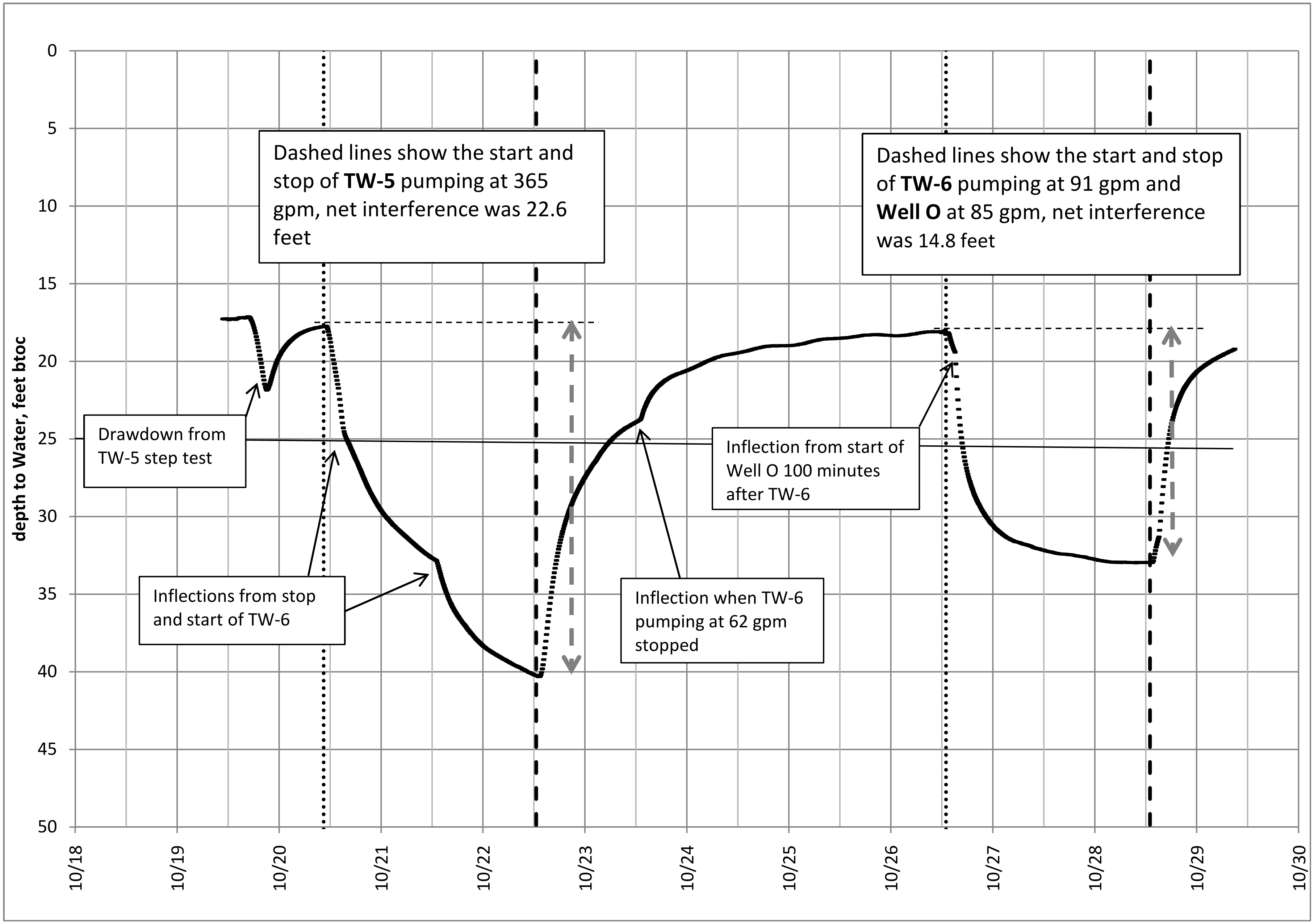

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Figure 4-2b

Observation Well HH Small Scale Hydrograph
October 19 thru 29, 2010

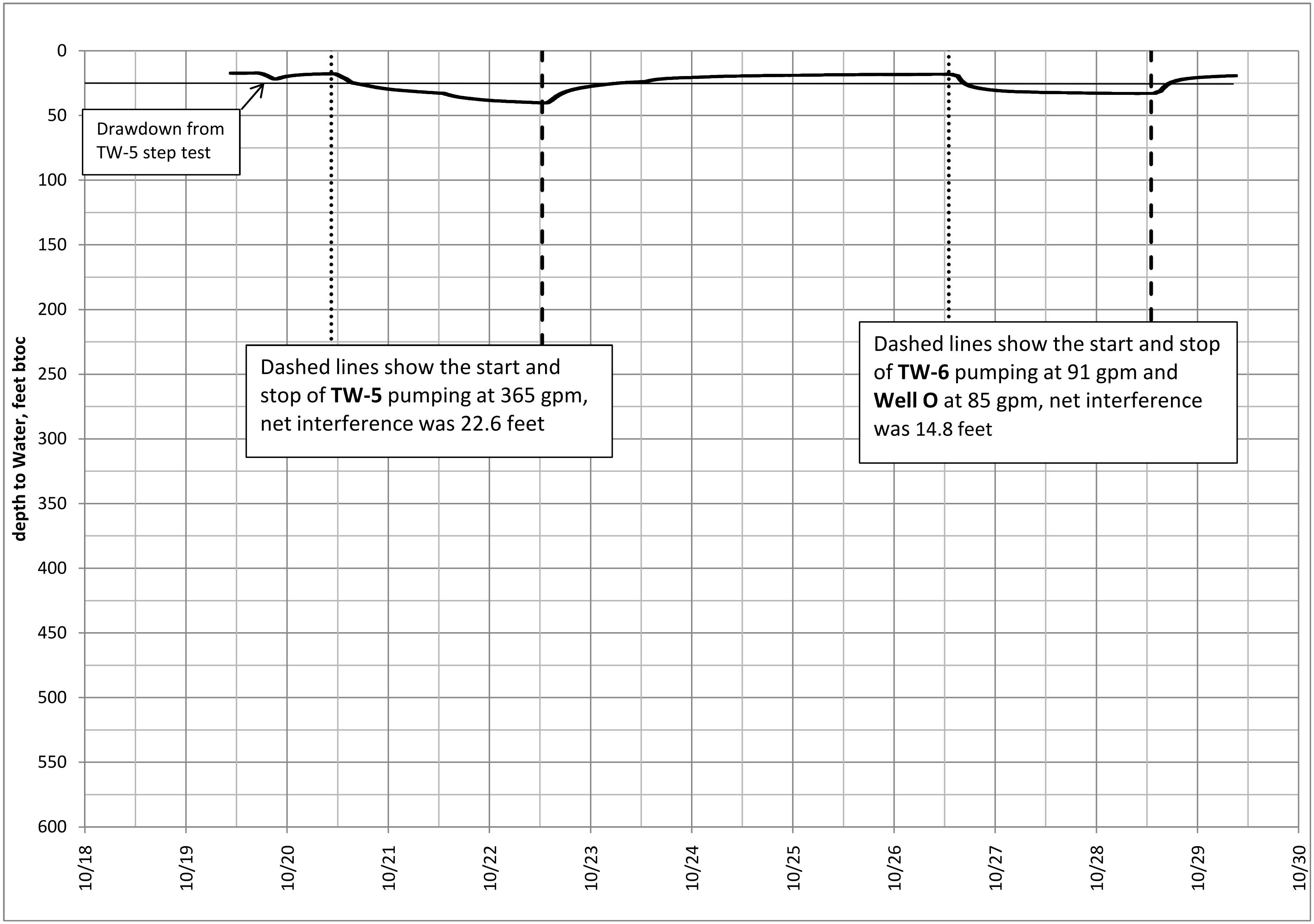

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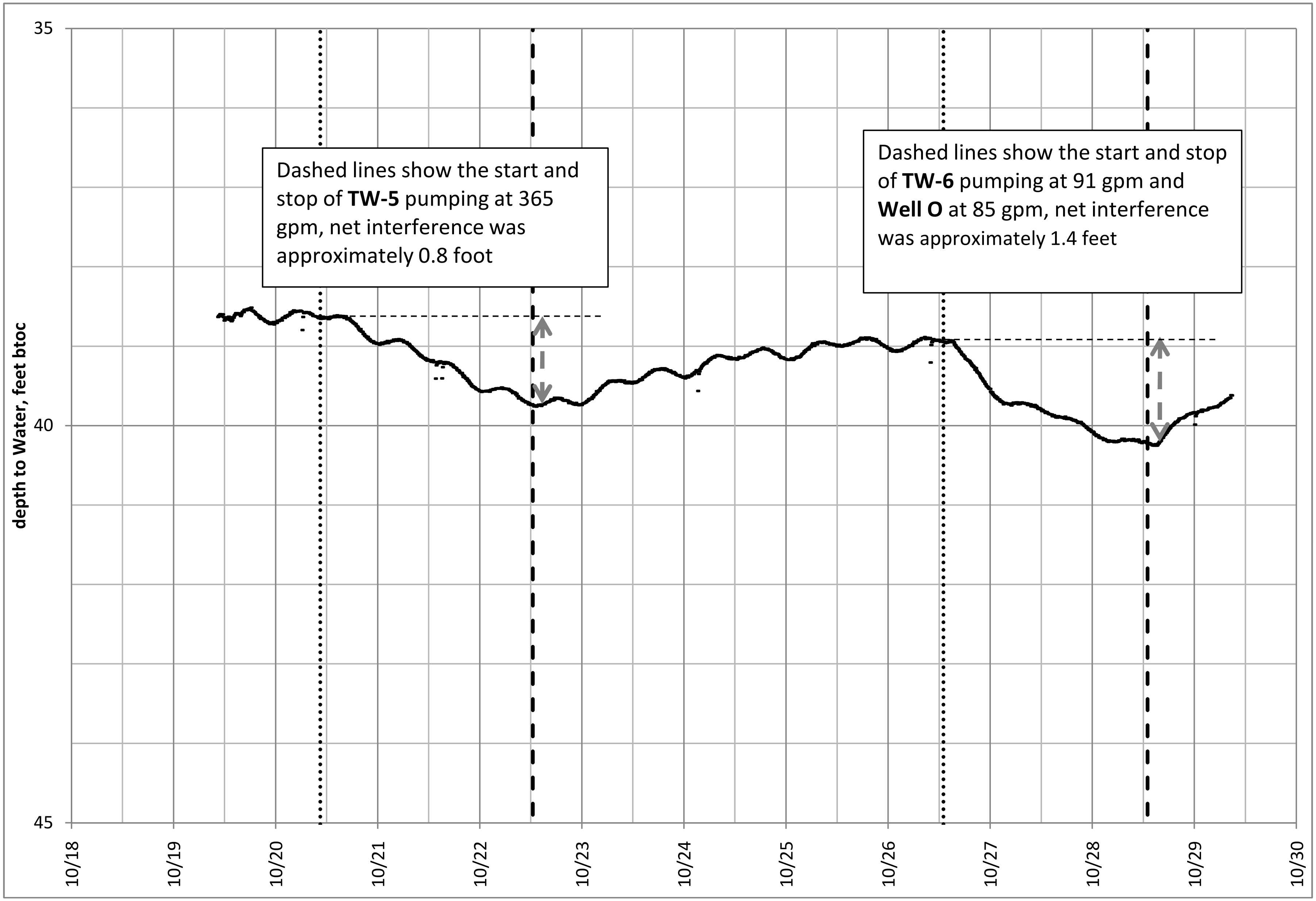
Figure 4-3

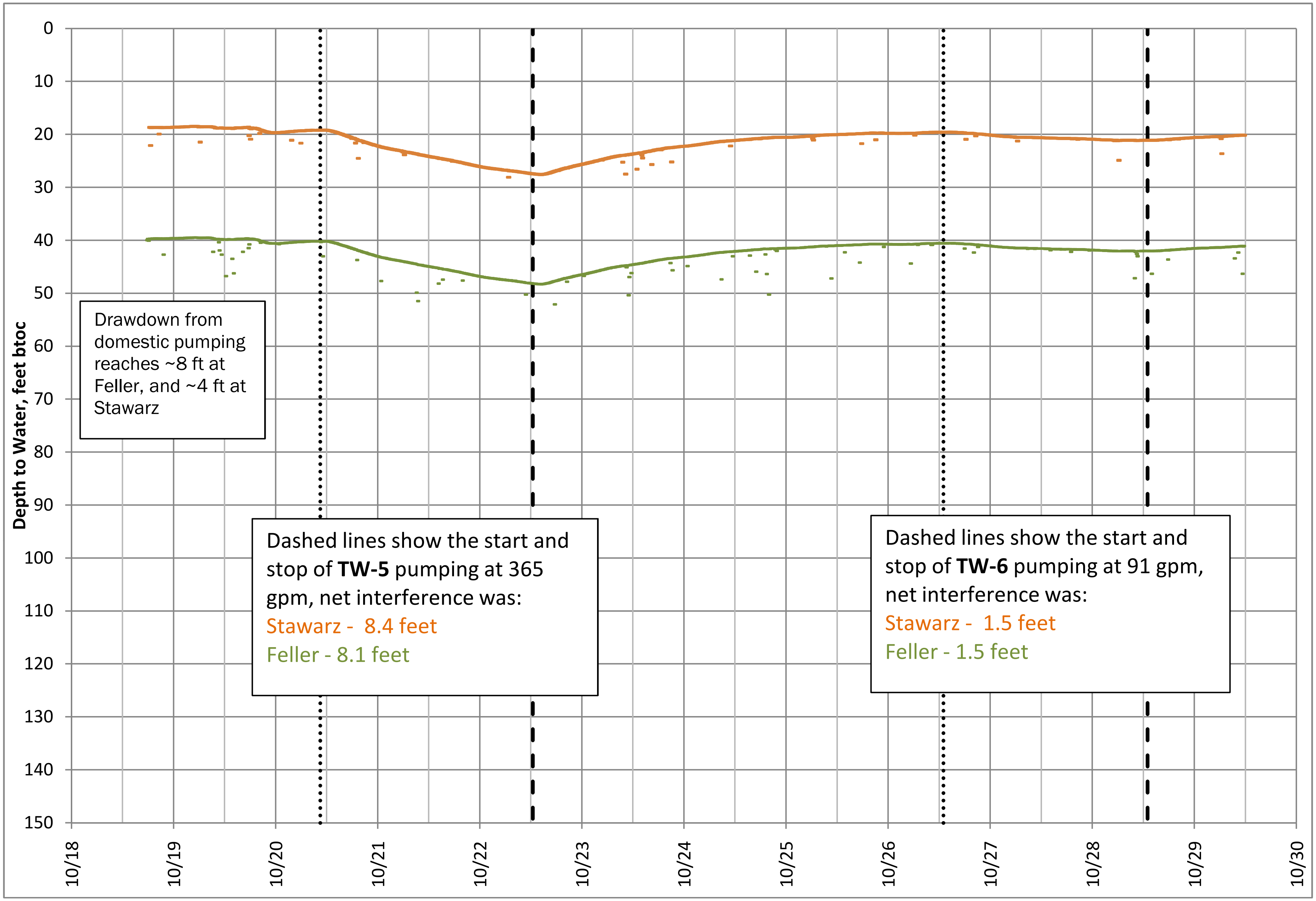
Observation Well BB Hydrograph
October 19 thru 29, 2010



Double Diamond Companies - Lost Lake Resort Site
Advantage Engineers project 090539

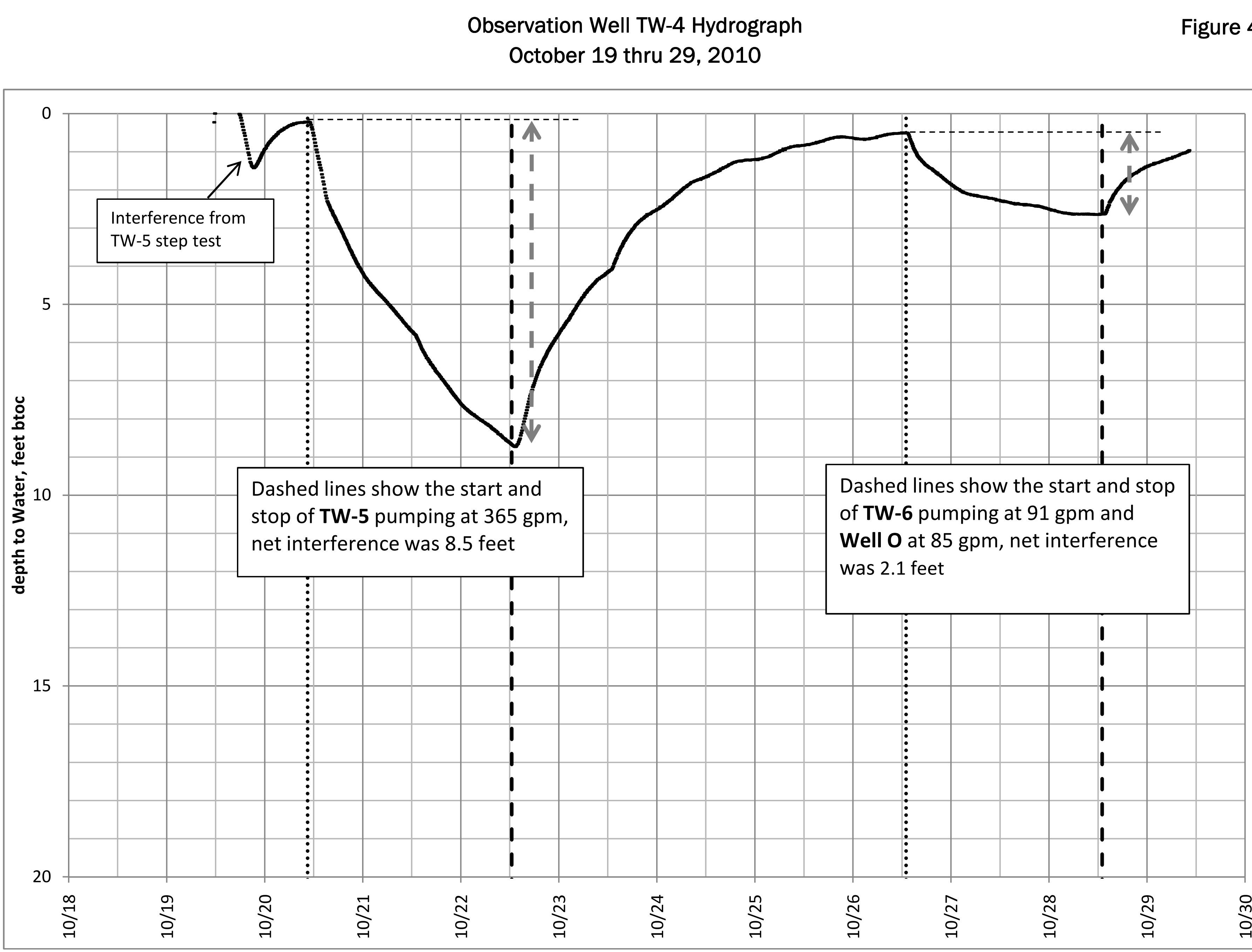
Figure 4-4

Stawarz and Feller Well Hydrographs
October 18 thru 29, 2010



Double Diamond Companies - Lost Lake Resort Site
Advantage Engineers project 090539

Figure 4-5



Double Diamond Companies - Lost Lake Resort Site
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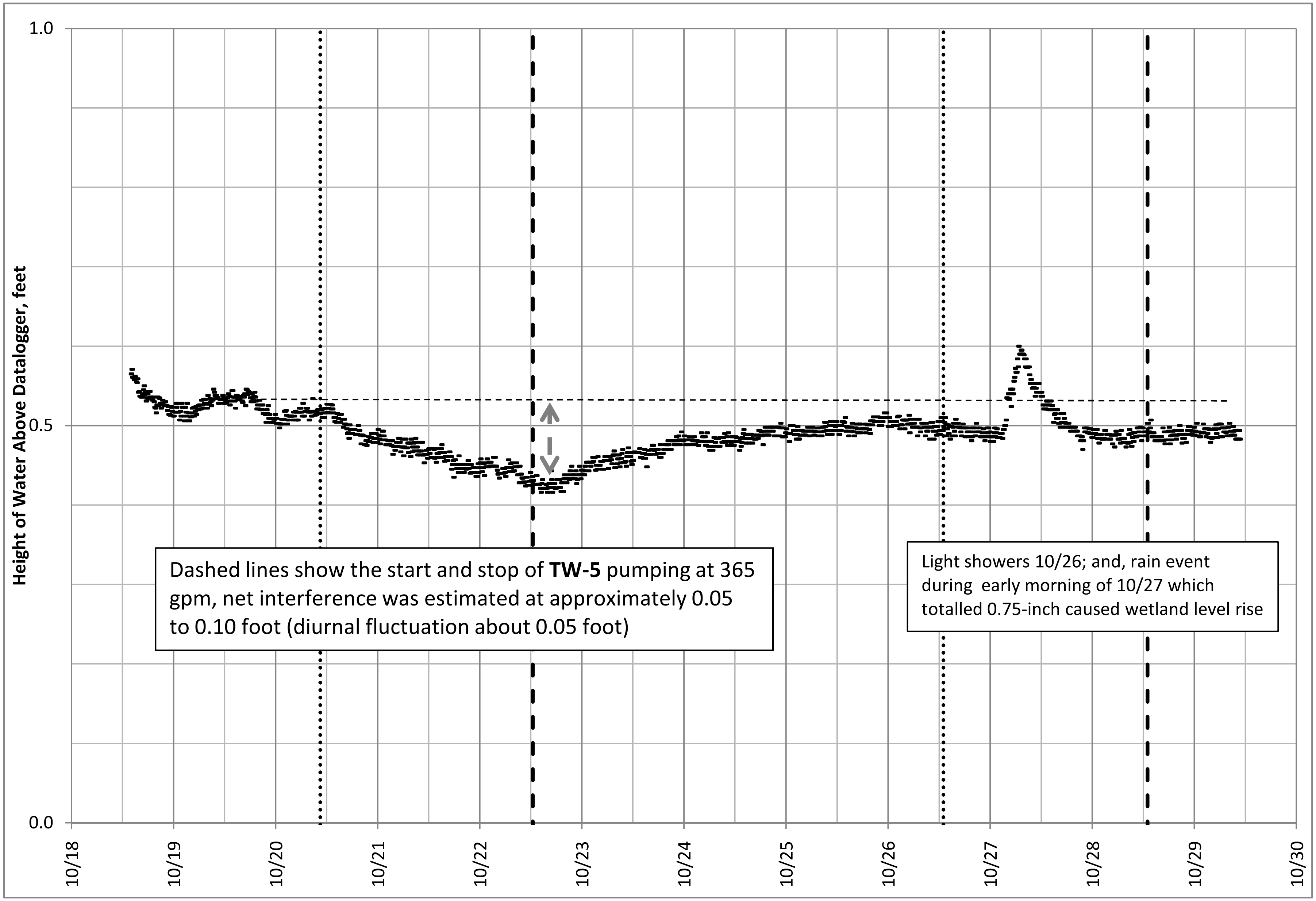
Figure 4-6

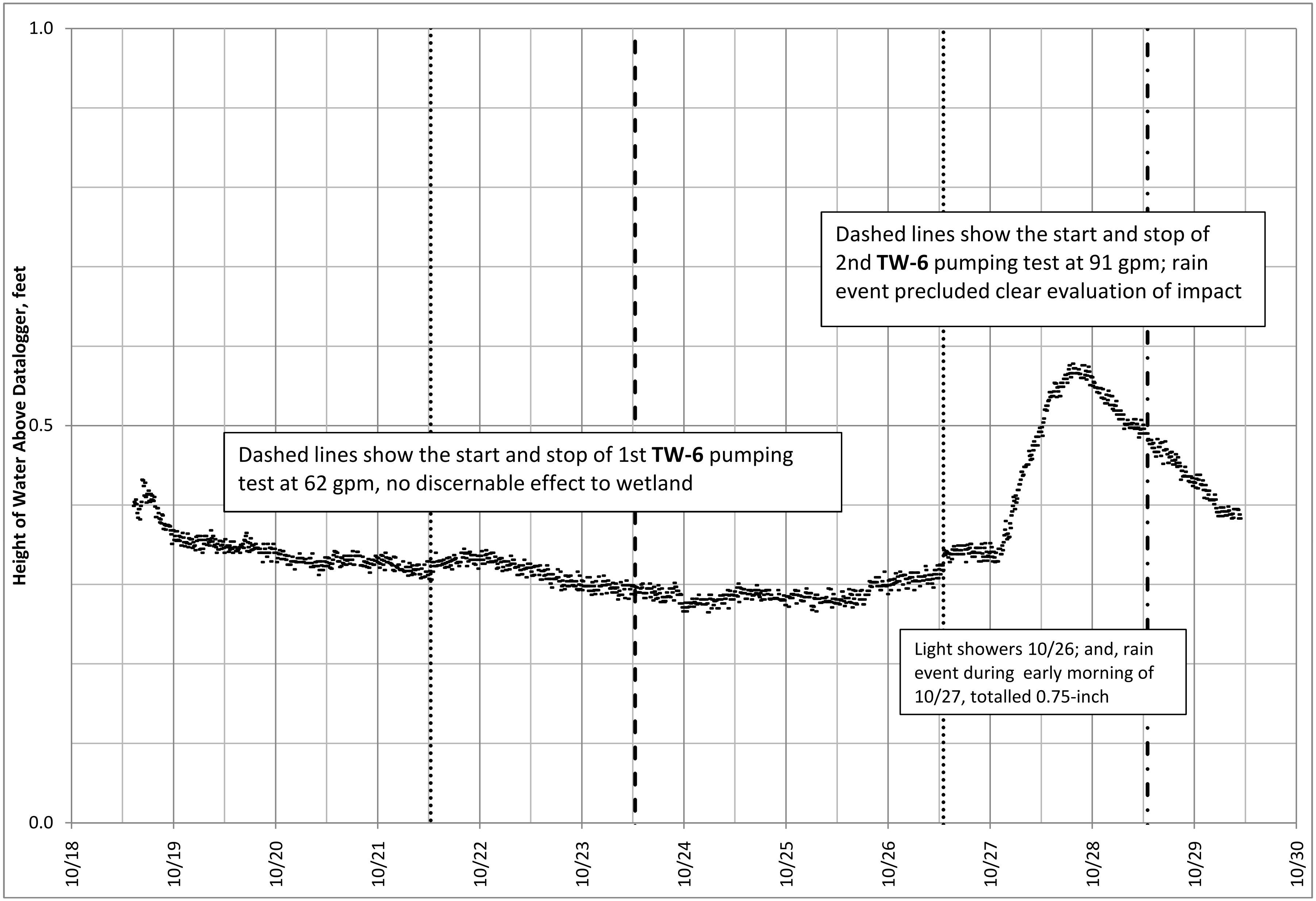
Hydrograph of Wetland Piezometer near Well TW-5
October 19 thru 25, 2010



Double Diamond Companies - Lost Lake Resort Site
Advantage Engineers project 090539

Figure 4-7

Hydrograph of Wetland Piezometer near Well TW-6
October 19 thru 29, 2010



Double Diamond Companies - Lost Lake Resort Site
Advantage Engineers project 090539

Figure 4-8

Stilling Well Near TW-5 Hydrograph
October 19 thru 24, 2010

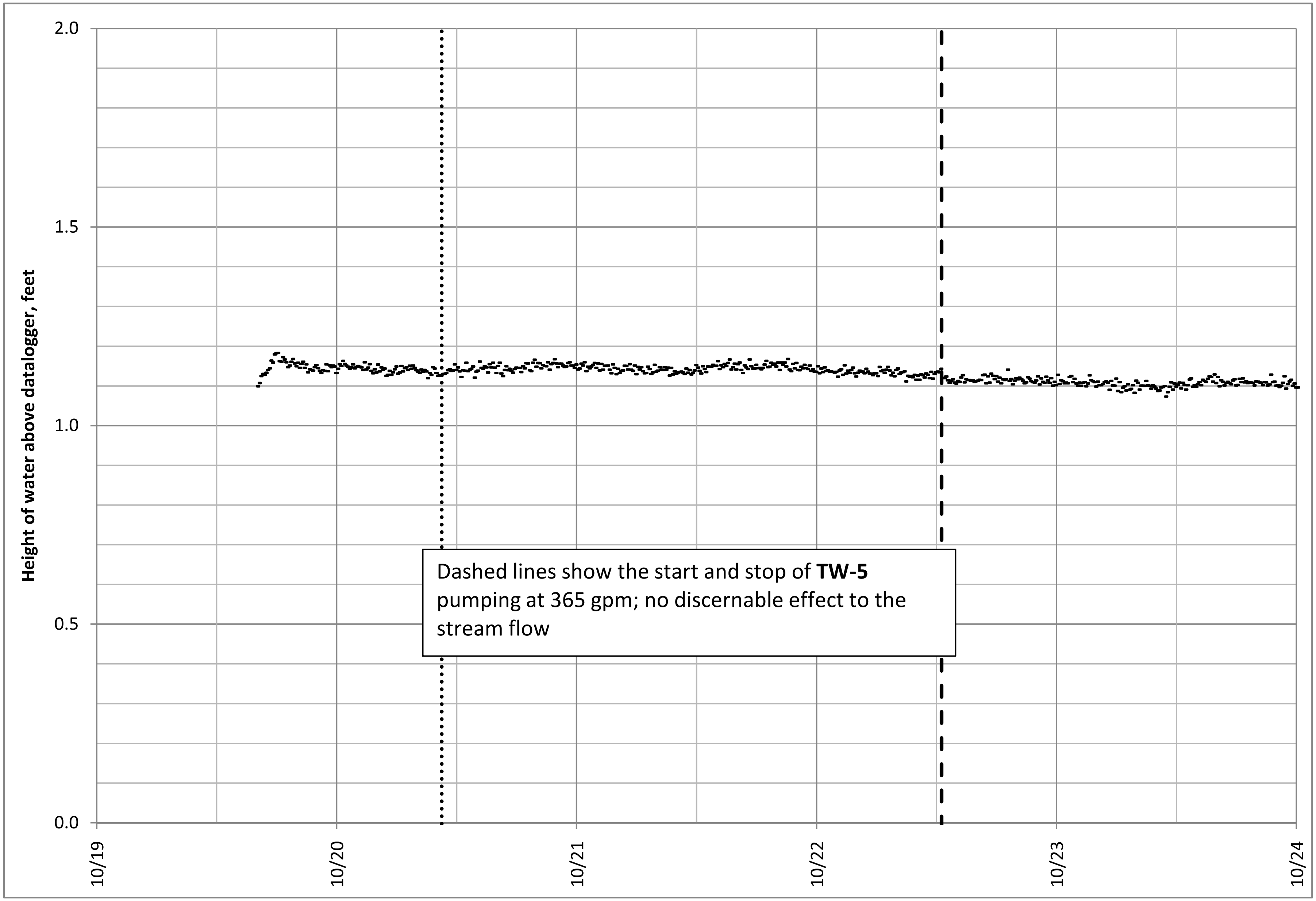
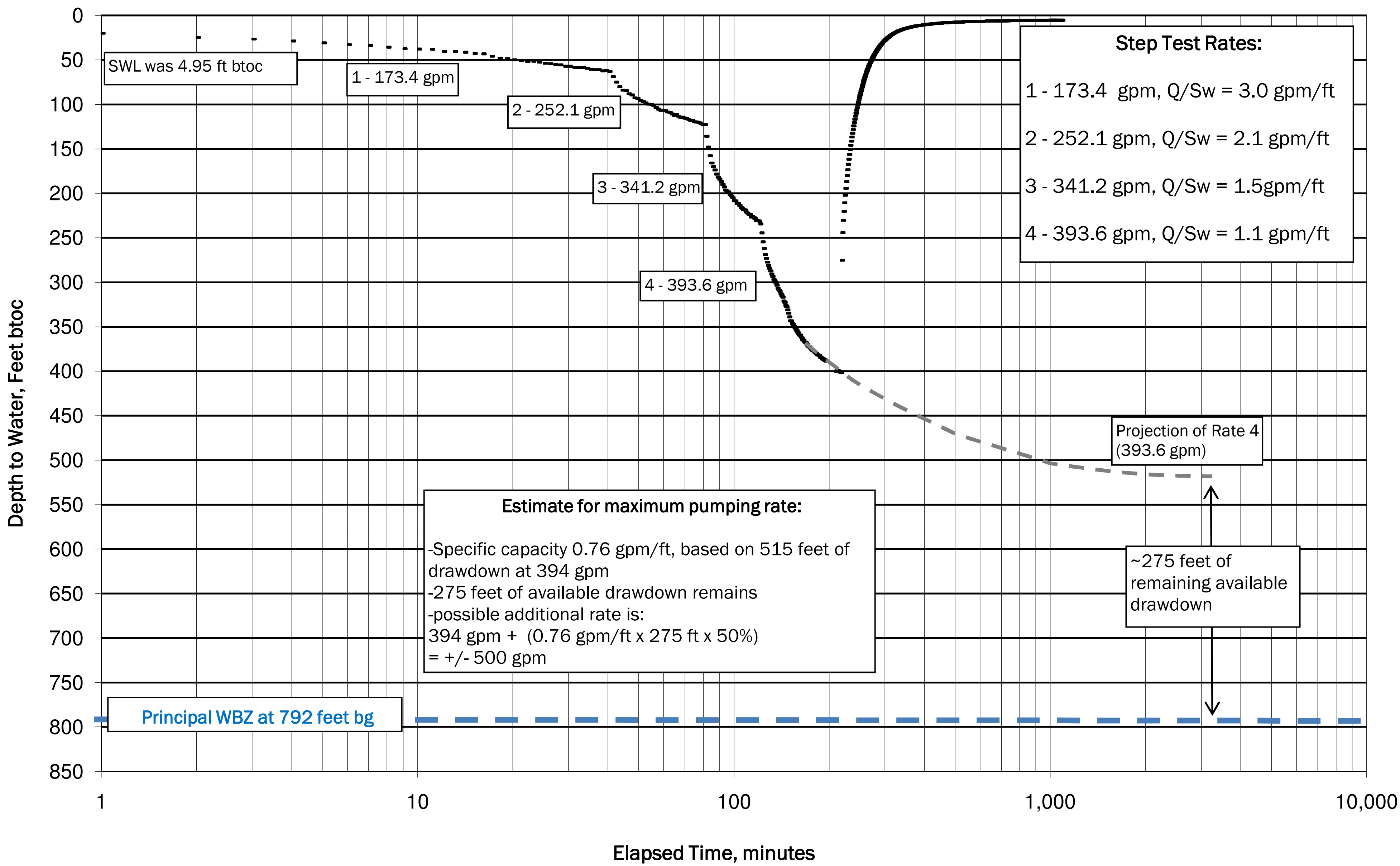


Figure 4-9

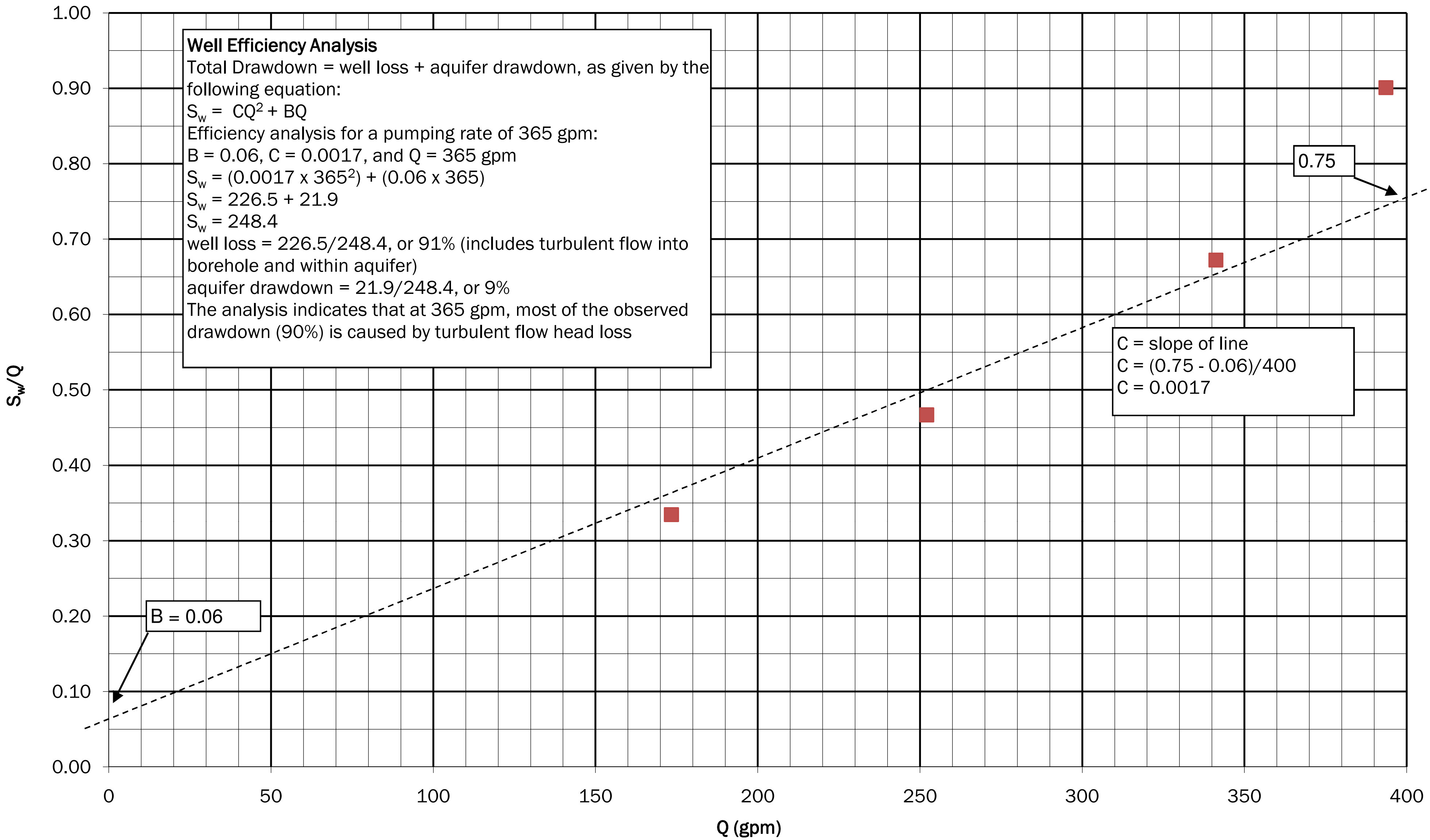
Well TW-5 Step Drawdown Semilog Plot
October 19, 2010



Double Diamond Companies - Lost Lake Resort
Advantage Engineers Project 090539

Well TW-5 Turbulent Flow Analysis

Figure 4-10



Double Diamond Companies - Lost Lake Resort
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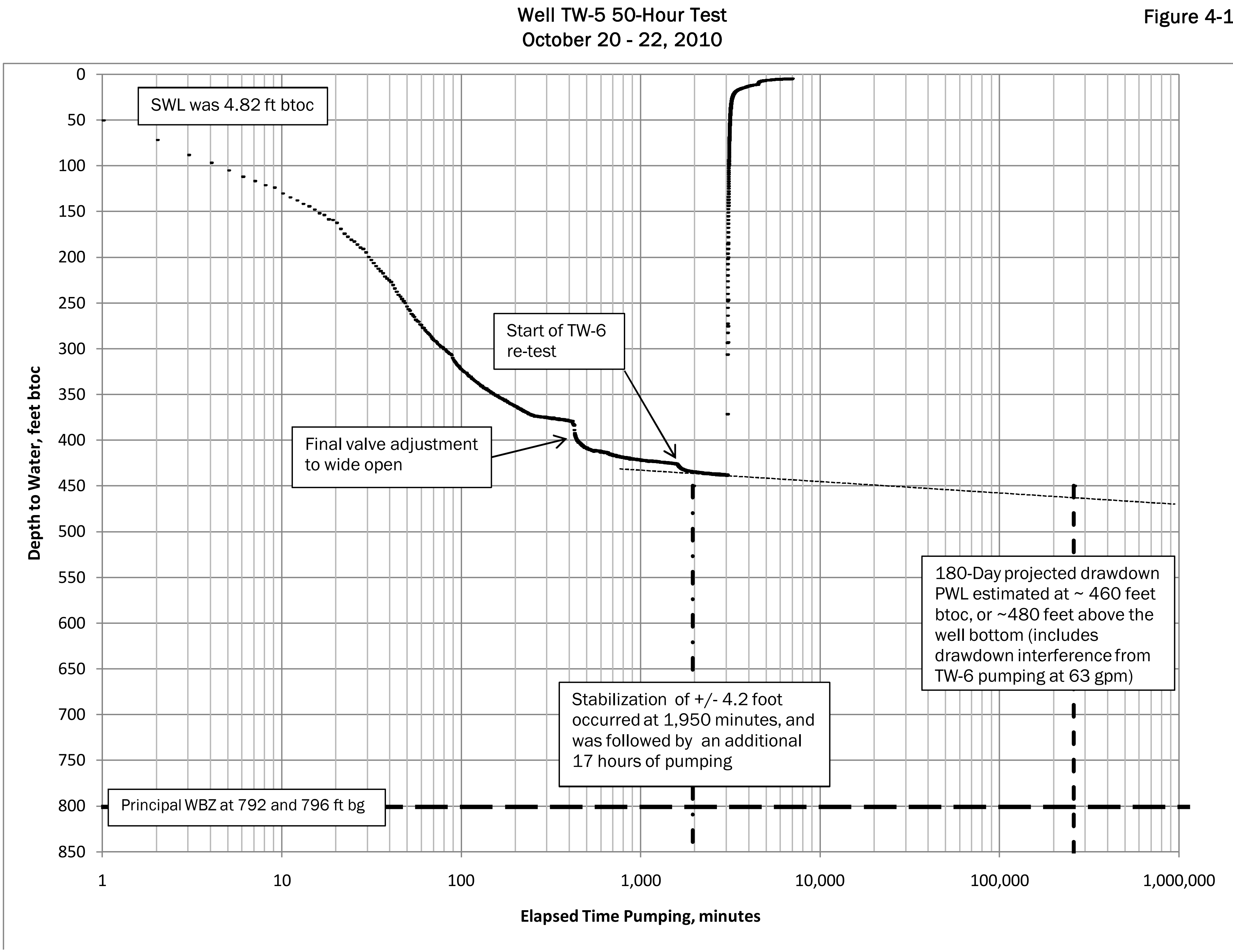
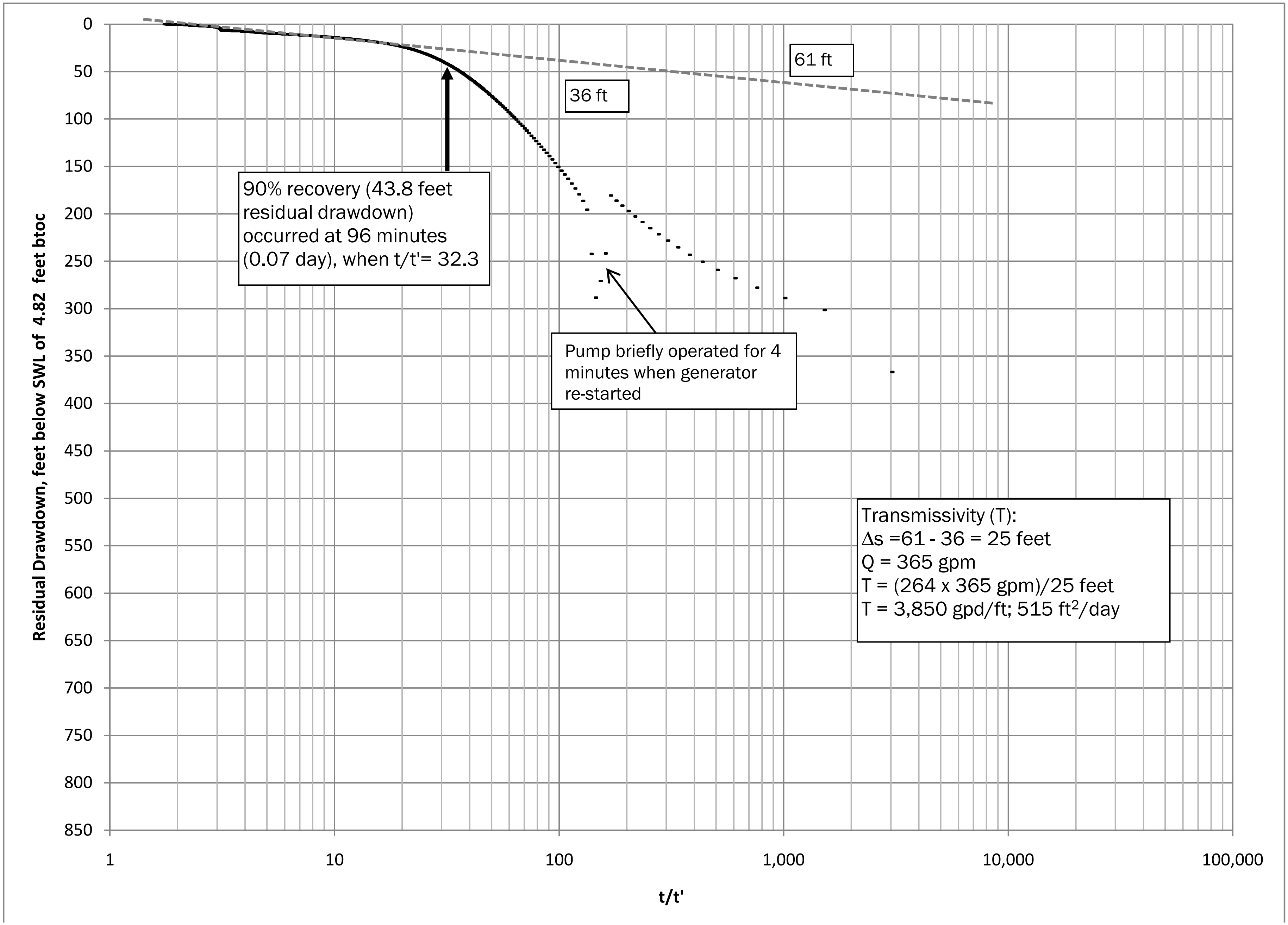
Figure 4-11



Double Diamond Companies - Lost Lake Resort Site
Advantage Engineers Project 090539

Figure 4-12

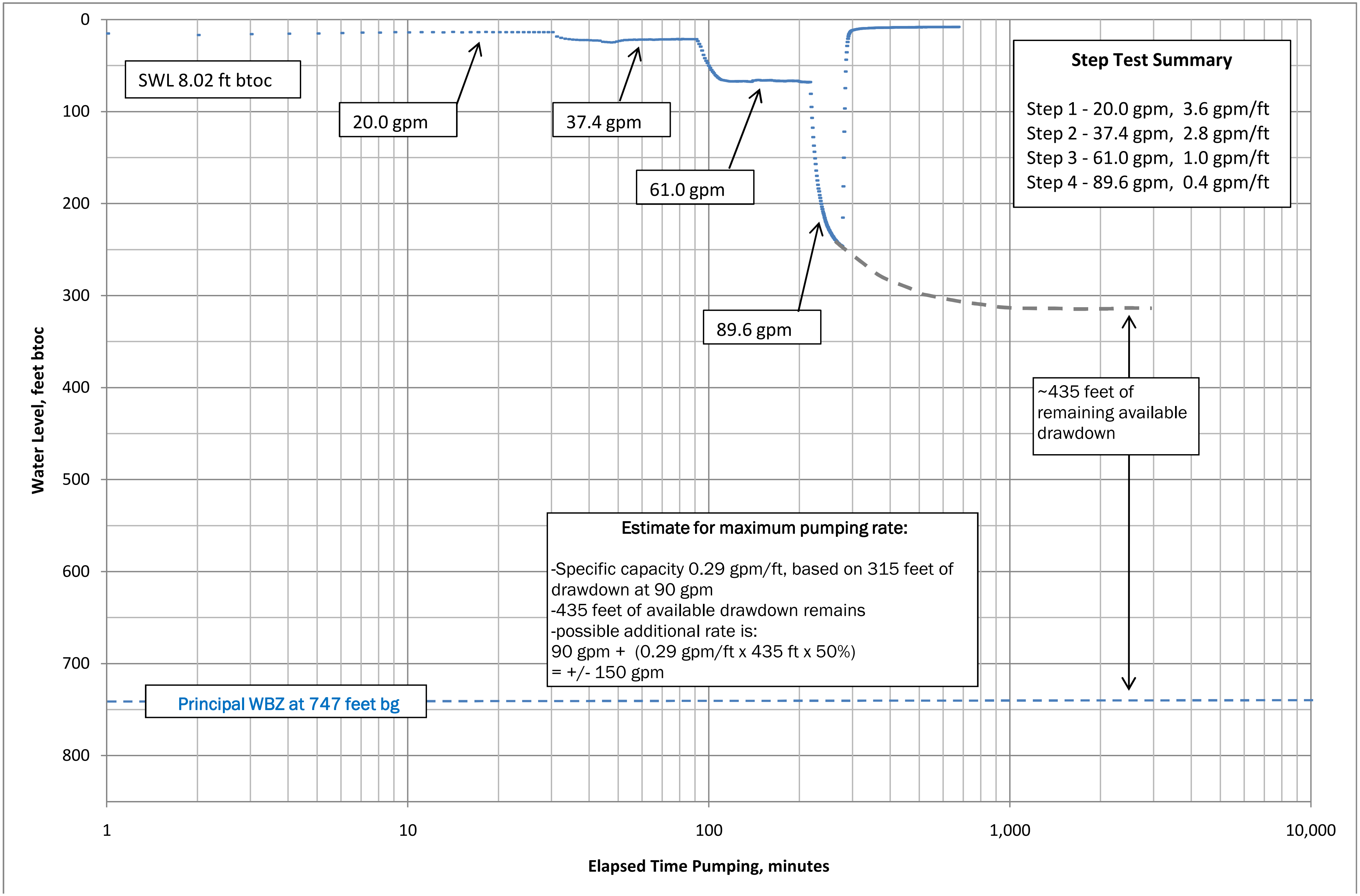
Well TW-5 Residual Drawdown Plot
October 22 - 25, 2010



Double Diamond Companies - Lost Lake Resort Site
Advantage Engineers Project No. 090539

Figure 4-13

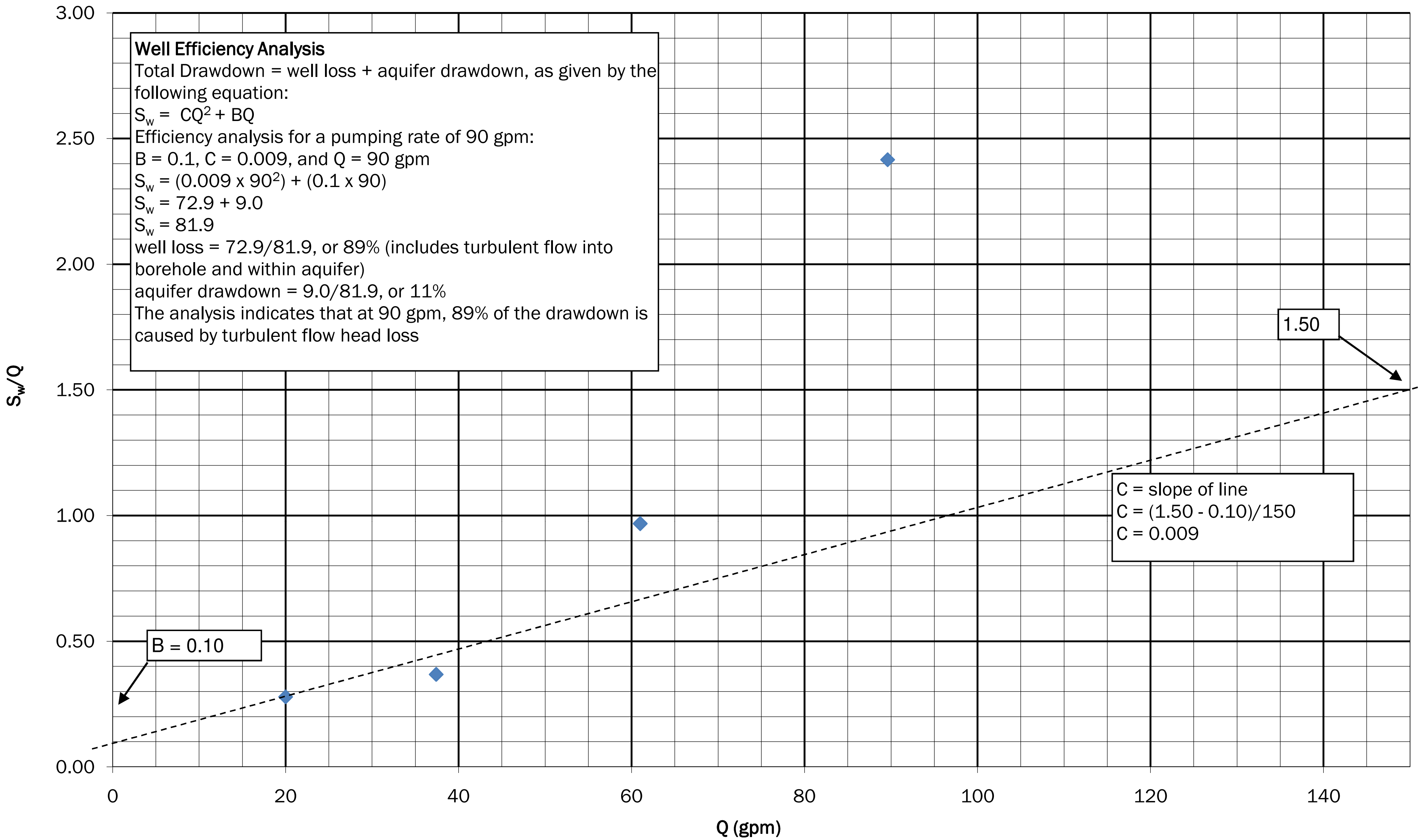
Well TW-6 Step Drawdown Test
October 18, 2010



Double Diamond Companies - Lost Lake Resort
Advantage Engineers Project 090539005

Figure 4-14

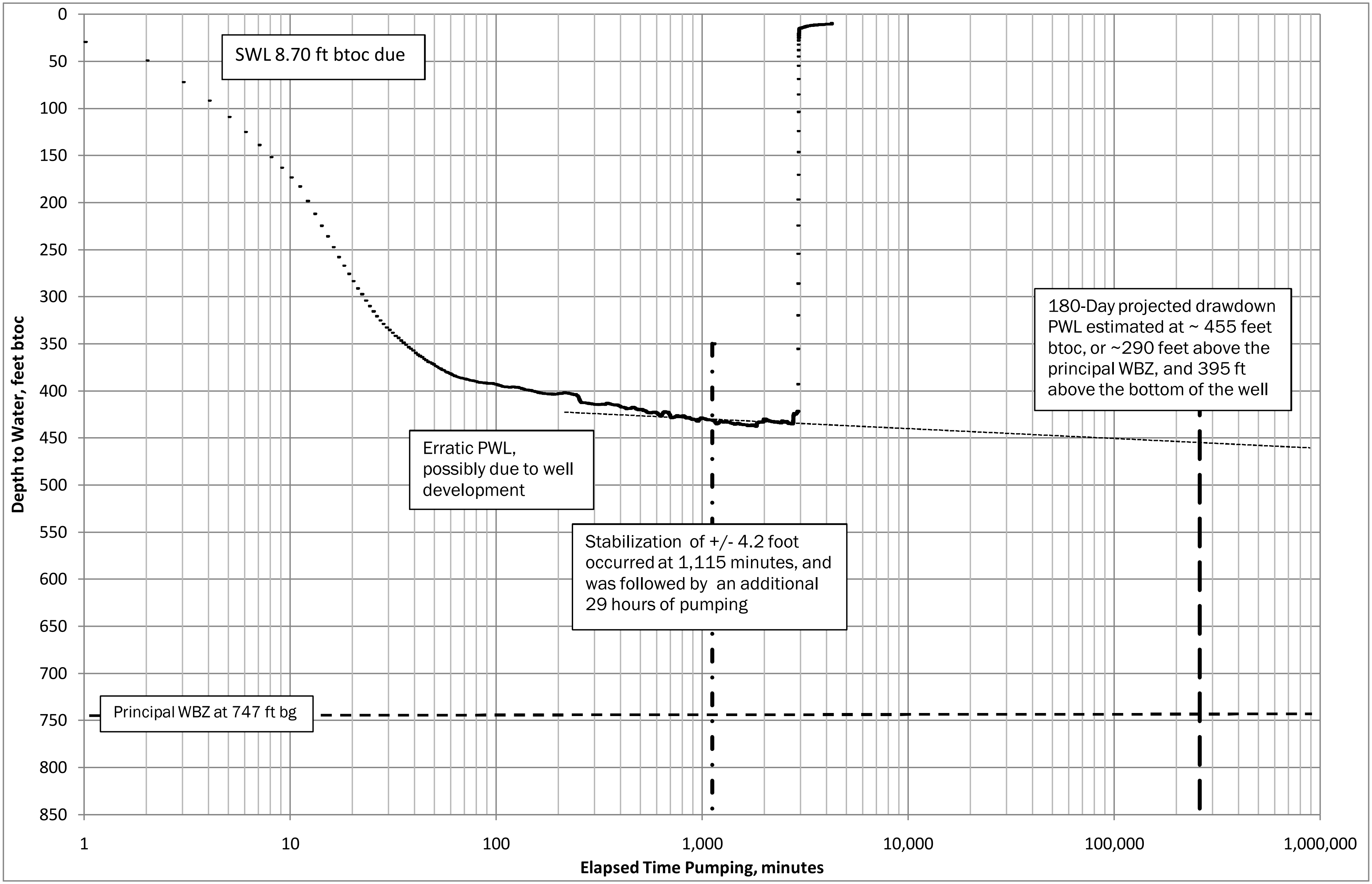
Well TW-6 Turbulent Flow Analysis



Double Diamond Companies - Lost Lake Resort
Advantage Engineers Project 090539

Figure 4-15

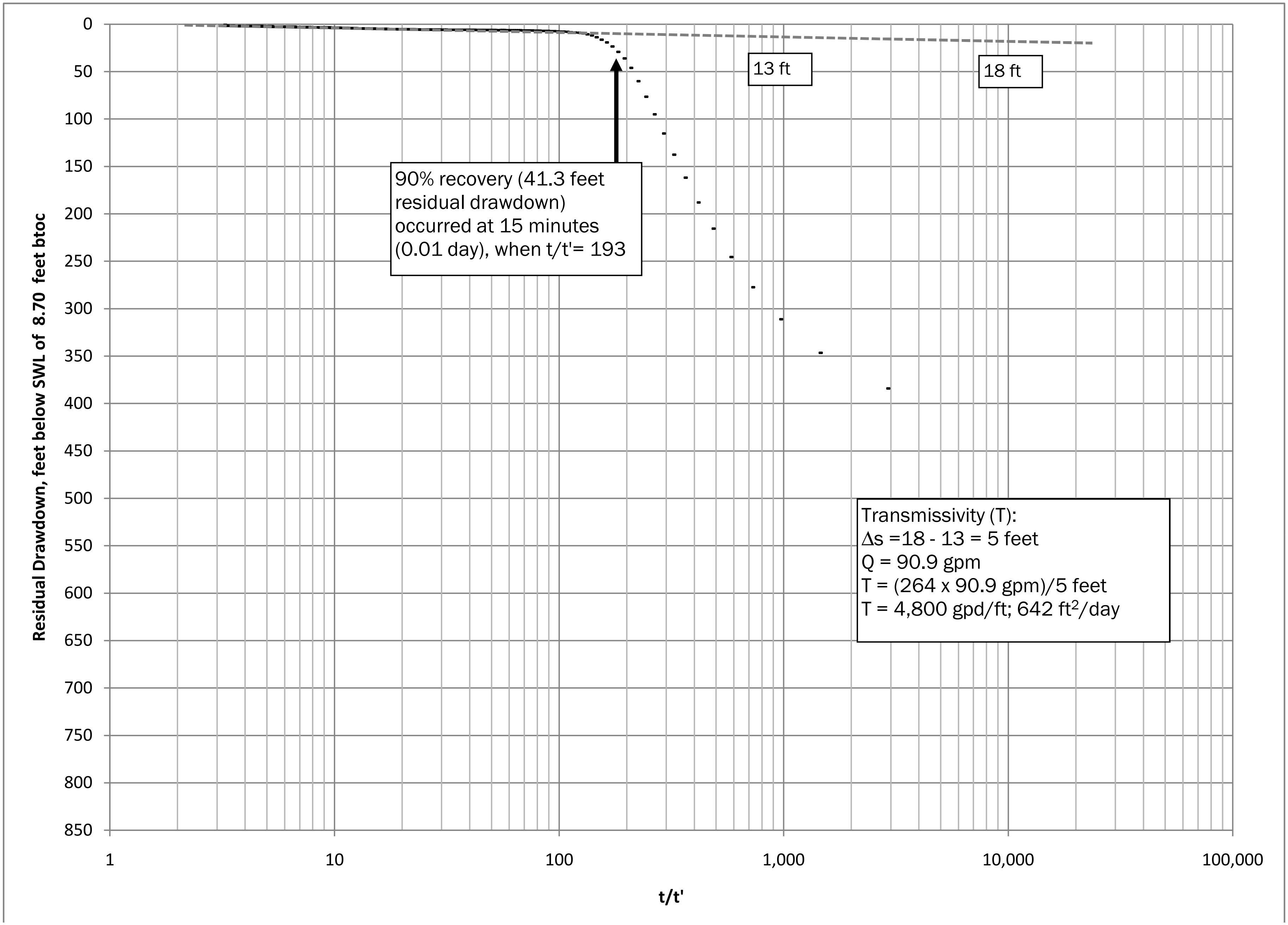
Well TW-6 Semilog Plot for 2nd Constant Rate Test
October 26 to 28, 2010



Double Diamond Companies - Lost Lake Resort
Advantage Engineers Project 090539

Figure 4-16

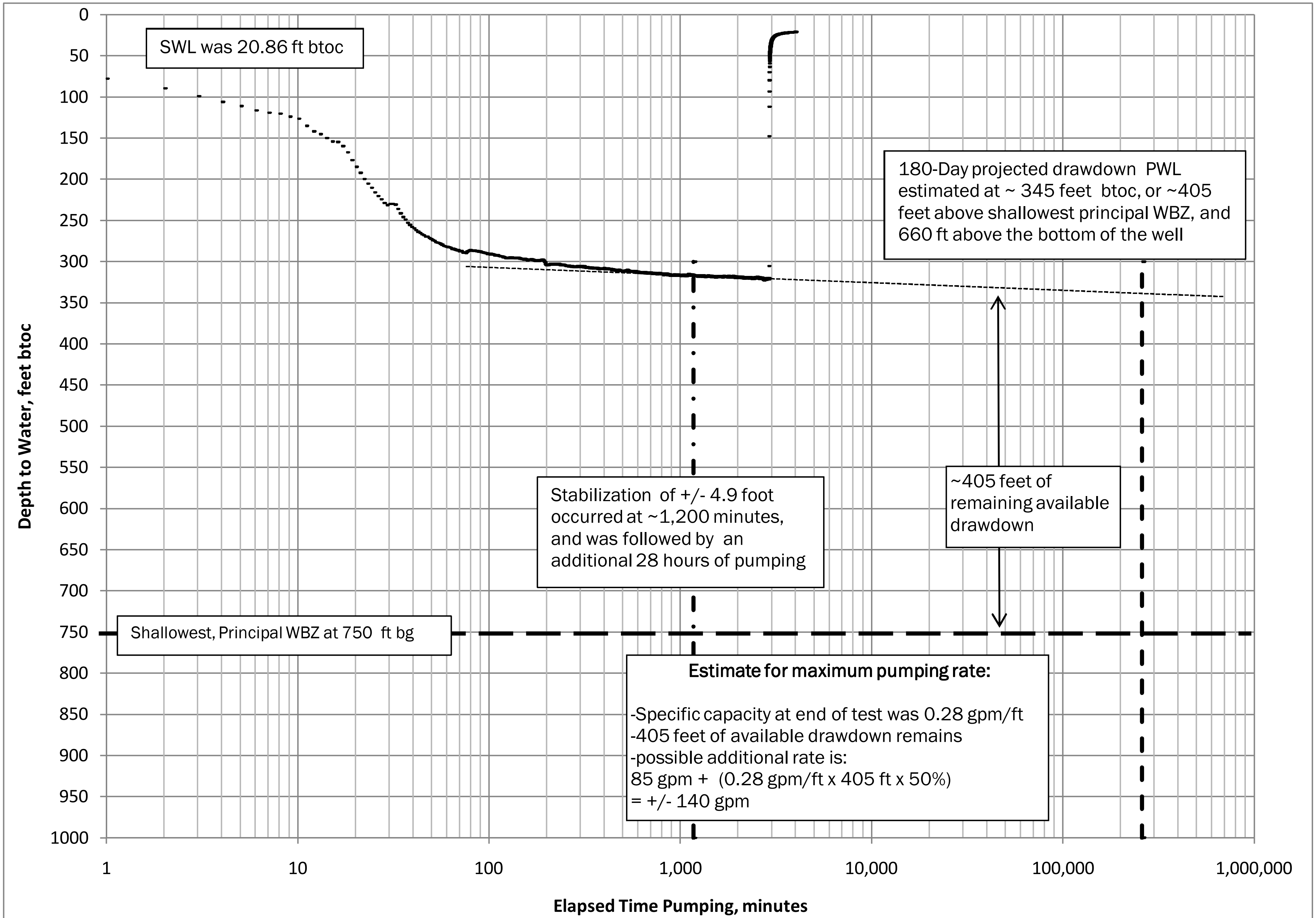
Well TW-6 Residual Drawdown Plot
October 28 - 29, 2010



Double Diamond Companies - Lost Lake Resort Site
Advantage Engineers Project No. 090539

Figure 4-17

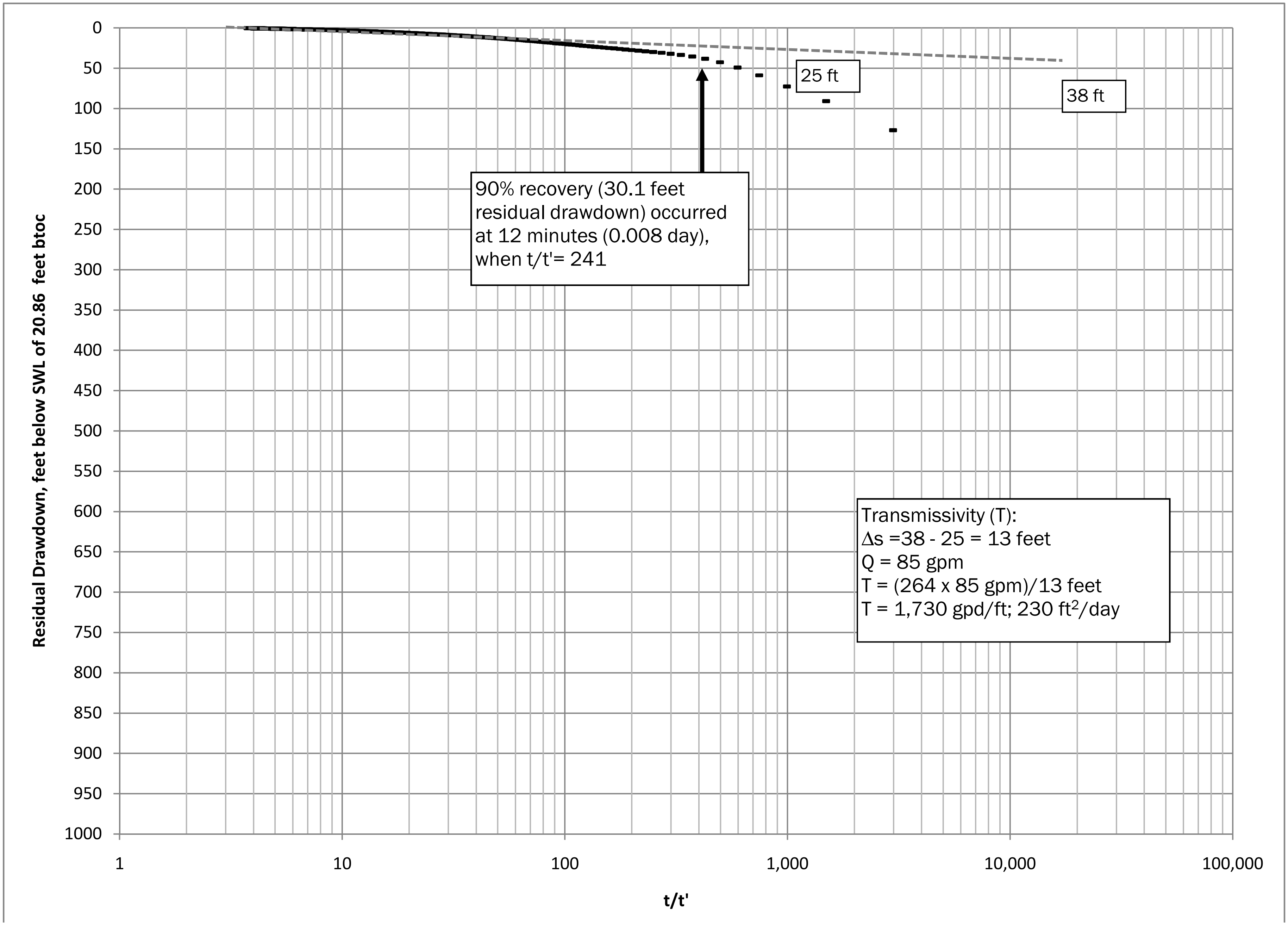
Well O Re-Test
October 26 - 28, 2010



Double Diamond Companies - Lost Lake Resort Site
Advantage Engineers Project 090539

Figure 4-18

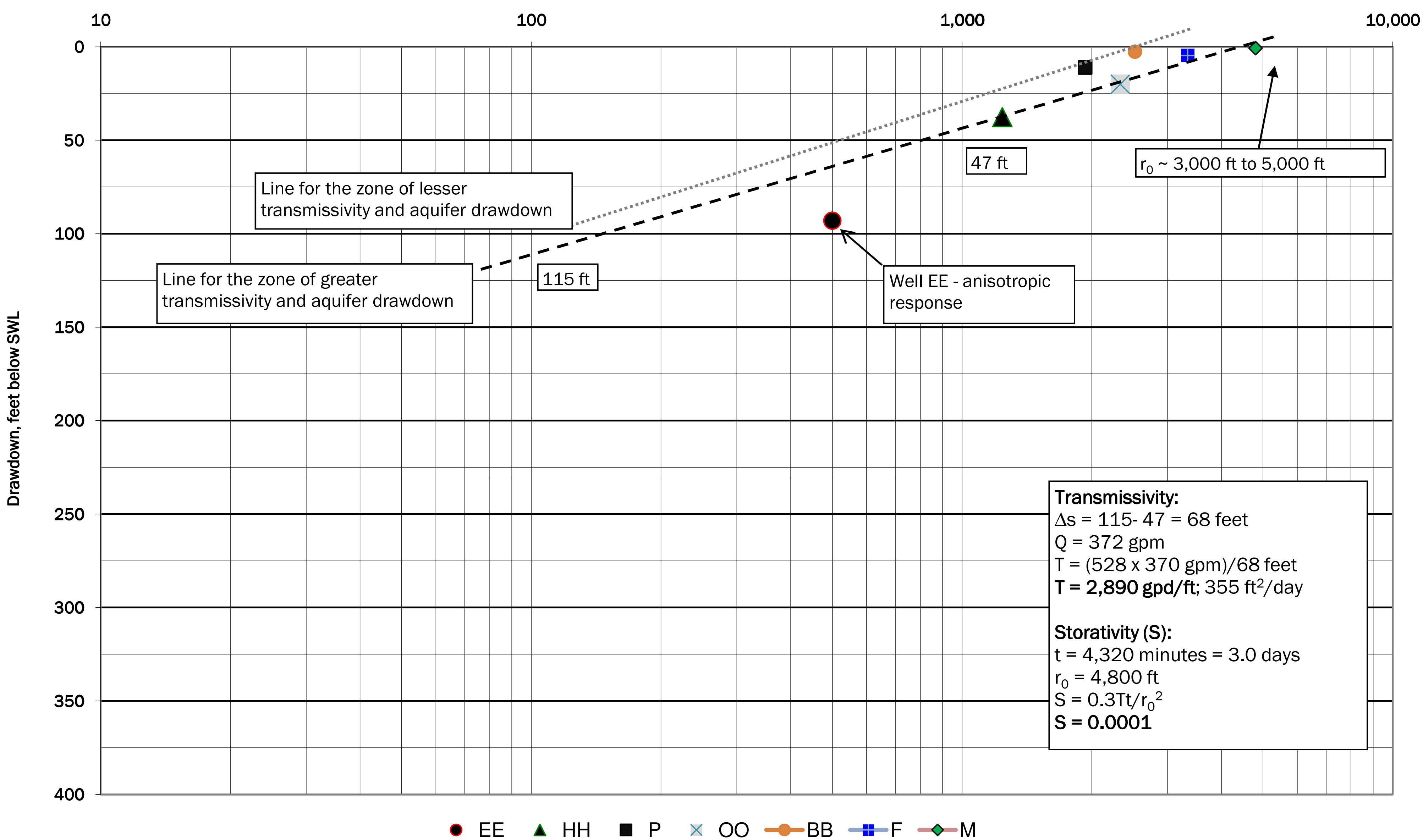
Well O Re-Test Residual Drawdown Plot
October 28 - 29, 2010



Double Diamond Companies - Lost Lake Resort Site
Advantage Engineers Project No. 090539

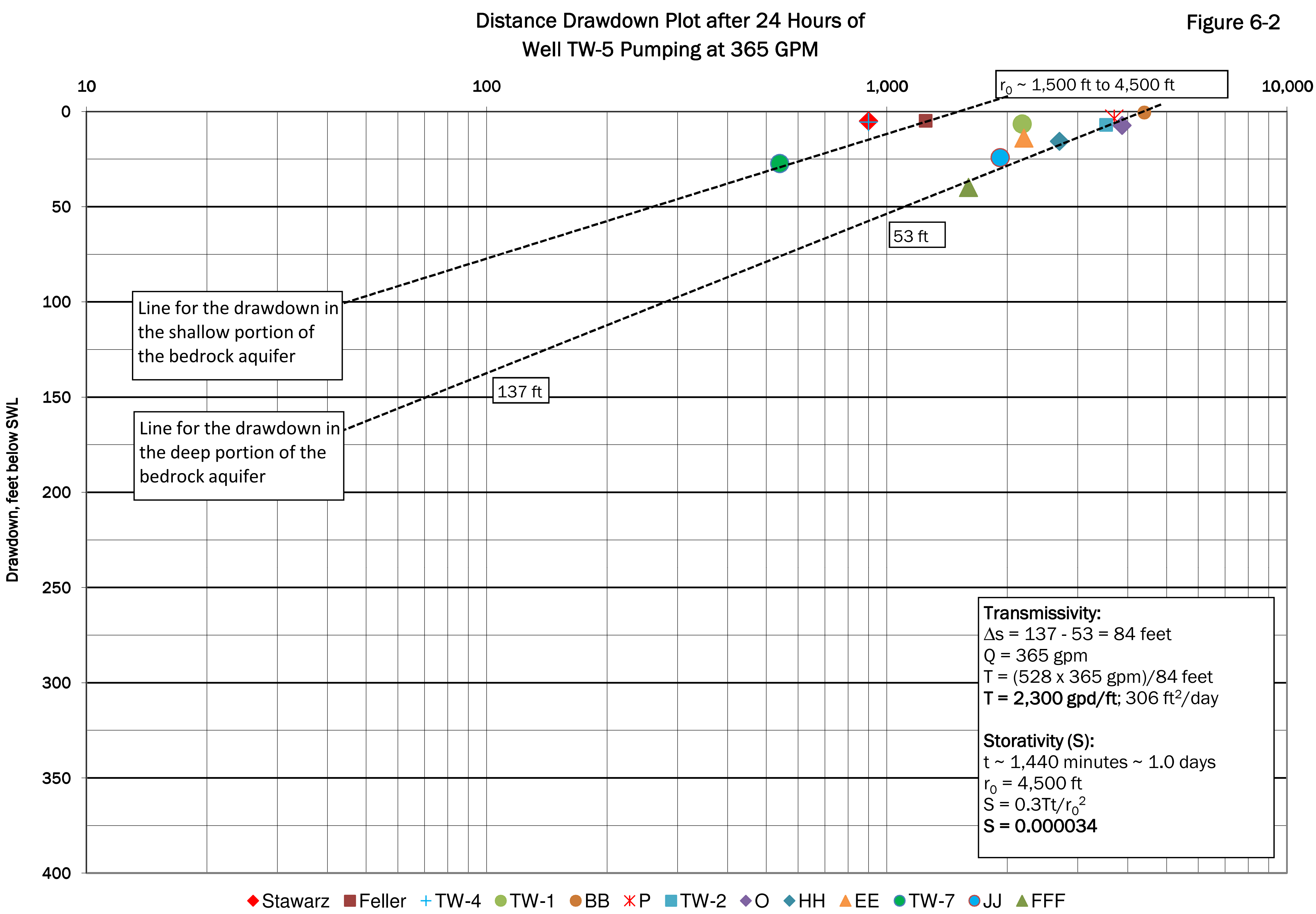
Figure 6-1

Distance Drawdown Plot at 4,320 Minutes of Wells FFF and JJJ Pumping at a Combined 372 GPM



Double Diamond Companies - Lost Lake Resort Site
Advantage Project 090539

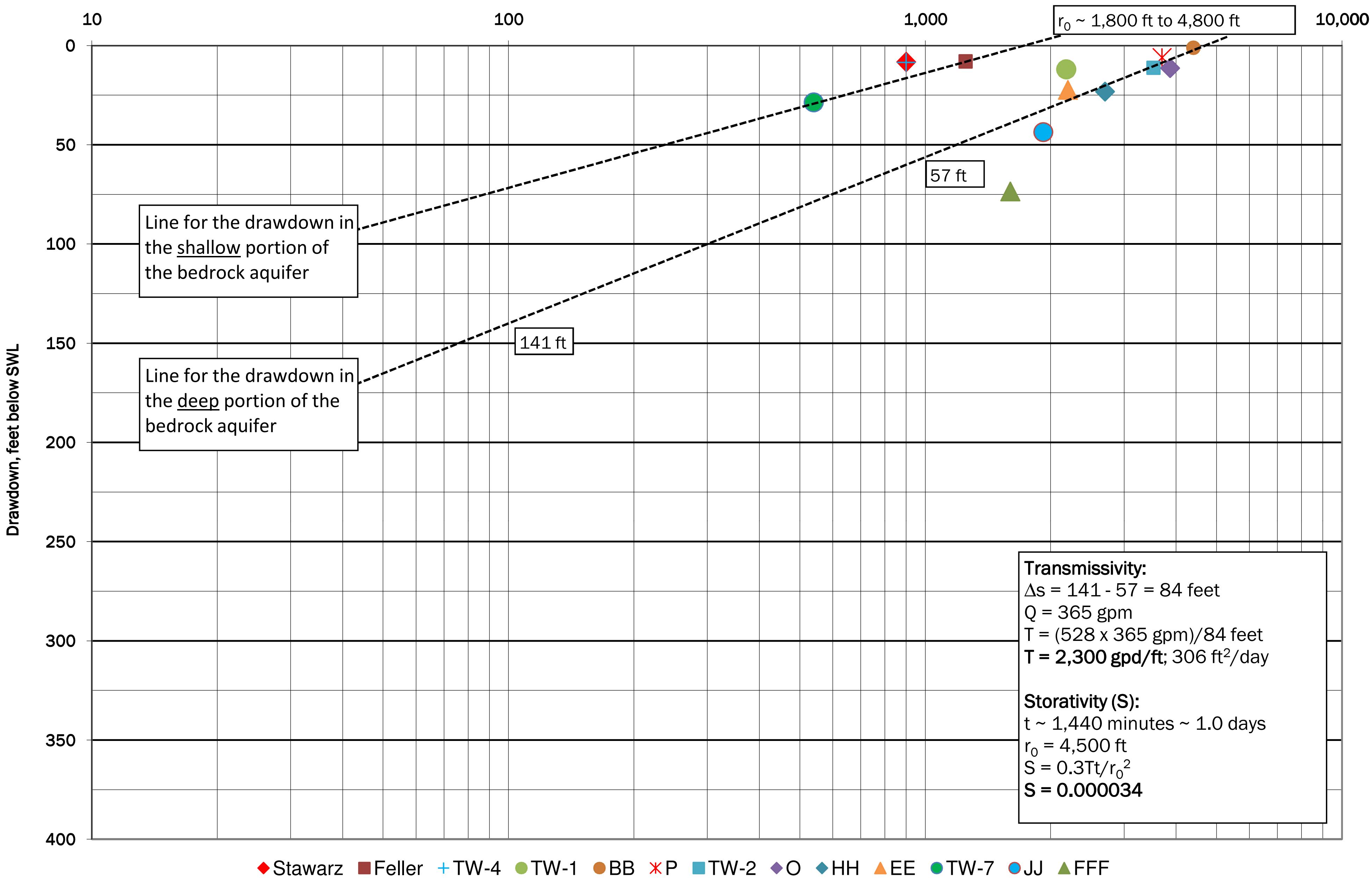
Figure 6-2



Double Diamond Companies - Lost Lake Resort Site
Advantage Project 090539

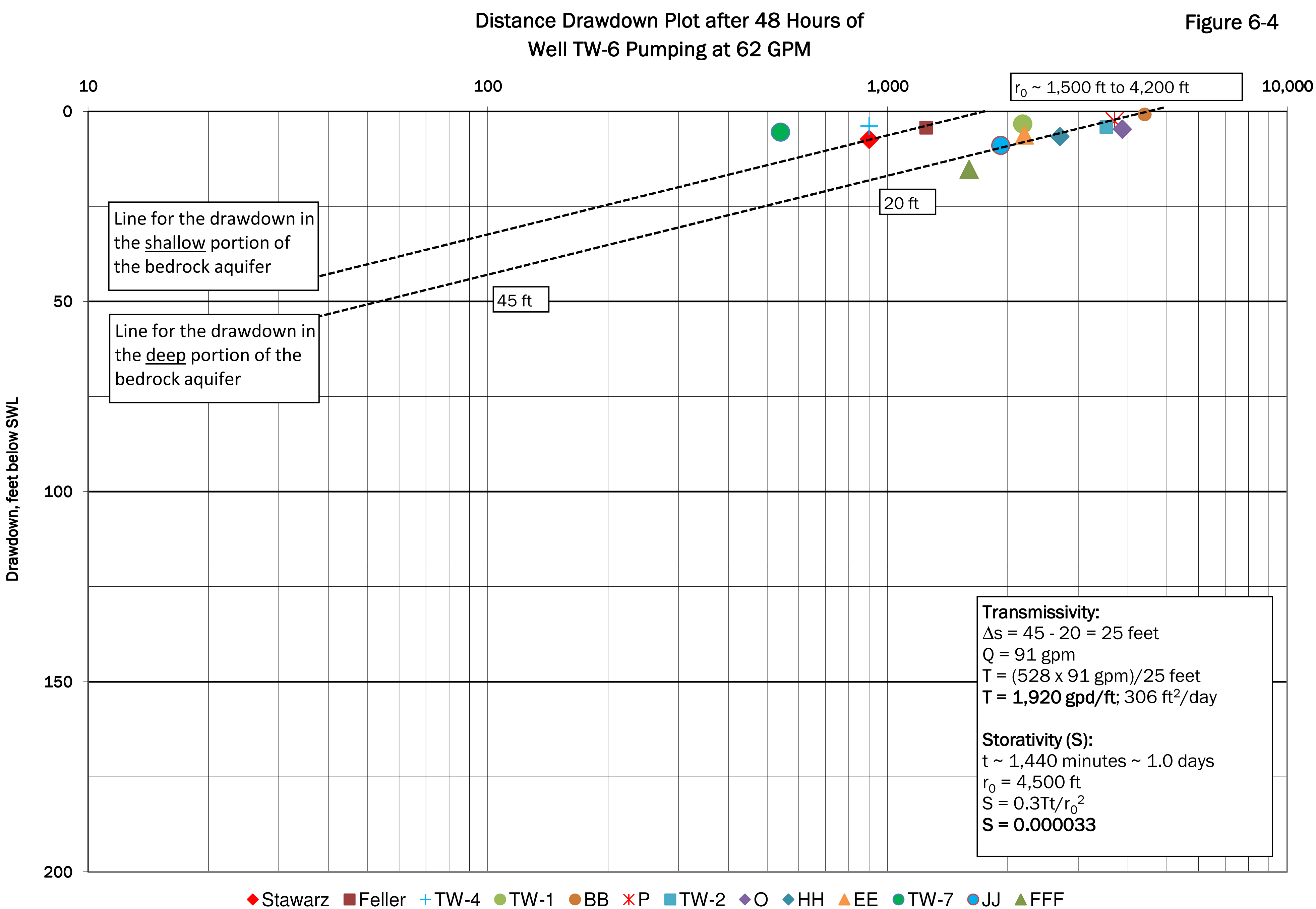
Figure 6-3

Distance Drawdown Plot after 48 Hours of Well TW-5 Pumping at 365 GPM, and 24 Hours of TW-6 at 62 gpm



Double Diamond Companies - Lost Lake Resort Site
Advantage Project 090539

Figure 6-4



Double Diamond Companies - Lost Lake Resort Site
Advantage Project 090539

ATTACHMENT 2

Residential Water Demand

benesch
alfred benesch & company
Engineers • Surveyors • Planners
400 One Norwegian Plaza • P.O. Box 1090 • Pottsville, PA 17901
570-622-4055 • Fax: 570-622-1232 • www.benesch.com

September 10, 2010

Mr. Michael Montysko, P.E.
Center for Environmental Health
New York State Department of Health
Flanigan Square, 547 River Street
Troy, NY 12180-2216

Subject: Residential Water Demand
Lost Lake Resort
Benesch Project No. 30107.01

Dear Mr. Montysko:

As discussed previously, Alfred Benesch & Company is a consulting engineering firm hired by Double Diamond Resorts to provide assistance with the proposed Lost Lake Resort development in the Town of Forestburgh, Sullivan County. Per our telephone conversation on September 1, 2010, we would like to present our request to lower the average daily water consumption rate of 330 gpd per residential connection that is typically used in planning to a value that is consistent with the information presented herein.

We recently have obtained water consumption data from four different public water providers within the State of New York:

- Village of Monticello, Sullivan County
- Town of Thompson, Sullivan County
- Dutchess County Water and Wastewater Authority
- Town of Fishkill, Dutchess County

The average water consumption rates per residential connection for these areas are shown in the table below. Correspondences with the public water providers for each area are also attached. These public water providers were chosen because of their location and either their high percentage of residential population or their ability to separate residential demand from commercial due to the metering of their system.

Public Water Provider	Water District/Zone	Connections	Average Daily Usage per Connection
Village of Monticello	Monticello	1500	208 gpd
Town of Thompson	Cold Spring	76	205 gpd
	Dillon Farms	14	140 gpd
	Lucky Lake	19	179 gpd
Dutchess County Water and Wastewater Authority	Dalton Farms	602	146 gpd
	Rokeby	57	133 gpd
	Valley Dale	165	167 gpd
	Hyde Park	1224	165 gpd
Town of Fishkill	Van Wyck at Merritt Park - Meadows	226	97 gpd
	Van Wyck at Merrit Park – Glen	210	111 gpd

We believe the above information supports our previous requests to lower the average water consumption rate that will be used to determine future water demand. Our initial request was to use a water rate of 200 gpd per residential connection. While we still feel comfortable with that number, we would be agreeable to using an even more conservative number of 250 gpd per residential connection. Based on the information in the table above, we believe the rate of 250 gpd per residential connection with a peaking factor of 1.75 is a conservative realistic value of what can be expected at the Lost Lake development.

Over the past few months, test wells have been drilled in various locations to determine the amount of groundwater available for the proposed development. The latest hydrogeologic data available reveals a combined safe yield of 825 gpm, as shown in the table below. An average consumption rate of 250 gpd per residential connection and a peaking factor of 1.75 will require a safe yield of 830 gpm. Enclosed is a spreadsheet calculating the water demand, and a map showing well locations. We feel the existing yields are sufficient for the future water demands. If necessary, we can drill an additional well for use as a backup source.

Well Identification	Safe Yield
HH (DD)	200 gpm
O	50 gpm
P	18 gpm
FFF	210 gpm
JJJ	100 gpm
EE	20 gpm
OO	20 gpm
TW-1	37 gpm
TW-2	45 gpm
TW-3	125 gpm
Total	**825 gpm**

As a reminder, the previous request to use a lower average residential water consumption rate was made in June of this year with data obtained from the Pennsylvania Department of Environmental Protection (PADEP) for the Eagle Rock Resort in Hazleton, PA. On June 2, 2010, three years of water consumption data for the Eagle Rock Resort was submitted to NYSDOH via e-mail to Glenn Illing and Dan Machell. On June 7, Dan Machell forwarded the e-mail to Mark Migliaccio. The e-mail contained four pdf attachments: three yearly facility reports from PADEP and a summary. The attachments from PADEP reveal that the average daily demands at the Eagle Rock Resort were 176 gpd per connection in year 2007, 181 gpd per connection in year 2008, and 137 gpd in year 2009 – all considerably below the requested 250 gpd per connection. The Eagle Rock Resort is owned and managed by Double Diamond Resorts, and serves as a model for the proposed Lost Lake Resort. Eagle Rock Resort is located approximately 120 miles from Lost Lake Resort. Double Diamond's business plan for Lost Lake Resort includes marketing the same area and demographics as was done for Eagle Rock. As such, we believe the Eagle Rock Resort water data further substantiates our request for Lost Lake's average residential consumption rate to be lowered to 250 gpd per connection.

We are aware of the uniqueness of this request and would like to suggest some alternatives if the newly requested and more conservative rate of 250 gpd per residential connection is not permissible. One alternative would be to allow a slightly higher consumption rate, say 275 gpd per connection, along with a slightly lower peaking factor, say 1.6. A second alternative would be to provide additional storage in the system to reduce daily demands and peaks.

Upon reviewing this information, we would like to hold a meeting to further explain the project and our request in more detail. Also, per your request, a CD of the DEIS is being forwarded to you separately by Tim Miller Associates.

Thank you for your assistance in this matter. If you have any questions, please feel free to contact our office.

Very truly yours,

Alfred Benesch & Company

William T. Orlowsky, P.E.
Project Engineer

M. Christopher McCoach, P.E.
Project Manager

Attachments

WTO:mag/cb
X:\30100S\30107.01\Office_Documents\Correspondence\Letters\LT.Montysko.091010.docx

cc: Randy Gracy, Double Diamond Companies (w/attachments)
Fred Wells, Tim Miller Associates (w/attachments)
Steve Read, Advantage Engineering (with attachments)
Mike Brinkash, Brinkash Engineering (w/attachments)
John Grohol, Eagle Rock Resorts (w/attachments)

ATTACHMENT 3

Well Logs

Tw-3a

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

(1) COUNTY Sullivan

(2) TOWN Forestburgh

(3) DEC Well Number SV3651

WATER WELL COMPLETION REPORT

(4) OWNER Double Diamond Company

(5) ADDRESS 10100 North Central Expressway, Dallas, TX 75231

(6) LOCATION OF WELL (See Instructions On Reverse) (Check here ☐ if same as address above, also provide Lat / Long below)
Show Lat/Long if available and method used: TW3A Section 7, Block 1, Lot 1

☐ GPS ☐ Map Interpolation

(7) DEPTH OF WELL BELOW LAND SURFACE (feet) 203

(8) DEPTH TO GROUNDWATER BELOW LAND SURFACE (feet) 10 DATE MEASURED

CASINGS

(9) DIAMETER 10 in. | in. | in. | in.

(10) LENGTH 16 ft. | ft. | ft. | in.

(11) GROUT TYPE / SEALING Cement/bentonite

(12) GROUT / SEALING INTERVAL (feet) FROM 16 TO 0

SCREENS

(13) MAKE & MATERIAL PVC

(14) OPENINGS Torch

(15) DIAMETER 6 in. | in. | in. | in.

(16) LENGTH 15 ft. | ft. | ft. | in.

(17) DEPTH TO TOP OF SCREEN, FROM TOP OF CASING (Feet) 0

YIELD TEST

(18) DATE 9/21/10

(19) DURATION OF TEST 2 hours

(20) LIFT METHOD ☐ Pump ☑ Air Lift ☐ Bail

(21) STABILIZED DISCHARGE (GPM) 200

(22) STATIC LEVEL PRIOR TO TEST (feet/inches below top of casing)

(23) MAXIMUM DRAWDOWN (Stabilized) (feet/inches below top of casing)

(24) RECOVERY (Time in hours/minutes)

(25) Was the water produced during the test discharged away from immediate area? Yes ___ No ___

PUMP INSTALLATION

(26) PUMP INSTALLED? YES ___ NO ___

(27) DATE

(28) PUMP INSTALLER

(29) TYPE

(30) MAKE

(31) MODEL

(32) MAXIMUM CAPACITY (GPM)

(33) PUMP INSTALLATION LEVEL FROM TOP OF CASING (Feet)

(34) METHOD OF DRILLING ☑ Rotary ☐ Cable Tool ☐ Other ______

(35) USE OF WATER (See instructions for choices) Public/Test

(36) DATE DRILLING WORK STARTED 9/20/10

(37) DATE DRILLING WORK COMPLETED 9/22/10

(38) DATE REPORT FILED 10/19/10

(39) REGISTERED COMPANY Talon Drilling Company

(40) DEC REGISTRATION NO. NYRD 1843

(41) CERTIFIED DRILLER (Print name) Joseph Deithorn

(42) CERTIFIED DRILLER SIGNATURE * Joseph Deithorn

* By signing this document I hereby affirm that: (1) I am certified to supervise water well drilling activities as defined by Environmental Conservation Law §15-1502; (2) this water well was constructed in accordance with water well standards promulgated by the New York State Department of Health; (3) under the penalty of perjury the information provided in this Well Completion Report is true, accurate and complete, and I understand that any false statement made herein is punishable as a class A Misdemeanor under Penal Law

(43) LOG

Depth to Bedrock ______ (ft. below ground surface)

Ground Elev. ______ (ft. above S.L.)

Top of Casing ______ (ft., above (+) or below (-) ground surface)

TOP OF WELL

0-10'	Cobbles w/silt
10-16'	weathered rock
16-29'	Sandstone
29-34'	Large fracture
34-203'	Sand stone

BOTTOM OF HOLE

TW-5

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

(1) COUNTY Sullivan

(2) TOWN Forestburgh

(3) DEC Well Number SV 3613

WATER WELL COMPLETION REPORT

(4) OWNER
Double Diamond Company

(5) ADDRESS
10100 North Central Expressway, Dallas, TX 7231

(6) LOCATION OF WELL (See Instructions On Reverse) (Check here ☐ if same as address above, also provide Lat / Long below)
Show Lat/Long if available and method used: TW5 Section 8, Block 1, Lot 1
☐ GPS ☐ Map Interpolation 41.5600N, 74.6839W

(7) DEPTH OF WELL BELOW LAND SURFACE (feet): 840

(8) DEPTH TO GROUNDWATER BELOW LAND SURFACE (feet): 12 DATE MEASURED

CASINGS

(9) DIAMETER	16 in.	10 in.	in.	in.
(10) LENGTH	7 1/2 ft.	46 ft.	ft.	in.

(11) GROUT TYPE / SEALING: cement / bentonit

(12) GROUT / SEALING INTERVAL (feet) FROM 46 TO 0

SCREENS

(13) MAKE & MATERIAL

(14) OPENINGS

(15) DIAMETER	in.	in.	in.	in.
(16) LENGTH	ft.	ft.	ft.	in.

(17) DEPTH TO TOP OF SCREEN, FROM TOP OF CASING (Feet)

YIELD TEST

(18) DATE: 10/4/10

(19) DURATION OF TEST: 2 hours

(20) LIFT METHOD ☐ Pump ☑ Air Lift ☐ Bail

(21) STABILIZED DISCHARGE (GPM): 500

(22) STATIC LEVEL PRIOR TO TEST (feet/inches below top of casing)

(23) MAXIMUM DRAWDOWN (Stabilized) (feet/inches below top of casing)

(24) RECOVERY (Time in hours/minutes)

(25) Was the water produced during the test discharged away from immediate area? Yes ___ No ___

PUMP INSTALLATION

(26) PUMP INSTALLED? YES ___ NO ✓

(27) DATE

(28) PUMP INSTALLER

(29) TYPE

(30) MAKE

(31) MODEL

(32) MAXIMUM CAPACITY (GPM)

(33) PUMP INSTALLATION LEVEL FROM TOP OF CASING (Feet)

(34) METHOD OF DRILLING ☑ Rotary ☐ Cable Tool ☐ Other ______

(35) USE OF WATER (See Instructions for choices): Public/Test

(36) DATE DRILLING WORK STARTED: 10/4/10

(37) DATE DRILLING WORK COMPLETED: 10/15/10

(38) DATE REPORT FILED: 11/19/10

(39) REGISTERED COMPANY: Talon Drilling Co.

(40) DEC REGISTRATION NO.: NYRD 1843

(41) CERTIFIED DRILLER (Print name): Joseph Deithorn

(42) CERTIFIED DRILLER SIGNATURE *: Joseph Deithorn

* By signing this document I hereby affirm that: (1) I am certified to supervise water well drilling activities as defined by Environmental Conservation Law §15-1502; (2) this water well was constructed in accordance with water well standards promulgated by the New York State Department of Health; (3) under the penalty of perjury the information provided in this Well Completion Report is true, accurate and complete, and I understand that any false statement made herein is punishable as a class A Misdemeanor under Penal Law §210.45

(43) LOG

Depth to Bedrock ______ (ft. below ground surface)

Ground Elev. ______ (ft. above S.L.)

Top of Casing ______ (ft., above (+) or below (-) ground surface)

TOP OF WELL

7 1/2 - 46'	Gray sand stone
46 - 780'	Gray sand stone some inner bedded red shale
780 - 795'	Red shale
795 - 840'	Gray sand stone
790' Fracture	

BOTTOM OF HOLE

TW-6 [1]

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

(1) COUNTY Sullivan

(2) TOWN Forestburgh

(3) DEC Well Number SV 3618

WATER WELL COMPLETION REPORT

(4) OWNER Double Diamond Company

(5) ADDRESS 10100 North Central Expressway, Dallas, TX 75231

(6) LOCATION OF WELL (See Instructions On Reverse) (Check here ☐ if same as address above, also provide Lat / Long below)
Show Lat/Long if available and method used: TW-6, Sect 8, Block 1, Lot 1, 260 Rt 108, Forestburgh
N41°5644 W074°6840

☒ GPS ☐ Map Interpolation

(7) DEPTH OF WELL BELOW LAND SURFACE (feet) 850'

(8) DEPTH TO GROUNDWATER BELOW LAND SURFACE (feet) DATE MEASURED

CASINGS

(9) DIAMETER 10 in. | in. | in. | in.

(10) LENGTH 26 ft. | ft. | ft. | in.

(11) GROUT TYPE / SEALING Cement

(12) GROUT / SEALING INTERVAL (feet) FROM 26 TO 0

SCREENS

(13) MAKE & MATERIAL

(14) OPENINGS

(15) DIAMETER in. | in. | in. | in.

(16) LENGTH ft. | ft. | ft. | in.

(17) DEPTH TO TOP OF SCREEN, FROM TOP OF CASING (Feet)

YIELD TEST

(18) DATE 10/14/10

(19) DURATION OF TEST 1/2 hour

(20) LIFT METHOD ☐ Pump ☒ Air Lift ☐ Bail

(21) STABILIZED DISCHARGE (GPM) 55

(22) STATIC LEVEL PRIOR TO TEST (feet/inches below top of casing)

(23) MAXIMUM DRAWDOWN (Stabilized) (feet/inches below top of casing)

(24) RECOVERY (Time in hours/minutes)

(25) Was the water produced during the test discharged away from immediate area? Yes X No ___

PUMP INSTALLATION

(26) PUMP INSTALLED? YES ___ NO X

(27) DATE

(28) PUMP INSTALLER

(29) TYPE

(30) MAKE

(31) MODEL

(32) MAXIMUM CAPACITY (GPM)

(33) PUMP INSTALLATION LEVEL FROM TOP OF CASING (Feet)

(34) METHOD OF DRILLING ☒ Rotary ☐ Cable Tool ☐ Other ___

(35) USE OF WATER (See instructions for choices) Public / Test

(36) DATE DRILLING WORK STARTED 9/22/10

(37) DATE DRILLING WORK COMPLETED 10/14/10

(38) DATE REPORT FILED 10/15/10

(39) REGISTERED COMPANY Negley's Well Drilling, Inc.

(40) DEC REGISTRATION NO. NYRD 10339

(41) CERTIFIED DRILLER (Print name) Dustin Negley

(42) CERTIFIED DRILLER SIGNATURE * [signature]

* By signing this document I hereby affirm that: (1) I am certified to supervise water well drilling activities as defined by Environmental Conservation Law §15-1502; (2) this water well was constructed in accordance with water well standards promulgated by the New York State Department of Health; (3) under the penalty of perjury the information provided in this Well Completion Report is true, accurate and complete, and I understand that any false statement made herein is punishable ...

(43) LOG

Depth to Bedrock ___ (ft. below ground surface)

Ground Elev. ___ (ft. above S.L.)

Top of Casing 1 1/2+ (ft., above (+) or below (-) ground surface)

TOP OF WELL

2'		fill
6'		Clay
11'	5 gpm @ 9'	Broken Sandstone
22'		Sand
28'		Gray Sandstone
34'	20 gpm @ 30'	Broken Sandstone
75'		Gray Sandstone
76'	10 gpm @ 76'	fractured Gray Sandstone
144'		Gray Sandstone
151'		Red Shale
204'		Gray Sandstone
205'		Red Shale
274'		Gray Sandstone
277'		Red Shale
504'		Gray Sandstone
511'		Red Shale
672'		Gray Sandstone
674'		Red shale
850'	4 @ 712' 10 @ 724' 25 @ 742' 3 @ 825'	Gray Sandstone

BOTTOM OF HOLE

DRILLER COPY

WellTW-1

1

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

(1) COUNTY Sullivan

(2) TOWN Forestburgh

(3) DEC Well Number SV 3587

WATER WELL COMPLETION REPORT

(4) OWNER Double Diamond Company

(5) ADDRESS 10100 North Central Expressway, Dallas TX 75231

(6) LOCATION OF WELL (See Instructions On Reverse) (Check here ☐ if same as address above, also provide Lat / Long below)
Show Lat/Long if available TW-1, Sect.8, Block 1, Lot 1,2 off Rt 102, Forestburgh
and method used: ~~[illegible]~~

☒ GPS ☐ Map Interpolation 41° 34' 01" N, -74° 41' 03" W

(7) DEPTH OF WELL BELOW LAND SURFACE (feet) 1123'

(8) DEPTH TO GROUNDWATER BELOW LAND SURFACE (feet) 13' DATE MEASURED 8/16/10

CASINGS

(9) DIAMETER 6 5/8 in. | in. | in. | in.

(10) LENGTH 40 ft. | ft. | ft. | in.

(11) GROUT TYPE / SEALING

(12) GROUT / SEALING INTERVAL (feet) FROM ________ TO ________

SCREENS

(13) MAKE & MATERIAL

(14) OPENINGS

(15) DIAMETER in. | in. | in. | in.

(16) LENGTH ft. | ft. | ft. | in.

(17) DEPTH TO TOP OF SCREEN, FROM TOP OF CASING (Feet)

YIELD TEST

(18) DATE 8/16/10

(19) DURATION OF TEST 1/2 hr.

(20) LIFT METHOD ☐ Pump ☒ Air Lift ☐ Bail

(21) STABILIZED DISCHARGE (GPM) 39

(22) STATIC LEVEL PRIOR TO TEST (feet/inches below top of casing)

(23) MAXIMUM DRAWDOWN (Stabilized) (feet/inches below top of casing)

(24) RECOVERY (Time in hours/minutes)

(25) Was the water produced during the test discharged away from immediate area? Yes X No____

PUMP INSTALLATION

(26) PUMP INSTALLED? YES ____ NO X

(27) DATE

(28) PUMP INSTALLER

(29) TYPE

(30) MAKE

(31) MODEL

(32) MAXIMUM CAPACITY (GPM)

(33) PUMP INSTALLATION LEVEL FROM TOP OF CASING (Feet)

(34) METHOD OF DRILLING ☒ Rotary ☐ Cable Tool ☐ Other ________

(35) USE OF WATER (See instructions for choices) Public / Test

(36) DATE DRILLING WORK STARTED 8/9/10

(37) DATE DRILLING WORK COMPLETED 8/16/10

(38) DATE REPORT FILED 8/20/10

(39) REGISTERED COMPANY Negley's Well Drilling, Inc.

(40) DEC REGISTRATION NO. NYRD 10339

(41) CERTIFIED DRILLER (Print name) Neil C. Negley

(42) CERTIFIED DRILLER SIGNATURE * Neil C Negley

* By signing this document I hereby affirm that: (1) I am certified to supervise water well drilling activities as defined by Environmental Conservation Law §15-1502; (2) this water well was constructed in accordance with water well standards promulgated by the New York State Department of Health; (3) under the penalty of perjury the information provided in this Well Completion Report is true, accurate and complete, and I

(43) LOG

Depth to Bedrock 33 (ft. below ground surface)

Ground Elev. ________ (ft. above S.L.)

Top of Casing +1 (ft., above (+) or below (-) ground surface)

TOP OF WELL

2'		Fill
14'		Broken rock & Sand
16'		Gravel & Water
31'		Gray Sand rock
33'		Soft Layer
49'		Gray Sandstone
52'		Yellow Sandstone & Soft Clay
56'		Soft Gray Sandstone
194	15 gpm @ 57'	Gray Sandstone
711'	2 gpm @ 711'	Lighter Gray Sandstone
716'		Red-Grey Layers
931' ~~[illegible]~~		Grey Sandstone
951'		Red Shale
977'		Gray Sandstone
1052'	10 gpm @ 1048'	Red Shale
1109'		Gray Sandstone
1122'	12 gpm @ 1118'	Red shale
1123'		Gray Sandstone

BOTTOM OF HOLE 1123'

NYSDEC COPY

TW-3 [1]

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

(1) COUNTY Sullivan

(2) TOWN Forestburgh

(3) DEC Well Number SV 3601

WATER WELL COMPLETION REPORT

(4) OWNER
Double Diamond Company

(5) ADDRESS
10100 North Central Expressway, Dallas, TX 75231

(6) LOCATION OF WELL (See Instructions On Reverse) (Check here ☐ if same as address above, also provide Lat / Long below)
Show Lat/Long if available and method used: TW-3, Sect 7, Block 1, Lot 13 off Rt 108, Forestburgh

☒ GPS ☐ Map Interpolation N41°5716 W74°6882

(7) DEPTH OF WELL BELOW LAND SURFACE (feet) 968'

(8) DEPTH TO GROUNDWATER BELOW LAND SURFACE (feet) DATE MEASURED

CASINGS

(9) DIAMETER 6 5/8 in. | in. | in. | in.

(10) LENGTH 80 ft. | ft. | ft. | in.

(11) GROUT TYPE / SEALING

(12) GROUT / SEALING INTERVAL (feet) FROM ______ TO ______

SCREENS

(13) MAKE & MATERIAL

(14) OPENINGS

(15) DIAMETER in. | in. | in. | in.

(16) LENGTH ft. | ft. | ft. | in.

(17) DEPTH TO TOP OF SCREEN, FROM TOP OF CASING (Feet)

YIELD TEST

(18) DATE 8/25/10

(19) DURATION OF TEST 1/2 hr

(20) LIFT METHOD ☐ Pump ☒ Air Lift ☐ Bail

(21) STABILIZED DISCHARGE (GPM) 120 - 150

(22) STATIC LEVEL PRIOR TO TEST (feet/inches below top of casing)

(23) MAXIMUM DRAWDOWN (Stabilized) (feet/inches below top of casing)

(24) RECOVERY (Time in hours/minutes)

(25) Was the water produced during the test discharged away from immediate area? Yes X No____

PUMP INSTALLATION

(26) PUMP INSTALLED? YES ____ NO X

(27) DATE

(28) PUMP INSTALLER

(29) TYPE

(30) MAKE

(31) MODEL

(32) MAXIMUM CAPACITY (GPM)

(33) PUMP INSTALLATION LEVEL FROM TOP OF CASING (Feet)

(34) METHOD OF DRILLING ☒ Rotary ☐ Cable Tool ☐ Other ______

(35) USE OF WATER (See instructions for choices) Public / Test

(36) DATE DRILLING WORK STARTED 8/17/10

(37) DATE DRILLING WORK COMPLETED 8/25/10

(38) DATE REPORT FILED 8/27/10

(39) REGISTERED COMPANY Negley's Well Drilling, Inc

(40) DEC REGISTRATION NO. NYRD 10339

(41) CERTIFIED DRILLER (Print name) Neil C. Negley

(42) CERTIFIED DRILLER SIGNATURE * Neil C Negley

* By signing this document I hereby affirm that: (1) I am certified to supervise water well drilling activities as defined by Environmental Conservation Law §15-1502; (2) this water well was constructed in accordance with water well standards promulgated by the New York State Department of Health; (3) under the penalty of perjury the information provided in this Well Completion Report is true, accurate and complete, and I understand that any false statement made herein is punishable as a class A Misdemeanor under Penal Law §210.45

(43) LOG

Depth to Bedrock ______ (ft. below ground surface)

Ground Elev. ______ (ft. above S.L.)

Top of Casing + 1 (ft., above (+) or below (-) ground surface)

TOP OF WELL

9'		Clay
17'	3gpm @ 10'	Fractured Sandrock
28'		Gray Sandstone
33'	10gpm @ 31'	Hole with Clay
39'		Fractured Sandstone
44'		Soft Layers of Clay and Sandstone
139'	30 gpm @ 48'	Gray Sandrock
152'	4gpm 151'	Red Shale
226		Gray Sandstone
295'		Red Shale
310'		Gray Sandstone
312	2gpm @ 311'	Red Shale
372'		Gray Sandstone
383'		Red Shale
566'		Gray Sandstone
568'		Red Shale
608'		Gray Sandstone
609'	40 gpm @ 608'	Soft Layer
768'		Gray Sandstone
772'		Red Shale
796'		Gray Sandstone
798'		Red Shale
947'		Gray Sandstone
952'	75-100gpm	Quartz
968'		Sandstone

BOTTOM OF HOLE

NYSDEC COPY

TW-4 [1]

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

(1) COUNTY Sullivan

(2) TOWN Fallsburgh

(3) DEC Well Number: SV 3602

WATER WELL COMPLETION REPORT

(4) OWNER: Double Diamond Company

(5) ADDRESS: 10100 North Central Expressway, Dallas TX 75231

(6) LOCATION OF WELL (See Instructions On Reverse) (Check here ☐ if same as address above, also provide Lat / Long below)
Show Lat/Long if available and method used: TW-4, Sect. 2, Block 1, Lot 12.2 off Rt 42, Fallsburgh
☑ GPS ☐ Map Interpolation N41°5621 W74°6824

(7) DEPTH OF WELL BELOW LAND SURFACE (feet): 1100'

(8) DEPTH TO GROUNDWATER BELOW LAND SURFACE (feet): DATE MEASURED

CASINGS

(9) DIAMETER	6 5/8 in.	10 3/4 in.	in.	in.
(10) LENGTH	60 ft.	24 ft.	ft.	in.

(11) GROUT TYPE / SEALING

(12) GROUT / SEALING INTERVAL (feet) FROM ______ TO ______

SCREENS

(13) MAKE & MATERIAL

(14) OPENINGS

(15) DIAMETER	in.	in.	in.	in.
(16) LENGTH	ft.	ft.	ft.	in.

(17) DEPTH TO TOP OF SCREEN, FROM TOP OF CASING (Feet)

YIELD TEST

(18) DATE: 9/15/10

(19) DURATION OF TEST: 1/2 hr.

(20) LIFT METHOD ☐ Pump ☒ Air Lift ☐ Bail

(21) STABILIZED DISCHARGE (GPM): 60

(22) STATIC LEVEL PRIOR TO TEST (feet/inches below top of casing)

(23) MAXIMUM DRAWDOWN (Stabilized) (feet/inches below top of casing)

(24) RECOVERY (Time in hours/minutes)

(25) Was the water produced during the test discharged away from immediate area? Yes X No ____

PUMP INSTALLATION

(26) PUMP INSTALLED? YES ____ NO X

(27) DATE

(28) PUMP INSTALLER

(29) TYPE

(30) MAKE

(31) MODEL

(32) MAXIMUM CAPACITY (GPM)

(33) PUMP INSTALLATION LEVEL FROM TOP OF CASING (Feet)

(34) METHOD OF DRILLING ☒ Rotary ☐ Cable Tool ☐ Other ______

(35) USE OF WATER (See instructions for choices): Public / Test

(36) DATE DRILLING WORK STARTED: 9/7/10

(37) DATE DRILLING WORK COMPLETED: 9/15/10

(38) DATE REPORT FILED: 9/17/10

(39) REGISTERED COMPANY: Negley's Well Drilling, Inc

(40) DEC REGISTRATION NO.: NYRD 10239

(41) CERTIFIED DRILLER (Print name): Neil Negley

(42) CERTIFIED DRILLER SIGNATURE *: [signature]

* By signing this document I hereby affirm that: (1) I am certified to supervise water well drilling activities as defined by Environmental Conservation Law §15-1502; (2) this water well was constructed in accordance with water well standards promulgated by the New York State Department of Health; (3) under the penalty of perjury the information provided in this Well Completion Report is true, accurate and complete, and I understand that any false statement made herein is punishable as a class A Misdemeanor under Penal Law

(43) LOG

Depth to Bedrock ______ (ft. below ground surface)

Ground Elev. ______ (ft. above S.L.)

Top of Casing +1 (ft., above (+) or below (-) ground surface)

TOP OF WELL

	GPM	
2'		Fill
10'		Broken Gray Sandstone
22'	10 gpm	Gravel
28'		Gray Sandstone
41'	10 @ 37'	Yellow Sandstone
68'		Gray Sandstone
70'	8 @ 69'	Red Shale
82'		Gray Sandstone
84'	30 @ 83'	Brown Sandstone
335'	70 @ 335'	Gray & Red Layers
336'		Red
345'		Gray & Red Layers
358'	15+ @ 350'	Red
547'		Gray & Blue Shale
549	70 @ 548'	Soft Blue Shale
613		Gray & Red Layers
620'		Blue & Weathered
679'		Gray & Red Layers
724'		Gray Shale
726'	100 @ 730'	Red Shale
846'		Gray & Red Shale
854'		Red Shale
903'		Gray & Red Shale
925'		Red Shale
1100'		Gray & Red Shale

BOTTOM OF HOLE

DRILLER COPY

ATTACHMENT 4

Tables

Table 2-5 - Well FFF Rate and Chemistry Measurements

Test Time	Rate	Temperature	pH	Specific Conductance
	(gpm)	(°C)	(pH units)	(microSiemens/cm)
1	300.0			
4	300.0			
5	280.0			
6	290.0			
7	270.0			
8	280.0			
10	280.0			
15	268.0			
20	280.0			
25	272.0			
30	274.0			
35	274.0			
40	278.0			
85	268.7	11.2	7.7	190
146	261.0	11.5	6.9	190
213	256.9	11.6	7.9	190
260	254.2	12	7.6	190
320	269.8			
350	252.8	11.9	7.7	190
370	252.0	11.6	7.7	190
400	252.2	11.5	7.7	190
550	250.6	11.2	7.7	200
580	250.0			
610	249.5	10.8	7.6	190
640	249.3	10.7	7.6	190
880	248.5	10.6	7.6	190
1045	248.3			
1165	248.4			
1255	247.1	10.4	7.6	190
1305	245.6	10.5	7.6	180
1350	245.4	10.5	7.8	190
1370	245.5	10.5	7.4	190
1410	245.5	10.7	7.7	190
1450	245.3	10.9	7.7	190
1625	244.8	11.3	7.7	190
1700	244.5	11.3	7.7	190
1720	244.3	11.4	7.7	190
1970	244.3	11.8	7.7	190
2280	244.2			
2510	244.2			
2745	244.0			
2750	244.0			
2825	244.6	10.6	7.8	190
3000	244.1	11.3	7.7	190
3090	243.5	11.5	7.7	200
3370	242.7	11.7	7.7	200
4155	242.0	11.6	7.8	190
4285	241.7	11.3	7.7	190
Minimum	241.7	10.4	6.9	180
Maximum	300.0	12	7.9	200
Median	245.8	11.3	7.7	190

Table 2-6 - Well JJJ Rate and Chemistry Measurements

Test Time	Rate	Temperature	pH	Specific Conductance
	(gpm)	(°C)	(pH units)	(microSiemens/cm)
9	190.0			
11	195.0			
13	162.0	12.5	7.1	135
15	185.0			
18	160.0			
20	177.5	12	7.3	142
24	178.8			
30	155.0			
35	175.0			
40	162.0			
44	150.0			
48	148.0			
51	165.0			
54	165.0	12.4	7.6	152
68	145.0			
77	141.7			
86	146.7			
100	141.4	12.7	7.9	156
120	136.2			
130	137.5	12.8	7.9	159
140	132.0			
160	135.5	12.9	7.9	156
170	131.5			
190	135.0	12.9	7.8	157
223	131.2	12.9	7.9	156
230	132.9			
250	133.0			
280	130.6	13.2	7.9	156
296	130.0			
310	130.0			
340	128.0	13.5	7.8	156
360	129.3			
410	129.1	12.8	7.9	156
560	128.0	12.7	7.6	159
620	124.3	12.9	7.8	158.5
850	125.0	12.5	7.9	158.3
1030	125.0	12.3	7.8	157.9
1150	125.0	12	7.8	157.8
1240	125.0	11.8	7.9	157.13
1300	124.0	11.9	7.9	156.8
1340	124.3	11.4	7.9	159.6
1380	124.4	12.1	7.9	159.9
1640	124.2	13.1	7.8	156.6
1670	123.2	13	7.8	158.9
1710	123.9	12.9	7.9	159.7
1716	123.9	13.1	7.9	158.4
1983	123.0	13	7.8	150.5
1994	123.9			
2260	123.9			
2500	123.9			
2730	123.8			
2740	123.5	11.9	8.0	160.9
2810	122.9			
2850	123.9			
2990	123.5	12.6	8.0	160.3
3060	124.6	13.3	8.0	159.2
3120	123.8	13.2	7.9	158.1
3360	124.3	13.1	7.9	158.6
4150	126.5	12.8	7.8	158.3
4280	128.2	13.1	7.9	158.5
Minimum	122.9	11.4	7.1	135
Maximum	195.0	13.5	8.0	160.9
Median	126.3	12.8	7.9	158

Table 2-7 - Bush Kill UNT Chemistry Measurements During Well FFF/JJJ Testing

Test Time	Temperature	pH	Specific Conductance
minutes since pumping started	(°C)	(pH units)	(microSiemens/cm)
110	22	6.4	50
583	21.8	7.1	50
1365	17.6	7.1	50
1632	17.3	7.5	50
1727	19.1	7.4	60
1975	19.7	7.1	50
3006	17.7	7.3	50
3370	19.7	7.7	50
(pumping stopped at 4,320 minutes, different chemistry meter used)			
4690	23.1	5.0	40
5680	21.3	4.6	46
5922	22.1	4.9	45
7100	21.6	5.8	46
7580	23.5	5.6	45
8500	22.7	5.6	47

Table 3-4 - Well TW-3a Rate and Chemistry Measurements				
Test Time	Rate	Temperature	pH	Specific Conductance
	(gpm)	(°C)	(pH units)	(microSiemens/cm)
2	111.0	10.6	6.5	98
5	118.0			
11	119.0	10.6	6.2	91
140	118.6	10.9	6.2	78
157	118.4			
205	119.9	10.9	6.0	78
996	115.8	10.9	6.2	79
1010	116.1			
1113	115.9	11.0	6.1	78
1216	115.8	10.8	5.8	78
1410	116.0	11.4	6.0	78
1484		11.0	5.9	79
1150	114.9	10.9	5.9	78
1585	113.1	10.6	6.0	78
2473	113.6	10.4	6.0	81
2681	114.0	10.8	5.9	77
2710	114.0			
2790	114.0	11.2	6.0	81
2945	114.0	11.5	6.2	81
3070	114.1	11.4	6.1	81
3901	113.7	10.0	6.1	84
3975	113.4	10.1	6.2	81
4065	113.2	10.3	6.2	83
4205	113.1	10.9	6.1	82
4300	113.4	11.4	6.1	82
4320	113.0			
Minimum	111.0	10.0	5.8	77
Maximum	119.9	11.5	6.5	98
Median	114.0	10.9	6.1	81

Table 3-6 - Bush Kill UNT Chemistry Measurements at Stilling Well

Date/Time	Minutes Since Pumping at TW-3a Started	Temperature (°C)	pH (pH units)	Specific Conductance (microSiemens/cm)
10/4/10, 11:15	na	-	5.0	51.5
10/5/10, 14:51	na	12	4.9	49
10/6/10, 10:20	1160	12.3	5.2	48
10/7/10, 8:50	2510	11.4	4.7	46
10/8/2010	4000	10.5	4.3	49.8
	Median Values	11.7	4.9	49

Table 4-4 - Well TW-5 Rate and Chemistry Measurements				
Test Time	Rate	Temperature	pH	Specific Conductance
	(gpm)	(°C)	(pH units)	(microSiemens/cm)
2	400.0			
6	400.0			
9	376.7			
10	370.0			
18	372.5			
28	360.0			
29	419.0			
39	345.0	10.1	7.6	202
41	360.0			
65	390.0			
86	378.0			
102	376.2	10.7	7.8	171
120	372.7	10.9	7.7	172
135	370.6			
150	365.3	10.8	7.7	173
280	358.3			
330	351.0			
390	354.0	10.7	7.8	174
415	352.4			
416	380.0			
420	352.5			
422	365.0			
423	390.0			
424	370.0			
425	360.0			
430	374.0			
450	371.0	10.6	7.7	172
480	368.0	10.7	7.8	175
1305	355.7	10.4	7.7	171
1320	367.3			
1350	367.3			
1515	367.1			
1630	366.4	10.7	7.8	180
1890	363.2	10.9	7.7	172
2945	360.7	10.7	7.7	179
Minimum	345.0	10.1	7.6	171
Maximum	419.0	10.9	7.8	202
Median	367.3	10.7	7.7	173

Table 4-7 - Well TW-6 2nd Test Rate and Chemistry Measurements				
Test Time	Rate	Temperature	pH	Specific Conductance
	(gpm)	(°C)	(pH units)	(microSiemens/cm)
1	120.0			
4	117.0			
10	111.4			
20	115.0			
25	110.0			
30	106.4			
35	103.8			
40	102.3			
50	100.8			
60	99.5	11.1	7.9	187
70	98.5			
240	94.5			
1185	91.5	10.7	7.8	177
1560	90.1			
2700	89.5	10.3	7.7	179
2850	88.4			
2880	88.0			
Minimum	88.0	10.3	7.7	177
Maximum	120.0	11.1	7.9	187
Median	100.8	10.7	7.8	179

Table 4-8 - Well TW-O Re-Test Rate and Chemistry Measurements				
Test Time	Rate	Temperature	pH	Specific Conductance
	(gpm)	(°C)	(pH units)	(microSiemens/cm)
1	100.0			
5	102.0			
10	99.4			
20	109.8			
30	105.6			
50	98.9			
60	95.5			
70	94.0			
80	92.9			
90	92.1	12.3	7.7	187
100	91.4			
110	90.9			
160	89.9			
1070	85.7	11.9	7.8	173
1500	84.1			
2550	83.5	12.0	7.7	171
2830	83.0	11.8	7.7	171
2840	82.2			
Minimum	82.2	11.8	7.7	171
Maximum	109.8	12.3	7.8	187
Median	92.5	12.0	7.7	172

Table 4-9 - Bush Kill Chemistry Measurements at Stilling Well

Date/Time	Minutes Since Pumping at TW-3a Started	Temperature (°C)	pH (pH units)	Specific Conductance (microSiemens/cm)
10/19/2010	na	9.5	5.4	87.4
10/21/2010	24 hours	8.7	5.7	90.3
10/22/2010	49 hours	8.5	5.3	94.3

ATTACHMENT 5

Analytical Reports

EnviroTest Laboratories Inc.

ANALYTICAL REPORT

Job Number: 420-37446-1

SDG Number: Lost Lake Resort, Forestburgh, NY

Job Description: Advantage Engineers

For:
Advantage Engineers
910 Century Drive
Mechanicsburg, PA 17055

Attention: Mr. Pierre O. MaCoy

Debra Bayer
Customer Service Manager
dbayer@envirotestlaboratories.com
09/15/2010

METHOD SUMMARY

Client: Advantage Engineers

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Description	Lab Location	Method	Preparation Method
Matrix: Water			
ICP Metals by 200.7	EnvTest	EPA 200.7 Rev 4.4	
200 Series Drinking Water Prep Determination Step	EnvTest		EPA 200
ICPMS Metals by 200.8	EnvTest	EPA 200.8	
200 Series Drinking Water Prep Determination Step	EnvTest		EPA 200
Apparent Color	EnvTest	SM21 2120B	
Mercury in Water by CVAA	EnvTest	EPA 245.1	
Digestion for CVAA Mercury in Waters	EnvTest		EPA 245.1
Anions by Ion Chromatography	EnvTest	MCAWW 300.0	
Anions by Ion Chromatography	EnvTest	MCAWW 300.0	
Volatile Organic Compounds by Purge and Trap (Preserved)	EnvTest	EPA 502.2	
Turbidity	EnvTest	SM20 SM 2130B	
Odor, Threshold Test	EnvTest	SM20 SM 2150B	
Cyanide, Total: Colorimetric Method	EnvTest	SM18 SM 4500 CN E	
Cyanide: Distillation	EnvTest		SM18 SM 4500 CN C
Membrane Filter Technique - Fecal Coliform Procedure	EnvTest	SM18 SM 9222D	
Total Coliform and Escherichia coli by Colilert - Quantity Tray	EnvTest	SMWW SM 9223	
General Sub Contract Method		Subcontract	
General Sub Contract Method	Env.Assoc.	Subcontract	
General Sub Contract Method	SET Labs	Subcontract	

Lab References:

=

Env.Assoc. = Environmental Associates

EnvTest = EnviroTest

SET Labs =

Method References:

EPA = US Environmental Protection Agency

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

SM18 = "Standard Methods For The Examination Of Water And Wastewater", 18th Edition, 1992.

SM20 = "Standard Methods For The Examination Of Water And Wastewater", 20th Edition."

SM21 = "Standard Methods For The Examination Of Water And Wastewater", 21st Edition

SMWW = "Standard Methods for the Examination of Water and Wastewater"

SAMPLE SUMMARY

Client: Advantage Engineers

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
420-37446-1	Well-JJJ Lost Lake Resort	Water	08/09/2010 0850	08/09/2010 1400
420-37446-2	Well-FFF Lost Lake Resort	Water	08/09/2010 0830	08/09/2010 1400

Mr. Pierre O. MaCoy
Advantage Engineers
910 Century Drive
Mechanicsburg, PA 17055

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Client Sample ID: Well-JJJ Lost Lake Resort
Lab Sample ID: 420-37446-1

Date Sampled: 08/09/2010 0850
Date Received: 08/09/2010 1400
Client Matrix: Water

Analyte	Result/Qualifier	Unit	NONE	NONE	Dilution
Method: 2120B		Date Analyzed:	08/10/2010 1140		
Apparent Color	2.5	Color Units			1.0

Mr. Pierre O. MaCoy
Advantage Engineers
910 Century Drive
Mechanicsburg, PA 17055

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Client Sample ID: Well-JJJ Lost Lake Resort
Lab Sample ID: 420-37446-1

Date Sampled: 08/09/2010 0850
Date Received: 08/09/2010 1400
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: 502.2			Date Analyzed:	08/10/2010 1912		
1,1,1,2-Tetrachloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,1,1-Trichloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,1,2,2-Tetrachloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,1,2-Trichloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,1-Dichloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,1-Dichloroethene	0.50	U	ug/L	0.50	0.50	1.0
1,1-Dichloropropene	0.50	U	ug/L	0.50	0.50	1.0
1,2,3-Trichlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
1,2,3-Trichloropropane	0.50	U	ug/L	0.50	0.50	1.0
1,2,4-Trichlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
1,2,4-Trimethylbenzene	0.50	U	ug/L	0.50	0.50	1.0
1,2-Dichloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,2-Dichlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
1,2-Dichloropropane	0.50	U	ug/L	0.50	0.50	1.0
1,3,5-Trimethylbenzene	0.50	U	ug/L	0.50	0.50	1.0
1,3-Dichlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
1,3-Dichloropropane	0.50	U	ug/L	0.50	0.50	1.0
1,4-Dichlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
2,2-Dichloropropane	0.50	U	ug/L	0.50	0.50	1.0
Benzene	0.50	U	ug/L	0.50	0.50	1.0
Bromobenzene	0.50	U	ug/L	0.50	0.50	1.0
Bromochloromethane	0.50	U	ug/L	0.50	0.50	1.0
Bromomethane	0.50	U	ug/L	0.50	0.50	1.0
n-Butylbenzene	0.50	U	ug/L	0.50	0.50	1.0
cis-1,2-Dichloroethene	0.50	U	ug/L	0.50	0.50	1.0
cis-1,3-Dichloropropene	0.50	U	ug/L	0.50	0.50	1.0
Carbon tetrachloride	0.50	U	ug/L	0.50	0.50	1.0
Chlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
Chloroethane	0.50	U	ug/L	0.50	0.50	1.0
Chloromethane	0.50	U *	ug/L	0.50	0.50	1.0
Dibromomethane	0.50	U	ug/L	0.50	0.50	1.0
Dichlorodifluoromethane	0.50	U	ug/L	0.50	0.50	1.0
Ethylbenzene	0.50	U	ug/L	0.50	0.50	1.0
Hexachlorobutadiene	0.50	U	ug/L	0.50	0.50	1.0
Isopropylbenzene	0.50	U	ug/L	0.50	0.50	1.0
p-Isopropyltoluene	0.50	U	ug/L	0.50	0.50	1.0
Methylene Chloride	1.0	U	ug/L	1.0	1.0	1.0
m-Xylene & p-Xylene	0.50	U	ug/L	0.50	0.50	1.0
2-Chlorotoluene	0.50	U	ug/L	0.50	0.50	1.0
o-Xylene	0.50	U	ug/L	0.50	0.50	1.0

Mr. Pierre O. MaCoy
Advantage Engineers
910 Century Drive
Mechanicsburg, PA 17055

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Client Sample ID: Well-JJJ Lost Lake Resort
Lab Sample ID: 420-37446-1

Date Sampled: 08/09/2010 0850
Date Received: 08/09/2010 1400
Client Matrix: Water

Analyte	Result	Qualifier	Unit	RL	RL	Dilution
Tetrachloroethene	0.50	U	ug/L	0.50	0.50	1.0
4-Chlorotoluene	0.50	U	ug/L	0.50	0.50	1.0
N-Propylbenzene	0.50	U	ug/L	0.50	0.50	1.0
sec-Butylbenzene	0.50	U	ug/L	0.50	0.50	1.0
Styrene	0.50	U	ug/L	0.50	0.50	1.0
trans-1,2-Dichloroethene	0.50	U	ug/L	0.50	0.50	1.0
trans-1,3-Dichloropropene	0.50	U	ug/L	0.50	0.50	1.0
tert-Butylbenzene	0.50	U	ug/L	0.50	0.50	1.0
Trichloroethene	0.50	U	ug/L	0.50	0.50	1.0
Trichlorofluoromethane	0.50	U	ug/L	0.50	0.50	1.0
Toluene	0.50	U	ug/L	0.50	0.50	1.0
Vinyl chloride	0.50	U	ug/L	0.50	0.50	1.0
Methyl tert-butyl ether	1.0	U	ug/L	1.0	1.0	1.0
Xylenes, Total	1.0	U	ug/L	1.0	1.0	1.0

Surrogate		Unit	Acceptance Limits
4-Bromofluorobenzene (Surr)	104	%	51 - 128
Dibromofluoromethane (Surr)	85	%	68 - 118
4-Bromofluorobenzene (HALL)	82	%	62 - 113

Method: 200.7 Rev 4.4 Date Analyzed: 08/11/2010 1938
Prep Method: 200 Date Prepared: 08/11/2010 1125

Analyte	Result	Qualifier	Unit	RL	RL	Dilution
Ag	10	U	ug/L	10	10	1.0
Fe	60	U	ug/L	60	60	1.0
Mn	15	U	ug/L	15	15	1.0
Na	4700		ug/L	200	200	1.0
Zn	28		ug/L	20	20	1.0

Method: 200.8 Date Analyzed: 08/11/2010 1819
Prep Method: 200 Date Prepared: 08/11/2010 1125

Analyte	Result	Qualifier	Unit	RL	RL	Dilution
Pb	1.0	U	ug/L	1.0	1.0	1.0
As	2.6		ug/L	1.4	1.4	1.0
Be	0.30	U	ug/L	0.30	0.30	1.0
Cd	1.0	U	ug/L	1.0	1.0	1.0
Cr	1.9		ug/L	1.0	1.0	1.0
Cu	1.0	U	ug/L	1.0	1.0	1.0
Ni	0.74		ug/L	0.50	0.50	1.0
Sb	1.2		ug/L	0.40	0.40	1.0
Tl	0.30	U	ug/L	0.30	0.30	1.0
Ba	30		ug/L	2.0	2.0	1.0
Se	2.0	U	ug/L	2.0	2.0	1.0

Method: 245.1 Date Analyzed: 08/12/2010 1348

Mr. Pierre O. MaCoy
Advantage Engineers
910 Century Drive
Mechanicsburg, PA 17055

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Client Sample ID: Well-JJJ Lost Lake Resort
Lab Sample ID: 420-37446-1

Date Sampled: 08/09/2010 0850
Date Received: 08/09/2010 1400
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Prep Method: 245.1			Date Prepared:	08/11/2010 1100		
Hg	0.20	U	ug/L	0.20	0.20	1.0
Method: 300.0			Date Analyzed:	08/10/2010 1236		
Nitrate as N	0.040		mg/L	0.010	0.010	1.0
Chloride	1.5	U	mg/L	1.5	1.5	1.0
Nitrite as N	0.0040	U	mg/L	0.0040	0.0040	1.0
Sulfate	8.9		mg/L	5.0	5.0	1.0
Fluoride	0.50	U	mg/L	0.50	0.50	1.0
Method: SM 2130B			Date Analyzed:	08/10/2010 1150		
Turbidity	0.26		NTU	0.10	0.10	1.0
Method: SM 2150B			Date Analyzed:	08/10/2010 1140		
Odor	1.0		Units for Odor	1.0	1.0	1.0
Method: SM 4500 CN E			Date Analyzed:	08/13/2010 1400		
Prep Method: SM 4500 CN C			Date Prepared:	08/09/2010 1100		
Cyanide, Total	0.0050	U	mg/L	0.0050	0.0050	1.0
Method: SM 9222D			Date Analyzed:	08/09/2010 1634		
Coliform, Fecal	10	U	CFU/100mL	10	10	10
Method: SM 9223			Date Analyzed:	08/09/2010 1615		
Coliform, Total	1.0	U	CFU/100mL	1.0	1.0	1.0
Escherichia coli	1.0	U	CFU/100mL	1.0	1.0	1.0

Mr. Pierre O. MaCoy
Advantage Engineers
910 Century Drive
Mechanicsburg, PA 17055

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Client Sample ID: Well-FFF Lost Lake Resort
Lab Sample ID: 420-37446-2

Date Sampled: 08/09/2010 0830
Date Received: 08/09/2010 1400
Client Matrix: Water

Analyte	Result/Qualifier	Unit	NONE	NONE	Dilution
Method: 2120B		Date Analyzed:	08/10/2010 1140		
Apparent Color	2.5	Color Units			1.0

Mr. Pierre O. MaCoy
Advantage Engineers
910 Century Drive
Mechanicsburg, PA 17055

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Client Sample ID: Well-FFF Lost Lake Resort
Lab Sample ID: 420-37446-2

Date Sampled: 08/09/2010 0830
Date Received: 08/09/2010 1400
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: 502.2			Date Analyzed:	08/10/2010 2002		
1,1,1,2-Tetrachloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,1,1-Trichloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,1,2,2-Tetrachloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,1,2-Trichloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,1-Dichloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,1-Dichloroethene	0.50	U	ug/L	0.50	0.50	1.0
1,1-Dichloropropene	0.50	U	ug/L	0.50	0.50	1.0
1,2,3-Trichlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
1,2,3-Trichloropropane	0.50	U	ug/L	0.50	0.50	1.0
1,2,4-Trichlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
1,2,4-Trimethylbenzene	0.50	U	ug/L	0.50	0.50	1.0
1,2-Dichloroethane	0.50	U	ug/L	0.50	0.50	1.0
1,2-Dichlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
1,2-Dichloropropane	0.50	U	ug/L	0.50	0.50	1.0
1,3,5-Trimethylbenzene	0.50	U	ug/L	0.50	0.50	1.0
1,3-Dichlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
1,3-Dichloropropane	0.50	U	ug/L	0.50	0.50	1.0
1,4-Dichlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
2,2-Dichloropropane	0.50	U	ug/L	0.50	0.50	1.0
Benzene	0.50	U	ug/L	0.50	0.50	1.0
Bromobenzene	0.50	U	ug/L	0.50	0.50	1.0
Bromochloromethane	0.50	U	ug/L	0.50	0.50	1.0
Bromomethane	0.50	U	ug/L	0.50	0.50	1.0
n-Butylbenzene	0.50	U	ug/L	0.50	0.50	1.0
cis-1,2-Dichloroethene	0.50	U	ug/L	0.50	0.50	1.0
cis-1,3-Dichloropropene	0.50	U	ug/L	0.50	0.50	1.0
Carbon tetrachloride	0.50	U	ug/L	0.50	0.50	1.0
Chlorobenzene	0.50	U	ug/L	0.50	0.50	1.0
Chloroethane	0.50	U	ug/L	0.50	0.50	1.0
Chloromethane	0.50	U *	ug/L	0.50	0.50	1.0
Dibromomethane	0.50	U	ug/L	0.50	0.50	1.0
Dichlorodifluoromethane	0.50	U	ug/L	0.50	0.50	1.0
Ethylbenzene	0.50	U	ug/L	0.50	0.50	1.0
Hexachlorobutadiene	0.50	U	ug/L	0.50	0.50	1.0
Isopropylbenzene	0.50	U	ug/L	0.50	0.50	1.0
p-Isopropyltoluene	0.50	U	ug/L	0.50	0.50	1.0
Methylene Chloride	1.0	U	ug/L	1.0	1.0	1.0
m-Xylene & p-Xylene	0.50	U	ug/L	0.50	0.50	1.0
2-Chlorotoluene	0.50	U	ug/L	0.50	0.50	1.0
o-Xylene	0.50	U	ug/L	0.50	0.50	1.0

Mr. Pierre O. MaCoy
Advantage Engineers
910 Century Drive
Mechanicsburg, PA 17055

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Client Sample ID: Well-FFF Lost Lake Resort
Lab Sample ID: 420-37446-2

Date Sampled: 08/09/2010 0830
Date Received: 08/09/2010 1400
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Tetrachloroethene	0.50	U	ug/L	0.50	0.50	1.0
4-Chlorotoluene	0.50	U	ug/L	0.50	0.50	1.0
N-Propylbenzene	0.50	U	ug/L	0.50	0.50	1.0
sec-Butylbenzene	0.50	U	ug/L	0.50	0.50	1.0
Styrene	0.50	U	ug/L	0.50	0.50	1.0
trans-1,2-Dichloroethene	0.50	U	ug/L	0.50	0.50	1.0
trans-1,3-Dichloropropene	0.50	U	ug/L	0.50	0.50	1.0
tert-Butylbenzene	0.50	U	ug/L	0.50	0.50	1.0
Trichloroethene	0.50	U	ug/L	0.50	0.50	1.0
Trichlorofluoromethane	0.50	U	ug/L	0.50	0.50	1.0
Toluene	0.50	U	ug/L	0.50	0.50	1.0
Vinyl chloride	0.50	U	ug/L	0.50	0.50	1.0
Methyl tert-butyl ether	1.0	U	ug/L	1.0	1.0	1.0
Xylenes, Total	1.0	U	ug/L	1.0	1.0	1.0

Surrogate			Acceptance Limits
4-Bromofluorobenzene (Surr)	92	%	51 - 128
Dibromofluoromethane (Surr)	86	%	68 - 118
4-Bromofluorobenzene (HALL)	84	%	62 - 113

Method: 200.7 Rev 4.4 Date Analyzed: 08/11/2010 1945
Prep Method: 200 Date Prepared: 08/11/2010 1125

Ag	10	U	ug/L	10	10	1.0
Fe	60	U	ug/L	60	60	1.0
Mn	15	U	ug/L	15	15	1.0
Na	5400		ug/L	200	200	1.0
Zn	110		ug/L	20	20	1.0

Method: 200.8 Date Analyzed: 08/11/2010 1822
Prep Method: 200 Date Prepared: 08/11/2010 1125

Pb	1.0	U	ug/L	1.0	1.0	1.0
As	1.4	U	ug/L	1.4	1.4	1.0
Be	0.30	U	ug/L	0.30	0.30	1.0
Cd	1.0	U	ug/L	1.0	1.0	1.0
Cr	1.6		ug/L	1.0	1.0	1.0
Cu	1.6		ug/L	1.0	1.0	1.0
Ni	0.80		ug/L	0.50	0.50	1.0
Sb	0.40	U	ug/L	0.40	0.40	1.0
Tl	0.30	U	ug/L	0.30	0.30	1.0
Ba	12		ug/L	2.0	2.0	1.0
Se	2.0	U	ug/L	2.0	2.0	1.0

Method: 245.1 Date Analyzed: 08/12/2010 1350

Mr. Pierre O. MaCoy
Advantage Engineers
910 Century Drive
Mechanicsburg, PA 17055

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Client Sample ID: Well-FFF Lost Lake Resort
Lab Sample ID: 420-37446-2

Date Sampled: 08/09/2010 0830
Date Received: 08/09/2010 1400
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Prep Method: 245.1			Date Prepared:	08/11/2010 1100		
Hg	0.20	U	ug/L	0.20	0.20	1.0
Method: 300.0			Date Analyzed:	08/10/2010 1246		
Nitrate as N	0.040		mg/L	0.010	0.010	1.0
Chloride	1.6		mg/L	1.5	1.5	1.0
Nitrite as N	0.0040	U	mg/L	0.0040	0.0040	1.0
Sulfate	7.9		mg/L	5.0	5.0	1.0
Fluoride	0.50	U	mg/L	0.50	0.50	1.0
Method: SM 2130B			Date Analyzed:	08/10/2010 1150		
Turbidity	0.14		NTU	0.10	0.10	1.0
Method: SM 2150B			Date Analyzed:	08/10/2010 1140		
Odor	1.0		Units for Odor	1.0	1.0	1.0
Method: SM 4500 CN E			Date Analyzed:	08/13/2010 1400		
Prep Method: SM 4500 CN C			Date Prepared:	08/09/2010 1100		
Cyanide, Total	0.0050	U	mg/L	0.0050	0.0050	1.0
Method: SM 9222D			Date Analyzed:	08/09/2010 1634		
Coliform, Fecal	10	U	CFU/100mL	10	10	10
Method: SM 9223			Date Analyzed:	08/09/2010 1615		
Coliform, Total	1.0	U	CFU/100mL	1.0	1.0	1.0
Escherichia coli	1.0	U	CFU/100mL	1.0	1.0	1.0

DATA REPORTING QUALIFIERS

Client: Advantage Engineers

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Lab Section	Qualifier	Description
GC VOA		
	*	LCS or LCSD exceeds the control limits
	U	The analyte was analyzed for but not detected at or above the stated limit.
Metals		
	U	The analyte was analyzed for but not detected at or above the stated limit.
General Chemistry		
	U	The analyte was analyzed for but not detected at or above the stated limit.

EnviroTest Laboratories, Inc.

CHAIN OF CUSTODY

Lab Name: EnviroTest Laboratories
Address & Phone: 315 Fullerton Avenue, Newburgh, New York 12550 845-562-0890

REPORT# (Lab Use Only): 37446

PROJECT REFERENCE: Lost Lake Resort	PROJECT NO.	PROJECT LOCATION: Forestburgh, NY
ENVIROTEST PROJECT MANAGER: Debbie Rohl	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Pierre MaCoy	CLIENT PHONE: 717-458-0800	CLIENT FAX: 717-458-0801
CLIENT NAME: Advantage Engineers	PMACOY@ADVANTAGEENGINEERS.COM	
CLIENT ADDRESS: 910 Century Drive, Mechanicsburg, PA 17055		
COMPANY CONTRACTING THIS WORK (if applicable):		

PAGE 1 of 1

TURNAROUND TIME: NORMAL ✓ QUICK ___ VERBAL ___

#OF COOLERS: 3

Matrix type: COMPOSITE (C) OR GRAB (G) *INDICATE*; AQUEOUS (WATER); D (Drinking Water) or W (Waste Water) *Indicate*; SOLID OR SEMISOLID; OTHER *Specify*

REQUIRED ANALYSES / NUMBER OF CONTAINERS SUBMITTED

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	C/G	AQUEOUS	D/W	SOLID OR SEMISOLID	OTHER	Total # of Containers	40ml vial HCL	40ml vial sulfuric	250ml Plasic Sulfuric	250ml amber sulfuric	250 Plastic Nitric Acid	250ml Plastic Sod. Hydrox.	Liter Plastic	250ml Plastic	125ml Plastic Sterile	8 oz. Soil	40ml No2503	REMARKS
8/9/10	8:50	Well-JJJ Lost Lake Resort	G	W	D			30												See Attached
		Fecal + Total Coliform @ 910																		
8/9/10	8:30 AM	Well-FFF Lost Lake Resort	G	W	D			30												See Attached
		Fecal + Total Coliform @ 9:00 A.M.																		

	COMPANY	DATE	TIME	RECEIVED BY: (SIGNATURE)	COMPANY	DATE	TIME
RELINQUISHED BY: (SIGNATURE) [signature]	Advantage	8/9/10	9:15	—		—	—
SAMPLED BY: (SIGNATURE) Pierre MaCoy	AE	8/9/10	9:15	—		—	—
RELINQUISHED BY: (SIGNATURE) Charles C.	ETL	8/9/10	2:30 pm	—		—	—

NOTE: ** SHORT HOLDING TIME **

Field Service Time:

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT YES NO	Cooler Temp.	LABORATORY REMARKS:
				1.4°C	ICE X pH ___ CL2 ___ Reviewed by ___

GROUP	CONTAMINANTS	MCL	UNITS
Table 8B	Antimony	0.006	mg/L
	Arsenic	0.01	mg/L
	Barium	2.0	mg/L
	Beryllium	0.004	mg/L
	Cadmium	0.005	mg/L
	Chromium	0.1	mg/L
	Cyanide	0.2	mg/L
	Mercury	0.002	mg/L
	Nickel	none	mg/L
	Selenium	0.05	mg/L
	Thallium	0.002	mg/L
	Fluoride	2.2	mg/L
	Bromate	0.010	mg/L
	Chlorite	1.0	mg/L
	Copper	1.3	mg/L
	Lead	0.015	mg/L
Table 8C	Nitrate	10.0	mg/L
	Nitrite	1.0	mg/L
Table 8D	Chloride	250.0	mg/L
	Iron	0.3	mg/L
	Manganese	0.3	mg/L
	Silver	0.1	mg/L
	Sodium	none	mg/L
	Sulfate	250	mg/L
	Zinc	5.0	mg/L
	Color	15.0	color units
	Odor	3.0	units
Table 9B	Vinyl Chloride	0.002	mg/L
	Methyl-tertiary-butyl-ether (MTBE)	0.010	mg/L
Table 9C	Alachlor	0.002	mg/L
	Aldicarb	0.003	mg/L
	Aldicarb Sulfoxide	0.004	mg/L
	Aldicarb Sulfone	0.002	mg/L
	Atrazine	0.003	mg/L
	Carboduran	0.04	mg/L
	Chlordane	0.002	mg/L
	Dibromochloropropane (DBCP)	0.0002	mg/L
	2,4-D	0.05	mg/L
	Endrin	0.002	mg/L
	Ethylene Dibromide (EDB)	0.00005	mg/L
	Heptachlor	0.0004	mg/L
	Heptachlor epoxide	0.0002	mg/L
	Lindane	0.002	mg/L

LOGIN SAMPLE RECEIPT CHECK LIST

Client: Advantage Engineers

Job Number: 420-37446-1
Sdg Number: Lost Lake Resort, Forestburgh, NY

Login Number: 37446

Question	T/F/NA	Comment
Radioactivity either was not measured or, if measured, is at or below background	NA	
The cooler's custody seal, if present, is intact.	NA	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	

ENVIRONMENTAL ASSOCIATES LTD.
24 Oak Brook Drive, Ithaca, NY 14850
(607) 272-8902 Fax (607) 256-7092

REPORT: MICROSCOPIC PARTICULATE ANALYSIS
NYSDOH Modified Method

Filter ID: 38103

Client: Debbie Bayer
EnviroTest Laboratories Inc.
315 Fullerton Ave.
Newburgh NY 12550

Station/Body of water: WELL-JJJ Lost Lake Resort(420-37446-1)

RECEIPT OF FILTER:

Date Received: 8/10/2010 | # of filters: NA | Type: NA | Carrier: Fed Ex Priority

COLLECTION:

Collector: N/A
Temperature: °F
Water Type: Ground Water

Date & Time collected: 8/9/2010 8:50 AM
Turbidity: ------
Date & Time Processed: 8/10/2010 2:00 PM
Date Analyzed: 9/7/2010

FILTER PROCESSING

Susan Boutros Dr. Susan Boutros / President & Lab Director

Color of water around filter: NA
Filter color: NA
Color of sediment: tan
gallons filtered: 3

Total volume of sediment: ≤0.02 ml
Volume of sediment/100 gallons: ≤0.8 ml/100gal.
IFA equivalent liter volume examined: ------
Phase equivalent gallon volume examined: 3

ANALYSIS OF PARTICULATES:

key = (EH) - extremely heavy [>20/field @ 100X] (H) - heavy [10-20/field @ 100X]
(M) -moderate [4-9/field @ 100X] (R) - rare [<1-3/field @ 100X] (NF) - none found

PARTICULATE DEBRIS	Quantity	Description
Large part. 5 μm & larger	EH	fine silt & sand
Small part. up to 5 μm	EH	fine amorphous debris
Plant debris	NF	

OTHER ORGANISMS	Quantity	Description
Nematodes	NF	
Nematode eggs	NF	
Rotifers	NF	
Crustaceans	NF	
Crustacean eggs	NF	
Insects	NF	
Other	NF	

PROTOZOANS	Quantity	Description
Other Coccidia	NF	
Other protozoans	NF	

ALGAE	Quantity	Description
Green Algae	NF	
Diatoms	NF	
Blue-Green Algae	NF	
Flagellated Algae	NF	

COMMENTS:

No biological materials were observed. Based upon microscopic particulate analysis and the proposed EPA risk factors associated with bio-indicators there is a low risk of surface contamination (EPA risk factors= 0 low risk).
Sample was collected and processed using the NYSDOH Modified Microscopic Particulate Analysis method.

REPORT REVIEWED BY: Susan Boutros
Dr. Susan Boutros / President & Lab Director

DATE: September 9, 2010

ENVIRONMENTAL ASSOCIATES LTD.
24 Oak Brook Drive, Ithaca, NY 14850
(607) 272-8902 Fax (607) 256-7092

REPORT: MICROSCOPIC PARTICULATE ANALYSIS
NYSDOH Modified Method

Filter ID: 38104

Client: Debbie Bayer
EnviroTest Laboratories Inc.
315 Fullerton Ave.
Newburgh NY 12550

Station/Body of water: WELL-FFF Lost Lake Resort(420-37446-2)

RECEIPT OF FILTER:

Date Received: 8/10/2010 # of filters: NA Type: NA Carrier: Fed Ex Priority

COLLECTION:

Collector: N/A
Temperature: °F
Water Type: Ground Water

Date & Time collected: 8/9/2010 8:30 AM
Turbidity: ------
Date & Time Processed: 8/10/2010 1:30 PM
Date Analyzed: 9/7/2010

FILTER PROCESSING

Susan N. Boutros Dr. Susan Boutros President & Lab Director

Color of water around filter: NA
Filter color: NA
Color of sediment: tan
gallons filtered: 2.8

Total volume of sediment: ≤0.1 ml
Volume of sediment/100 gallons: ≤3.8 ml/100 gal.
IFA equivalent liter volume examined: ------
Phase equivalent gallon volume examined: 2.8

ANALYSIS OF PARTICULATES:

key = (EH) - extremely heavy [>20/field @ 100X] (H) - heavy [10-20/field @ 100X]
(M) -moderate [4-9/field @ 100X] (R) - rare [<1-3/field @ 100X] (NF) - none found

PARTICULATE DEBRIS	Quantity	Description
Large part. 5 μm & larger	EH	fine silt & sand
Small part. up to 5 μm	H	fine amorphous debris
Plant debris	NF	

OTHER ORGANISMS	Quantity	Description
Nematodes	NF	
Nematode eggs	NF	
Rotifers	NF	
Crustaceans	NF	
Crustacean eggs	NF	
Insects	NF	
Other	NF	

PROTOZOANS	Quantity	Description
Other Coccidia	NF	
Other protozoans	NF	

ALGAE	Quantity	Description
Green Algae	NF	
Diatoms	NF	
Blue-Green Algae	NF	
Flagellated Algae	NF	

COMMENTS:

No biological materials were observed. Based upon microscopic particulate analysis and the proposed EPA risk factors associated with bio-indicators there is a low risk of surface contamination (EPA risk factors= 0 low risk).
Sample was collected and processed using the NYSDOH Modified Microscopic Particulate Analysis method.

REPORT REVIEWED BY: Susan N. Boutros **DATE:** September 9, 2010

Dr. Susan Boutros President & Lab Director

REPORT: MICROSCOPIC PARTICULATE ANALYSIS
NYSDOH Modified Method

PWS ID#	Well ID#	Utility Name	EAL Sample ID:
	WELL-JJJ Lost Lake Resort(420	EnviroTest Laboratories Inc.	38103

Date: 8/9/2010

EPA Relative Surface Water Risk Factors

Primary Particulates	#/100 gallon	Relative Frequency	Relative Risk Factor	Comments
Coccidia (confirmed)	0	NF	0	
Diatoms	0	NF	0	
Other Algae	0	NF	0	
Insects/larvae	0	NF	0	
Rotifers	0	NF	0	
Plant Debris (with chloro.)	0	NF	0	
		EPA Relative Risk = 0	Low Risk	

Secondary Particulates			
Nematodes	0	NF	
Crustaceans	0	NF	
Amoeba	0	NF	
Non-photo. flag. & ciliates	0	NF	
Photosynthetic flagellates	0	NF	
Other:	0	NF	

COMMENTS: No biological materials were observed. Based upon microscopic particulate analysis and the proposed EPA risk factors associated with bio-indicators there is a low risk of surface contamination (EPA risk factors= 0 low risk). Sample was collected and processed using the NYSDOH Modified Microscopic Particulate Analysis method.

REPORT REVIEWED BY: Susan N. Boutros **DATE:** September 9, 2010

Dr. Susan Boutros / President & Lab Director

Environmental Associates, Ltd.

REPORT: MICROSCOPIC PARTICULATE ANALYSIS
NYSDOH Modified Method

PWS ID#	*Well ID#*	*Utility Name*	*EAL Sample ID:*
	WELL-FFF Lost Lake Resort(420	**EnviroTest Laboratories Inc.**	**38104**

Date: 8/9/2010

EPA Relative Surface Water Risk Factors

Primary Particulates	#/100 gallon	Relative Frequency	Relative Risk Factor	Comments
Coccidia (confirmed)	0	NF	0	
Diatoms	0	NF	0	
Other Algae	0	NF	0	
Insects/larvae	0	NF	0	
Rotifers	0	NF	0	
Plant Debris (with chloro.)	0	NF	0	
		EPA Relative Risk = 0	Low Risk	

Secondary Particulates			
Nematodes	0	NF	
Crustaceans	0	NF	
Amoeba	0	NF	
Non-photo. flag. & ciliates	0	NF	
Photosynthetic flagellates	0	NF	
Other:	0	NF	

COMMENTS: No biological materials were observed. Based upon microscopic particulate analysis and the proposed EPA risk factors associated with bio-indicators there is a low risk of surface contamination (EPA risk factors= 0 low risk). Sample was collected and processed using the NYSDOH Modified Microscopic Particulate Analysis method.

REPORT REVIEWED BY: Susan N. Boutros **DATE:** September 9, 2010

Dr. Susan Boutros President & Lab Director

Environmental Associates, Ltd.

Hazen Research, Inc.
4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE	August 13, 2010
HRI PROJECT	009-587
HRI SERIES NO	H179/10
DATE REC'D.	8/10/2010
CUST. P.O.#	420-37446-1

EnviroTest Laboratories, Inc. - Newburgh
Debra Bayer
315 Fullerton Avenue
Newburgh, NY 12550

REPORT OF ANALYSIS

SAMPLE NO. H179/10-1

SAMPLE IDENTIFICATION: 420-37446-1 - Well-JJJ - Lost Lake Resort - Project #42001334
Sampled on 08/09/2010 @ 0850

PARAMETER	RESULT	DETECTION LIMIT	METHOD	ANALYSIS DATE	ANALYST
Radon (+-Precision*), pCi/l (T)	890(+-30)	11	SM 7500-Rn B	8/10/2010 @ 1356	SB

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.
Certification ID's: CO/EPA CO00008; CT PH-0152; KS E-10265; NH 232809;
NYELAP 11417; PADEP 68-00551; RI LAO00284; WI 998376610

Results reported herein relate only to discrete samples submitted by the client. Hazen Research, Inc. does not warrant that the results are representative of anything other than the samples that were received in the laboratory.

CODES: (T) = Total (D) = Dissolved (S) = Suspended (R) = Total Recoverable
(PD) = Potentially Dissolved < = Less Than

By: ______

Robert Rostad
Laboratory Manager

Hazen Research, Inc.
4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE	August 13, 2010
HRI PROJECT	009-587
HRI SERIES NO	H179/10
DATE REC'D.	8/10/2010
CUST. P.O.#	420-37446-1

EnviroTest Laboratories, Inc. - Newburgh
Debra Bayer
315 Fullerton Avenue
Newburgh, NY 12550

REPORT OF ANALYSIS

SAMPLE NO. H179/10-2

SAMPLE IDENTIFICATION: 420-37446-2 - Well-FFF - Lost Lake Resort - Project #42001334
Sampled on 08/09/2010 @ 0830

PARAMETER	RESULT	DETECTION LIMIT	METHOD	ANALYSIS DATE	ANALYST
Radon (+-Precision*), pCi/l (T)	1020(+-30)	11	SM 7500-Rn B	8/10/2010 @ 1358	SB

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.
Certification ID's: CO/EPA CO00008; CT PH-0152; KS E-10265; NH 232809;
NYELAP 11417; PADEP 68-00551; RI LAO00284; WI 998376610

Results reported herein relate only to discrete samples submitted by the client. Hazen Research, Inc. does not warrant that the results are representative of anything other than the samples that were received in the laboratory.

CODES: (T) = Total (D) = Dissolved (S) = Suspended (R) = Total Recoverable
(PD) = Potentially Dissolved < = Less Than

By: ____________
Robert Rostad
Laboratory Manager

EnviroTest Laboratories, Inc.
315 Fullerton Avenue
Newburgh, NY 12550
Phone (845) 562-0890 Fax (845) 562-0841

Chain of Custody Record

EnviroTest Laboratories Inc.

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Bayer, Debra	Carrier Tracking No(s):	COC No: 420-4790.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: dbayer@envirotestlaboratories.com		Page: Page 1 of 1
Company: Hazen Research Inc				STL Job #: 420-37446-1
Address: 4601 Indiana Street, ,	Due Date Requested: 8/19/2010			
City: Golden	TAT Requested (days):			
State, Zip: CO, 80403				
Phone:	PO #:			
Email:	WO #:			
Project Name: Advantage Engineers	Project #: 42001334			
Site:	SSOW#:			

Analysis Requested

Sample Identification Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUBCONTRACT/ Radon	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
Well-JJJ Lost Lake Resort (420-37446-1)	8/9/10	8:50		Water			X	2	
Well-FFF Lost Lake Resort (420-37446-2)	8/9/10	8:30		Water			X	2	

Preservation Codes:

A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2SO3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - ph 4-5
Z - other (specify)

Other:

Possible Hazard Identification

☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Deliverable Requested: I, II, III, IV, Other (specify)

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For ________ Months*

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by: Bayer	Date/Time: 8/9/10 16:00	Company: Env	Received by: Diane Tipton	Date/Time: 8-10-10 1330	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: N/A

EnviroTest Laboratories, Inc.
315 Fullerton Avenue
Newburgh, NY 12550
Phone (845) 562-0890 Fax (845) 562-0841

Chain of Custody Record

EnviroTest Laboratories Inc.

Client Information (Sub Contract Lab)

Client Contact: Shipping/Receiving
Company: Summit Environmental Technologies, Inc.
Address: 3310 Win Street,
City: Cuyahoga Falls
State, Zip: OH, 44223
Phone:
Email:
Project Name: Advantage Engineers
Site:

Sampler:
Phone:
Due Date Requested: 8/19/2010
TAT Requested (days):
PO #:
WO #:
Project #: 42001334
SSOW#:

Lab PM: Bayer, Debra
E-Mail: dbayer@envirotestlaboratories.com
Carrier Tracking No(s):

COC No: 420-4791.1
Page: Page 1 of 1
STL Job #: 420-37446-1

Analysis Requested

Sample Identification Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUBCONTRACT/ Bromate to TA Sav	SUBCONTRACT/ Chlorite to TA Sav	SUBCONTRACT/ 504.1 to Summit	SUBCONTRACT/ 508 to Summit	SUBCONTRACT/ 515.1 to Summit	SUBCONTRACT/ 525.2 to Summit	SUBCONTRACT/ 531.1 to Summit	SUBCONTRACT/ Gross Alpha/Beta to Summit	SUBCONTRACT/ Uranium to Summit	Subcontract/Radium 226+228				Total Number of containers	Special Instructions/Note:
			Preservation Code:																		
Well-JJJ Lost Lake Resort (420-37446-1)	8/9/10	8:50		Water			X	X	X	X	X	X	X	X	X	X				16	
Well-FFF Lost Lake Resort (420-37446-2)	8/9/10	8:30		Water			X	X	X	X	X	X	X	X	X	X				16	

1012401-01-02

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)
Other:

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment:

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
D Bayer	8/9/10 1600	Env	Jackie Reid	8-10-10 9:50	S.E.T.

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Summit Environmental Technologies, Inc.
Drinking Water Cooler Receipt Form

Client: Enviro Test

Order Number: 1012401

Date Received: 8-10-10

Time Received: ~~11:40~~ 9:50

Number of Coolers/Boxes: 1

N/A

Shipper: (FED EX) UPS US Postal Walk-in Pickup Other:

Packaging: Peanuts (Bubble Wrap) Paper Foam None Other:

Tape on cooler/box:	(Y)	N	N/A
Custody Seals intact	(Y)	N	N/A
C-O-C in plastic	(Y)	N	N/A

Ice X Blue ice ______ present / absent / melted N/A

Sample Temperature	1.2 °C		N/A
Samples within holding time limits (see HT limits)	(Y)	N	N/A
C-O-C filled out properly	(Y)	N	N/A
Samples in separate bags	(Y)	N	N/A
Sample containers intact*	(Y)	N	N/A

*If no, list broken sample(s):

Sample label(s) complete (ID, date, etc.)	(Y)	N	N/A
Label(s) agree with C-O-C	(Y)	N	N/A
Correct containers used	(Y)	N	N/A
Sufficient sample received	(Y)	N	N/A
Bubbles absent from 40 mL vials**	Y	N	N/A

** Samples with bubbles less than the size of a pea are acceptable.

Was client contacted about samples	Y	N
Will client send new samples	Y	N

Client contact:

Date/Time:

Logged in by:

Comments:

SUMMIT
ENVIRONMENTAL TECHNOLOGIES, INC.
Analytical Laboratories

LABORATORY REPORT

Client
EnviroTest Laboratories
315 Fullerton Ave.
Newburgh, NY 12550

Order Number
1012401

Project Number
42001334

Issued
Monday, August 30, 2010

Total Number of Pages
7 (excluding C.O.C. and cooler receipt form)

Approved By :

QA Manager

NELAC Accreditation #E87688

SUMMIT
ENVIRONMENTAL TECHNOLOGIES, INC.
Analytical Laboratories

Sample Summary

Client: EnviroTest Laboratories
Order Number: 1012401

Laboratory ID	Client ID	Matrix	Sampling Date
1012401-01	420-37446-1	Drinking Water	8/9/2010
1012401-02	420-37446-2	Drinking Water	8/9/2010

"Analytical Integrity" · EPA Certified · NELAP Certified
3310 Win Street · Cuyahoga Falls, Ohio 44223 • Phone: 330-253-8211 · Fax: 330-253-4489
Web Site: www.settek.com

Report Narrative

Client: EnviroTest Laboratories

Order Number: 1012401

No problems were encountered during analysis of this order number, except as noted.

Data Qualifiers:
B = Analyte found in the method blank
J = Estimated concentration of analyte between MDL (LOD) and Reporting Limit (LOQ)
C = Analyte has been confirmed by another instrument or method
E = Analyte exceeds the upper limit of the calibration curve.
D = Sample or extract was analyzed at a higher dilution
X = User defined data qualifier.
S = Surrogate out of control limits
U = Undetected
a = Not Accredited by NELAC

ND = Non Detected at LOQ
DF = Dilution Factor

Limit Of Quantitation (LOQ) = Laboratory Reporting Limit (not adjusted for dilution factor)
Limit Of Detection (LOD) = Laboratory Detection Limit

Matrices:
A = Air
C = Cream
DW = Drinking Water
L = Liquid
O = Oil
SL = Sludge
SO = Soil
S = Solid
T = Tablet
TC = TCLP Extract
WW = Waste Water
W = Wipe

Estimated uncertainty values are available upon request.

The test results meet the requirements of the NELAC standard, except where noted. The information contained in this analytical report is the sole property of Summit Environmental Technologies, Inc. and that of the client. It cannot be reproduced in any form without the consent of Summit Environmental Technologies, Inc. or the client for which this report was issued. The results contained in this report are only representative of the samples received. Conditions can vary at different times and at different sampling conditions. Summit Environmental Technologies, Inc. is not responsible for use or interpretation of the data included herein.

SUMMIT
ENVIRONMENTAL TECHNOLOGIES, INC.
Analytical Laboratories

August 30, 2010

Client: EnviroTest Laboratories
Address: 315 Fullerton Ave.
Newburgh, NY 12550

Received: 8/10/2010
Project #: 42001334

Client ID#	Lab ID#	Collected	Analyte	Result	Units	Matrix	Method	DF	LOQ	Run	Analyst
420-37446-1	1012401-01	09-Aug-10	Gross Alpha	U +/- 1.3	pci/l	DW	900.0	1	3	12-Aug-10	MO

Client ID#	Lab ID#	Collected	Analyte	Result	Units	Matrix	Method	DF	LOQ	Run	Analyst
420-37446-1	1012401-01	09-Aug-10	Gross Beta	U +/- 0.7	pci/l	DW	900.0	1	4	12-Aug-10	MO

Client ID#	Lab ID#	Collected	Analyte	Result	Units	Matrix	Method	DF	LOQ	Run	Analyst
420-37446-1	1012401-01	09-Aug-10	Radium-226	U +/- 0.18	pci/l	DW	903.0	1	1	13-Aug-10	MO

Client ID#	Lab ID#	Collected	Analyte	Result	Units	Matrix	Method	DF	LOQ	Run	Analyst
420-37446-1	1012401-01	09-Aug-10	Radium-228	U +/- 0.31	pci/l	DW	904.0	1	1	16-Aug-10	MO

Client ID#	Lab ID#	Collected	Analyte	Result	Units	Matrix	Method	DF	LOQ	Run	Analyst
420-37446-1	1012401-01	09-Aug-10	Uranium	U +/- 0.83	pci/l	DW	908.0	4	0.5	25-Aug-10	MO

"Analytical Integrity" · EPA Certified · NELAP Certified
3310 Win Street · Cuyahoga Falls, Ohio 44223 • Phone: 330-253-8211 · Fax: 330-253-4489
Web Site: www.settek.com

SUMMIT ENVIRONMENTAL TECHNOLOGIES, INC.

Analytical Laboratories

Safe Drinking Water Program Laboratory Reporting Form

August 30, 2010

Client: EnviroTest Laboratories
Address: 315 Fullerton Ave.
Newburgh, NY 12550
Date Collected: 8/9/2010
Date Received: 8/10/2010
Project #: 42001334
Client ID #: 420-37446-1
Laboratory ID #: 1012401-01
Matrix: Drinking Water

Parameter	MCL*	Units	Results	LOQ	Qualifier	Method	MDL	Preparation Date	Analyst	Analysis Date	Analysis Time
Endrin	0.002	mg/L	ND	0.000022	U	EPA508	0.00002	8/16/10	JT	08/24/10	09:43
Lindane	0.0002	mg/L	ND	0.000044	U	EPA508	0.00002	8/16/10	JT	08/24/10	09:43
Methoxychlor	0.04	mg/L	ND	0.000220	U	EPA508	0.00002	8/16/10	JT	08/24/10	09:43
Toxaphene	0.003	mg/L	ND	0.0022	U	EPA508	0.0007	8/16/10	JT	08/24/10	09:43
Dalapon	0.2	mg/L	ND	0.0022	U	EPA515.1	0.0007	8/12/10	JT	08/26/10	11:21
di-(2-Ethylhexyl)adipate	0.4	mg/L	ND	0.0013	U	EPA525.2	0.0004	8/18/10	AE	08/21/10	00:54
Oxamyl	0.2	mg/L	ND	0.0044	U	EPA531.2	0.0006	NA	JT	08/25/10	19:50
Simazine	0.004	mg/L	ND	0.00015	U	EPA525.2	0.0002	8/18/10	AE	08/21/10	00:54
di-(2-Ethylhexyl)phthalate	0.006	mg/L	ND	0.0030	U	EPA525.2	0.001	8/18/10	AE	08/21/10	00:54
Picloram	0.5	mg/L	ND	0.00022	U	EPA515.1	0.0001	8/12/10	JT	08/26/10	11:21
Dinoseb	0.007	mg/L	ND	0.00044	U	EPA515.1	0.0003	8/12/10	JT	08/26/10	11:21
Hexachlorocyclopentadiene	0.05	mg/L	ND	0.00022	U	EPA525.2	0.0001	8/18/10	AE	08/21/10	00:54
Carbofuran	0.04	mg/L	ND	0.0030	U	EPA531.2	0.0007	NA	JT	08/25/10	19:50
Atrazine	0.003	mg/L	ND	0.00022	U	EPA525.2	0.0002	8/18/10	AE	08/21/10	00:54
Alachlor	0.002	mg/L	ND	0.00044	U	EPA525.2	0.00020	8/18/10	AE	08/21/10	00:54
Heptachlor	0.0004	mg/L	ND	0.000088	U	EPA508	0.00005	8/16/10	JT	08/24/10	09:43
Hepachlor epoxide	0.0002	mg/L	ND	0.000044	U	EPA508	0.00001	8/16/10	JT	08/24/10	09:43
2,4-D	0.07	mg/L	ND	0.00022	U	EPA515.1	0.0001	8/12/10	JT	08/26/10	11:21
2,4,5-TP (Silvex)	0.05	mg/L	ND	0.00044	U	EPA515.1	0.0003	8/12/10	JT	08/26/10	11:21
Hexachlorobenzene	0.001	mg/L	ND	0.00022	U	EPA525.2	0.0001	8/18/10	AE	08/21/10	00:54
Benzo(a)pyrene	0.0002	mg/L	ND	0.00010	U	EPA525.2	0.0001	8/18/10	AE	08/21/10	00:54
Pentachlorophenol	0.001	mg/L	ND	0.000088	U	EPA515.1	0.00008	8/12/10	JT	08/26/10	11:21
Aroclor 1221 (PCB)	0.0005	mg/L	ND	0.00020	U	EPA508	0.00008	8/16/10	JT	08/24/10	09:43
Aroclor 1232 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00003	8/16/10	JT	08/24/10	09:43
Aroclor 1242 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00005	8/16/10	JT	08/24/10	09:43
Aroclor 1248 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00007	8/16/10	JT	08/24/10	09:43
Aroclor 1016 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00003	8/16/10	JT	08/24/10	09:43
Aroclor 1254 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00005	8/16/10	JT	08/24/10	09:43
Aroclor 1260 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00002	8/16/10	JT	08/24/10	09:43
1,2-Dibromo-3-chloropropane	0.0002	mg/L	ND	0.000040	U	EPA504.1	0.00003	8/10/10	JT	08/12/10	13:27
Ethylene dibromide	0.00005	mg/L	ND	0.000020	U	EPA504.1	0.00001	8/10/10	JT	08/12/10	13:27
Chlordane (tech.)	0.002	mg/L	ND	0.00044	U	EPA508	0.00003	8/16/10	JT	08/24/10	09:43
gamma-Chlordane	NA	mg/L	ND	0.00004	U	EPA508	0.00001	8/16/10	JT	08/24/10	09:43
Aldicarb	NA	mg/L	ND	0.0020	U	EPA531.2	0.0002	NA	JT	08/25/10	19:50
Aldicarb sulfone	NA	mg/L	ND	0.0020	U	EPA531.2	0.0003	NA	JT	08/25/10	19:50
Aldicarb sulfoxide	NA	mg/L	ND	0.0020	U	EPA531.2	0.0003	NA	JT	08/25/10	19:50
Carbaryl	NA	mg/L	ND	0.0020	U	EPA531.2	0.0004	NA	JT	08/25/10	19:50
3-Hydroxycarbofuran	NA	mg/L	ND	0.0044	U	EPA531.2	0.0003	NA	JT	08/25/10	19:50
Methomyl	NA	mg/L	ND	0.0020	U	EPA531.2	0.0002	NA	JT	08/25/10	19:50
Dicamba	NA	mg/L	ND	0.000088	U	EPA515.1	0.00008	8/12/10	JT	08/26/10	11:21
Aldrin	NA	mg/L	ND	0.000022	U	EPA508	0.000007	8/16/10	JT	08/24/10	09:43
Dieldrin	NA	mg/L	ND	0.000022	U	EPA508	0.000004	8/16/10	JT	08/24/10	09:43
Butachlor	NA	mg/L	ND	0.00040	U	EPA525.2	0.0003	8/18/10	AE	08/21/10	00:54
Metolachlor	NA	mg/L	ND	0.00020	U	EPA525.2	0.0002	8/18/10	AE	08/21/10	00:54
Metribuzin	NA	mg/L	ND	0.00020	U	EPA525.2	0.0002	8/18/10	AE	08/21/10	00:54
Propachlor	NA	mg/L	ND	0.00020	U	EPA525.2	0.0001	8/18/10	AE	08/21/10	00:54

*MCL (Maximum contaminant level, NATIONAL DRINKING WATER STANDARDS, as of March 2009

U = "Not detected above LOQ (Limit of Quantification)   MDL = Method Detection Limit

SUMMIT
ENVIRONMENTAL TECHNOLOGIES, INC.
Analytical Laboratories

August 30, 2010

Client: EnviroTest Laboratories
Address: 315 Fullerton Ave.
Newburgh, NY 12550

Received: 8/10/2010
Project #: 42001334

Client ID#	Lab ID#	Collected	Analyte	Result	Units	Matrix	Method	DF	LOQ	Run	Analyst
420-37446-2	1012401-02	09-Aug-10	Gross Alpha	U +/- 1.3	pci/l	DW	900.0	1	3	12-Aug-10	MO

Client ID#	Lab ID#	Collected	Analyte	Result	Units	Matrix	Method	DF	LOQ	Run	Analyst
420-37446-2	1012401-02	09-Aug-10	Gross Beta	U +/- 0.8	pci/l	DW	900.0	1	4	12-Aug-10	MO

Client ID#	Lab ID#	Collected	Analyte	Result	Units	Matrix	Method	DF	LOQ	Run	Analyst
420-37446-2	1012401-02	09-Aug-10	Radium-226	U +/- 0.18	pci/l	DW	903.0	1	1	13-Aug-10	MO

Client ID#	Lab ID#	Collected	Analyte	Result	Units	Matrix	Method	DF	LOQ	Run	Analyst
420-37446-2	1012401-02	09-Aug-10	Radium-228	U +/- 0.19	pci/l	DW	904.0	1	1	16-Aug-10	MO

Client ID#	Lab ID#	Collected	Analyte	Result	Units	Matrix	Method	DF	LOQ	Run	Analyst
420-37446-2	1012401-02	09-Aug-10	Uranium	U +/- 0.51	pci/l	DW	908.0	4	0.5	25-Aug-10	MO

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Web Site: www.settek.com

SUMMIT ENVIRONMENTAL TECHNOLOGIES, INC.

Analytical Laboratories

Safe Drinking Water Program Laboratory Reporting Form

August 30, 2010

Client: EnviroTest Laboratories
Address: 315 Fullerton Ave.
Newburgh, NY 12550
Date Collected: 8/9/2010
Date Received: 8/10/2010
Project #: 42001334
Client ID #: 420-37446-2
Laboratory ID #: 1012401-02
Matrix: Drinking Water

Parameter	MCL*	Units	Results	LOQ	Qualifier	Method	MDL	Preparation Date	Analyst	Analysis Date	Analysis Time
Endrin	0.002	mg/L	ND	0.000022	U	EPA508	0.00002	8/16/10	JT	08/24/10	10:19
Lindane	0.0002	mg/L	ND	0.000044	U	EPA508	0.00002	8/16/10	JT	08/24/10	10:19
Methoxychlor	0.04	mg/L	ND	0.000220	U	EPA508	0.00002	8/16/10	JT	08/24/10	10:19
Toxaphene	0.003	mg/L	ND	0.0022	U	EPA508	0.0007	8/16/10	JT	08/24/10	10:19
Dalapon	0.2	mg/L	ND	0.0022	U	EPA515.1	0.0007	8/12/10	JT	08/26/10	11:53
di-(2-Ethylhexyl)adipate	0.4	mg/L	ND	0.0013	U	EPA525.2	0.0004	8/18/10	AE	08/21/10	01:26
Oxamyl	0.2	mg/L	ND	0.0044	U	EPA531.2	0.0006	NA	JT	08/25/10	20:48
Simazine	0.004	mg/L	ND	0.00015	U	EPA525.2	0.0002	8/18/10	AE	08/21/10	01:26
di-(2-Ethylhexyl)phthalate	0.006	mg/L	ND	0.0030	U	EPA525.2	0.001	8/18/10	AE	08/21/10	01:26
Picloram	0.5	mg/L	ND	0.00022	U	EPA515.1	0.0001	8/12/10	JT	08/26/10	11:53
Dinoseb	0.007	mg/L	ND	0.00044	U	EPA515.1	0.0003	8/12/10	JT	08/26/10	11:53
Hexachlorocyclopentadiene	0.05	mg/L	ND	0.00022	U	EPA525.2	0.0001	8/18/10	AE	08/21/10	01:26
Carbofuran	0.04	mg/L	ND	0.0030	U	EPA531.2	0.0007	NA	JT	08/25/10	20:48
Atrazine	0.003	mg/L	ND	0.00022	U	EPA525.2	0.0002	8/18/10	AE	08/21/10	01:26
Alachlor	0.002	mg/L	ND	0.00044	U	EPA525.2	0.00020	8/18/10	AE	08/21/10	01:26
Heptachlor	0.0004	mg/L	ND	0.000088	U	EPA508	0.00005	8/16/10	JT	08/24/10	10:19
Hepachlor epoxide	0.0002	mg/L	ND	0.000044	U	EPA508	0.00001	8/16/10	JT	08/24/10	10:19
2,4-D	0.07	mg/L	ND	0.00022	U	EPA515.1	0.0001	8/12/10	JT	08/26/10	11:53
2,4,5-TP (Silvex)	0.05	mg/L	ND	0.00044	U	EPA515.1	0.0003	8/12/10	JT	08/26/10	11:53
Hexachlorobenzene	0.001	mg/L	ND	0.00022	U	EPA525.2	0.0001	8/18/10	AE	08/21/10	01:26
Benzo(a)pyrene	0.0002	mg/L	ND	0.00010	U	EPA525.2	0.0001	8/18/10	AE	08/21/10	01:26
Pentachlorophenol	0.001	mg/L	ND	0.000088	U	EPA515.1	0.00008	8/12/10	JT	08/26/10	11:53
Aroclor 1221 (PCB)	0.0005	mg/L	ND	0.00020	U	EPA508	0.00008	8/16/10	JT	08/24/10	10:19
Aroclor 1232 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00003	8/16/10	JT	08/24/10	10:19
Aroclor 1242 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00005	8/16/10	JT	08/24/10	10:19
Aroclor 1248 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00007	8/16/10	JT	08/24/10	10:19
Aroclor 1016 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00003	8/16/10	JT	08/24/10	10:19
Aroclor 1254 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00005	8/16/10	JT	08/24/10	10:19
Aroclor 1260 (PCB)	0.0005	mg/L	ND	0.00010	U	EPA508	0.00002	8/16/10	JT	08/24/10	10:19
1,2-Dibromo-3-chloropropane	0.0002	mg/L	ND	0.000040	U	EPA504.1	0.00003	8/10/10	JT	08/12/10	13:31
Ethylene dibromide	0.00005	mg/L	ND	0.000020	U	EPA504.1	0.00001	8/10/10	JT	08/12/10	13:31
Chlordane (tech.)	0.002	mg/L	ND	0.00044	U	EPA508	0.00003	8/16/10	JT	08/24/10	10:19
gamma-Chlordane	NA	mg/L	ND	0.00004	U	EPA508	0.00001	8/16/10	JT	08/24/10	10:19
Aldicarb	NA	mg/L	ND	0.0020	U	EPA531.2	0.0002	NA	JT	08/25/10	20:48
Aldicarb sulfone	NA	mg/L	ND	0.0020	U	EPA531.2	0.0003	NA	JT	08/25/10	20:48
Aldicarb sulfoxide	NA	mg/L	ND	0.0020	U	EPA531.2	0.0003	NA	JT	08/25/10	20:48
Carbaryl	NA	mg/L	ND	0.0020	U	EPA531.2	0.0004	NA	JT	08/25/10	20:48
3-Hydroxycarbofuran	NA	mg/L	ND	0.0044	U	EPA531.2	0.0003	NA	JT	08/25/10	20:48
Methomyl	NA	mg/L	ND	0.0020	U	EPA531.2	0.0002	NA	JT	08/25/10	20:48
Dicamba	NA	mg/L	ND	0.000088	U	EPA515.1	0.00008	8/12/10	JT	08/26/10	11:53
Aldrin	NA	mg/L	ND	0.000022	U	EPA508	0.000007	8/16/10	JT	08/24/10	10:19
Dieldrin	NA	mg/L	ND	0.000022	U	EPA508	0.000004	8/16/10	JT	08/24/10	10:19
Butachlor	NA	mg/L	ND	0.00040	U	EPA525.2	0.0003	8/18/10	AE	08/21/10	01:26
Metolachlor	NA	mg/L	ND	0.00020	U	EPA525.2	0.0002	8/18/10	AE	08/21/10	01:26
Metribuzin	NA	mg/L	ND	0.00020	U	EPA525.2	0.0002	8/18/10	AE	08/21/10	01:26
Propachlor	NA	mg/L	ND	0.00020	U	EPA525.2	0.0001	8/18/10	AE	08/21/10	01:26

*MCL (Maximum contaminant level, NATIONAL DRINKING WATER STANDARDS, as of March 2009

U = "Not detected above LOQ (Limit of Quantification) MDL = Method Detection Limit

Summit Environmental Techr
Method 903.0/9315
QC Repo

Batch ID 265

Parameter	Spiked conc. pci/l	Recovered conc. %	%RPD
Blank		<1pci/l	
LCS	5	70	
LCSD	5	88	22.7
MS	5	96.9	

Summit Environmental Technologies, Inc.
Method 900.0(Gross Alpha,Gross Beta)
QC Report

Batch ID 285

	Gross Alpha		Gross Beta	
Blank	<3 pci/l		<4pci/l	
	%Rec.	%RPD	%Rec.	%RPD
LCS	83.3		92.5	
LCSD	81	2.8	97	4.7
MS	96.7		109	
Sample/ Sample DUP		0		0

Summit Environmental Technologies, Inc.
Method 904.0/9320(Radium-228)
QC Report

Batch ID 266

		%Rec.	%RPD
Blank	<1pci/l		
LCS		83	
MS		98.0	
Sample/ Sample DUP			0.0

Summit Environmental Technologies, Inc.
Uranium 908
QC Report

Batch ID 282

		%Rec.	%RPD
Blank	<2 pci/l		
LCS		99.9	
Sample/ Sample DUP			0