WATERFORD ELEMENTARY SCHOOL GROUNDWATER SUPPLY REPORT

WATERFORD, VIRGINIA

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1 EXECUTIVE SUMMARY

GeoTrans performed a hydrogeologic study in 2006 on behalf of Loudoun County Public Schools (LCPS) to evaluate (1) the sustainability of the groundwater resource to supply increased enrollment (to 600 students) at the Waterford Elementary School (WES) and (2) potential impacts of increased pumping on wells in the surrounding area. Groundwater was pumped at an average rate of 644 gallons per day (GPD) and maximum monthly rate of 950 GPD for approximately 225 students and staff in 2005. Based on linear extrapolation to operate the WES with 600 students, the pumping rate would have to increase to an average rate of 1718 GPD and 2533 GPD during a month of maximum water use.

A series of controlled aquifer tests was performed between April and July 2006 by pumping groundwater from the WES well at increased rates and monitoring water-levels using automated pressure transducer/dataloggers in the WES well, nine nearby wells, and one spring. Normal pumping for school use during this test period, which was approximately 2.8 gallons per minute (gpm) during each 8-hour school period, caused drawdown in the WES well from a static level of 19 feet below the top of casing (TOC) to between 25 and 37 feet. Pumping an additional 4 to 10 gpm extended drawdown to between 37 and 42 feet, and pumping 12.2 gpm continuously for 48 hours caused drawdown to 43 feet. The only offsite wells that revealed drawdown due to pumping at the WES supply well are an unused Waterford Foundation monitoring well, which is located approximately 120 feet northeast of the WES well, and the Hutton domestic well, which is approximately 350 feet southeast of the WES well. Maximum drawdown observed during the 48-hour test was 3.5 feet at the Waterford Foundation well and 1 foot at the Hutton well.

Extrapolation of the WES well drawdown trend suggests that long-term pumping at 12 gpm is feasible and might not cause the groundwater level to decline to more than 50 feet below TOC. Drawdown at nearby wells caused by WES pumping will be less than that experienced at the WES well and is unlikely to be noticeable to users. Results of modeling analysis of groundwater flow in the Waterford area support the interpretations that (1) higher rates of pumping at the existing WES well are sustainable and (2) impacts to other groundwater users in the Waterford area that would result from increased pumping to support enrollment of 600 students would probably not be noticeable.

Due to uncertainty in forecasting groundwater conditions, it is prudent to monitor the performance and impacts (or lack thereof) of pumping at the WES. We recommend that an automated water-level recording device be installed in the WES supply well and in two or three of the other of the monitoring network wells for long-term monitoring. The collected data can be retrieved on a quarterly or semi-annual schedule and as needed to help diagnose reported well problems or alleged drawdown impacts. LCPS should also continue to record flowmeter readings to document WES well pumping rates.

2 INTRODUCTION

GeoTrans performed a hydrogeologic study in 2006 on behalf of the Loudoun County Public Schools (LCPS) to evaluate (1) the sustainability of the groundwater resource to supply increased enrollment at the Waterford Elementary School (WES) and (2) potential impacts of increased pumping on wells in the surrounding area, including in the Village of Waterford. The WES is located at 15513 Loyalty Road in the northeastern end of the Village as shown in **Figure 1**. During site development, student enrollment was projected to be 210 students upon opening in 1965 and was anticipated to ultimately increase to 450 students (VDH, 5/21/64). Other information, however suggests that there were only approximately 100 students attending the WES in the early 1980s (WCA, 2006). The school was renovated in 1999. By 2005, enrollment had increased to approximately 225 students (LCPS, 2006), and LCPS is considering future construction that would accommodate up to 600 students at the site.

The source of water supply for the school is groundwater pumped from a single non-community supply well identified by Loudoun County as WWNC-1965-0080 (**Figure 1**). Monthly water use at the WES during 2005, which is summarized in **Table 1** based on totalizing flowmeter records, shows an average pumping rate of 644 gallons per day (GPD) during the entire year and an average pumping rate of 950 GPD during the month of maximum water use (September 2005). Based on linear extrapolation of water use necessary to operate the WES with 600 students (**Table 1**), the pumping rate would have to increase to an average rate of 1718 GPD and 2533 GPD during a month of maximum water use.

Concerns have been raised, notably by the Waterford Citizens Association (www.waterfordva-wca.org/school/water-use.htm), that increased groundwater withdrawal to support an enlarged WES (and resulting groundwater drawdown) may adversely impact existing groundwater users in the Village. Approximately 80 homes in Waterford are served by individual wells. As detailed in this report, many of these are low-yielding wells that were drilled to great depth in rock with very little permeability. Methods and results of this study, which was conducted to evaluate the ability of the existing WES well to supply an increased school population and potential impacts on groundwater availability, are presented herein.

3 HYDROGEOLOGIC SETTING

3.1 GEOLOGY

The Waterford area is located on the eastern limb of the northeast-trending Blue Ridge anticlinorium, which is a large allochthonous fold of rock that was formed more than a billion years ago during the Grenville orogeny. As described by Burton et al. (1995) and Southworth et al. (1999), the anticlinorium is cored by high-grade Middle Proterozoic paragneiss and granitic gneisses with lesser discontinuous belts and lenses of nongranitic layered and mafic gneiss that were subjected to intense metamorphic deformation probably during the Grenville orogeny and the more recent Alleghenian orogeny (~250 to 300 million years ago). These rocks were extensively intruded by northeast-striking Late Proterozoic metadiabase dikes. Based on their chemical composition and distribution, the dikes are considered to be feeders to the overlying metabasalt of the Catoctin Formation, which is eroded locally, but present along Catoctin Ridge to the east.

As shown on **Figure 2**, the U.S. Geological Survey (USGS) reports that the WES is underlain by metanorite (Ygn) and that the Village is underlain by leucocratic and Marshall metagranite (Yg, Ymb) and metadiabase (Zmd). These crystalline metamorphic rocks have essentially no primary porosity. Groundwater flow occurs through fractures in the rock, which provide a heterogeneous network of secondary porosity and permeability. According to Burton et al. (1995):

> "In the [dissected] western plateau [west of Catoctin Mountain,] the obvious structural features, which may exert a considerable influence on ground-water flow, are the closely spaced, northeast-striking, moderately to steeply dipping sheetlike metadiabase dikes intruding gneiss, together with the subparallel and generally pervasive Paleozoic schistosity developed in both lithologies."

3.2 WELL YIELD DATA

Well yield and depth data derived from the Loudoun County 'Wells' database are posted for the Waterford area in **Figure 3** and a detailed water well atlas and summary table are provided in **Appendix A**. The yields (in gallons per minute, gpm) typically represent estimated flow rates observed by drillers when water was being blown from each well by air

pressure at the end of drilling. An unusually high proportion of wells in the Village have low or very low well yields in comparison to other areas in western Loudoun County.

The spatial distribution of well yield data in the Waterford area was evaluating using the kriging interpolation routine implemented in the Spatial Analyst module of ESRI's ArcMap™ Version 9 Geographic Information System (GIS) program. As shown by the results presented in **Figure 4**, a northeast-trending band of wells with low well yields is identified throughout much of Waterford, but does not include the eastern end of the Village where the WES is located.

3.3 WES WELL YIELD AND DEPTH

Little information was available prior to this study regarding the yield, depth, construction, water-level, and time-drawdown pumping characteristics of the WES well. A VDH document provided in **Appendix B** indicates that the well was drilled in 1964 and had a yield of 15 gpm, but provides no information on its depth. No Water Well Completion Report is on file for this well with the County Health Department. The well is located in a large subsurface vault beyond the north end of the school soccer field as shown in **Figure 2**. Writing within the vault dated October 1968 indicates that the well was 150 feet deep and had a pump installed to a depth of 120 feet.

Following a review of site information, Robert Edelman, District Engineer for the Virginia Department of Health Office of Drinking Water, requested that a video camera inspection be performed to confirm well depth, casing depth, pump setting, and general condition. A video camera log was conducted by Valley Drilling Corporation on April 10, 2005. Results of the log are documented on a DVD and on a copy of select borehole images in **Appendix B**.

Key observations derived from the video inspection are: (1) the 6-inch steel well casing extends to 47 feet below the top of casing (TOC), which was approximately 6 feet below the vault (ground) surface; (2) the total well depth is 128 feet below TOC; (3) sediment was present at the well bottom and possibly extends to the reported drilled depth of 150 feet; (4) fracture zones are apparent at 51 to 53 feet, 65 feet, and 73 to 76 feet below TOC; and (5) the static water-level (after several days without pumping) was measured at 19 feet below TOC. Other smaller fractures were identified in the video; however, it was not

possible to determine groundwater inflow associated with any of the intervals based on the video log.

Following the video inspection, Valley Drilling reset the pump (Goulds model 18LS10422) to a depth of 120 feet below TOC. The pump is a nominal 18 gpm pump with a 1.0 HP motor. Its date stamp (E9619-9-03) indicates that it was built in 1996, and thus, was installed in 1996 or later. The pump appears to be in good shape.

GeoTrans performed an initial controlled pump test on the WES well on April 14, 2006. Pumping the well at a constant rate of 7.0 gpm for 8 hours caused the well water level to decline from 27.8 to 33.8 feet below TOC. After a recovery period of 30 minutes, the well water level had risen to 29.3 feet below TOC. A description of the aquifer testing program performed between April and July 2006 at the WES supply well and surrounding observation wells is presented in Section 4.

3.4 GROUNDWATER ELEVATION SURVEY AND INFERRED FLOW

With the much appreciated assistance of Dr. Nicholas Ratcliffe, a geologist and long-time resident of Waterford, GeoTrans measured the depth-to-water in 48 wells distributed throughout the Waterford area during April and May of 2006. Most of the measurements were made in private domestic water-supply wells using a sonic water-level probe. Groundwater elevations away from supply wells that are pumped intermittently are expected to be somewhat higher than measured in the pump wells. Hydraulic heads were determined by subtracting the depth-to-water from the estimated TOC elevation (derived from topographic contour maps) at each well. The hydraulic head survey measurements are documented in **Table 2** and a contour map of hydraulic heads is provided as **Figure 5**. The hydraulic head contours shown in **Figure 5** were interpolated using the kriging algorithm in the Golden Software Surfer Version 8 program and 5-ft cell dimensions.

The hydraulic head data and contours in **Figure 5** reveal (1) relatively flat hydraulic gradients and groundwater flow to the west and southwest in the area east of High Street, and (2) large drawdown in the immediate vicinity of and converging flow to domestic wells in the residential sections of Waterford. Observed water levels in many wells in Waterford are more than 100 feet below the elevation of surface water in Catoctin Creek; this reflects the density of pumping wells, low aquifer transmissivity, and the low rate of aquifer recharge in

the Village. Two springs (WWSP-1964-0092 and WWSP-1964-0093, see **Appendix A Figure A-6**) that reportedly flow continuously are located on the north side of Butchers Row near where hydraulic gradients increase substantially from east to west. Their location may result from the presence of a hydrogeologic barrier (tight rock) to the west.

4 AQUIFER TESTING PROGRAM

A series of controlled aquifer tests were performed between April 14 and July 22, 2006 by pumping groundwater from the WES well and monitoring water-levels every few minutes using automated pressure transducer/dataloggers (Solinst Leveloggers and In-Situ LevelTrolls) in the WES well, nine nearby wells, and spring WWSP-1964-0093. Locations of the monitoring wells are shown in **Figure 6**.

Due to ongoing use of the school, which made it impossible to maintain a steady pumping rate, aquifer testing that occurred during May and June involved increasing the pumping rate above normal school use by discharging water from a sink faucet through a flowmeter to the sanitary sewer. A valve was used to adjust the extra flow rate. Flowmeter readings were recorded at the start and end of each discharge period (typically at 7 am and 3 pm on test days). After the conclusion of the school year, a 48-hour constant pumping rate (12.2 gpm) aquifer test was conducted in July during a period when there was minimal use of water for cleaning activities in the school. The 12.2 gpm pumping rate used during the 48-hour test was selected based in part on guidance provided by Robert Edelman, District Engineer for the Virginia Department of Health Office of Drinking Water (see letter dated April 12, 2006 in Appendix B).

Records of extra pumping at the WES are provided in **Table 3**. Pumping stresses imposed at the WES production well during the aquifer testing program are summarized below:

- April 14 – 8-hour constant rate aquifer test (7 gpm),
- May 3 to May 5 – pumped an additional ~8 gpm between 7 am and 3 pm,
- May 8 to May 12 – pumped an additional ~10 gpm between 7 am and 3 pm,
- May 22 to June 14 – pumped an additional ~4.2 gpm between 7am and 3pm on 16 school days, and
- July 5 to July 7 – pumped 12.2 gpm for 48 hours (**Appendix C**).

A graph showing the relationship between pumping rate and WES well water level during the test period is presented in **Figure 7**. The static water-level was measured in the WES well at 19 feet below TOC on April 10 after several days without pumping during the Easter recess. As shown in **Figure 7**, normal pumping for school use caused drawdown to

between 25 and 37 feet, extra pumping of 4 to 10 gpm extended drawdown to between 37 and 42 feet, and pumping 12.2 gpm continuously for 48 hours caused drawdown to 43 feet below TOC.

At the WES, groundwater is pumped from the well to a storage tank in the well vault, which provides water under pressure to the school. The submersible pump turns on whenever the pressure in the tank declines to a set point. Although this caused water levels in the WES well to rise and fall as the pump turned on and off approximately 65 times during the 48-hour aquifer test, it did not affect water levels in observation wells and did not impair interpretation of test data (from either the pump well or the observation wells).

All water-level data recorded by dataloggers in the WES well and offsite monitoring wells during the aquifer test period are plotted in **Figures 8 to 19**. Available water-level data from the Loudoun County monitoring well shown on **Figure 6** (which does not extend into the WES test period) is shown on **Figure 20**; and plots of barometric pressure fluctuation and daily precipitation for the period between April and July 2006 are plotted on **Figure 21**. The only wells that revealed drawdown due to pumping at the WES supply well are the unused Waterford Foundation monitoring well, which is located approximately 120 feet northeast of the WES well, and the Hutton domestic well, which is approximately 350 feet southeast of the WES well. Maximum drawdown observed during the 48-hour test was approximately 3.5 feet at the unused Waterford Foundation well and 1 foot at the Hutton well.

Analyses were made of pump and observation well time-drawdown data derived from the 48-hour test using the Aqtesolv™ well hydraulics program (www.aqtesolv.com). Results shown in **Figures 22 to 26** provide aquifer transmissivity estimates of 175 ft^2/d, 122 ft^2/d, and 442 ft^2/d based on data from the WES, unused Waterford Foundation, and Hutton wells, respectively. Extrapolation of the WES well drawdown trend on a semi-log plot (**Figure 24**) suggests that long-term pumping at 12 gpm is feasible and might not cause the groundwater level to decline to more than approximately 50 feet below TOC (~30 feet of drawdown). Drawdown at nearby wells caused by WES pumping will be less than that experienced at the WES well and is unlikely to be noticeable.

5 WATERWORKS CALCULATIONS

Section 12VAC5-590-690 of the Virginia Waterworks Regulations establishes a capacity design criterion for elementary schools without showers of 10 GPD per person. This design criterion also applies to faculty and staff as well as students. Assuming a total of 660 persons at an enlarged WES, the school's waterworks would have to be capable of providing at least 6,600 GPD to the school. As most school activity occurs between 8 am and 4 pm, the average design water demand during this 8-hour period would be: 6,600 gallons ÷ 480 minutes = 13.75 gpm.

Given the successful demonstration of a 12.2 gpm pumping rate, we understand that the WES waterworks permit design basis can become:

12.2 gpm x 1440 minutes/day = 17,568 GPD based on pump capacity and well yield.

Pumping 12.2 gpm during an 8-hour period provides 5856 gallons of water. The difference between the calculated design water supply of 6600 GPD and the 8-hour well yield of 5856 is 744 gallons. This shortfall can be provided for by storing water pumped after the 8-hour period in an approved tank. The reported capacity of the existing storage tank in the WES well vault of 1500 gallons is approximately double the calculated shortfall volume.

Note that the design criterion of 10 GPD per person is reasonably conservative compared to the measured rates used by 225 students in 2005 (**Table 1**).

6 PUMPING RATE COMPARISONS

One of the goals of this study is to evaluate what impact increased pumping at the WES might have on other groundwater users. Components of this assessment include comparing how much groundwater is pumped at the WES to that extracted by others in Waterford (Section 6.1) and to recharge rate estimates (Section 6.2).

6.1 COMPARISON OF WES PUMPING TO PUMPING BY OTHERS

Totalizing flowmeter measurements of monthly water use at the WES during 2005 to support approximately 225 students (**Table 1**) show average pumping rates of 644 GPD for the entire year and 950 GPD during the month of maximum water use (September 2005). Based on linear extrapolation of water use necessary to operate the WES with 600 students (**Table 1**), the pumping rate would have to increase to an average rate of 1718 GPD and 2533 GPD during a month of maximum water use. Three methods used by GeoTrans to estimate how much water is pumped from other water wells in Waterford are described below.

6.1.1 BASED ON DOMESTIC WELL PUMPING RATE ESTIMATES

The Loudoun County Health Department and Department of Building and Development estimate that each occupant of a house served by a domestic well uses 75 GPD of water. If the average number of residents per house in Waterford is 2.5, and if there are 80 houses occupied by residents, then the estimated pumping rates would be187 GPD/home and a total withdrawal of 15,000 GPD from domestic wells in Waterford. If it is assumed that each person uses only 50 GPD, then the estimated pumping rates would be 125 GPD/home and a total withdrawal of 10,000 GPD from all domestic wells. Note that groundwater is also pumped for businesses in Town. There are 96 connections to the Waterford wastewater treatment plant (WWTP). Using the lower estimate of 10,000 GPD to represent pumping from all domestic wells in Waterford, then the existing WES pumping represents 6% of total groundwater withdrawal in the Village, and the projected future WES pumping would represent 15% of total groundwater withdrawal in the Village.

6.1.2 BASED ON WATERFORD WELL FLOWMETER READINGS 1979 TO 1981

The Loudoun County Sanitation Authority (LCSA) installed flowmeters and made quarterly meter readings at numerous individual wells in Waterford circa 1979 to 1981 to help establish WWTP fees. A complete record of available flowmeter readings is provided in **Appendix D**. LCSA reports that the meters installed were regularly getting clogged and not reading accurately. As a result, LCSA abandoned trying to meter water use in the Village.

Based on the LCSA flowmeter data, which are summarized in **Table 4**, GeoTrans calculated the mean pumping rate of 45 wells in the Village to be 116 GPD. This value is believed to be biased low due to clogging of the flowmeter chambers by particulate matter; however, some attempt was made to reduce this error by neglecting periods when meters were clearly clogged as reflected in **Table 4**. Minimum, mean, and maximum pumping rates for residential and commercial wells in Waterford determined using the LCSA flowmeter data are provided in **Table 5**. Using the mean pumping rate of 116 GPD and applying this rate to 95 connections to the WWTP (not including the WES), then the estimated total pumping rate for other wells in Waterford is 11,020 GPD, the existing WES pumping represents 6% of total groundwater withdrawal in the Village, and the projected future WES pumping would represent 15% of total groundwater withdrawal in the Village.

6.1.3 BASED ON WATERFORD WWTP OUTFLOW DATA

The Waterford WWTP receives wastewater discharge from 96 connections in the Village. Based on the assessment of WWTP outfall flow data, which are summarized in **Table 6** and **Figure 27**, it appears that the average GPD of pumped groundwater that is discharged to the WWTP is approximately 13,655 GPD. There appears to be no relationship between precipitation and discharge rate at the WWTP, which is consistent with LCSA observations that surface and groundwater inflow to the sewer lines appears to be minor. Thus, it appears that average daily pumping at the WES of 644 GPD in 2005 constitutes approximately 5% of the total groundwater withdrawal in the Village and the projected future WES pumping would represent 11% of total groundwater withdrawal in the Village.

6.1.4 PUMPING RATE COMPARISON SUMMARY

The existing measured average pumping rate of 644 GPD from the WES water-supply well represents approximately 5% to 6% of the total rate of groundwater pumped from within the Village of Waterford based on the three different estimation methods described above. Considering the possible increase in students enrolled at the WES to a maximum of 600 children, then the projected average pumping rate of 1718 GPD from the WES well would represent approximately 11% to 15% of the total rate of groundwater pumped from within the Village.

6.2 COMPARISON OF PROJECTED WITHDRAWAL TO RECHARGE

Groundwater removed by pumping at the WES well is balanced by (1) a lowered hydraulic head locally in the aquifer (removal of groundwater from storage), (2) an increase in recharge to the aquifer from above, (3) a decrease in the rate of natural discharge from the aquifer to streams, or, most likely, (4) a combination of all three sources. A quantitative evaluation of the water balance in the Waterford area based on mathematical modeling is described in Section 7. The existing and projected WES pumping rates are compared to estimates of groundwater recharge in western Loudoun County below.

The adequacy of the groundwater supply at the site for can be assessed by comparing the rates of pumping to the rate of recharge to the groundwater system. Given that the WES parcel occupies 10.4 acres, then a recharge rate of 0.83 inches per year (in/yr) over the 10.4 acres parcel is equivalent to 644 GPD, and a recharge rate of 2.21 in/yr over the 10.4 acres is equivalent to a projected average annual pumping rate of 1718 GPD. Of course, the rate of recharge to the WES parcel varies significantly as a function of slope, surface cover, and other factors, and it is advantageous to manage surface runoff to promote recharge by engineered means.

Using a water budget approach, studies from the Piedmont regions in Maryland and Virginia indicate that about 70 percent of total precipitation is lost to evapotranspiration, 7 percent is lost as surface water runoff, and the remaining 23 percent recharges the groundwater system (Richardson, 1982; Murphy, 1979; Water Information Center, 1973). Estimates of effective groundwater recharge from these studies range from 8.5 to 11.3 in/yr. Assuming that the average precipitation in the study area is 42.15 in/yr (Murphy, 1979, and

data from NOAA's gaging station in Lincoln, Virginia), the average recharge rate would be 9.7 in/yr.

Stream baseflow measurements are a more direct way of assessing groundwater recharge in an area. Under this method, it is assumed that mean baseflow in a stream is equal to groundwater recharge. This method produces average recharge rates within an entire watershed reflecting variations in climate, geology, topography, and existing land use and land cover conditions during the period of stream flow gaging. Based on continuous-record streamflow gaging stations on Catoctin Creek at Taylorstown from 1973 to 1984 and on Goose Creek at Middleburg from 1967 to 1984, the groundwater recharge rates were estimated at 9.2 and 10.7 in/yr, respectively (Nelms and others, 1995). Weighted for watershed drainage area, this represents an average groundwater recharge rate of 10.1 in/yr over the 212 square mile area encompassing these two watersheds. Rutledge and Mesko (1996) presented a method to estimate recharge in drought years, which yields a value of 6 in/yr locally.

Loudoun County staff has estimated recharge rates in the County to be 10 and 6 inches during normal and drought years, respectively. These recharge rate estimates are supported by the studies described above and exceed the equivalent recharge rate necessary to meet the existing and projected rates of groundwater extraction at the WES parcel.

7 GROUNDWATER MODEL ANALYSIS

GeoTrans constructed a two-dimensional mathematical model to examine groundwater flow in the Waterford area using the MODFLOW finite-difference program developed by the USGS (Harbaugh et al., 2000) and the Groundwater Vistas program from ESI (2005). The model domain extends from west of Catoctin Creek eastward to the Catoctin Ridge and thousands of feet north and south of Waterford (**Figure 28**). The finite-difference grid includes 1000 rows, 710 columns, and 1 layer comprising 710,000 blocks with uniform row and column spacings of 20 feet.

Model boundary conditions include: (1) specified recharge (of precipitation), (2) a portion of Catoctin Creek represented by river nodes[1], (3) several perennial and ephemeral streams represented by drain nodes[2], (4) 321 pumping wells each pumping 125 GPD, (5) the WES well pumping 644 GPD for the existing condition and 12.2 gpm (17,568 GPD) to assess impacts of increased pumping, (6) the Custer spring with a specified discharge rate of 2880 GPD, and (7) no-flow boundaries at the base and perimeter of the model. River and drain boundary condition cells, and wells included in the model, are shown in **Figure 28**.

Several steady-state simulations (also referred to as 'runs') were performed to evaluate existing groundwater conditions and attempt to match the measured distribution of hydraulic heads in the Waterford area (see **Figure 5**). A reasonable match of observed water levels was achieved by using low values of recharge rate (1 inch per year) and transmissivity (2.0 or 0.2 ft^2/d) in the western quarter of the model domain, including in most of Waterford as shown in **Figure 28**. The existence of low aquifer transmissivity in the area between Catoctin Creek and High Street and extending south and north is reflected by the

[1] The river boundary condition is a head-dependent boundary condition. In a river cell, water flow into or out of the aquifer is dependent on the head assigned to the river and the conductance term. The head (also referred to as river stage) is compared to the computed head in the aquifer for the cell containing the river. If the aquifer head is higher than the river head, then the river removes water from the aquifer. The amount of water removed is based on the conductance term. The conductance, C, is computed from the following equation: C = K L W/D; where K is the hydraulic conductivity of the river bed material, L is the length of the river in the cell, W is the width of the river in the cell, and D is the thickness of the river bed material.

[2] The drain boundary condition is also a head-dependent boundary condition. In a drain cell, the flow of water out of the aquifer is dependent on the head assigned to the stream (drain) and the conductance term. The head (or stage) is compared to the computed head in the aquifer for the cell containing the drain. If the aquifer head is higher than the drain head, then the drain removes water from the aquifer. If the drain head (stage) is higher than the aquifer head, then the drain is considered to be dry and no water is removed or added to the aquifer. The amount of water removed is based on the conductance term as described in footnote 5.

geostatistical analysis of well yield data displayed in **Figure 4** as well as by the many low yield wells in the residential portion of Waterford. Recharge is limited by low aquifer transmissivity. Given the distribution of pumping wells and estimated pumping rates in Waterford, it was necessary to represent the immediate area with a low transmissivity and recharge rate in order to simulate the observed drawdown. Much higher transmissivity (100 ft^2/d), comparable to the WES aquifer test results, and recharge rate (6 in/yr) values were input in the central and eastern portion of the model domain. Using these parameters, simulated steady-state hydraulic head values (**Figure 29**) reasonably matched the observed hydraulic head distribution and inferred groundwater flow conditions (**Figure 5**).

Note that the model is a simplistic representation of a complex and heterogeneous fractured bedrock aquifer system. It was used to enhance understanding to of the hydrogeology of the Waterford area and to project drawdown impacts that can be expected to result from potential increased pumping at the WES.

The results of a predictive steady-state simulation in which a constant pumping rate of 12.2 gpm (17,568 GPD) was assigned to the WES well are shown in **Figure 30** and simulated water balances for the model area are provided in **Figure 31**. The simulated drawdown and hydraulic head contours resulting from the increase in pumping (which substantially exceeds that necessary to support 600 students) are consistent with the results of the 48-hour aquifer test and the interpretation that (1) higher rates of pumping at the existing WES well are sustainable and (2) impacts to other groundwater users in the Waterford area that would result from increased pumping at the WES would probably not be noticeable.

8 LONG-TERM GROUNDWATER MONITORING

Due to uncertainty in forecasting groundwater conditions, it is prudent to monitor the performance and impacts (or lack thereof) of pumping at the WES. We recommend that an automated water-level recording device (i.e., a Solinst Levelogger or In-Situ LevelTroll) be installed in the WES supply well and in two or three of the other of the monitoring network wells shown on **Figure 6** for long-term monitoring. The collected data can be retrieved on a quarterly or semi-annual schedule and as needed to help diagnose reported well problems or alleged drawdown impacts. LCPS should also continue to record flowmeter readings to document WES well pumping rates.

9 LIMITATIONS

The findings contained in this report regarding groundwater conditions represent our professional judgment at this time. There may be hydrogeologic and/or environmental conditions not disclosed by our investigation. This report has been prepared in accordance with generally accepted hydrogeologic practices. No warranty regarding groundwater supply, well yield, water quality, future precipitation, or related matters, expressed or implied, is made.

10 REFERENCES

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Table 1. Summary of groundwater pumping rate data from the WES production well in 2005 and extrapolated rates assuming an increase from 225 to 600 students.

Meter Reading Date	Totalizing Meter Reading (gallons)	Water Use Month	Gallons Used in Month	Ave. GPD Used in Month	Ave. GPM Used in Month	Ave. GPD on School Days (assuming no water use on other days)	Ave. GPD per Student on School (assuming 225 students and no water use on other days)	Ave. GPM Used during School Hours (assuming an 8-hour school day and no water use on other days)	Number of School Days Assumed in Month
12/31/04	337,100								
1/31/05	356,500	Jan-05	19,400	626	0.43	1078	4.79	2.25	18
2/28/05	372,500	Feb-05	16,000	571	0.40	842	3.74	1.75	19
3/31/05	390,600	Mar-05	18,100	584	0.41	787	3.50	1.64	23
4/31/05	413,800	Apr-05	23,200	773	0.54	1547	6.87	3.22	15
5/31/05	442,800	May-05	29,000	935	0.65	1381	6.14	2.88	21
6/30/05	463,100	Jun-05	20,300	677	0.47	1845	8.20	3.84	11
7/29/05	465,100	Jul-05	2,000	65	0.04				0
8/31/05	478,500	Aug-05	13,400	432	0.30				0
9/31/2005	507,000	Sep-05	28,500	950	0.66	1583	7.04	3.30	18
10/31/05	533,500	Oct-05	26,500	855	0.59	1325	5.89	2.76	20
11/30/05	557,200	Nov-05	23,700	790	0.55	1317	5.85	2.74	18
12/31/05	572,300	Dec-05	15,100	487	0.34	888	3.95	1.85	17
TOTAL 2005 (225 students)			**235,200**	**644**	**0.45**	**1259**	**5.60**	**2.62**	**180**
Linear Extrapolation (600 students)			**627,200**	**1,718**	**1.19**	**3358**	**5.60**	**7.00**	**180**

Table 2. Hydraulic head survey measurements made in the Waterford area circa April-May 2006.

Hydraulic Head Measure-ment Date	Well ID	Easting	Northing	Name	Address	Reported Yield (gpm)	Well Depth (feet)	Ground Surface Elevation (feet > MSL)	Depth to Water (feet)	Hydraulic Head (feet > MSL)	Comment
5/4/2006	WWIN-1998-0132	11734823	7116576	Paschall, Philip D & Elizabeth Cox	40203 Main Street	<1	680	394	329	65	
5/4/2006	WWIN-1981-0171	11734637	7116774	Gravatt, Claude C. Jr., and Ann Tees	15493 Second Street	NA	NA	375	12	364	
5/4/2006	WWIN-1993-0267	11734785	7116529	Bednarik, David J & Peggy L T/C	15512 Second Street	7	600	389	162	227	
5/4/2006	WWIN-1992-0159	11734926	7116539	Carter, Christopher Ashton	40200 Church Street	2	440	404	152	252	
5/4/2006	WWIN-1986-0338	11735038	7116515	Soechtig, Steven A & Barbara M R/S	40215 Main Street	<1	600	419	246	174	
5/4/2006	NA	11734809	7116933	Biby, Richard F & Jennifer R/S	40187 Main Street	NA	NA	437	233	204	Not in County GIS
5/4/2006	WWIN-1979-0163?	11734873	7116871	Ferguson, Sarah A	40191 Main Street	1	710	400	144	256	Not in County GIS
5/4/2006	WWIN-2001-0393	11735263	7116687	Rose, Paul & Adene R/S	40216 Main Street	1	1000	415	106	309	
5/4/2006	WWIN-1996-0110	11735237	7116779	Charlton, Anne Bentley	40210 Main Street	1	680	403	159	244	
5/4/2006	WWIN-1979-0160	11735046	7116726	Caskie, Brian & Kathryn R/S	40200 Main Street	3	300	431	89	342	
5/4/2006	WWIN-1981-0174	11734630	7117407	Benschoter, Ronald JR & G Jessee JT	40154 Main Street	4	240	511	90	421	
5/4/2006	WWIN-1986-0334	11734621	7117446	Keybank National Association	40152 Main Street	12	325	412	62	350	
5/4/2006	WWIN-1996-0267	11734441	7117619	Magennis, Cathleen A	40138 Main Street	3	500	382	237	145	
5/4/2006	WWIN-1991-0155	11735133	7117577	Waterford Foundation	pasture E. of Main St	1	500	405	69	336	
5/4/2006	WWIN-1982-0125	11734838	7117180	Middleton Waterford LLC	40174 Main Street	35	160	420	75	345	
5/4/2006	WWIN-1987-0361	11734244	7115978	Ratcliffe, Nicholas M & Katherine W	15575 Second Street	3	320	377	36	341	
5/4/2006	WWDU-1962-0072	11734344	7115968	Ratcliffe, Nicholas M & Katherine W	15575 Second Street	NA	NA	383	7	376	
5/4/2006	WWIN-1999-0179	11734595	7115953	Lloveras, Lang Elizabeth	15570 Second Street	0	680	406	284	122	
5/4/2006	WWIN-1973-0307	11734571	7116026	Lloveras, Lang Elizabeth	15570 Second Street	1	600	403	425	-22	
5/4/2006	WWIN-1983-0115	11734102	7116299	Morton, W B III & Margaret T R/S	15555 Second Street	4	365	367	18	349	
5/4/2006	WWIN-1957-0069	11734364	7116069	Good, C Edward & Margaret R/S	15567 Second Street	NA	NA	383	25	358	
5/4/2006	WWIN-1986-0340	11734539	7115874	Lehmann, Edward & Edeth Crockett JT	15580 Second Street	1	500	403	76	328	No pump
5/4/2006	WWIN-1986-0341	11734548	7115895	Lehmann, Edward & Edeth Crockett JT	15580 Second Street	2	550	403	249	154	
5/4/2006	WWIN-1974-0153	11734556	7116181	Hunley, William Henry & CarolynC	15552 Second Street	NA	NA	393	244	149	
5/4/2006	WWIN-1986-0339	11734909	7116317	Rose, Paul & Adene R/S	40186 Patrick Street	4	560	413	262	151	

Table 2. Hydraulic head survey measurements made in the Waterford area circa April-May 2006.

Hydraulic Head Measure-ment Date	Well ID	Easting	Northing	Name	Address	Reported Yield (gpm)	Well Depth (feet)	Ground Surface Elevation (feet > MSL)	Depth to Water (feet)	Hydraulic Head (feet > MSL)	Comment
5/4/2006	WWIN-1988-0528	11734897	7116406	Stup, James Michael & Paige Cox R/S	15520 Second Street	NA	NA	407	227	180	
5/4/2006	NA	11734675	7116451	James, Nicholas L & Randall J James	40170 Patrick Street	NA	NA	385	22	363	Dug Well
5/4/2006	WWNC-1965-0080	11736620	7116969	Waterford Elementary School Well	15513 Loyalty Road	15	150	462	26	436	
5/19/2006	WWIN-89-0336	11738569	7117437	Sutton, Erica	Brown Street	25	365	525	60	465	
5/19/2006	WWIN-1980-150	11734778	7115629	Loudoun Mutual Insurance (outside)	15609 High Street	1	705	425	177	248	Pump well.
5/19/2006	NA	11734774	7115737	Loudoun Mutual Insurance (basement)	15609 High Street	NA	~100?	417	28	389	6" drilled well in basement, not in use. Reportedly drilled in 1949 to about 100 feet.
5/19/2006	WWIN-1990-0404	11734481	7115311	Laura Lee Shaw	40143 Janney Street	4	600	400	116	284	
5/19/2006	WWIN-1962-0083	11734645	7115209	Gibson, Joseph & Elizabeth R/S	15655 High Street	NA	NA	410	25	385	Well in vault
5/19/2006	by WWIN-1956-0076	11734311	7115527	Jackson, Robert & Judy R/S	15620 Second Street	1	620	390	107	283	Yield and depth per owner
5/19/2006	WWIN-1964-0097	11734385	7115624	Thompson, Robert C & Marsha A Tees	15606 Second Street	NA	230	390	41	350	Depth per owner; says high yield
5/19/2006	WWCO-1989-0329	11736630	7114850	Virginia Friend	Fairfax Street	1.5	500	400	12	388	aka HF-7
5/19/2006	WWCO-1989-0330	11737428	7114921	Virginia Friend	Fairfax Street	NA	NA	410	14	396	no cap
5/19/2006	WWCO-1989-0325	11736180	7114817	Virginia Friend	Fairfax Street	605	7.68	391	3	388	aka HF-4
4/7/2006	WWIN-1996-0110	11735237	7116779	Anne B. Charlton	40210 Main Street	1	680	403	>150	<253	Thick electric cable, DTW>150'.
4/7/2006	WWIN-1981-0198	11735329	7116425	Waterford Foundation	Old School Site	NA	350	441	38	403	
4/7/2006	WWIN-1998-0115	11736734	7117015	Waterford Foundation	Loyalty Road	5	620	471	26	445	No pump in well
4/7/2006	WWIN-1995-0229	11736696	7116623	Mary Hutton	15498 Loyalty Road	50	285	463	25	438	
4/7/2006	WWIN-1988-0529	11736615	7116390	Martha Baine	15510 Loyalty Road	NA	NA	447	8	439	Obstruction ~60'
4/10/2006	WWIN-1964-0094	11735791	7116795	Matthew and Valerie Custer	40266 Water Street	NA	NA	441	~10	431	Obstruction ~45'
4/10/2006	WWSP-1964-0093	11735622	7116681	Matthew and Valerie Custer	40266 Water Street	NA	NA	423	5	418	Flowing spring in vault
4/10/2006	WWIN-1988-0524	11735471	7116560	Greg Stuessi and Mary Ann Naber	15525 Butchers Row	2	445	431	28	403	
4/11/2006	WWIN-1998-0117	11735943	7117413	Jeff and Kathryn Nesbit	15443 Loyalty Road			453	28	425	
4/11/2006	WWIN-1998-0116	11736834	7117337	Jeff and Kathryn Nesbit	15443 Loyalty Road	20	460	478	29	449	No pump in well
5/2004	WWTS-1997-0210	11735557	7116083	Friend - County monitoring well	Fairfax Street			440	18	422	

Table 3. Flowmeter records of extra pumping at the WES with discharge to the sanitary sewer between May and July 2006.

Time On	Flowmeter Reading at Start of Pumping Period (gallons)*	Time Off	Flowmeter Reading at End of Pumping Period (gallons)*	Extra Gallons Pumped to Waste During Day	Rate (GPM)
5/3/06 1:20 PM	10	5/3/06 3:00 PM	721	711	7.11
5/4/06 7:00 AM	721	5/4/06 3:00 PM	4684	3963	8.26
5/5/06 7:00 AM	4684	5/5/06 3:00 PM	8747	4063	8.46
5/8/06 7:00 AM	8747	5/8/06 3:00 PM	13396	4649	9.69
5/9/06 7:00 AM	13396	5/9/06 3:00 PM	18110	4714	9.82
5/10/06 7:00 AM	18110	5/10/06 3:05 PM	22987	4877	10.06
5/11/06 7:00 AM	22987	5/11/06 3:00 PM	27937	4950	10.31
5/12/06 7:00 AM	27937	5/12/06 3:00 PM	32895	4958	10.33
5/22/06 8:30 AM	32895	5/22/06 3:00 PM	34559	1664	4.27
5/23/06 7:00 AM	34559	5/23/06 3:00 PM	36550	1991	4.15
5/24/06 7:00 AM	36550	5/24/06 3:00 PM	38451	1901	3.96
5/26/06 7:00 AM	38451	5/26/06 3:00 PM	40081	1630	3.40
5/30/06 7:00 AM	40081	5/30/06 3:00 PM	41866	1785	3.72
5/31/06 7:10 AM	41866	5/31/06 3:10 PM	43982	2116	4.41
6/1/06 7:00 AM	43982	6/1/06 3:00 PM	46044	2062	4.30
6/2/06 7:00 AM	46044	6/2/06 3:00 PM	48052	2008	4.18
6/5/06 1:30 PM	48052	6/5/06 3:00 PM	48437	385	4.28
6/6/06 7:00 AM	48437	6/6/06 1:30 PM	50026	1589	4.07
6/7/06 7:00 AM	50026	6/7/06 3:00 PM	52054	2028	4.22
6/8/06 7:00 AM	52054	6/8/06 3:00 PM	54177	2123	4.42
6/9/06 7:00 AM	54177	6/9/06 3:00 PM	56124	1947	4.06
6/12/06 7:00 AM	56124	6/12/06 3:00 PM	58150	2026	4.22
6/13/06 7:00 AM	58150	6/13/06 3:00 PM	60166	2016	4.20
6/14/06 7:00 AM	60166	6/14/06 3:00 PM	62206	2040	4.25
7/5/06 11:22 AM	2778173*	7/7/06 11:22 AM	2813274*	35101	12.19

* Data through 6/14/2006 are based on flowmeter readings in a closet with discharge to a sink. Pumping rates were recorded in the WES well vault and in the closet using two totalizing flowmeters during the 48-hour aquifer test in July 2006. The calculated flow rate based on the closet flowmeter readings was 11.95 gpm. The difference is attributed to water use in the school to support cleaning activities.

Table 4. Summary of individual well pumping rates in Waterford circa 1979 - 1981 based on LCSA flowmeter records*.

Account ID	Name	Connection Type	Address	Key Period of Record Data					Comments
				First Reading Date	Last Reading Date	Days in Period	Total Gallons Used In Period	Average Use in Period (GPD)	
WF-1	Henry A. Kitselman	Residential	Main Street	11/1/78	7/1/81	973	127,000	131	No remarks
WF-2	Marie D. Hilton	Residential	Bond Street	1/25/79	7/1/81	888	36,000	41	No remarks
WF-4	Eleanor James	Residential	Bond Street	7/31/79	5/12/81	651	33,000	51	No remarks
WF-8	Mary E. Wallace	Residential	Main Street	11/1/78	7/1/81	973	33,000	34	No remarks
WF-9	Joseph W. Keating	Residential	Main Street	4/23/79	7/31/79	99	9,000	91	After 7/31/79, meter clogged.
WF-11	James Van Riper	Residential	Main Street	4/23/79	7/31/79	99	26,000	263	Cleaned meter nearly each quarter after period and discontinued use.
WF-13	Anne C. Sweney	Residential	Main Street	5/14/79	7/1/81	779	42,000	54	Meter cleaned during period.
WF-14	Wilfred Gleadall	Residential	Main Street	2/8/79	7/1/81	874	153,000	175	No remarks
WF-15	J. Terence McCracken	Residential	Main Street	9/1/78	7/1/81	1034	61,000	59	No remarks
WF-18	Anne C. Sweney	Residential	Main Street						Empty and discontinued notes. Dates truncated.
WF-21	Ray A. Downs	Residential	Main Street	8/28/79	7/1/81	673	82,000	122	No remarks
WF-24	Patrich Acheson	Residential	Main Street	9/25/79	7/1/81	645	146,000	226	"CK-LK" and "Adjusted" noted
WF-25	Alice Rigdon	Residential	Main Street	11/4/80	5/12/81	189	17,000	90	"empty, discontinued" . . . Most ot record
WF-27	John T. Rollison	Residential	Main Street	2/5/80	11/4/80	273	10,000	37	"cleaned meter"
WF-28	Charles Anderson	Residential	Main Street	9/12/79	7/1/81	658	85,000	129	No remarks
WF-29	Douglass Lea	Residential	Main Street	4/1/80	7/1/81	456	45,000	99	No remarks (other than "14 mo." by 2nd entry)
WF-31	L. Sullivan	Residential	Main Street	8/5/80	7/1/81	330	51,000	155	"Plumbing corrected" at start of period
WF-37	Ernest C. Long	Residential	Main Street	8/5/80	7/1/81	330	45,000	136	Period starts after "cleaned replaced chamber" note.
WF-51	A. Russell Versaci	Residential	Second Street	1/31/80	5/12/81	467	11,000	24	No remarks during period.
WF-55	Brent L. Chambers	Residential	Second Street	11/1/78	7/1/81	973	109,000	112	No remarks
WF-57	Benjamin Morgan	Residential	Second Street	9/12/78	7/1/81	1023	47,000	46	No remarks
WF-58	Raymond F. Bragg	Residential	Second Street	7/31/79	10/30/79	91	9,000	99	Prior to when meter cleaned. First date truncated.
WF-59	Randall James	Residential	Second Street	4/30/79	8/1/81	824	130,000	158	No remarks
WF-61	Lucile MacCallum	Residential	Second Street	11/4/80	7/1/81	239	23,000	96	No remarks. First date truncated.
WF-62	H.T. Edwards	Residential	Second Street	5/9/79	7/1/81	784	14,000	18	No remarks
WF-63	W.J. Chewing	Residential	Second Street	4/23/79	7/1/81	800	122,000	153	No remarks

Table 4. Summary of individual well pumping rates in Waterford circa 1979 - 1981 based on LCSA flowmeter records*.

Account ID	Name	Connection Type	Address	Key Period of Record Data					Comments
				First Reading Date	Last Reading Date	Days in Period	Total Gallons Used In Period	Average Use in Period (GPD)	
WF-64	W.B. Morton III	Residential	Second Street	4/23/79	5/6/80	379	63,000	166	Clogged next period.
WF-68	Nicholas Ratcliffe	Residential	Second Street	5/1/79	7/1/81	792	99,000	125	No remarks
WF-69	Walter L. Riddle	Residential	Second Street	11/7/79	7/1/81	512	107,000	209	Subtracted 90 days from days in period when meter not recording.
WF-72	David Dyregrov	Residential	Second Street	9/2/80	7/1/81	212	26,000	123	No remarks
WF-73	Antonia Walker	Residential	Second Street	12/12/79	7/1/81	567	64,000	113	No remarks
WF-74	D. Patrick Anderson	Residential	Second Street	2/5/80	7/1/81	421	51,000	121	Subtracted 91 days from days in period when meter not recording.
WF-75	Michael E. McGlauflin	Residential	Second Street	3/29/79	7/31/79	124	13,000	105	Meter stopped recording flow after selected period.
WF-76	Noah Robertson	Residential	Second Street	10/30/79	8/1/81	641	29000	45	No remarks
WF-79	K.M. Gonseth	Residential	Factory Street	11/13/79	7/1/81	596	61,000	102	No remarks
WF-80	Douglas Myers	Residential	Factory Street	2/6/79	7/31/79	175	31,000	177	Clogged next period. First date truncated.
WF-80A	Robert L. Felton	Residential	Factory Street	8/30/79	7/1/81	671	142,000	212	No remarks
WF-81	Wilbur Jewell	Residential	Factory Street	8/5/80	7/1/81	330	36,000	109	No remarks. First date truncated.
WF-86	Wilma B. Dillon	Residential	High Street	11/4/80	5/12/81	189	54,000	286	Cleaned prior to selected period.
WF-87	Mutual Fire Insurance	Commercial	High Street	2/5/80	7/1/81	512	45,000	88	Cleaned prior to selected period.
WF-88	Catoctin Presbyterian Church Parsonage	Church	High Street	9/12/79	7/1/81	658	168,000	255	"CK-OK" only remark.
WF-93	Waterford Foundation	Old School	Butcher's Row	8/25/80	7/1/81	310	12,000	39	No remarks. First date truncated.
WF-96	Laird Johnson	Residential	Butcher's Row	8/25/80	7/1/81	310	29,000	94	No remarks.
WF-98	Penny Keating	Residential	Route 665	11/7/79	11/4/80	363	45,000	124	No remarks during period. Discontinued after period.
WF-99	Pearly L. Baumgardner	Residential	Route 665	8/25/80	7/1/81	310	21,000	68	No remarks.
WF-104	Paul Rose	Residential	1 Patrick Street	4/30/79	7/1/81	702	52,000	74	Subtracted 91 days from days in period when meter not recording.

*Note: "LCSA has a low level of confidence in the accuracy of the data presented [in these meter reading records]. The water meters were installed on the customers' well water lines and were regularly getting clogged and not reading accurately. LCSA eventually abandoned trying to meter the water."

Table 5. Descriptive statistics of well pumping rates in Waterford circa 1979 - 1981.

	All Wells	Residential Wells	Commercial Wells
Number of Wells With Flowmeter Records	45	42	3
Minimum Pumping Rate (GPD)	18	18	39
Mean Pumping Rate (GPD)	116	115	127
Maximum Pumping Rate (GPD)	286	286	255

Table 6. Waterford WWTP outflow data (LCSA, 2006) and precipitation recorded at Dulles Airport (IAD).

Waterford WWTP Treatment Batch End Date	Treatment Batch Volume (Gallons)	Days Since Last Discharge	Average GPD During Days Since Last Discharge	Average GPD minus 644 GPD for WES	Ave GPD per Connection Minus WES Flow (Divide by 94 to 98 Connections)	Total Inches of Precipitation at IAD during Batch Period	Average Inches of Precipitation at IAD during Treatment Batch Period
1/14/00	209,930						
2/25/00	170,460	42	4,059	3,415	36		
3/3/00	225,510	7	32,216	31,572	336		
3/10/00	204,630	7	29,233	28,589	304		
3/17/00	235,820	7	33,689	33,045	352		
3/24/00	229,870	7	32,839	32,195	342		
5/26/00	229,350	63	3,640	2,996	32		
6/2/00	170,430	7	24,347	23,703	252		
6/9/00	238,240	7	34,034	33,390	355		
6/16/00	229,150	7	32,736	32,092	341		
6/23/00	248,970	7	35,567	34,923	372		
6/30/00	223,960	7	31,994	31,350	334		
7/14/00	258,190	14	18,442	17,798	189		
7/21/00	241,970	7	34,567	33,923	361		
7/28/00	194,690	7	27,813	27,169	289		
11/17/00	199,820	112	1,784	1,140	12		
12/15/00	206,200	28	7,364	6,720	71		
1/26/01	181,690	42	4,326	3,682	39		
2/16/01	238,333	21	11,349	10,705	114	1.05	0.05
2/22/01	183,333	6	30,556	29,912	318	0.80	0.13
3/2/01	237,760	8	29,720	29,076	309	0.35	0.04
3/30/01	241,197	28	8,614	7,970	85	3.82	0.14
4/20/01	254,000	21	12,095	11,451	122	2.29	0.11
4/27/01	227,000	7	32,429	31,785	338	0.01	0.00
5/3/01	179,000	6	29,833	29,189	311	0.00	0.00
6/22/01	242,000	50	4,840	4,196	45	8.41	0.17
6/29/01	240,000	7	34,286	33,642	358	0.11	0.02
7/3/01	98,000	4	24,500	23,856	254	0.40	0.10
7/6/01	77,000	3	25,667	25,023	266	1.91	0.64
7/13/01	237,000	7	33,857	33,213	353	0.68	0.10
7/20/01	250,000	7	35,714	35,070	373	0.14	0.02
10/19/01	222,000	91	2,440	1,796	19	10.45	0.11
10/26/01	190,000	7	27,143	26,499	282	0.00	0.00
12/7/01	196,000	42	4,667	4,023	43	0.84	0.02
12/14/01	226,000	7	32,286	31,642	337	1.04	0.15
2/1/02	233,000	49	4,755	4,111	44	1.77	0.04
2/8/02	208,000	7	29,714	29,070	309	0.02	0.00
2/15/02	195,000	7	27,857	27,213	290	0.10	0.01
4/5/02	220,000	49	4,490	3,846	41	3.64	0.07
4/12/02	218,000	7	31,143	30,499	324	0.48	0.07
5/10/02	235,000	28	8,393	7,749	82	4.04	0.14
5/17/02	219,000	7	31,286	30,642	326	0.19	0.03

Table 6. Waterford WWTP outflow data (LCSA, 2006) and precipitation recorded at Dulles Airport (IAD).

Waterford WWTP Treatment Batch End Date	Treatment Batch Volume (Gallons)	Days Since Last Discharge	Average GPD During Days Since Last Discharge	Average GPD minus 644 GPD for WES	Ave GPD per Connection Minus WES Flow (Divide by 94 to 98 Connections)	Total Inches of Precipitation at IAD during Batch Period	Average Inches of Precipitation at IAD during Treatment Batch Period
7/12/02	176,000	56	3,143	2,499	27	7.16	0.13
7/26/02	238,000	14	17,000	16,356	174	2.02	0.14
8/9/02	175,000	14	12,500	11,856	126	0.85	0.06
9/13/02	227,000	35	6,486	5,842	62	2.92	0.08
10/11/02	244,000	28	8,714	8,070	86	2.92	0.10
10/25/02	243,000	14	17,357	16,713	178	2.93	0.21
11/15/02	189,000	21	9,000	8,356	89	3.99	0.19
11/22/02	253,000	7	36,143	35,499	378	2.18	0.31
12/6/02	249,000	14	17,786	17,142	182	0.65	0.05
12/12/02	191,000	6	31,833	31,189	332	1.09	0.18
12/20/02	229,000	8	28,625	27,981	298	0.65	0.08
1/10/03	240,000	21	11,429	10,785	114	3.77	0.18
1/16/03	186,000	6	31,000	30,356	320	0.00	0.00
1/23/03	106,000	7	15,143	14,499	153	0.04	0.01
1/31/03	113,000	8	14,125	13,481	142	0.02	0.00
2/6/03	128,000	6	21,333	20,689	218	0.46	0.08
2/28/03	198,000	22	9,000	8,356	88	4.80	0.22
3/7/03	232,000	7	33,143	32,499	342	0.43	0.06
3/14/03	219,000	7	31,286	30,642	323	0.22	0.03
3/21/03	238,000	7	34,000	33,356	351	1.84	0.26
3/28/03	231,000	7	33,000	32,356	341	0.36	0.05
3/31/03	58,000	3	19,333	18,689	197	0.89	0.30
4/4/03	177,000	4	44,250	43,606	459	0.00	0.00
4/11/03	244,000	7	34,857	34,213	360	1.31	0.19
4/18/03	248,000	7	35,429	34,785	366	0.28	0.04
4/25/03	221,000	7	31,571	30,927	326	0.69	0.10
5/9/03	266,000	14	19,000	18,356	193	1.67	0.12
5/15/03	232,000	6	38,667	38,023	400	0.86	0.14
5/23/03	263,000	8	32,875	32,231	339	4.39	0.55
5/29/03	140,000	6	23,333	22,689	239	2.16	0.36
6/13/03	89,000	15	5,933	5,289	56	4.79	0.32
6/20/03	189,000	7	27,000	26,356	277	3.06	0.44
6/26/03	117,000	6	19,500	18,856	198	0.55	0.09
6/30/03	34,000	4	8,500	7,856	83	0.02	0.01
7/3/03	81,000	3	27,000	26,356	277	0.55	0.18
7/15/03	72,000	12	6,000	5,356	56	3.18	0.27
7/17/03	18,000	2	9,000	8,356	88	0.00	0.00
7/24/03	202,000	7	28,857	28,213	297	1.50	0.21
8/8/03	247,000	15	16,467	15,823	167	1.19	0.08
8/15/03	245,000	7	35,000	34,356	362	1.63	0.23
8/22/03	253,000	7	36,143	35,499	374	1.55	0.22
8/29/03	239,000	7	34,143	33,499	353	1.89	0.27

Table 6. Waterford WWTP outflow data (LCSA, 2006) and precipitation recorded at Dulles Airport (IAD).

Waterford WWTP Treatment Batch End Date	Treatment Batch Volume (Gallons)	Days Since Last Discharge	Average GPD During Days Since Last Discharge	Average GPD minus 644 GPD for WES	Ave GPD per Connection Minus WES Flow (Divide by 94 to 98 Connections)	Total Inches of Precipitation at IAD during Batch Period	Average Inches of Precipitation at IAD during Treatment Batch Period
9/4/03	101,000	6	16,833	16,189	170	1.23	0.21
9/12/03	213,000	8	26,625	25,981	273	0.27	0.03
9/18/03	119,000	6	19,833	19,189	202	1.24	0.21
9/22/03	45,000	4	11,250	10,606	112	1.78	0.45
9/26/03	74,000	4	18,500	17,856	188	2.50	0.63
9/29/03	17,000	3	5,667	5,023	53	0.22	0.07
10/2/03	66,000	3	22,000	21,356	225	0.00	0.00
10/7/03	75,000	5	15,000	14,356	151	0.06	0.01
10/10/03	71,000	3	23,667	23,023	242	0.00	0.00
10/24/03	235,000	14	16,786	16,142	170	1.53	0.11
11/7/03	238,000	14	17,000	16,356	172	4.89	0.35
11/19/03	130,000	12	10,833	10,189	107	0.49	0.04
11/26/03	129,000	7	18,429	17,785	187	2.20	0.31
12/5/03	241,000	9	26,778	26,134	275	0.66	0.07
12/10/03	157,000	5	31,400	30,756	324	1.05	0.21
12/19/03	236,000	9	26,222	25,578	269	2.98	0.33
12/23/03	73,000	4	18,250	17,606	185	0.00	0.00
12/31/03	139,000	8	17,375	16,731	176	0.37	0.05
1/9/04	254,000	9	28,222	27,578	281	0.22	0.02
1/15/04	191,000	6	31,833	31,189	318	0.02	0.00
1/23/04	192,000	8	24,000	23,356	238	0.34	0.04
2/13/04	185,000	21	8,810	8,166	83	2.39	0.11
2/27/04	247,000	14	17,643	16,999	173	0.01	0.00
3/5/04	239,000	7	34,143	33,499	342	0.38	0.05
3/12/04	246,000	7	35,143	34,499	352	1.09	0.16
4/8/04	185,000	27	6,852	6,208	63	2.33	0.09
4/16/04	228,000	8	28,500	27,856	284	1.84	0.23
4/30/04	249,000	14	17,786	17,142	175	1.53	0.11
5/21/04	202,000	21	9,619	8,975	92	2.01	0.10
6/3/04	136,000	13	10,462	9,818	100	0.63	0.05
6/18/04	246,000	15	16,400	15,756	161	2.91	0.19
6/25/04	249,000	7	35,571	34,927	356	0.72	0.10
6/30/04	179,000	5	35,800	35,156	359	0.08	0.02
7/1/04	18,000	1	18,000	17,356	177	0.00	0.00
7/9/04	161,000	8	20,125	19,481	199	1.88	0.24
7/16/04	242,000	7	34,571	33,927	346	0.48	0.07
9/10/04	168,900	56	3,016	2,372	24	6.60	0.12
9/17/04	228,000	7	32,571	31,927	326	0.37	0.05
9/24/04	241,000	7	34,429	33,785	345	2.39	0.34
10/15/04	196,000	21	9,333	8,689	89	1.74	0.08
10/22/04	250,000	7	35,714	35,070	358	0.75	0.11
11/30/04	93,000	39	2,385	1,741	18	4.24	0.11

Table 6. Waterford WWTP outflow data (LCSA, 2006) and precipitation recorded at Dulles Airport (IAD).

Waterford WWTP Treatment Batch End Date	Treatment Batch Volume (Gallons)	Days Since Last Discharge	Average GPD During Days Since Last Discharge	Average GPD minus 644 GPD for WES	Ave GPD per Connection Minus WES Flow (Divide by 94 to 98 Connections)	Total Inches of Precipitation at IAD during Batch Period	Average Inches of Precipitation at IAD during Treatment Batch Period
12/3/04	109,000	3	36,333	35,689	364	0.41	0.14
12/10/04	211,000	7	30,143	29,499	301	1.24	0.18
12/17/04	196,000	7	28,000	27,356	279	0.15	0.02
1/7/05	209,000	21	9,952	9,308	95	1.49	0.07
1/21/05	154,000	14	11,000	10,356	106	2.25	0.16
1/28/05	224,000	7	32,000	31,356	320	0.29	0.04
2/4/05	121,000	7	17,286	16,642	170	0.42	0.06
2/11/05	140,000	7	20,000	19,356	198	0.16	0.02
2/18/05	136,000	7	19,429	18,785	192	0.37	0.05
2/25/05	101,000	7	14,429	13,785	141	0.42	0.06
3/25/05	176,000	28	6,286	5,642	58	2.70	0.10
3/31/05	119,000	6	19,833	19,189	196	1.60	0.27
Entire Period	25,986,403	1,903	13,655	13,011	136	181.92	0.12

Notes:

1. Pumped water used for irrigation (or other outdoor use) does not enter to the sanitary sewer system and is not included in the WWTP flow data.
2. LCSA indicated that oberved infiltration to sanitary sewer pipes in Waterford is believed to be minor based on video inspection (Todd Danielson, personal communication). Correlation analysis suggests that there is no relationship between precipitation and WWTP flow volumes.
3. Exfiltration from the WWTP basin prior to discharge and measurement by flowmeter is believed to be low because the treatment basin is lined with clay.
4. There appears to be no correlation between WWTP flow rates and precipitation (correlation coefficient 0.02).
5. LCSA reported that the following number of connections in Waterford to the WWTP: 95 in 2000, 2001, and 2002; 96 in 2003; and 99 in 2004 and 2005 (Danielson, 5/8/2006).
6. Based on flowmeter data, the average pumping rate at the WES production well in 2005 was 644 GPD.
7. Based on WWTP outflow data, the average water discharge rate per connection (excluding the WES contribution) between 1/2000 and 3/2005 was 136 GPD.

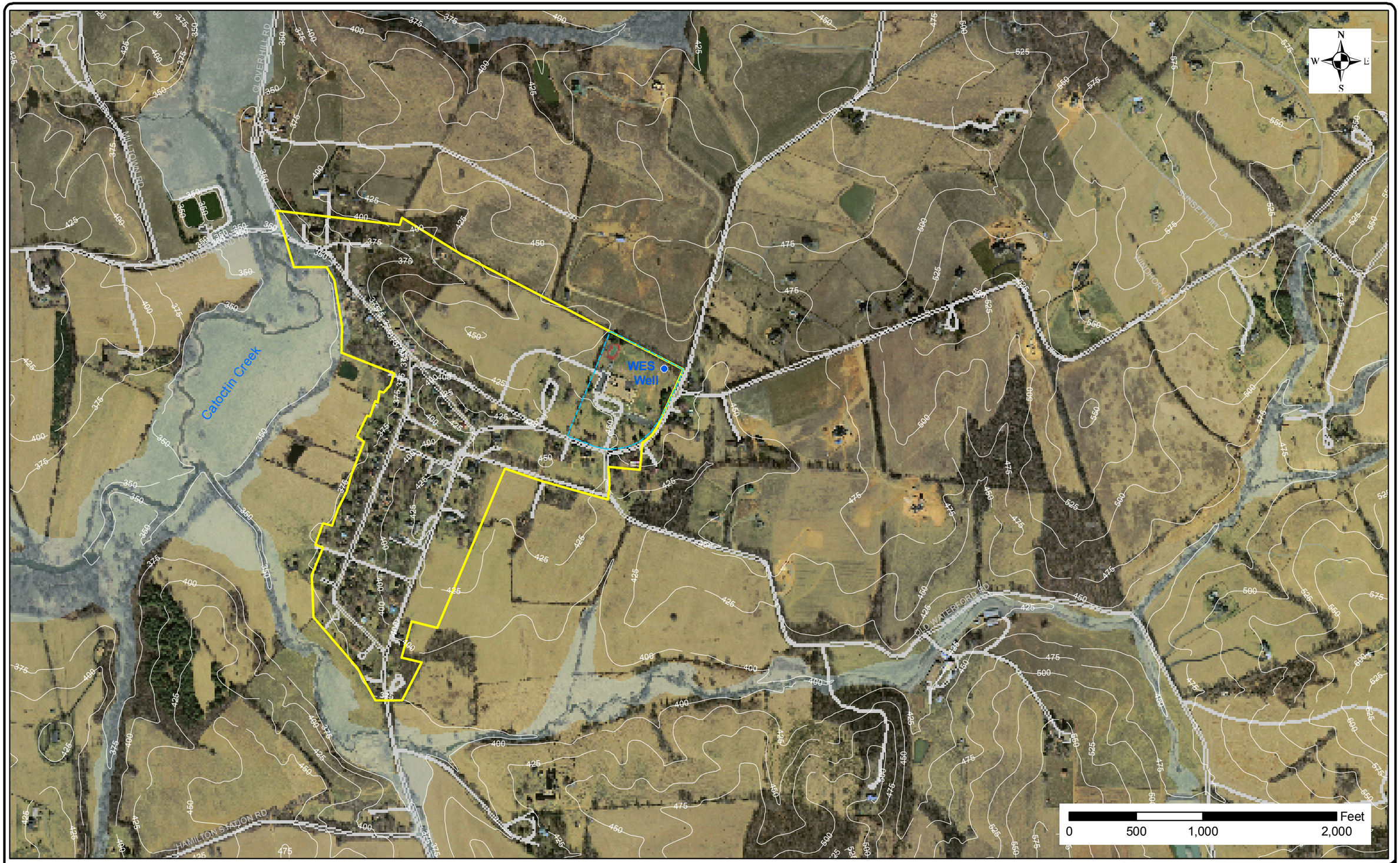

Figure 1. Locations of the Village of Waterford (outlined by yellow line),the Waterford Elementary School (oulined by dashed blue line), and the school's water-supply well in western Loudoun County. Topographic contours (25-ft) slope toward Catoctin Creek.

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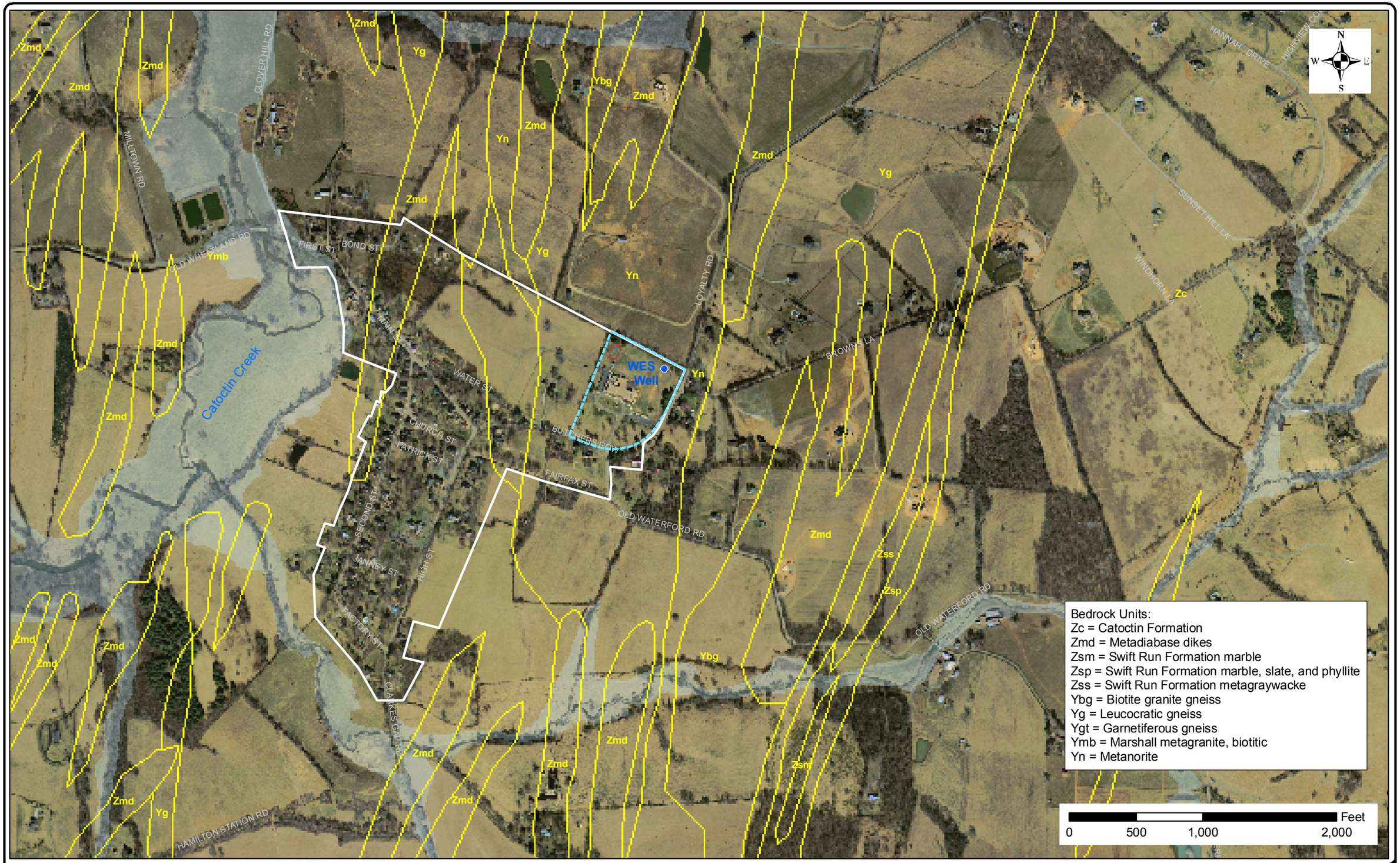

Figure 2. Bedrock geologic units mapped by the U.S. Geological Survey in the Waterford area.

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Well Types

- WWCO - Community Well
- WWDH - Dry Hole
- WWDU - Dug Well
- WWIN - Individual Well
- WWNC - Non-Community Well
- WWSP - Spring
- WWTS - Test Well

Feet
0 250 500 1,000

Figure 3. Well yield (gpm) / depth (feet) data in the vicinity of the Waterford Elementary School based on available records: "/" indicates no data are available. Well yields at 'Dry Holes' are near zero.

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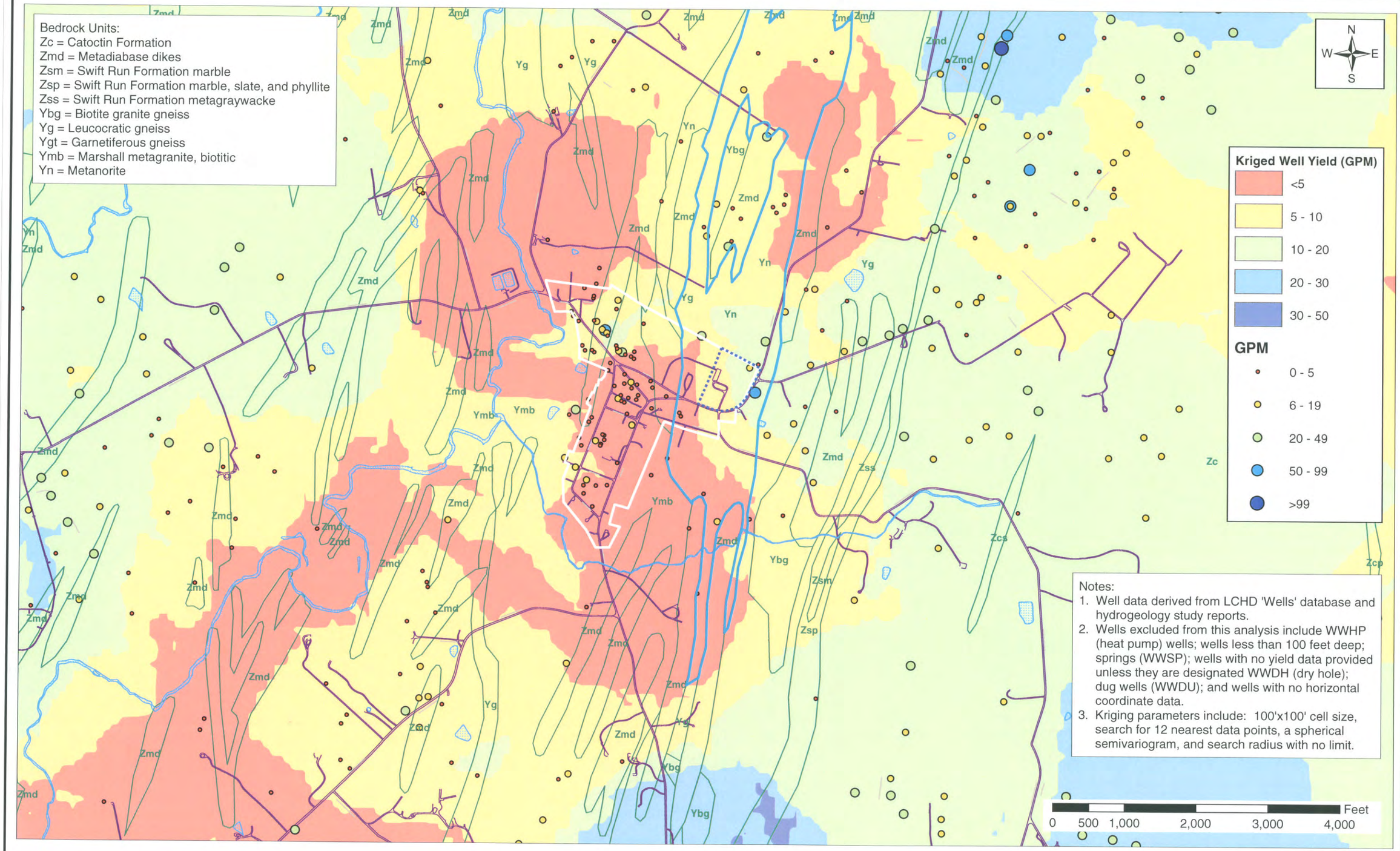

Figure 4. Reported well yields identified by symbol, kriged well yield data (map color), and bedrock geology in the Waterford area. Note that reported well yield depends on well depth, reporting accuracy, and other factors. Village of Waterford is outlined by white line; Waterford Elementary School parcel is outlined by dashed blue line.

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Figure 5. Hydraulic head values posted and contoured in feet above MSL based on measurements of depth-to-water in water wells during April and May of 2006. Note that nearly all of the wells are pumped to provide domestic water supplies. Contours (50-ft) were interpolated by kriging using a 5-ft cell size.

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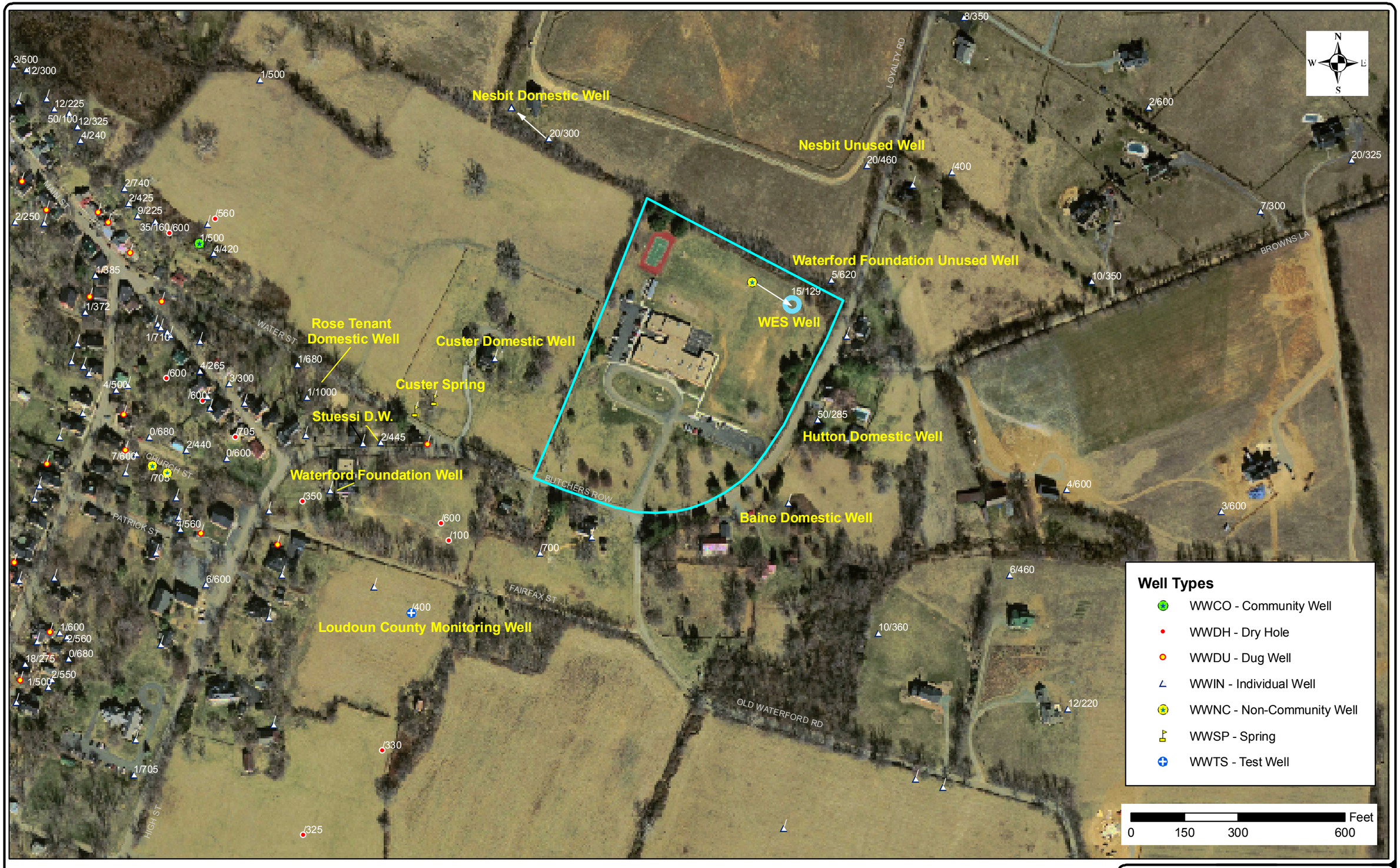

Figure 6. Waterford Elementary School aquifer test program monitoring network showing wells and spring with automated water-level recording devices. Reported well yield (gpm) / depth (feet) data based on LCHD records are also shown.

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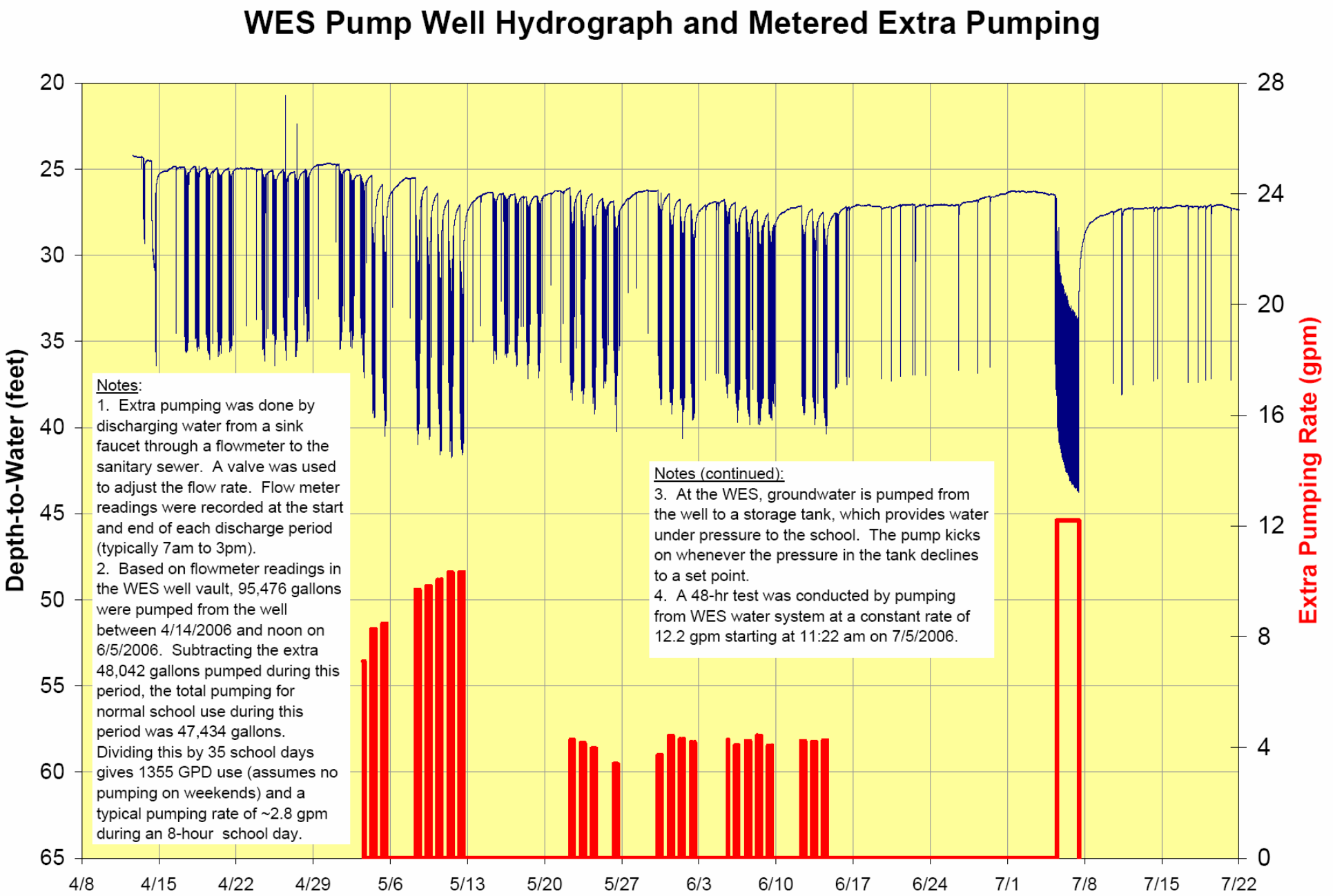


Figure 7. Relationship between WES well water level and extra pumping from April through July 2006.

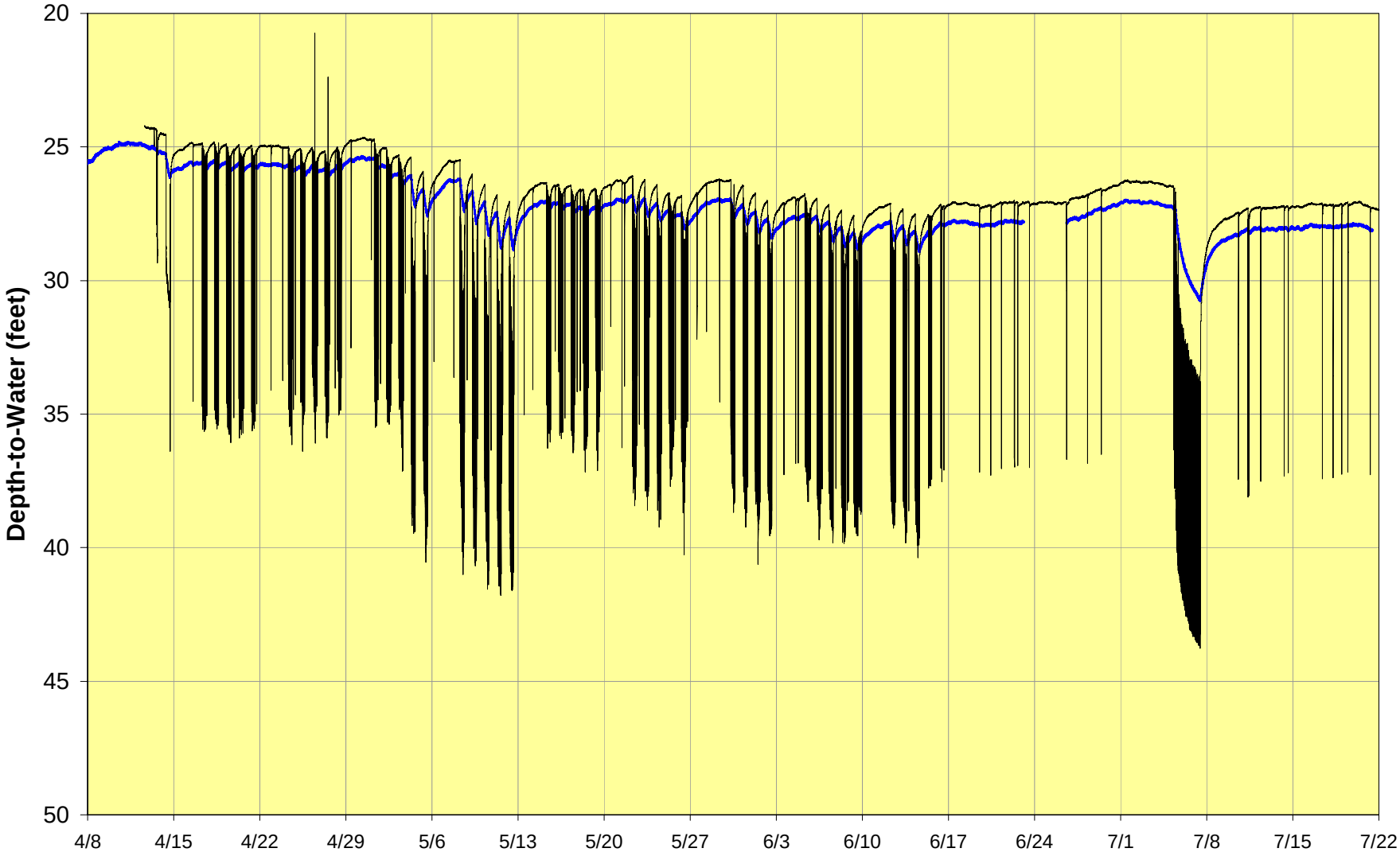


Figure 8. Comparison of hydrographs of the WES pump well and the unused Waterford Foundation well, which is located approximately 120 feet to the northwest and is affected by WES pumping.

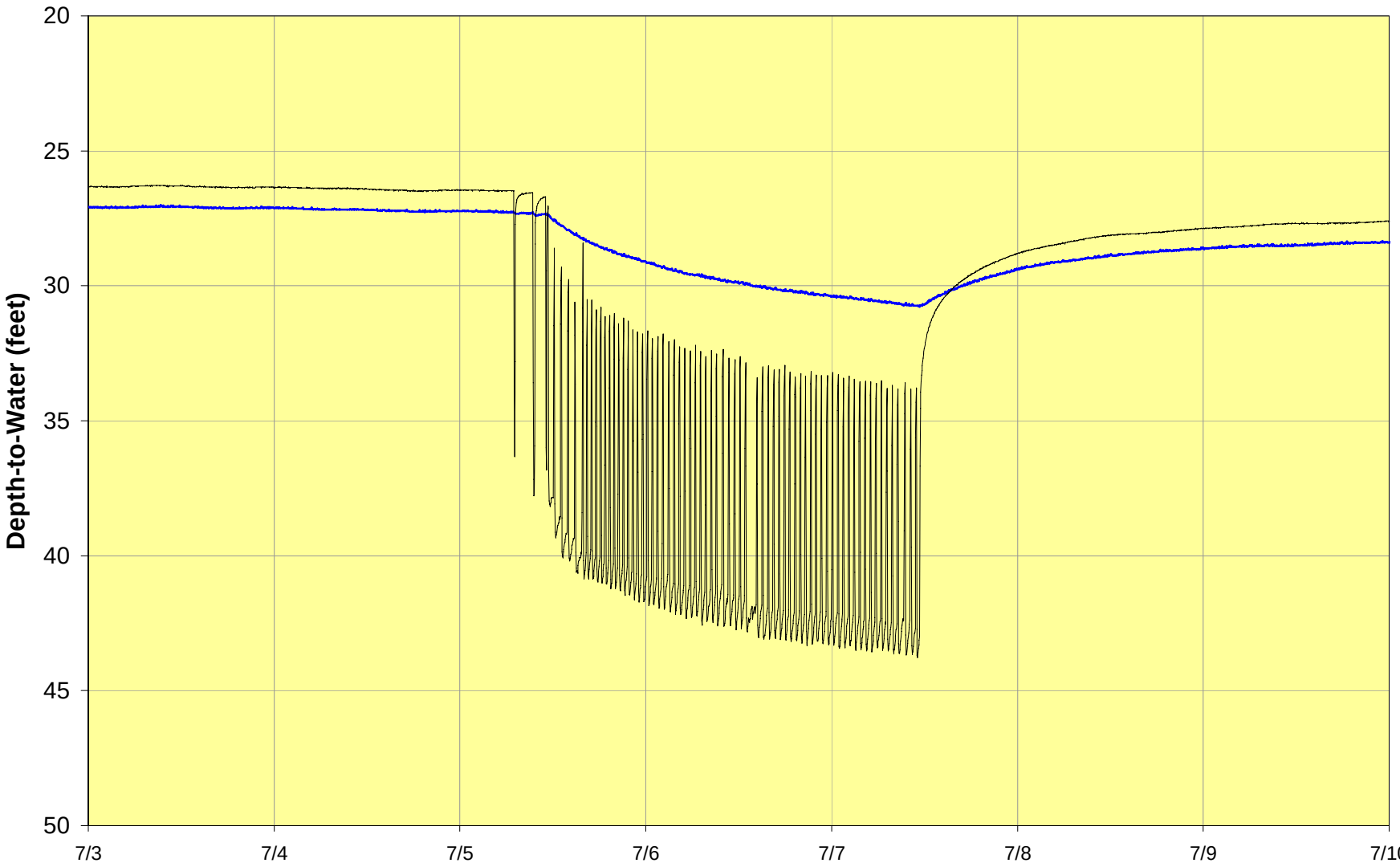


Figure 9. Comparison of hydrographs of the WES pump well and the unused Waterford Foundation well located 120 feet to the northeast, during the 48-hour aquifer test conducted in July 2006.

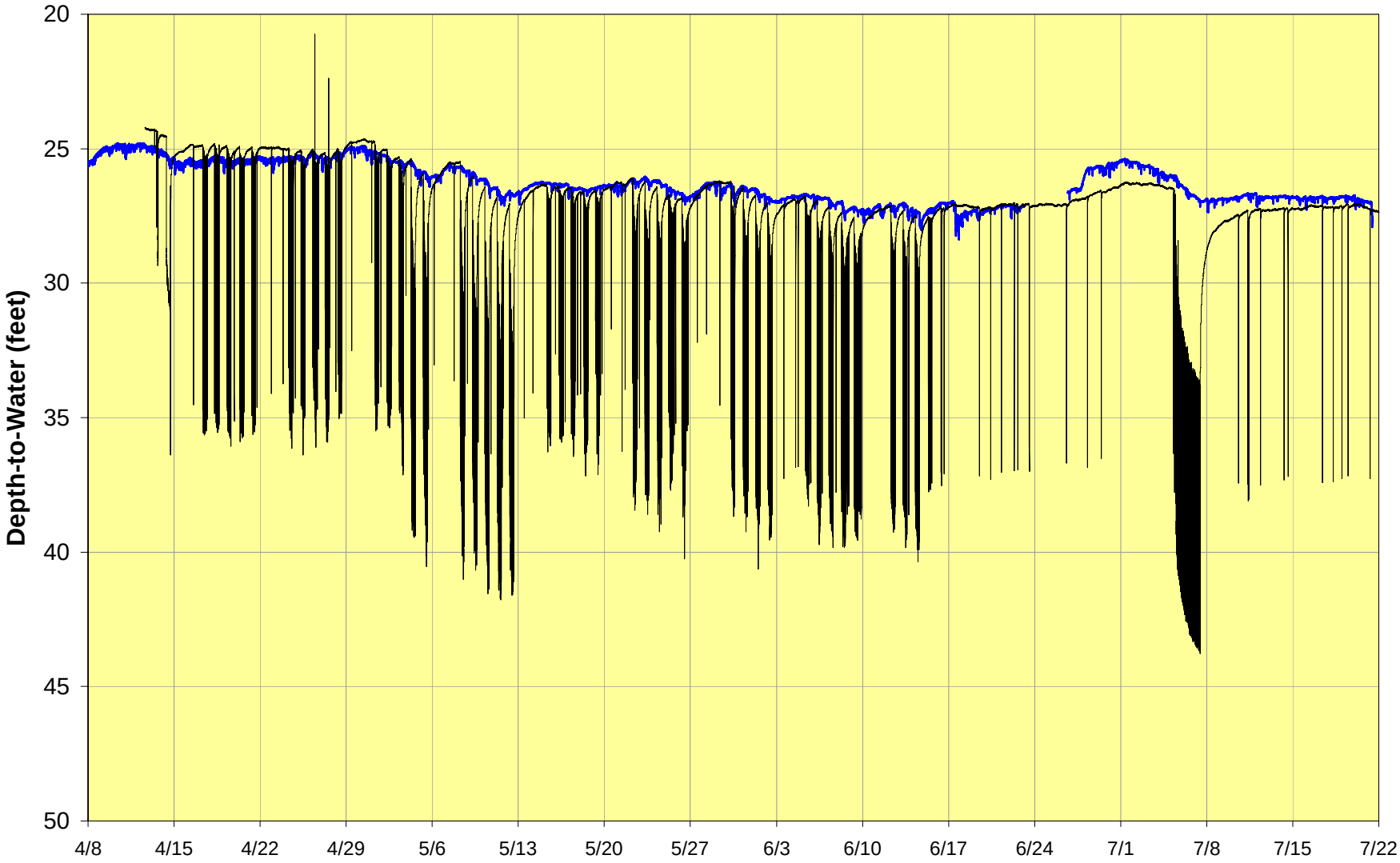


Figure 10. Comparison of hydrographs of the WES pump well and the Hutton domestic well, which is located appoximately 350 feet to the southeast and is affected by WES pumping.

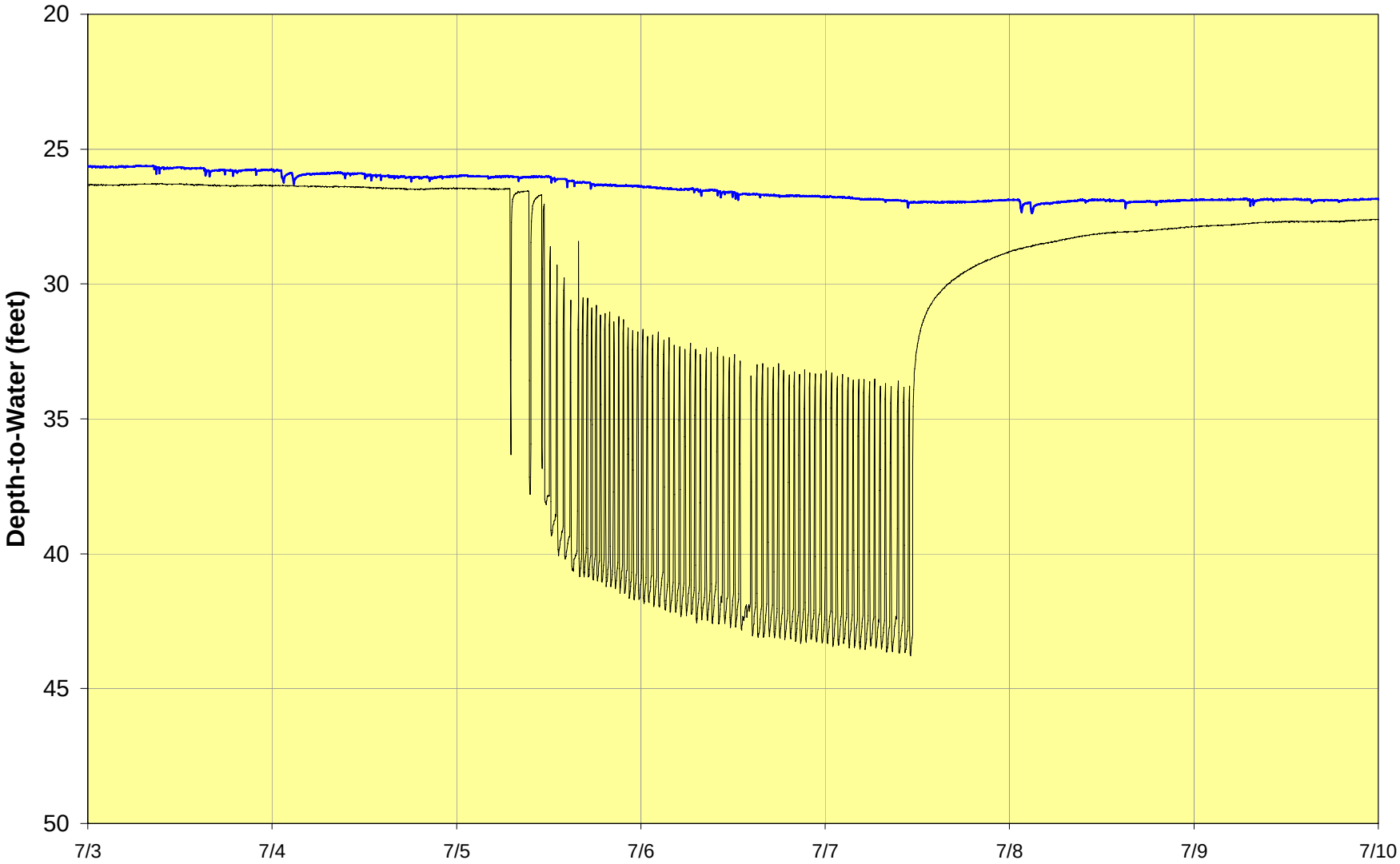


Figure 11. Comparison of hydrographs of the WES pump well and the Hutton dmestic well, located ~350 feet to the southeast, during the 48-hour aquifer teest conducted in July 2006.

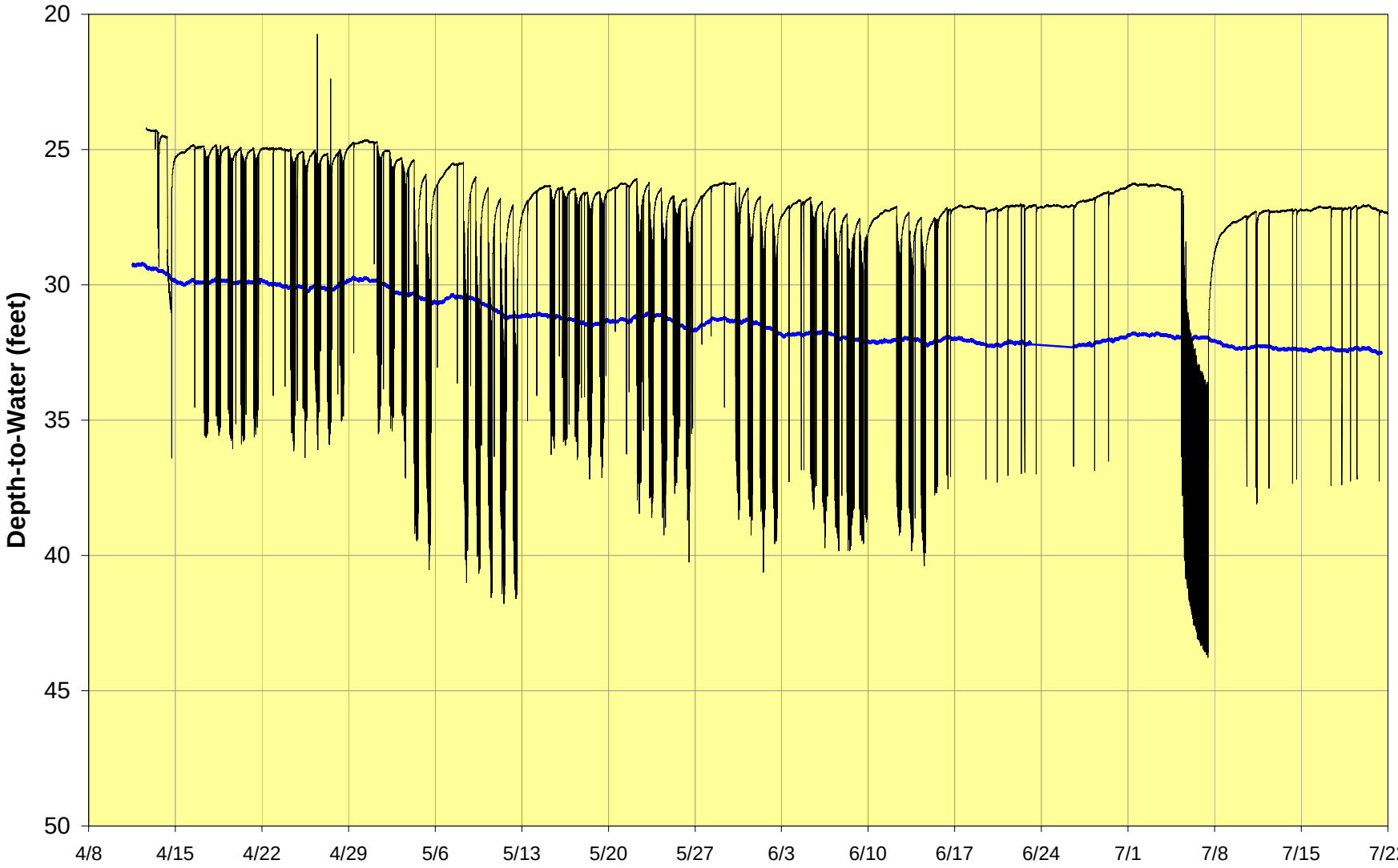


Figure 12. Comparison of hydrographs of the WES pump well and the unusued Nesbit well, which i
located ~425 feet to the northeast and does not appear to be affected by WES pumping.

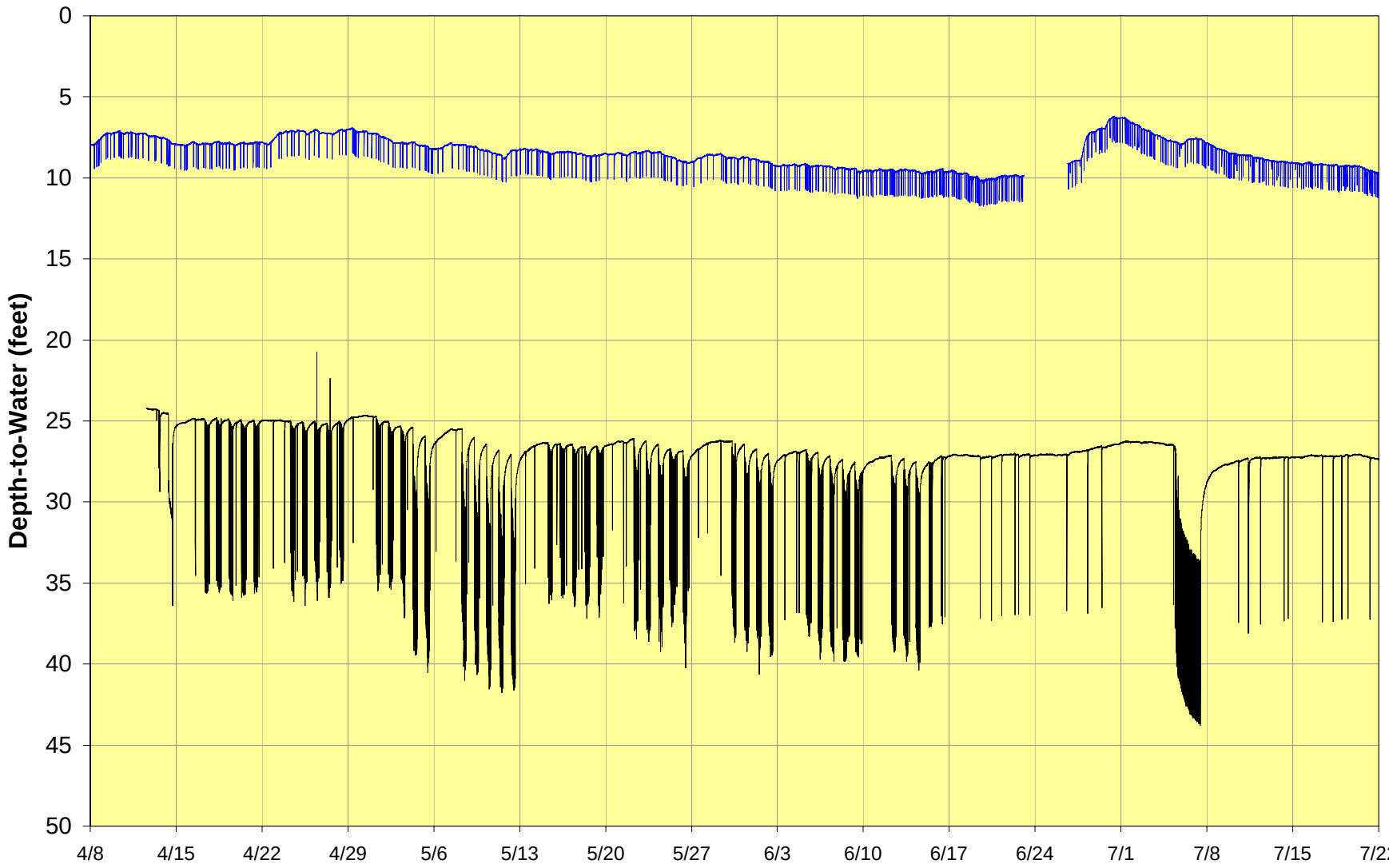


Figure 13. Comparison of hydrographs of the WES pump well and the Baine domestic well, which i located ~580 feet to the south and does not appear to be affected by WES pumping.

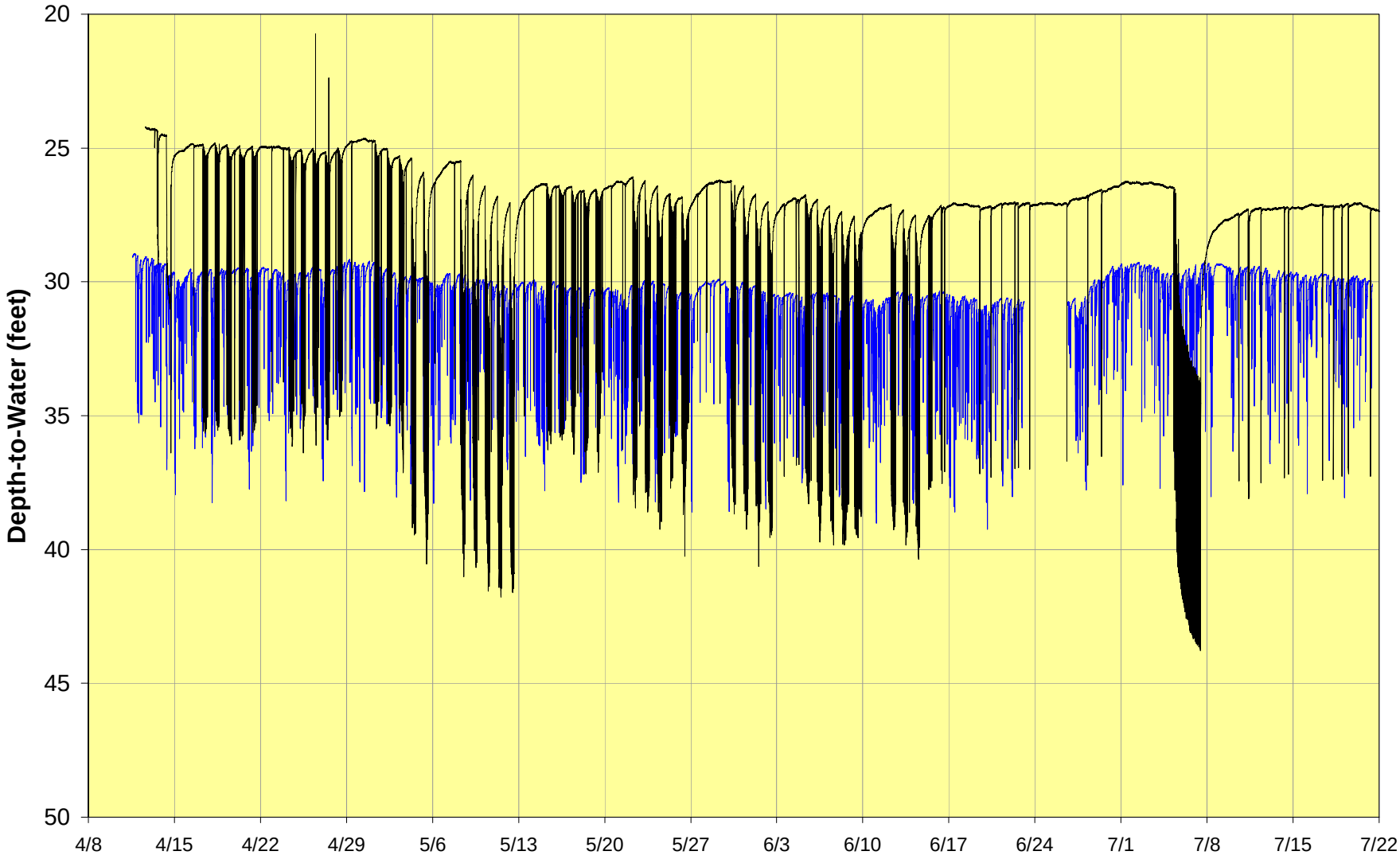


Figure 14. Comparison of hydrographs of the WES pump well and the Nesbit domestic well, which i
located ~955 feet to the northwest and does not appear to be affected by WES pumping.

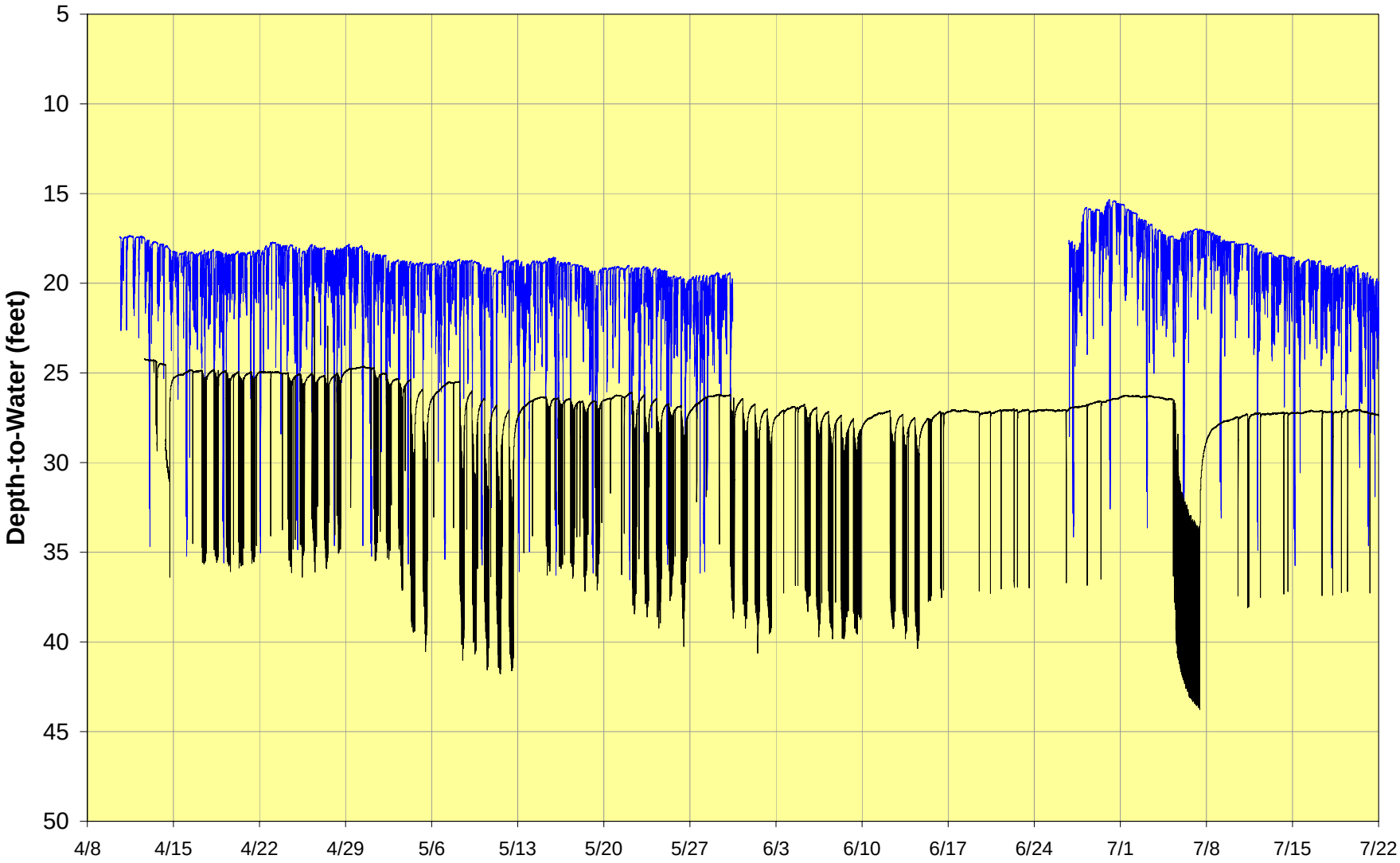


Figure 15. Comparison of hydrographs of the WES pump well and the Custer domestic well, which is located ~850 feet to the west and does not appear to be affected by WES pumping.

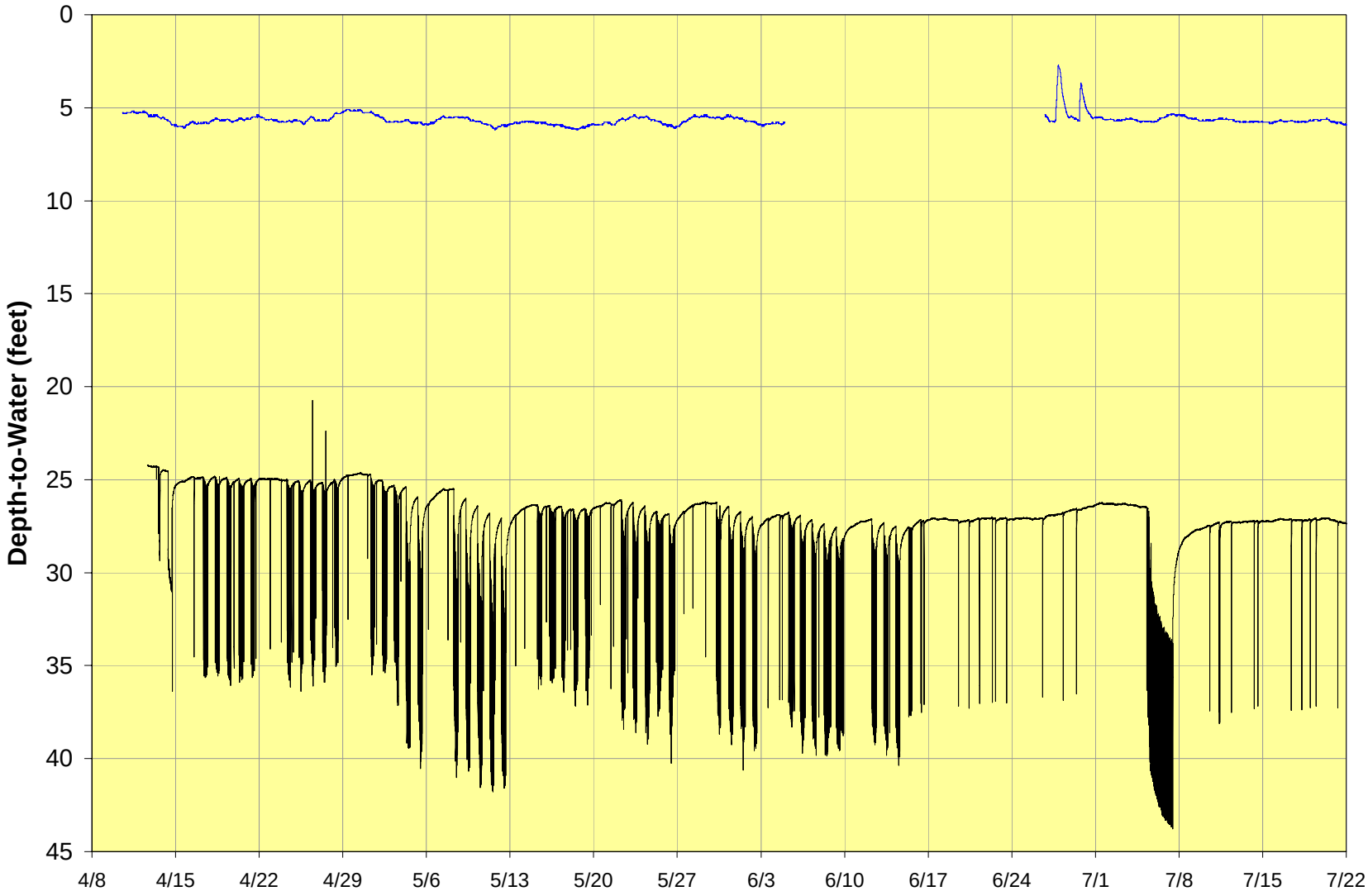


Figure 16. Comparison of hydrographs of the WES pump well and the Custer spring, which is ~1050 feet to the southwest and does not appear to be affected by WES pumping.

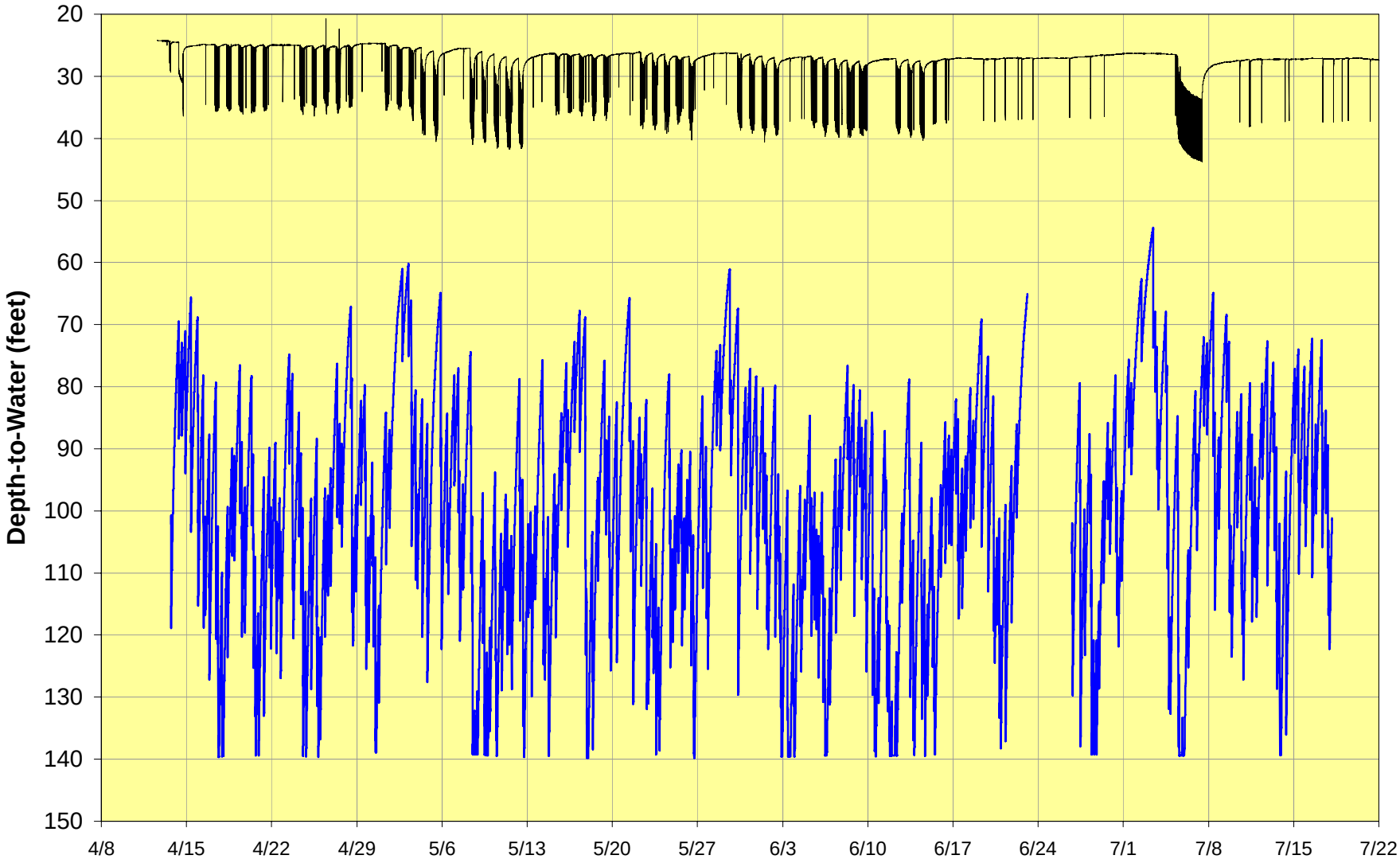


Figure 17. Comparison of hydrographs of the WES pump well and the Rose tenant domestic well, which is ~1395 feet to the southwest and does not appear to be affected by WES pumping.

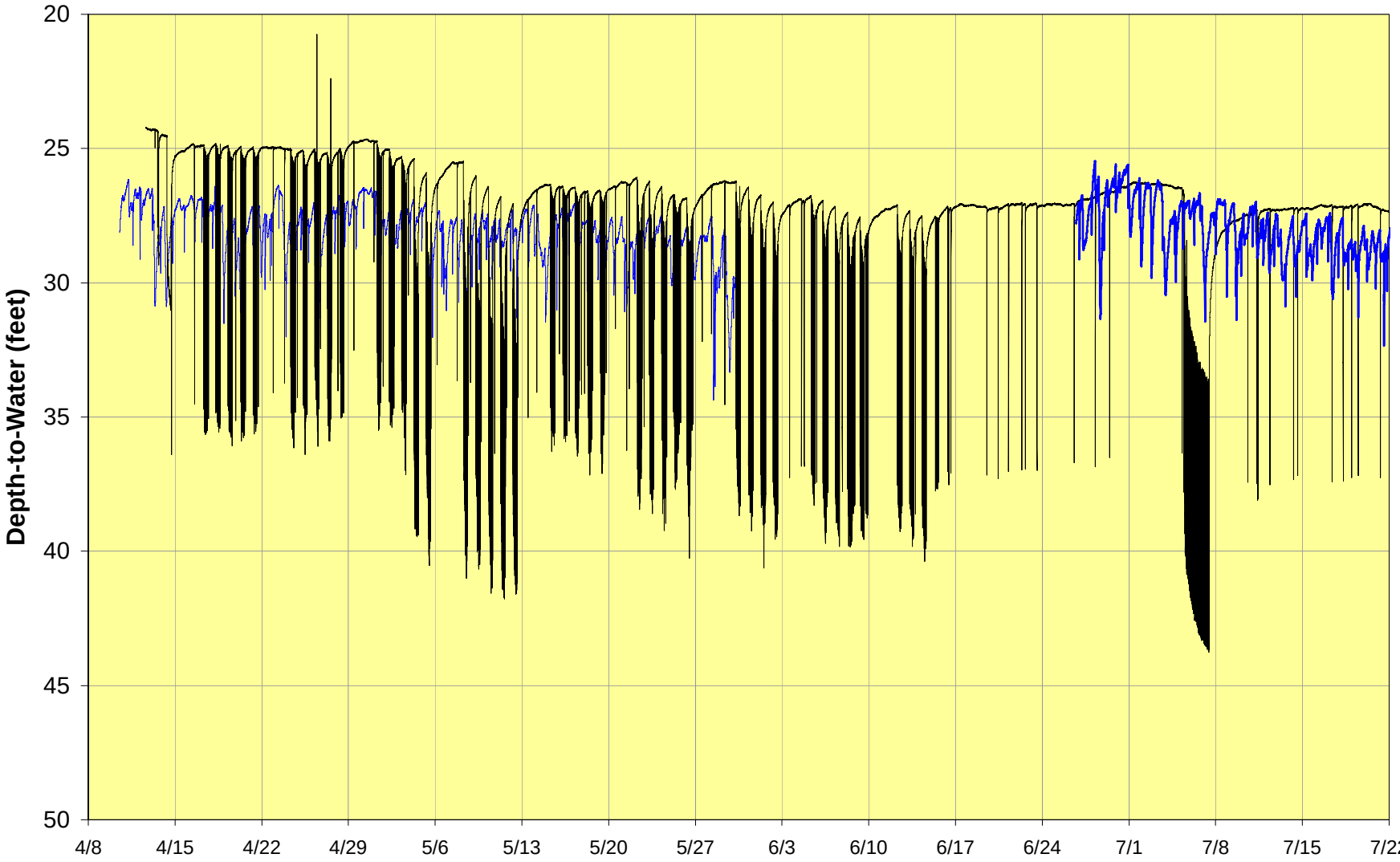


Figure 18. Comparison of hydrographs of the WES pump well and the Stuessi domestic well, which is located ~1230 feet to the southwest and does not appear to be affected by WES pumping.

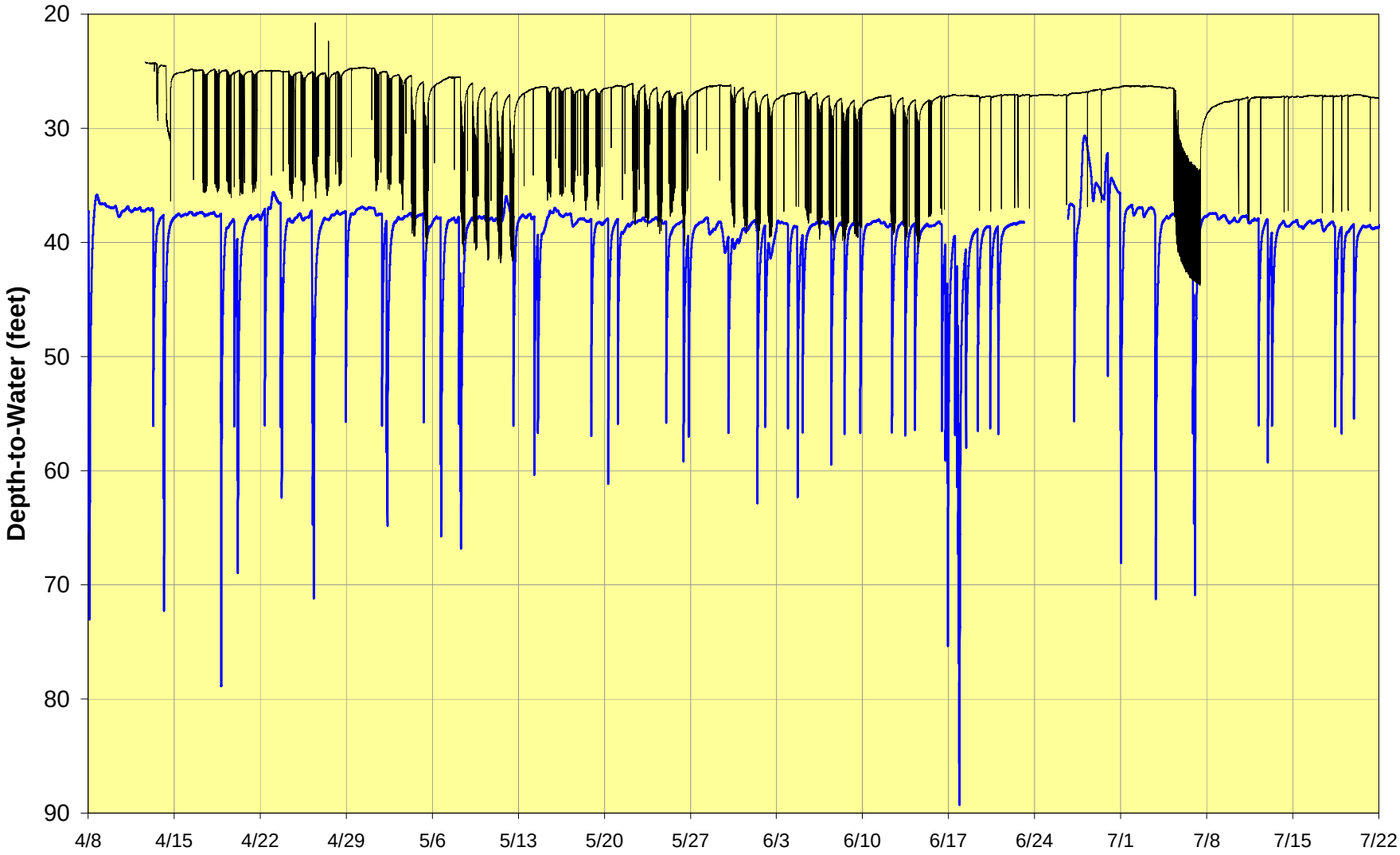


Figure 19. Comparison of hydrographs of the WES pump well and the Waterford Foundation old school well, which is ~1400 feet to the southwest and does not appear to be affected by WES pumping.

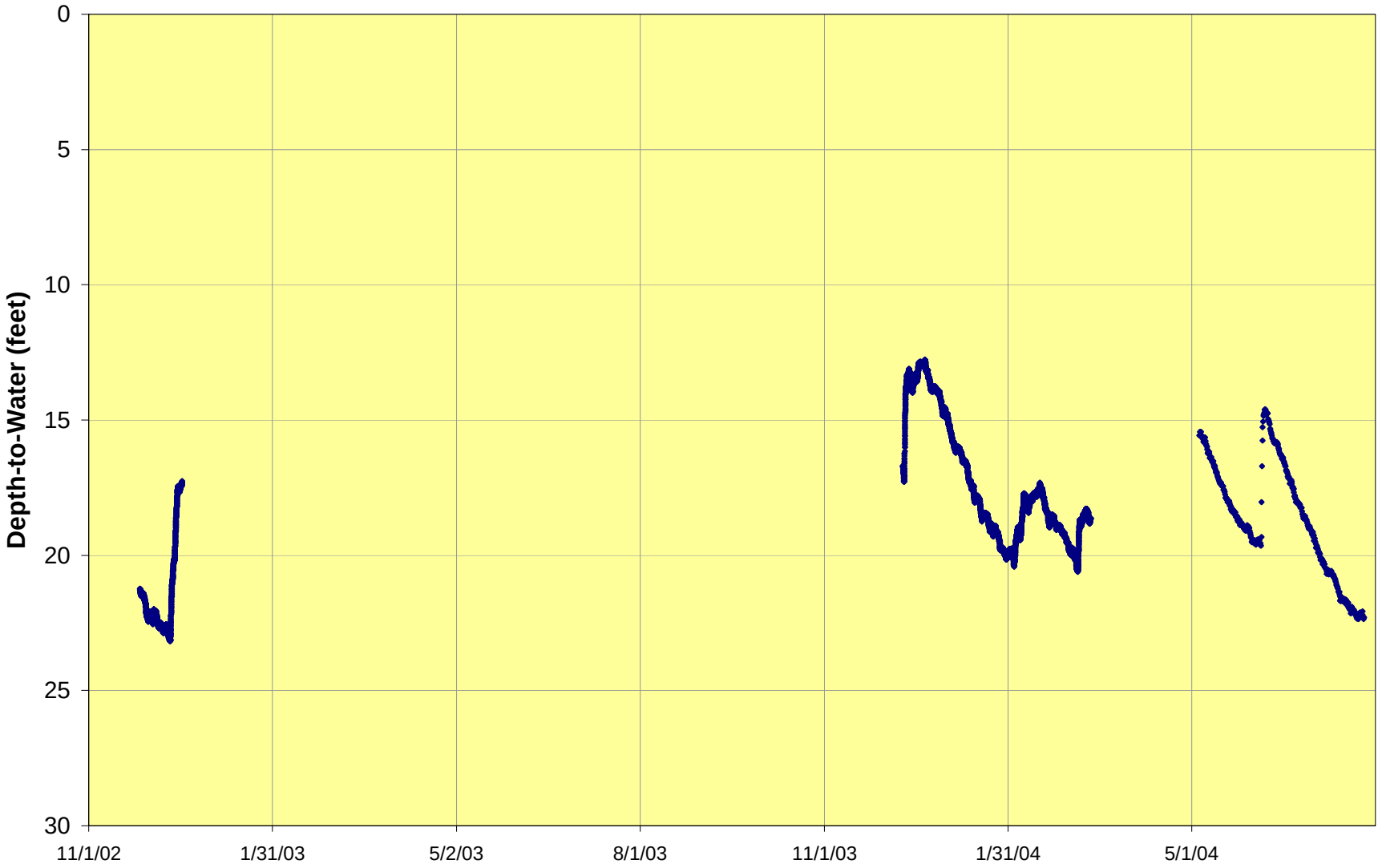


Figure 20. Hydrograph showing available water-level data for Loudoun County monitoring wel WWTS-1997-0210. No data are available for the WES test period.

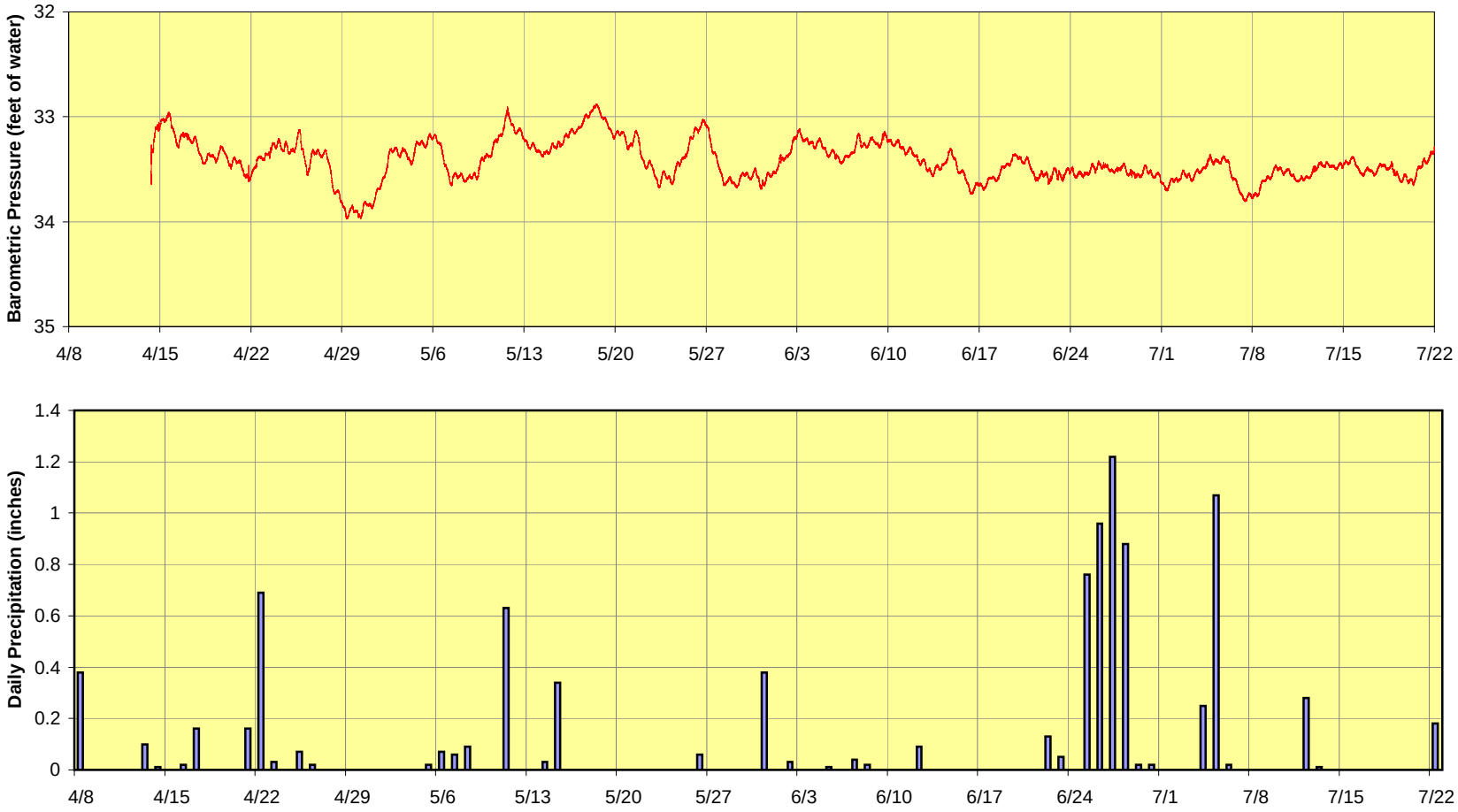
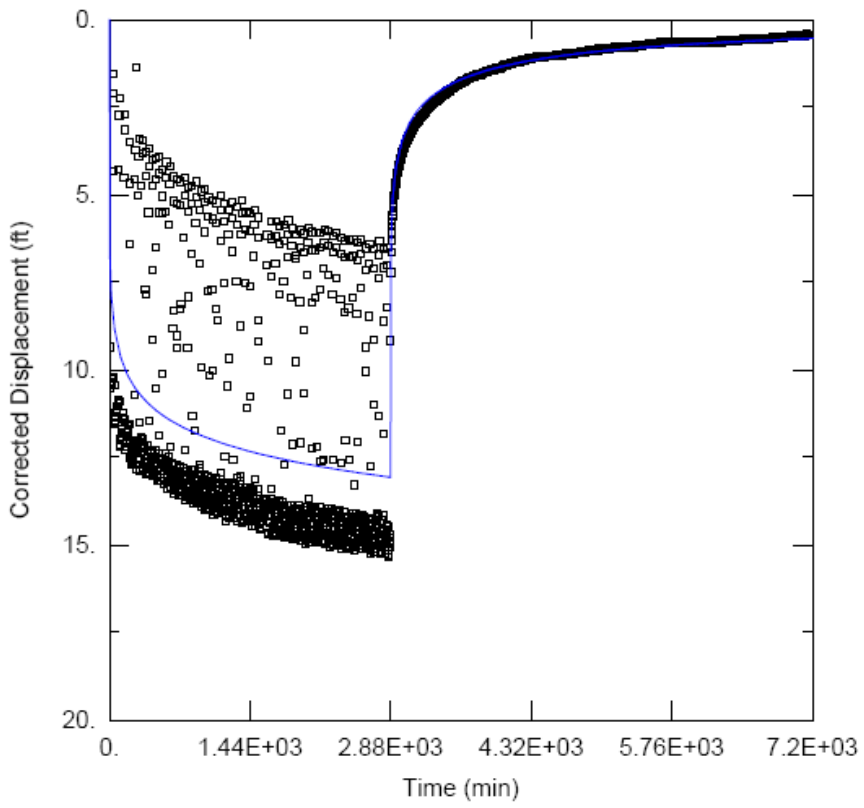


Figure 21. Barometric pressure at the WES and daily precipitation recorded in Lovettsville (station KVALOVET3).



WES AQUIFER TEST - 48 HOURS OF CONSTANT RATE PUMPING AT 12.2 GPM

Data Set: P:\Loudoun 2005\Waterford\PW-WES-OW-WES.aqt
Date: 11/30/06 Time: 15:31:07

PROJECT INFORMATION

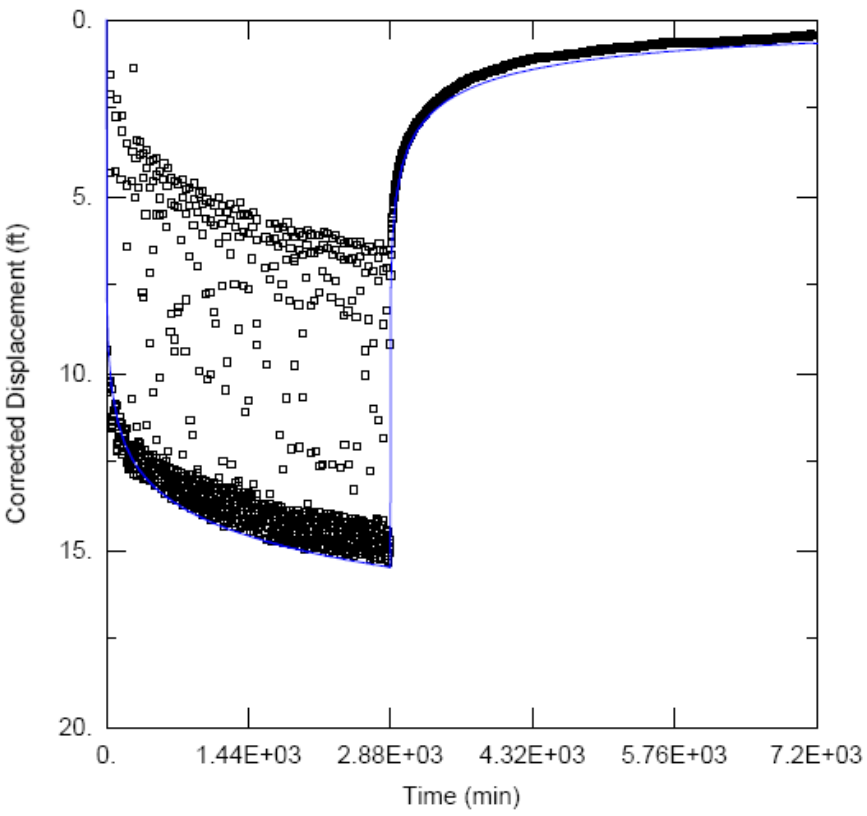
Company: GeoTrans, Inc.
Client: Loudoun County Public Schools
Project: 5612.001.01
Location: Waterford Elementary School
Test Well: WES Pump Well
Obs. Well: WES Pump Well
Test Date: 7/5/2006 - 7/7/2006

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 175.4 ft^2/day
S = 0.05911
Kz/Kr = 0.1
b = 100. ft

Figure 22. Best-fit unconfined Theis aquifer analysis of WES pump well time-drawdown data.



WES AQUIFER TEST - 48 HOURS OF CONSTANT RATE PUMPING AT 12.2 GPM

Data Set: P:\Loudoun 2005\Waterford\PW-WES-OW-WES.aqt
Date: 11/30/06 Time: 15:31:50

PROJECT INFORMATION

Company: GeoTrans, Inc.
Client: Loudoun County Public Schools
Project: 5612.001.01
Location: Waterford Elementary School
Test Well: WES Pump Well
Obs. Well: WES Pump Well
Test Date: 7/5/2006 - 7/7/2006

SOLUTION

Aquifer Model: Unconfined Solution Method: Theis

T = 145.9 ft^2/day S = 0.05911
Kz/Kr = 0.1 b = 100. ft

Figure 23. Unconfined Theis aquifer analysis of WES pump well time-drawdown data matching maximum drawdown of each pump cycle.

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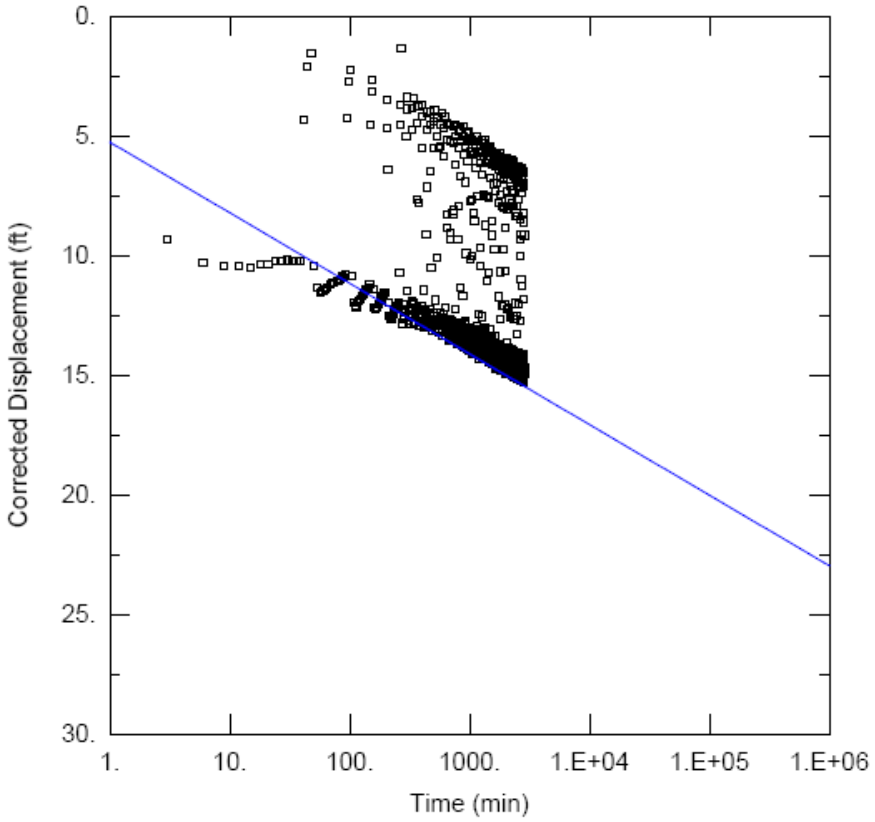

WES AQUIFER TEST - 48 HOURS OF CONSTANT RATE PUMPING AT 12.2 GPM

Data Set: P:\Loudoun 2005\Waterford\PW-WES-OW-WES.aqt
Date: 11/30/06 Time: 15:32:35

PROJECT INFORMATION

Company: GeoTrans, Inc.
Client: Loudoun County Public Schools
Project: 5612.001.01
Location: Waterford Elementary School
Test Well: WES Pump Well
Obs. Well: WES Pump Well
Test Date: 7/5/2006 - 7/7/2006

SOLUTION

Aquifer Model: Unconfined Solution Method: Cooper-Jacob

T = 145.9 ft^2/day S = 0.05911

Figure 24. Extrapolation of maximum drawdown in the WES pump well (12.2 gpm) to 694 days.

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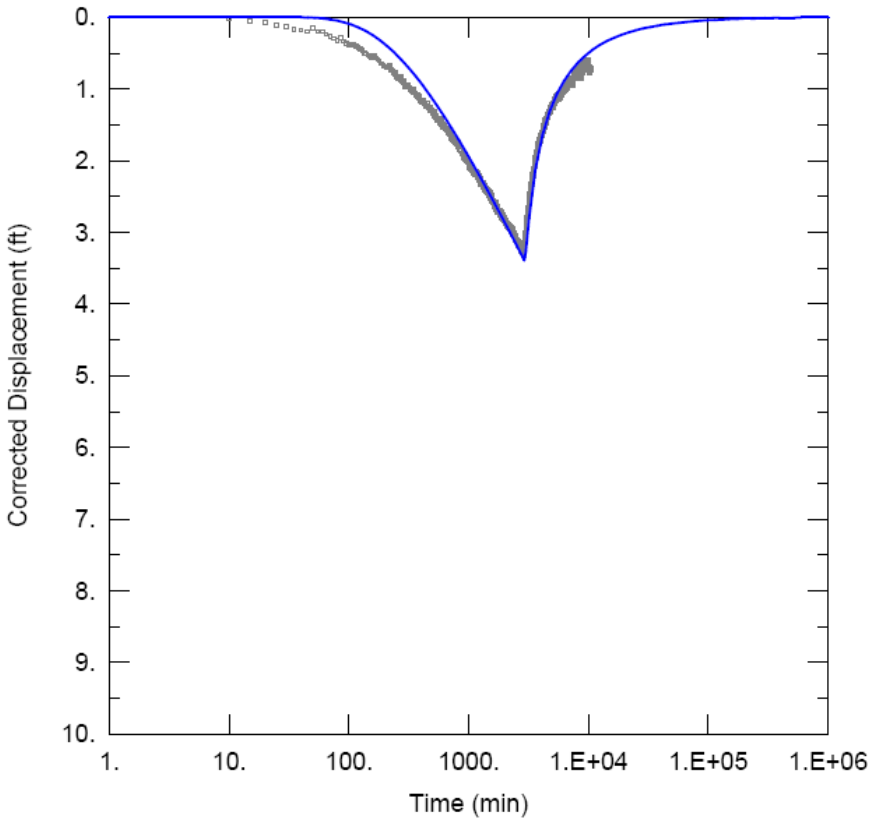
A TETRA TECH COMPANY



WES AQUIFER TEST - 48 HOURS OF CONTINUOUS PUMPING AT 12.2 GPM - UNUSED WF WELL

Data Set: P:\Loudoun 2005\Waterford\PW-WES-OW-WF.aqt
Date: 11/30/06 Time: 15:33:34

PROJECT INFORMATION

Company: GeoTrans, Inc.
Client: Loudoun County Public Schools
Project: 5612.001.01
Location: Waterford Elementary School
Test Well: WES Pump Well
Obs. Well: Unused WF Well
Test Date: 7/5/2006 - 7/7/2006

~120 feet from pump well

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 121.7 ft^2/day
S = 0.004334
Kz/Kr = 0.1
b = 100. ft

Figure 25. Best-fit unconfined Theis aquifer analysis of unused Waterford Foundation well time-drawdown data.

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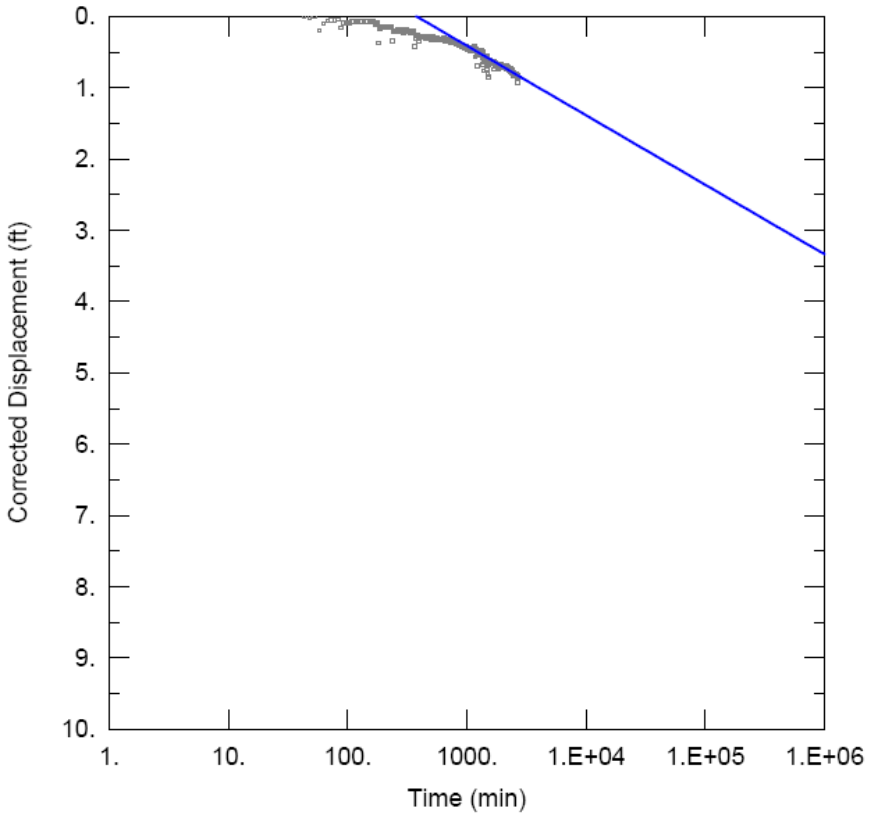

PROJECTED DRAWDOWN - CONTINUOUS PUMPING AT 12.2 GPM - HUTTON OBSERVATION WELL

Data Set: P:\Loudoun 2005\Waterford\PW-WES-OW-Hutton.aqt
Date: 11/30/06 Time: 15:34:44

PROJECT INFORMATION

Company: GeoTrans, Inc.
Client: Loudoun County Public Schools
Project: 5612.001.01
Location: Waterford Elementary School
Test Well: WES Pump Well
Obs. Well: Hutton Domestic Well
Test Date: 7/5/2006 - 7/7/2006

~350 feet from pump well

SOLUTION

Aquifer Model: Unconfined
Solution Method: Cooper-Jacob
T = 441.6 ft^2/day
S = 0.002531

Figure 26. Best-fit unconfined Cooper-Jacob aquifer analysis of Hutton domestic well time-drawdown data.

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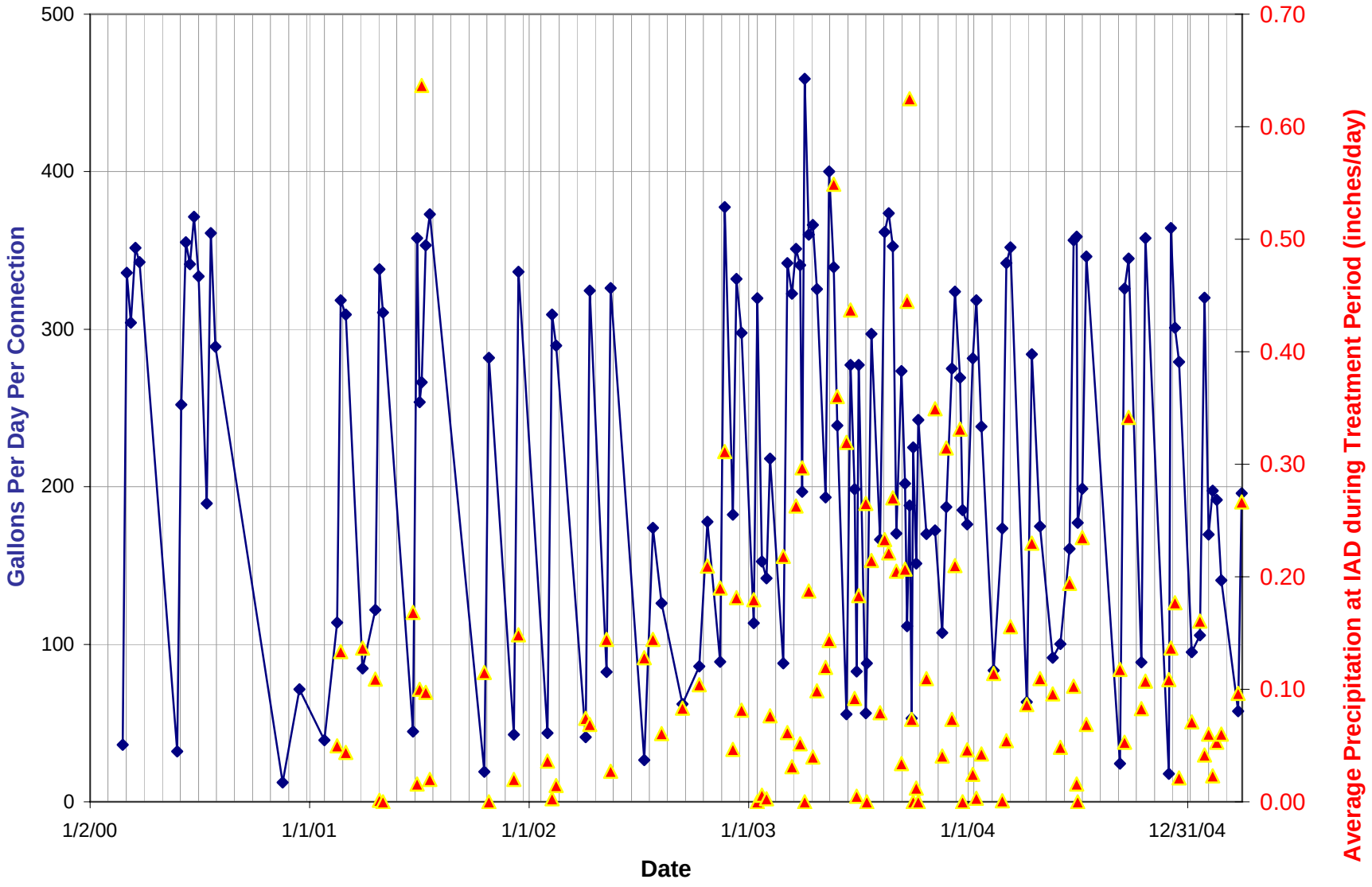
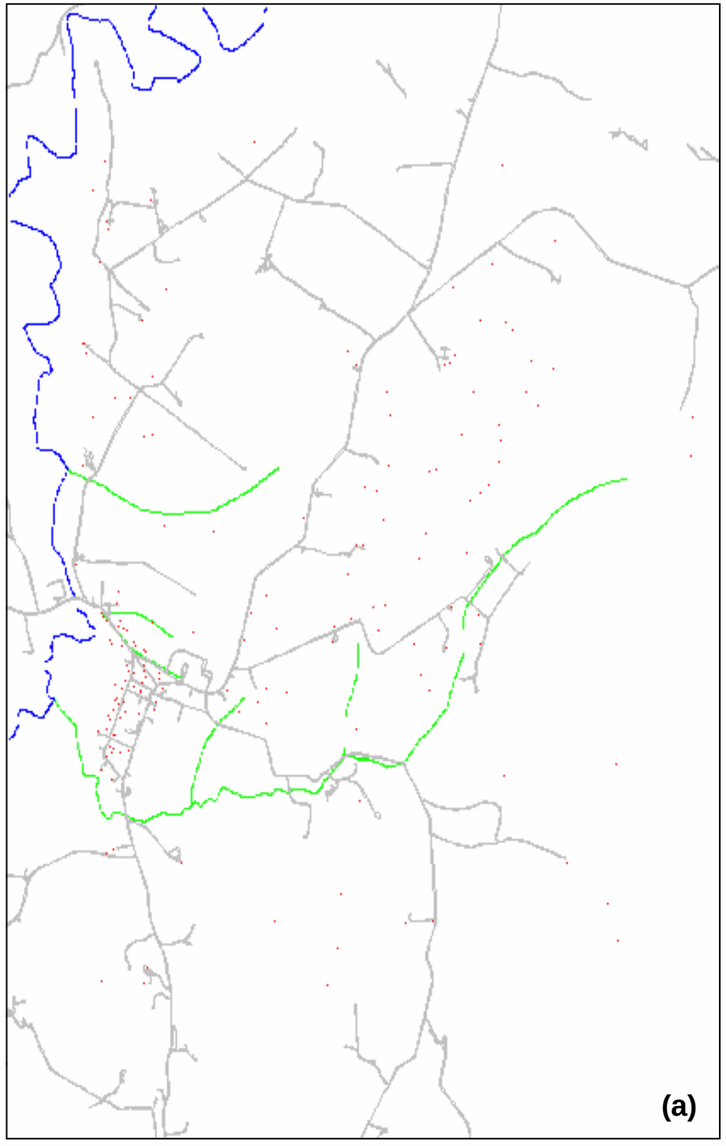
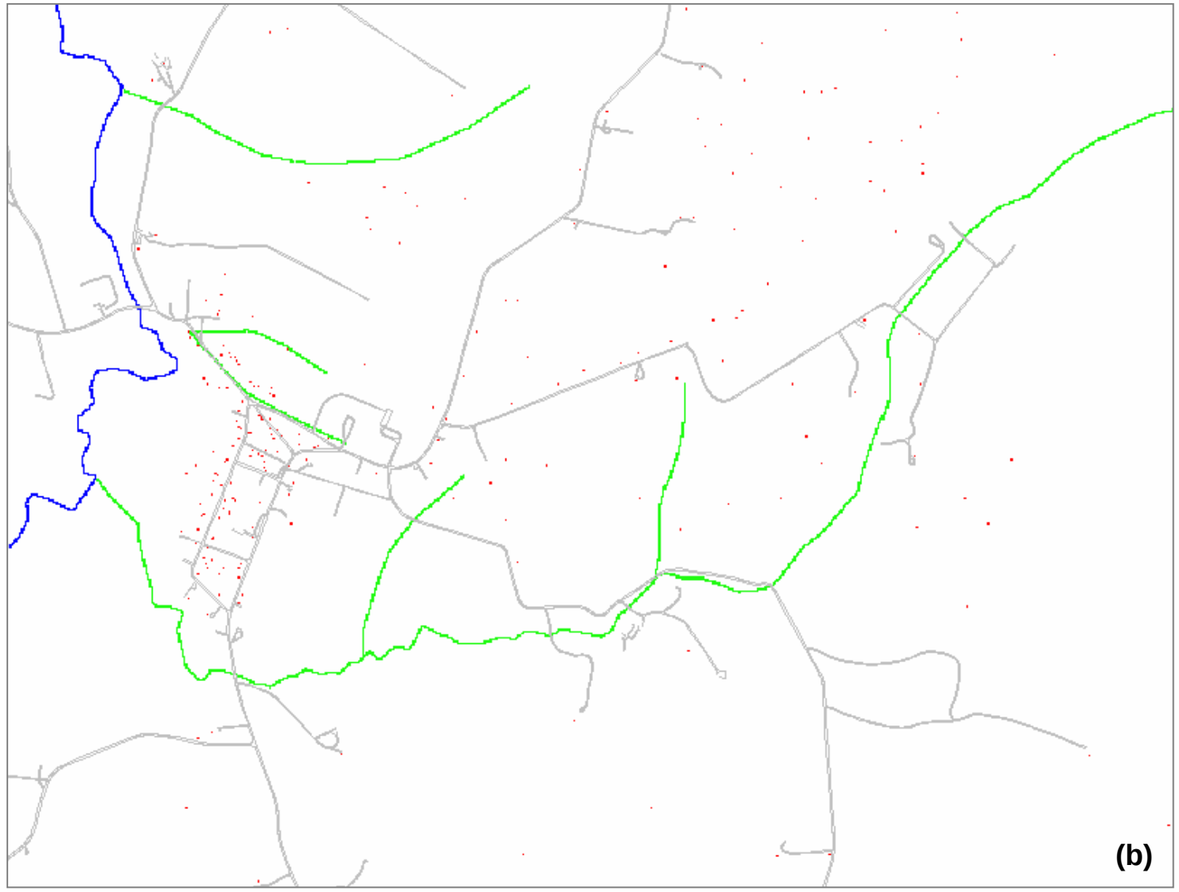


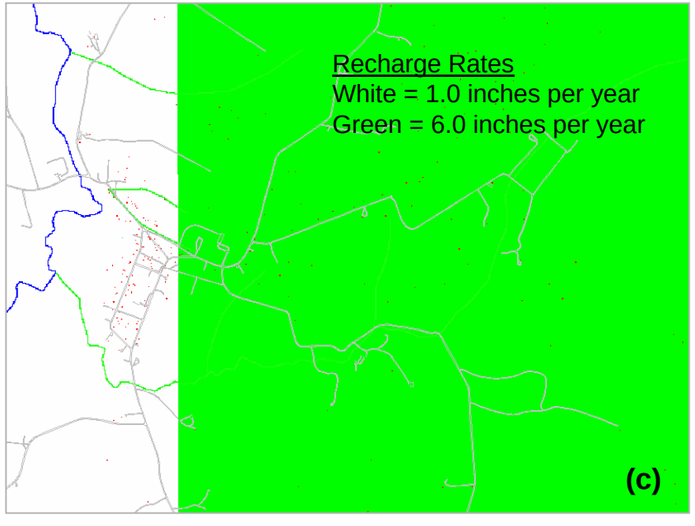
Figure 27. Waterford Sewer Treatment Plant flows calculated GPD treated per connection minus WES flow.



Boundary Conditions

Red = wells
Blue = river nodes
Green = drain nodes





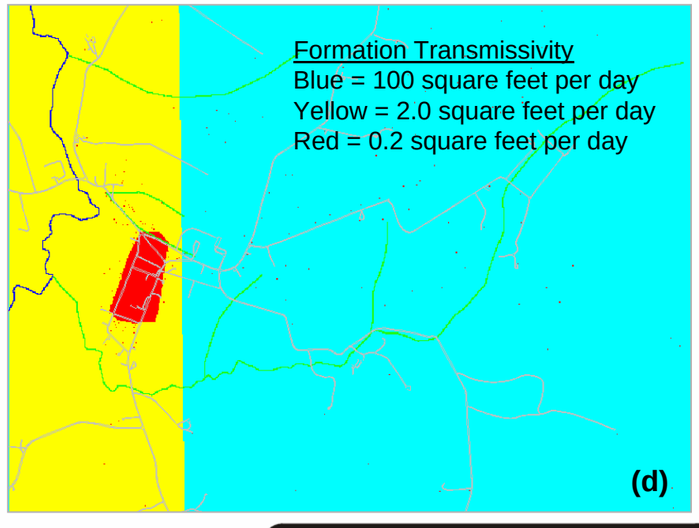


Figure 28. (a) MODFLOW model domain composed of 1000 rows and 710 columns with uniform 20-ft spacings; (b) Waterford area model boundary conditions; and, (c,d) Waterford area model recharge rate and transmissivity values.

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Figure 29. Simulated steady-state hydraulic head values contoured in feet above MSL (run WF-SS-1). Model results are based on a simplified representation of the existing condition. Each well was pumped at a rate of 125 GPD in the simulation, discharge from the spring near Butchers Row was set at 2880 GPD, and 644 GPD were pumped from the WES well.

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Figure 30. Simulated (run WF-SS-2) steady-state hydraulic head (yellow) and drawdown (light blue) contours in feet resulting from increasing the pumping rate at the WES supply well from 644 GPD to 2349 GPD. Model results are based on a simplified representation of hydrogeologic conditions. Other wells were pumped at a rate of 125 GPD each in the simulation, and 2880 GPD were discharged from the spring near Butchers Row.

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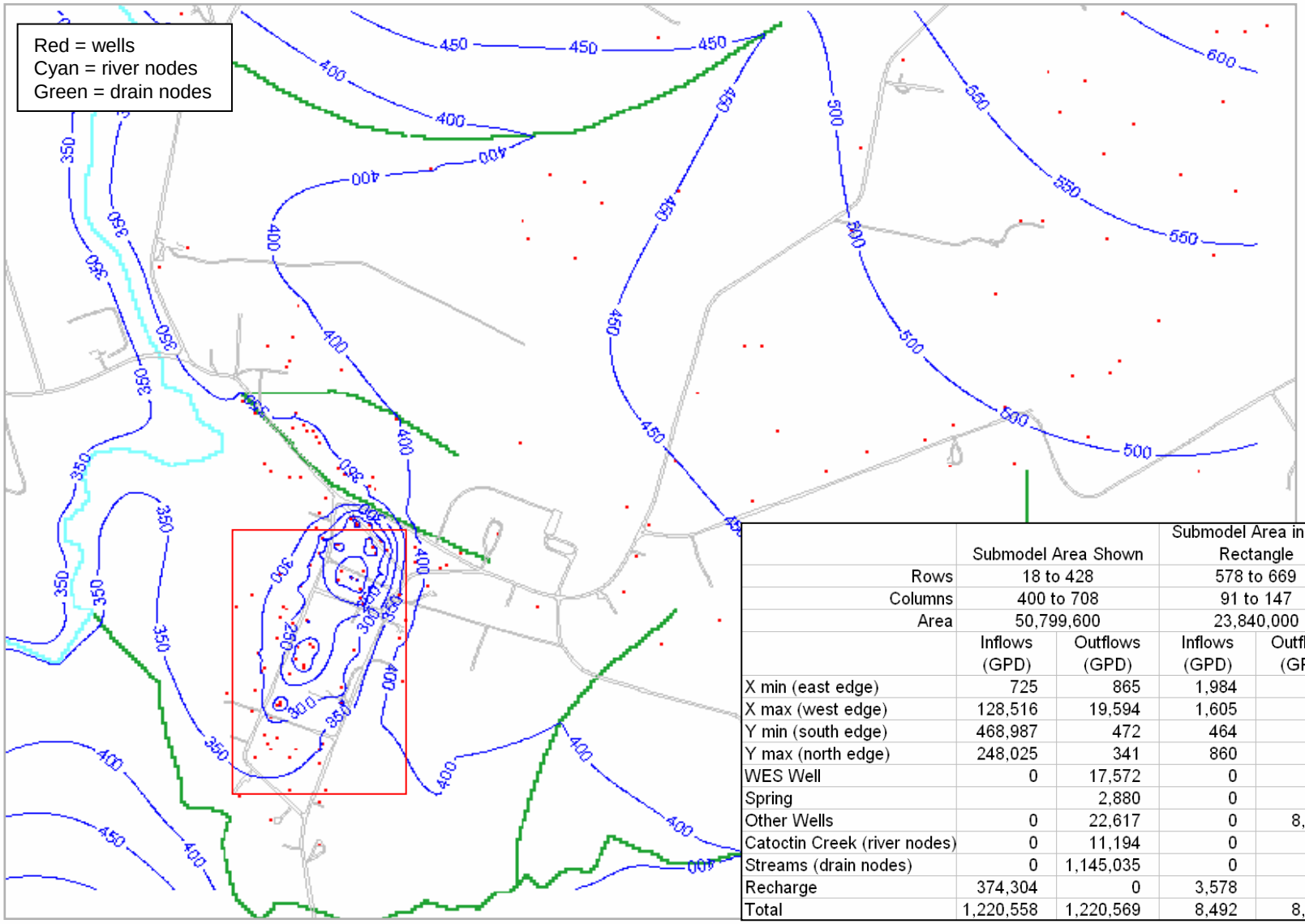

	Submodel Area Shown		Submodel Area in Red Rectangle	
Rows	18 to 428		578 to 669	
Columns	400 to 708		91 to 147	
Area	50,799,600		23,840,000	
	Inflows (GPD)	Outflows (GPD)	Inflows (GPD)	Outflows (GPD)
X min (east edge)	725	865	1,984	0
X max (west edge)	128,516	19,594	1,605	0
Y min (south edge)	468,987	472	464	45
Y max (north edge)	248,025	341	860	77
WES Well	0	17,572	0	0
Spring		2,880	0	0
Other Wells	0	22,617	0	8,370
Catoctin Creek (river nodes)	0	11,194	0	0
Streams (drain nodes)	0	1,145,035	0	0
Recharge	374,304	0	3,578	0
Total	1,220,558	1,220,569	8,492	8,492

Figure 31. Simulated steady-state water flow balances for two model areas derived from run WF-SS-2 in which pumping at the WES supply well was set at 17,572 GPD.

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APPENDIX A

Table A-1. Information pertaining to water wells and springs in the Waterford area based on Loudoun County Health Department records.

(Notes: Well Type: WWDH=Dry Well, WWDU=Dug Well, WWIN=Individual Well, WWNC=Non-Community Well, WWSP=Spring, WWTS=Test Well; Eastings and Northings are in feet Virginia state plane, datum NAD27; GW2 indicates whether or not a Water Well Completion Report is available at the County Health Department; All well yield, depth, and elevation data values are as reported in the County Wells database and are considered uncertain.)

Map	WELLID	Well Type	Easting (feet)	Northing (feet)	MCPI	Parcel Acres	Status	GW2	Base Elevation (feet)	Reported Static Water Level (feet)	Surface Water Elevation (feet)	Well Yield (gpm)	Well Depth (feet)	Well Dia. (inches)	Feet Casing	Feet Grout	Primary Yield Zone (gpm)	Primary Yield Zone Depth (feet)	Secondary Yield Zone (gpm)	Secondary Yield Zone Depth (feet)
A	WWCO-1974-0152	WWCO	2251970	555402	303272253	19.0	Active	N	420		356	1	500	6	40	40	0.8	360		
A	WWDH-1991-0014	WWDH	2251888	555430	303272253	19.0	Abandoned	Y	415		356	0	600	6		50				
A	WWDH-1991-0097	WWDH	2252014	555471	303272253	19.0	Abandoned	Y	435		410	0	560	6		80				
A	WWDH-1991-0130	WWDH	2251759	556064	303268392	4.9	Abandoned	Y	375	375	370	0	420	6		55				375
A	WWDU-1966-0094	WWDU	2251473	555577	303263654	0.4	Active	N	360		350	?	?							
A	WWDU-1979-0157	WWDU	2251688	555488	303267444	0.1	Active	N	390		356	?	?							
A	WWDU-1979-0158	WWDU	2251714	555460	303267938	0.1	Active	N	385		356	?	?							
A	WWDU-1979-0159	WWDU	2251778	555376	303268735	0.5	Active	N	385		356	?	?							
A	WWDU-1981-0172	WWDU	2251395	555643	303262972	0.3	Abandoned	N	360		350	?	?							
A	WWDU-1982-0123	WWDU	2251542	555496	303264248	0.3	Active	N	365		356	?	?							
A	WWDU-1987-0366	WWDU	2251254	556264	303362527	0.5	Active	N	380		350	?	?							
A	WWIN-1948-0008	WWIN	2251535	555459	303264942	0.2	Active	N	365		356	?	?							
A	WWIN-1978-0185	WWIN	2251484	555890	303264085	0.3	Active	Y	395		360	12	300	6	58	56	12.0	145		
A	WWIN-1980-0151	WWIN	2251542	555807	303264578	0.3	Active	N	405		360	?	?							
A	WWIN-1981-0168	WWIN	2251130	556030	303360508	0.9	Active	Y	350	342	345	3	240	6	38	36	2.5	120		
A	WWIN-1981-0169	WWIN	2251286	555554	303262972	0.3	Active	Y	350	240	350	1	600	6	59	50	1.0	-125		
A	WWIN-1981-0170	WWIN	2251452	555462	303264248	0.3	Active	Y	360	355	356	2	250	6	59	56	1.0	260	1.0	120
A	WWIN-1981-0173	WWIN	2251604	555767	303265872	0.3	Active	Y	415	397	385	50	100	6	55	50				
A	WWIN-1981-0174	WWIN	2251638	555690	303268392	4.9	Active	Y	410	348	350	4	240	6	55	50	2.0	240	2.0	200
A	WWIN-1982-0124	WWIN	2251772	555513	303267938	0.1	Active	N	410		356	2	425	6	28	20				
A	WWIN-1982-0125	WWIN	2251846	555464	303272253	19.0	Active	N	400		356	35	160	6	28	20				
A	WWIN-1984-0167	WWIN	2251325	555485	303263559	0.6	Active	N	355		350	3	200	6	52	50				
A	WWIN-1986-0327	WWIN	2251994	555455	303272253	19.0	Abandoned	N	430		420	?	?							
A	WWIN-1986-0328	WWIN	2252010	555373	303272253	19.0	Active	Y	430		420	4	420	6	52	50				
A	WWIN-1986-0334	WWIN	2251628	555730	303265872	0.3	Active	Y	415	396	385	12	325	6	62	50	12.0	125		
A	WWIN-1986-0343	WWIN	2251679	555311	303266929	0.1	Installed	Y	375	295	356	1	385	6	55	53		305		60
A	WWIN-1986-0344	WWIN	2251563	555778	303265377	0.2	Active	Y	405	361	360	12	225	6	63	52	7.0	215	5.0	320
A	WWIN-1987-0358	WWIN	2251156	555964	341103295	143.8	Abandoned?	N	300		350	3	240							
A	WWIN-1987-0359	WWIN	2251232	555894			Active	Y	355		245	3	300	6	100	100	2.5	70		
A	WWIN-1987-0364	WWIN	2251436	556215	303365322	0.5	Active	Y	380	358	360	2	605	6	62	51	1.5	70	0.5	10
A	WWIN-1987-0365	WWIN	2251441	556245	303365322	0.5	Active	Y	380	355	360	1	550	6	62	50	1.0	45		
A	WWIN-1987-0367	WWIN	2251309	556356	303362527	0.5	Active	Y	395	377	350	1	550	6	63	58	0.5	-85		
A	WWIN-1988-0516	WWIN	2251474	556417	303368789	73.4	Active	Y	410	392	385	2	650	6	39	28	1.0	200	1.0	-145
A	WWIN-1988-0522	WWIN	2251464	555798	303264578	0.3	Active	N	390		360	?	?							
A	WWIN-1991-0114	WWIN	2251781	556188	303268392	4.9	Active	Y	390	330	370	12	360	6	84	80	12.0	55		390
A	WWIN-1991-0155	WWIN	2252140	555861	303272253	19.0	Active	Y	405	336	400	1	500	6	60	50	1.0	15		
A	WWIN-1995-0302	WWIN	2251797	555479	303268437	0.1	Installed	Y	420	360	356	9	225	6	62	60	8.5	225		
A	WWIN-1996-0267	WWIN	2251449	555902			Active			50		0	500	6	60	50	3.0	240		
A	WWIN-1999-0178	WWIN	2251761	555555			Active			28		0	740	6	60	54	2.0	664		
A	WWIN-2000-0182	WWIN	2251988	554445			Active			40		0	600	6	73	70	6.0	75		
A	WWIN-2000-0802	WWIN	2251213	555708			Active					0	800	6	84	80				
A	WWIN-2002-0438	WWIN	2251420	555489			Active			50		0	600	6	58	55	0.5	200		
B	WWDH-1972-0174	WWDH	2251878	555024	303268907	0.4	Abandoned	N	400	400	300	0	600							
B	WWDH-1986-0337	WWDH	2252072	554860	303170484	0.3	Abandoned	Y	430		360	0	705	6		30				
B	WWDH-1987-0363	WWDH	2251980	554960	303169094	0.4	Active	Y	430		360	0	600	6						
B	WWDU-1960-0099	WWDU	2251452	554506	303164456	4.1	Active	N	380		375									
B	WWDU-1960-0101	WWDU	2251865	555239	303268922	0.4	Abandoned?	N	385		360	?	?							
B	WWDU-1960-0102	WWDU	2251974	554589	303170263	0.6	Active	N	415		375	?	?							
B	WWDU-1963-0071	WWDU	2252190	554557	303171852	0.7	Active	N	430		375	?	?							
B	WWDU-1972-0171	WWDU	2251543	554784	303165281	0.4	Active	N	375		370	?	?							

APPENDIX A

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(Notes: Well Type: WWDH=Dry Well, WWDU=Dug Well, WWIN=Individual Well, WWNC=Non-Community Well, WWSP=Spring, WWTS=Test Well; Eastings and Northings are in feet Virginia state plane, datum NAD27; GW2 indicates whether or not a Water Well Completion Report is available at the County Health Department; All well yield, depth, and elevation data values are as reported in the County Wells database and are considered uncertain.)

Map	WELLID	Well Type	Easting (feet)	Northing (feet)	MCPI	Parcel Acres	Status	GW2	Base Elevation (feet)	Reported Static Water Level (feet)	Surface Water Elevation (feet)	Well Yield (gpm)	Well Depth (feet)	Well Dia. (inches)	Feet Casing	Feet Grout	Primary Yield Zone (gpm)	Primary Yield Zone Depth (feet)	Secondary Yield Zone (gpm)	Secondary Yield Zone Depth (feet)
B	WWDU-1973-0306	WWDU	2251552	554311	303165629	0.7	Active	N	395		375	?	?							
B	WWDU-1978-0186	WWDU	2251764	554821	303168178	0.7	Active	N	385		360	?	?							
B	WWDU-1980-0147	WWDU	2251664	555252	303266725	0.1	Abandoned?	N	370		356	?	?							
B	WWDU-1982-0127	WWDU	2251759	554921	303167394	0.1	Active	N	390		360	?	?							
B	WWIN-1111-0018	WWIN	2251849	554534			Active					?	?							
B	WWIN-1951-0015	WWIN	2251508	554686	303165067	0.4	Active	N	375		370	?	?							
B	WWIN-1952-0035	WWIN	2251972	555128	303268922	0.4	Active	N	410		360	?	?							
B	WWIN-1952-0036	WWIN	2252096	554953	303271701	0.2	Active	N	430		360	?	?							
B	WWIN-1954-0048	WWIN	2251628	555121	303266114	0.3	Active	N	375		360	?	?							
B	WWIN-1954-0049	WWIN	2251862	554276	303167929	0.5	Active	N	435		375	?	?							
B	WWIN-1957-0069	WWIN	2251372	554352	303163535	0.4	Active	N	380		375	?	?							
B	WWIN-1958-0069	WWIN	2251770	555003	303267504	0.3	Active	N	385		360	?	?							
B	WWIN-1958-0076	WWIN	2252268	554864	303173090	0.4	Active	N	430		360	?	?							
B	WWIN-1960-0098	WWIN	2251579	554860	303165688	0.6	Active	N	375		360	?	?							
B	WWIN-1960-0100	WWIN	2251411	554571	303164456	4.1	Active	N	375		375	?	?							
B	WWIN-1962-0073	WWIN	2251764	554758	303167973	0.4	Abandoned	N	385		370	?	?							
B	WWIN-1963-0072	WWIN	2252202	554472	303171852	0.7	Active	N	430		375	?	?							
B	WWIN-1966-0096	WWIN	2251912	554634	303168663	0.3	Active	N	410		375	?	?							
B	WWIN-1967-0093	WWIN	2251521	554722	303164873		Active	N	375		370	?	?							
B	WWIN-1971-0119	WWIN	2251993	554972	303169094	0.4	Active	N	430		360	?	?							
B	WWIN-1972-0175	WWIN	2251889	555143			Active	N	415		360	?	?	6	38	37				
B	WWIN-1973-0176	WWIN	2252165	554352	303171840	0.7	Active	N	435		375	?	?							
B	WWIN-1974-0150	WWIN	2251660	555036	303265808	0.2	Abandoned?	N	375		360	?	?							
B	WWIN-1974-0151	WWIN	2251644	554925			Active	N	375		360	?	?							
B	WWIN-1974-0153	WWIN	2251564	554464	303166157	0.9	Active	N	390		375	?	?							
B	WWIN-1976-0153	WWIN	2252000	554940	303169590	0.3	Active	N	430		360	?	?							
B	WWIN-1979-0160	WWIN	2252054	555009	303270810	0.3	Active	N	430		360	3	300	6	50	50				
B	WWIN-1979-0161	WWIN	2251853	555176	303268510	0.2	Active	N	395		360	?	?							
B	WWIN-1979-0162	WWIN	2251862	555166	303268510	0.2	Active	N	395		360	?	?							
B	WWIN-1979-0163	WWIN	2251880	555154			Active	Y	405	337	360	1	710	6	100	100				
B	WWIN-1981-0171	WWIN	2251644	555058	303265808	0.2	Active	N	375		360	?	?							
B	WWIN-1981-0198	WWIN	2252337	554708	303174967	4.1	Active	N	435		375	?	?							
B	WWIN-1981-0199	WWIN	2252165	554651	303174967	4.1	Active	N	420		375	?	?							
B	WWIN-1982-0126	WWIN	2251738	554991	303267504	0.3	Active	Y	380		360	3	500	6	63	56	1.5	260	1.5	190
B	WWIN-1983-0113	WWIN	2251466	554457	303163845	0.4	Active	N	365		365	?	?							
B	WWIN-1983-0114	WWIN	2251384	554485	303163845	0.4	Active	Y	380		375	0	545	6	57	50		50		
B	WWIN-1983-0115	WWIN	2251110	554582	303160752	3.9	Active	Y	365		365	3	365	6	63	52	2.5	145	0.5	25
B	WWIN-1984-0168	WWIN	2251972	555043			Installed	Y	425	309	360	6	265	6	58	50	3.0	325	1.0	285
B	WWIN-1985-0202	WWIN	2251650	555209	303266721	0.1	Active	Y	375	315	356	1	372	6	105	50	0.5	230		
B	WWIN-1986-0332	WWIN	2251424	554547	303164456	4.1	Active	Y	375	331	375	1	605	6	59	51	0.5	-15		
B	WWIN-1986-0338	WWIN	2252046	554799	303171175	0.4	Installed	Y	415	-85	360	0	600	6	104	100		-80		
B	WWIN-1986-0339	WWIN	2251917	554600	303168663	0.3	Active	Y	415	393	375	4	560	6	52	50				
B	WWIN-1987-0360	WWIN	2251611	555070			Active		375		360	?	?							
B	WWIN-1988-0528	WWIN	2251904	554690	303167973	0.4	Active	N	400		370	?	?							
B	WWIN-1991-0191	WWIN	2251378	554801	303165075	0.3	Installed	Y	365	307	370	6	360	6	107	100	5.5	55		
B	WWIN-1991-0265	WWIN	2251201	554654	303164456	4.1	Installed	Y	365	317	365	25	320	6	80	77	25.0	70		
B	WWIN-1992-0159	WWIN	2251934	554822	303169888	0.1	Installed	Y	400	336	360	2	440	6	120	100	2.0	-10		
B	WWIN-1993-0267	WWIN	2251793	554813	303168178	0.7	Active	Y	385	373	360	6	600	6	115	105	4.5	-5	1.5	185
B	WWIN-1996-0110	WWIN	2252245	555062			Active			50		0	680	6	83	75	0.5	240		
B	WWIN-1998-0132	WWIN	2251831	554859			Active			70		0	680	6	110	100		290		

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Map	WELLID	Well Type	Easting (feet)	Northing (feet)	MCPI	Parcel Acres	Status	GW2	Base Elevation (feet)	Reported Static Water Level (feet)	Surface Water Elevation (feet)	Well Yield (gpm)	Well Depth (feet)	Well Dia. (inches)	Feet Casing	Feet Grout	Primary Yield Zone (gpm)	Primary Yield Zone Depth (feet)	Secondary Yield Zone (gpm)	Secondary Yield Zone Depth (feet)
B	WWIN-2001-0393	WWIN	2252271	554970	303172496	0.4	Active	Y		50		1	1000	6	82	75	0.5	440		890
B	WWNC-1986-0335	WWNC	2251838	554779	303168178	0.7	Active	Y	390	328	360	0	505	6	59	50		200		
B	WWNC-1986-0336	WWNC	2251879	554759	303168178	0.7	Active	Y	395	329	360	0	705	6	59	50		40		
C	WWDH-1986-0322	WWDH	2252484	553980	304473640	46.0	Abandoned	Y	420		400	0	330	6		26				
C	WWDH-1986-0323	WWDH	2252262	553743	304473640	46.0	Abandoned	Y	425	0	395	0	325	6		29				
C	WWDU-1962-0072	WWDU	2251352	554251	303163227	0.3	Active	N	380		375	?	?							
C	WWDU-1981-0175	WWDU	2251468	554177	303165216	0.3	Active	N	390		375	?	?							
C	WWIN-1956-0076	WWIN	2251319	553810			Active	N	390		355	?	?							
C	WWIN-1964-0095	WWIN	2251358	553885	304464193	0.7	Active	N	390		350	?	?							
C	WWIN-1964-0096	WWIN	2251385	553887	304464193	0.7	Abandoned	N	390		350	?	?							
C	WWIN-1964-0097	WWIN	2251393	553907	304464193	0.7	Active	N	390		350	?	?							
C	WWIN-1966-0095	WWIN	2251262	554141	303162714	0.3	Active	N	380		375	?	?							
C	WWIN-1973-0175	WWIN	2251514	554285	303165629	0.7	Active	N	390		375	?	?							
C	WWIN-1973-0307	WWIN	2251578	554310	303165629	0.7	Installed	Y	395	370	375	1	600	6	63	63	0.8	160		
C	WWIN-1976-0152	WWIN	2251230	553987	303161502	0.5	Active	N	380		350	2	65	6						
C	WWIN-1980-0148	WWIN	2251281	554156	303162714	0.3	Active	Y	380	271	375	3	325	6	52	50	3.0	210		
C	WWIN-1980-0149	WWIN	2251792	554010	303167107	1.4	Active	N	425		375	?	?							
C	WWIN-1980-0150	WWIN	2251786	553912	303167107	1.4	Active	Y	420		375	1	705	6	50	50				
C	WWIN-1981-0176	WWIN	2251456	554114	303164811	0.3	Active	N	385		375	?	?							
C	WWIN-1984-0175	WWIN	2252178	554051	304473640	46.0	Active	N	445			?	?							
C	WWIN-1986-0340	WWIN	2251546	554157	303165216	0.3	Active	Y	400		375	1	500	6	50	50				
C	WWIN-1986-0341	WWIN	2251556	554178	303165216	0.3	Active	N	400		375	2	550	6	50	50	1.5	-99		
C	WWIN-1986-0342	WWIN	2251481	554223			Active	N	390	375	375	17	275	6	50	50	8.5	305	8.5	226
C	WWIN-1987-0361	WWIN	2251252	554262	303163227	0.3	Active	Y	375		375	3	320	6	50	52				
C	WWIN-1989-0337	WWIN	2251050	553981	303161502	0.5	Active	Y	375	315	350	10	505	6	62	50	8.0	-80	1.0	65
C	WWIN-1991-0089	WWIN	2251599	554298	303165629	0.7	Installed	Y	400		275	2	560	6	110	103	0.8	-50	0.8	-138
C	WWIN-1992-0236	WWIN	2251204	553850	304461782	0.3	Installed	Y	380	319	350	12	400	6	106	100	10.0	20	2.0	140
C	WWIN-1993-0024	WWIN	2251358	553673	304462969	0.3	Active	Y	385	372	355	15	480	6	100	70	15.0	-69		
C	WWIN-1999-0179	WWIN	2251603	554236			Active			80		0	680	6	110	103		580		
D	WWCO-1989-0331	WWCO	2252554	553024	304473640	46.0	Installed	N	390		385									
D	WWDU-1956-0084	WWDU	2251556	553320	304465127	0.5	Abandoned	N	400		355	0	35							
D	WWDU-1962-0084	WWDU	2251642	552894	304366999	1.4	Active	N	390		370	?	?							
D	WWDU-1972-0173	WWDU	2251196	553826	304461782	0.3	Active	N	380		350	?	?							
D	WWIN-1954-0050	WWIN	2251290	553698	304462969	0.3	Abandoned	Y	385		355	0	54			54				
D	WWIN-1955-0041	WWIN	2251228	553528	304462650	0.6	Active	N	385		355	?	?							
D	WWIN-1962-0083	WWIN	2251653	553492			Active	N	410		365	?	?							
D	WWIN-1962-0085	WWIN	2251642	552930	304366999	1.4	Active	N	390		370	?	?							
D	WWIN-1964-0099	WWIN	2251648	553235	304466318	0.6	Abandoned	N	400		355	?	?							
D	WWIN-1970-0102	WWIN	2251328	553120	304463314	1.1	Active	N	380		355	?	?							
D	WWIN-1970-0103	WWIN	2251670	553637	304466461	0.3	Abandoned?	N	415		355	?	?							
D	WWIN-1970-0104	WWIN	2251684	553308	304466318	0.6	Active	N	405		355	?	?							
D	WWIN-1978-0184	WWIN	2251125	553282	304461530	0.7	Active	N	370		355	?	?							
D	WWIN-1979-0164	WWIN	2251308	553627	304462564	0.2	Active	N	385		355	?	?							
D	WWIN-1979-0165	WWIN	2251440	553539	304464459	0.3	Active	N	395		355	?	?							
D	WWIN-1981-0197	WWIN	2251442	553304	304465127	0.5	Active	Y	390	318	355	4	385	6	58	50				
D	WWIN-1989-0355	WWIN	2251317	553598	304462564	0.2	Installed	Y	390	332	355	3	700	6	85	78	1.5	80	1.0	-225
D	WWIN-1990-0404	WWIN	2251488	553594	304464459	0.3	Active	Y	400	315	355	4	600	6	86	75	2.0	-55	1.0	-140
D	WWIN-1992-0140	WWIN	2251644	553602	304466461	0.3	Active	Y	415	352	355	3	580	6	57	53	2.0	-145	1.0	25
D	WWIN-2002-0436	WWIN	2251321	553484			Active			17		0	760	6	84	80	1.0	400		
D	WWTS-1997-0209	WWTS	2251631	553568			Active			30		0	600	6	57	57		535		555

APPENDIX A

Table A-1. Information pertaining to water wells and springs in the Waterford area based on Loudoun County Health Department records.

(Notes: Well Type: WWDH=Dry Well, WWDU=Dug Well, WWIN=Individual Well, WWNC=Non-Community Well, WWSP=Spring, WWTS=Test Well; Eastings and Northings are in feet Virginia state plane, datum NAD27; GW2 indicates whether or not a Water Well Completion Report is available at the County Health Department; All well yield, depth, and elevation data values are as reported in the County Wells database and are considered uncertain.)

Map	WELLID	Well Type	Easting (feet)	Northing (feet)	MCPI	Parcel Acres	Status	GW2	Base Elevation (feet)	Reported Static Water Level (feet)	Surface Water Elevation (feet)	Well Yield (gpm)	Well Depth (feet)	Well Dia. (inches)	Feet Casing	Feet Grout	Primary Yield Zone (gpm)	Primary Yield Zone Depth (feet)	Secondary Yield Zone (gpm)	Secondary Yield Zone Depth (feet)
E	WWDH-1993-0049	WWDH	2252260	554680	303174967	4.1	Abandoned	Y	430			0	350	6		50				
E	WWDH-1993-0050	WWDH	2252648	554617	303174967	4.1	Abandoned	Y	445		410	0	600	6		50				
E	WWDH-1993-0051	WWDH	2252670	554569	303174967	4.1	Abandoned	Y	450		410	0	100	6		50				
E	WWDU-1963-0067	WWDU	2252610	554838	303175784	0.1	Abandoned	N	425		430	?	?							
E	WWIN-1964-0094	WWIN	2252799	555078	303277303	3.3	Active	N	440		435	?	?							
E	WWIN-1964-0113	WWIN	2253786	555141	303288314	0.7	Active	N	465		435	?	?							
E	WWIN-1979-0166	WWIN	2253070	554580	303180549	2.8	Abandoned	N	445		410	?	?							
E	WWIN-1988-0524	WWIN	2252428	554840	303174687	0.3	Active	N	425		430	?	?							
E	WWIN-1988-0525	WWIN	2252464	554846	303174687	0.3	Installed	Y	425	359	430	2	445	6	61	56	1.5	40		
E	WWIN-1988-0529	WWIN	2253622	554673	303186954	7.9	Active	N	450		426	?	?							
E	WWIN-1994-0167	WWIN	2253874	554309	303189620	3.2	Active	Y	435	385	425	10	360	6	63	58	10.0	90		
E	WWIN-1994-0175	WWIN	2252460	554438			2		434		410	?	?							
E	WWIN-1995-0229	WWIN	2253703	554906	303188489	2.0	Active	Y	462	432	426	50	285	6	62	57	50.0	192		
E	WWIN-1998-0115	WWIN	2253742	555299	303285546	2.3	Active	Y		40		5	620	6	57	50	3.0	600	2.0	75
E	WWIN-2001-0737	WWIN	2252925	554534			Active					0	700	6	63	62				
E	WWNC-1965-0080	WWNC	2253521	555294	303184199	10.4	Active	N	470		435	15	128							
E	WWSP-1964-0092	WWSP	2252576	554932	303277303	3.3	Active	N	420	420	420	?	?							
E	WWSP-1964-0093	WWSP	2252630	554964	303277303	3.3	Active	N	420	420	420	?	?							
E	WWTS-1997-0210	WWTS	2252565	554366			Active			25		0	400	6	69	65		101		186
NE	WWDH-1991-0025	WWDH	2254980	556196	303397222	3.8	Abandoned	Y	475		472	0	600	6		75				
NE	WWDH-1995-0290	WWDH	2254110	557673	303493960	35.0	Installed	Y	442		472	0	590							
NE	WWDH-1995-0291	WWDH	2254088	557537	303493960	35.0	Installed	Y	440		472	0	410							
NE	WWDH-1995-0292	WWDH	2254694	557223	303493960	35.0	Installed	Y	434		472	0	390							
NE	WWDH-1995-0295	WWDH	2253933	557501	303493960	35.0	Installed	Y	427	412	472	1	640				0.8	387		
NE	WWIN-1952-0034	WWIN	2255745	555542	303206233	18.8	Active	N	535		470	?	?							
NE	WWIN-1956-0077	WWIN	2253971	555567	303290534	4.4	Active	N	465		435	?	?							
NE	WWIN-1964-0114	WWIN	2255109	557149	303302191	10.1	Active	N	485		480	?	?							
NE	WWIN-1988-0520	WWIN	2254946	555493	303296557	3.3	Active	Y	480	452	472	7	300	6	60	59	7.0	238		
NE	WWIN-1989-0334	WWIN	2256338	557219	303406724	10.5	Active	N	520		470	?	?							
NE	WWIN-1989-0335	WWIN	2255201	555636	303299773	4.9	Active	Y	505	487	472	20	325	6	81	52	10.0	205	5.0	365
NE	WWIN-1989-0336	WWIN	2255577	555720	303202593	4.8	Active	Y	530	512	472	25	365	6	94	65	24.0	185	1.0	250
NE	WWIN-1989-0354	WWIN	2254472	555295	303294444	3.1	Active	Y	470	442	435	10	350	6	63	62	5.0	242	5.0	156
NE	WWIN-1989-0360	WWIN	2254115	556037	303291588	1.8	Active	Y	470	447	455	8	350	6	58	57	4.0	287	4.0	138
NE	WWIN-1991-0024	WWIN	2254632	555783	303295493	3.1	Active	Y	475	406	472	1	600	6	65	60	0.7	-65	0.5	315
NE	WWIN-1991-0026	WWIN	2254404	556351	303392212	3.1	Installed	Y	465	404	455	5	450	6	80	78	2.5	375	2.5	45
NE	WWIN-1991-0264	WWIN	2254526	556357	303397222	3.8	Installed	Y	465	414	460	6	450	6	80	75	3.5	40	2.5	325
NE	WWIN-1992-0073	WWIN	2256202	557210	303406724	10.5	Active	Y	520	482	500	20	200	6	79	78	20.0	338		
NE	WWIN-1995-0094	WWIN	2256938	557864	264460484	4.6	Installed	Y	567	507	500	2	500	6	83	75	2.0	267		
NE	WWIN-1995-0243	WWIN	2255763	555813	303306314	10.0	Installed	Y	538	506	472	30	200	6	104	103	15.0	404	15.0	360
NE	WWIN-1995-0294	WWIN	2255175	557718	303493960	35.0	Installed	Y	462	452	472	1	740	6	53	50	0.5	-38		
NE	WWIN-1995-0296	WWIN	2253983	557422	303493960	35.0	Installed	Y	432	422	472	5	360	6	56	50	5.0	362		
NE	WWIN-1998-0111	WWIN	2253485	557336	303484644	7.3	Active	Y		50		2	800	6	74	65	1.0	620	0.5	720
NE	WWIN-1998-0116	WWIN	2253842	555620	303384618	26.2	Active	Y		40		20	460	6	75	60	17.0	440	3.0	300
NE	WWIN-1998-0125	WWIN	2256469	557949	264452988	10.6	Active	Y		50		9	240	6	80	70	9.0	185		
NE	WWIN-1998-0126	WWIN	2256749	557674	264457555	9.8	Active	Y		24		1	500	6	84	70	1.0	109		
NE	WWIN-1999-0175	WWIN	2256762	557085	264453643	8.0	Active	Y		42		5	420	6	63	60	5.0	94		
NE	WWIN-1999-0176	WWIN	2256652	555726	264257767	4.8	Active	Y		50		3	500	6	90	70	3.0	140		
NE	WWIN-2000-0181	WWIN	2256116	555934	264353845	10.0	Active	Y				45	300	6	108	108	45.0	165		237
NE	WWIN-2001-0387	WWIN	2256174	555544	264252551	5.9	Active	Y				14	340	6	90	90		336		256
NE	WWIN-2001-0391	WWIN	2256544	556154	264256378	5.0	Active	Y				7	440	6	82	76	5.0	411	2.0	431

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Map	WELLID	Well Type	Easting (feet)	Northing (feet)	MCPI	Parcel Acres	Status	GW2	Base Elevation (feet)	Reported Static Water Level (feet)	Surface Water Elevation (feet)	Well Yield (gpm)	Well Depth (feet)	Well Dia. (inches)	Feet Casing	Feet Grout	Primary Yield Zone (gpm)	Primary Yield Zone Depth (feet)	Secondary Yield Zone (gpm)	Secondary Yield Zone Depth (feet)
NE	WWIN-2002-0237	WWIN	2256228	556360			Active			67		0	800	6	80	78	9.0	165	1.0	120
NE	WWIN-2002-0238	WWIN	2256853	556254	264359224	9.7	Active	Y		50		6	540	6	82	75	4.0	120	2.0	520
NE	WWIN-2002-0239	WWIN	2256789	556181	264359224	9.7	Active	Y		40		7	520	6	80	75	4.0	510	3.0	120
NE	WWIN-2004-0010	WWIN	2256981	556625			Active					0	660	6	84	80				
NE	WWIN-2005-0045	WWIN	2254080	555602			Active					0	400	6	73	72				
NE	WWSP-1957-0068	WWSP	2256042	556721	303406724	10.5	Active	N	495	495	495	?	?							
NE	WWTS-2002-0427	WWTS	2254959	558020			Active			30		0	1000	6	59	60	1.0	701		
NW	WWDU-1949-0011	WWDU	2248948	557802	341497965	25.4	Active	N	435		388									
NW	WWDU-1988-0515	WWDU	2251273	556521	303368789	73.4	Abandoned	N	420		403	?	?							
NW	WWIN-1957-0066	WWIN	2248994	555893	341299894	2.5	Active	N	435		420	?	?							
NW	WWIN-1961-0076	WWIN	2250611	556901	303458712	13.1	Active	N	360		345	?	?							
NW	WWIN-1967-0072	WWIN	2248452	557343	341497965	25.4	Active	N	440		388	?	?							
NW	WWIN-1976-0208	WWIN	2249878	556234	303352541	8.3	Active	N	365		350	?	?							
NW	WWIN-1981-0194	WWIN	2249030	557640	341497965	25.4	Active	N	420		388	?	?							
NW	WWIN-1981-0195	WWIN	2249040	557663	341497965	25.4	Active	Y	420	315	388	3	300	6	26	22	2.5	215		
NW	WWIN-1986-0348	WWIN	2250788	557024	303458712	13.1	Active	Y	365	345	340	1	500	6	59	51	0.5	145	0.5	-35
NW	WWIN-1986-0370	WWIN	2248999	557703	341497965	25.4	Active	Y	420	402	388	12	265	6	39	30	12.0	216		
NW	WWIN-1988-0514	WWIN	2251516	556636	303368789	73.4	Abandoned	Y	430	402	403	1	685	6		50	1.0	-145		
NW	WWIN-1998-0112	WWIN	2253369	557482	303484644	7.3	Active	Y		40		5	700	6	74	65	3.5	560	1.5	680
NW	WWIN-1998-0113	WWIN	2253008	557091	303383893	10.1	Active	Y		30		15	360	6	80	65	11.0	330	4.0	100
NW	WWIN-1998-0117	WWIN	2252951	555696	303384618	26.2	Active	Y		40		20	300	6	80	60	20.0	280		
NW	WWIN-1998-0118	WWIN	2252376	557576	303477255	10.9	Active	Y		60		2	600	6	70	60	1.5	300		
NW	WWIN-1998-0131	WWIN	2253146	557539	303484644	7.3	Active	Y		40		10	440	6	67	60	6.0	420	4.0	380
NW	WWIN-1998-0362	WWIN	2253314	556945	303383893	10.1	Active	Y		50		20	400	6	69	60	16.0	365	4.0	175
NW	WWIN-1998-0363	WWIN	2253357	557020			Active			50		0	800	6	80	70	2.0	520		
NW	WWIN-1998-0410	WWIN	2252971	557217	303477255	10.9	Abandoned	Y		30		3	500	6		88	2.0	360	1.0	100
SE	WWCO-1986-0325	WWCO	2253188	553100	304484651	29.1	Installed	Y	395	391	390	8	605	6	59	51	7.9	45		
SE	WWCO-1986-0326	WWCO	2254102	553187	304484651	29.1	Installed	Y	410	399	400	5	605	6	59	50	2.3	250	2.3	270
SE	WWCO-1989-0329	WWCO	2253638	553134	304484651	29.1	Installed	Y	400	387	390	2	500	6	61	50	0.8	40	0.5	-75
SE	WWCO-1989-0330	WWCO	2254436	553204	304484651	29.1	Installed	N	410		400									
SE	WWIN-1976-0146	WWIN	2255111	552015	304301366	8.0	Active	Y	500		445	10	140	6	60	50	10.0	385		
SE	WWIN-1986-0316	WWIN	2253608	553761	304484651	29.1	Active	N	435		400	?	?							
SE	WWIN-1986-0318	WWIN	2253980	553899	304484651	29.1	Active	N	450		405	?	?							
SE	WWIN-1986-0319	WWIN	2254056	553876	304484651	29.1	Active	N	450		405	?	?							
SE	WWIN-1986-0320	WWIN	2254448	553309	304484651	29.1	Active	N	420		400	?	?							
SE	WWIN-1986-0321	WWIN	2254162	553059	304484651	29.1	Active	N	400		400	?	?							
SE	WWIN-1989-0363	WWIN	2256279	552743	265352646	12.5	Installed	Y	520	479	500	7	650	6	51	51	3.5	95	3.5	-98
SE	WWIN-1998-0124	WWIN	2254406	554097	303193008	3.0	Active	Y		22		12	220	6	60	50	12.0	147		
SE	WWIN-1999-0174	WWIN	2254243	554472	303192640	2.9	Active	Y		22		6	460	6	84	65	6.0	369		
SE	WWIN-2001-0015	WWIN	2256933	554447			Active			23		0	320	6	63	60	18.0	282		
SE	WWIN-2001-0386	WWIN	2254836	554650	303299607	6.2	Active	Y		30		3	600	6	73	60	2.5	385		
SE	WWIN-2001-0388	WWIN	2255790	554307	303104843	17.5	Active	Y		45		20	260	6	126	80		253		
SE	WWIN-2001-0389	WWIN	2254523	553653	303196916	9.8	Active	Y		70		10	400	6	80	75	8.0	380	2.0	125
SE	WWIN-2001-0390	WWIN	2256202	553989	265452685	11.5	Active	Y		90		12	440	6	80	70	9.0	425	3.0	145
SE	WWIN-2001-0563	WWIN	2254403	554712	303192173	6.3	Active	Y		20		4	600	6	86	81	2.0	580	1.5	95
SE	WWIN-2001-0574	WWIN	2256699	554259	265457981	6.5	Active	Y				17	240	6	127	100		229		197
SE	WWIN-2005-0193	WWIN	2255045	553277			Active					0	800	6	96	95				
SW	WWCO-1986-0324	WWCO	2252994	553485	304473640	46.0	Installed	Y	400	396	395	4	700	6	59	50	1.3	10	1.3	145
SW	WWCO-1989-0328	WWCO	2252796	553004	304473640	46.0	Installed	Y	390	387	385	5	500	6	61	51	3.0	-65	1.0	60
SW	WWDU-1986-0317	WWDU	2253036	553441	304473640	46.0	Abandoned	N	395		395	?	?							

APPENDIX A

Table A-1. Information pertaining to water wells and springs in the Waterford area based on Loudoun County Health Department records.

(Notes: Well Type: WWDH=Dry Well, WWDU=Dug Well, WWIN=Individual Well, WWNC=Non-Community Well, WWSP=Spring, WWTS=Test Well; Eastings and Northings are in feet Virginia state plane, datum NAD27; GW2 indicates whether or not a Water Well Completion Report is available at the County Health Department; All well yield, depth, and elevation data values are as reported in the County Wells database and are considered uncertain.)

Map	WELLID	Well Type	Easting (feet)	Northing (feet)	MCPI	Parcel Acres	Status	GW2	Base Elevation (feet)	Reported Static Water Level (feet)	Surface Water Elevation (feet)	Well Yield (gpm)	Well Depth (feet)	Well Dia. (inches)	Feet Casing	Feet Grout	Primary Yield Zone (gpm)	Primary Yield Zone Depth (feet)	Secondary Yield Zone (gpm)	Secondary Yield Zone Depth (feet)
SW	WWIN-1986-0346	WWIN	2249424	553100	342303899	14.1	Active	Y	395	377	365	6	225	6	44	40	5.0	195	1.0	295
SW	WWIN-1988-0519	WWIN	2249078	552381	342494900	33.0	Active	Y	425		375	3	425	6	31	31	3.0	24		
SW	WWIN-1989-0372	WWIN	2249152	552160	342203095	11.2	Abandoned	Y	420	355	380	1	665	6	64	55	1.0	-180		
SW	WWIN-1999-0177	WWIN	2252917	552094			Active			50		0	540	6	63	58	3.0	510	2.0	240
SW	WWIN-2003-0313	WWIN	2249138	552226	342203095	11.2	Active	Y		45		2	700	6	63	59	1.0	493	0.5	545

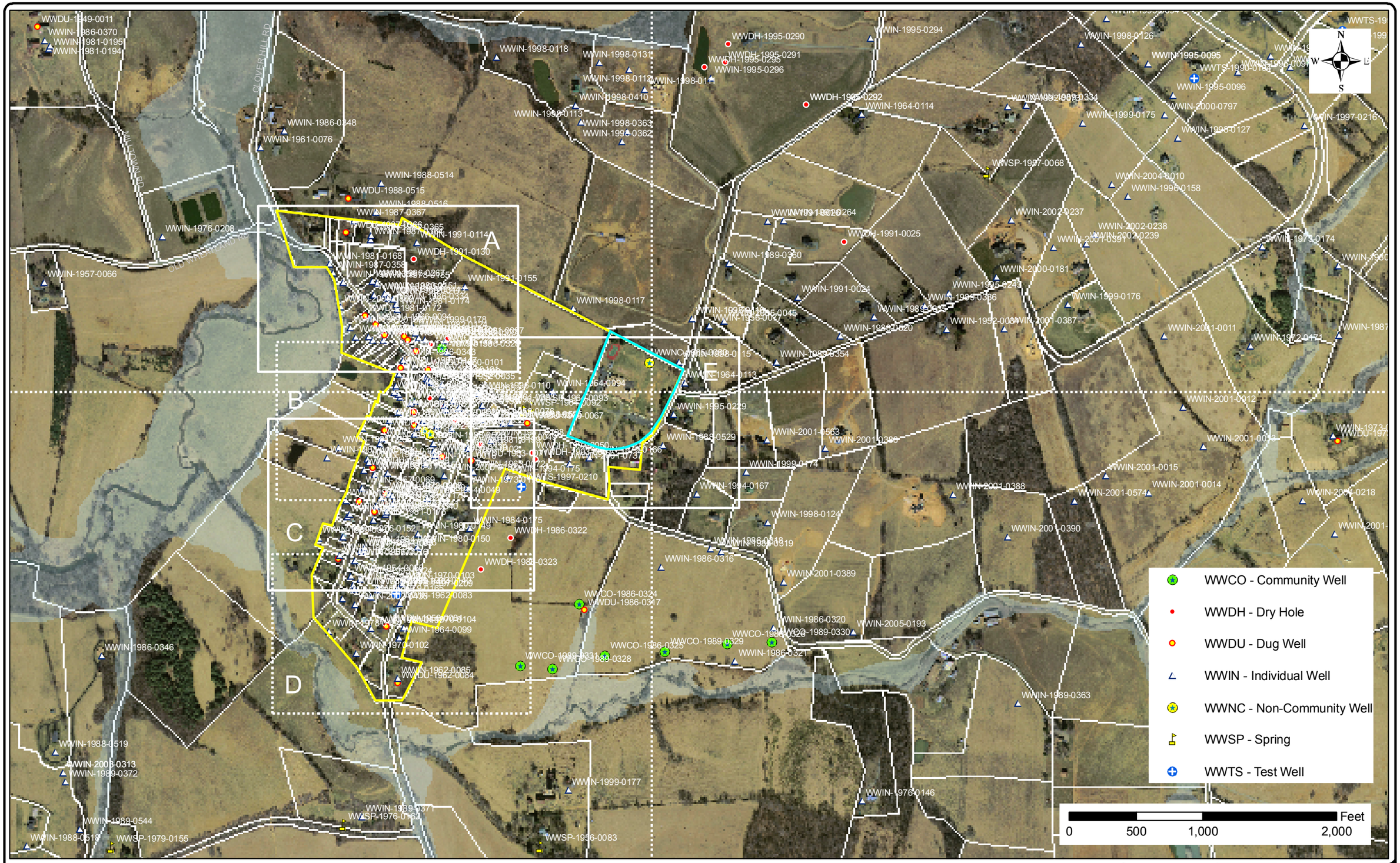

Figure A-1. Waterford well atlas index map showing enlarged map areas (A to E), parcel boundaries, and water wells.

GeoTrans, Inc.
A TETRA TECH COMPANY

Figure A-2. Waterford well atlas map A showing parcel boundaries and water wells.

GeoTrans, Inc.
A TETRA TECH COMPANY

Figure A-3. Waterford well atlas map B showing parcel boundaries and water wells.

GeoTrans, Inc.
A TETRA TECH COMPANY

Figure A-4. Waterford well atlas map C showing parcel boundaries and water wells.

GeoTrans, Inc.
A TETRA TECH COMPANY

Figure A-5. Waterford well atlas map D showing parcel boundaries and water wells.

GeoTrans, Inc.
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Figure A-6. Waterford well atlas map E showing parcel boundaries and water wells.

GeoTrans, Inc.
A TETRA TECH COMPANY

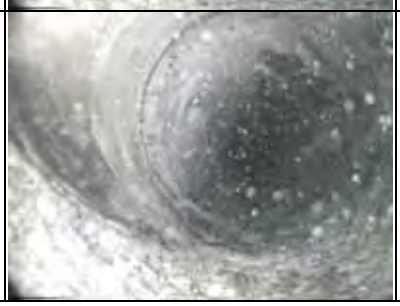
APPENDIX B

Televiewer log of WES Water-Supply Well Performed by Valley Drlling on April 10, 2006

Depth below Top of Casing (TOC), DVD Times, Comments	Downhole View	Sideways View
Downhole view time: 0:00:10 Top of 6-inch diameter casing in WES well vault approximately 6 feet below ground surface (bgs)		
Downhole view time: 0:00:34 Casing above water level in well Side view time: ~0:30:15		
Downhole view depth: ~17 feet Downhole view time: 0:01:04 Water level encountered at 19 feet below TOC		
Downhole view depth: ~30 feet Downhole view time: 0:01:39 Casing below water		
Downhole view depth: 47 feet Downhole view time: 0:03:26 Bottom of casing at 47 feet below TOC, and approximately 53 feet bgs		
Downhole view depth: 47 feet Downhole view time: 0:03:36 Base of casing at 47 feet and underlying rock Side view depth: 47 feet Side view time: 0:33:36		

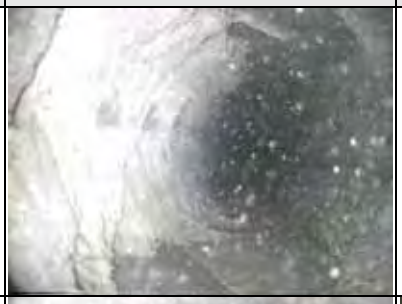
APPENDIX B

Televiewer log of WES Water-Supply Well Performed by Valley Drlling on April 10, 2006

Depth below Top of Casing (TOC), DVD Times, Comments	Downhole View	Sideways View
Downhole view depth: 51 feet Downhole view time: 0:04:02 Fractured rock over more competent rock Side view depth: ~51.5 feet Side view time: 0:34:08 Quartz vein		
Downhole view depth: 53 feet Downhole view time: 0:04:18 Apparent fracture zone Side view depth: 53 feet Side view time: 0:36:16 Apparent fracture zone		
Downhole view depth: 55 feet Downhole view time: 0:04:29 More competent rock below Side view depth: 53 feet Side view time: 0:36:52 Apparent fracture zone		
Downhole view depth: 56 feet Downhole view time: 0:04:52 Side view depth: 53 feet Side view time: 0:37:10 Apparent fracture zone		
Downhole view depth: 61 feet Downhole view time: 0:05:23 Side view depth: ~56 feet Side view time: 0:38:04 Rock foliation		
Downhole view depth: 63 feet Downhole view time: 0:05:39 Coarser over finer-grained rock Side view depth: 63 feet Side view time: 0:39:05 Finer-grained rock		

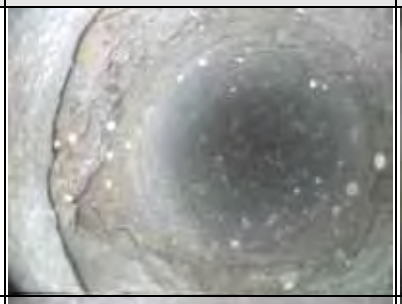
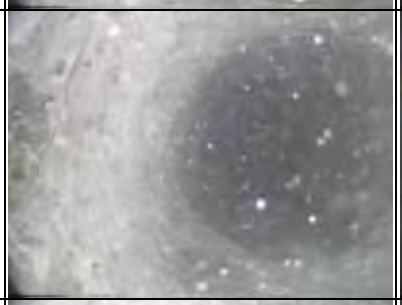
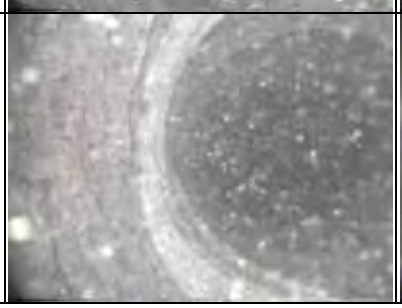
APPENDIX B

Televiewer log of WES Water-Supply Well Performed by Valley Drlling on April 10, 2006

Depth below Top of Casing (TOC), DVD Times, Comments	Downhole View	Sideways View
Downhole view depth: 65 feet Downhole view time: 0:05:51 Apparent fracture		
Downhole view depth: 67 feet Downhole view time: 0:06:15 Apparent vertical fractures Side view depth: 71 feet Side view time: 0:41:37 Possible iron-staining of yield seam at ~71 feet		
Downhole view depth: 71-72 feet Downhole view time: 0:06:40 Increased falling particles due to well disturbance Side view depth: 71 feet Side view time: 0:41:46		
Downhole view depth: 73 feet Downhole view time: 0:07:15 Fracture zone		
Downhole view depth: 75 feet Downhole view time: 0:07:20 Fracture zone Side view depth: ~75 feet Side view time: 0:42:10 Fracture zone		
Downhole view depth: 75-76 feet Downhole view time: 0:07:26 Fracture zone Side view depth: ~75 feet Side view time: 0:42:22 Possible iron-staining of yield seam at ~75 feet		

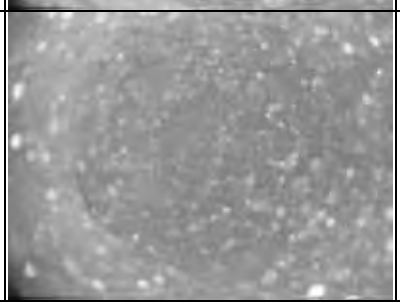
APPENDIX B

Televiewer log of WES Water-Supply Well Performed by Valley Drlling on April 10, 2006

Depth below Top of Casing (TOC), DVD Times, Comments	Downhole View	Sideways View
Downhole view depth: 76 feet Downhole view time: 0:07:32 Fracture zone Side view depth: ~75 feet Side view time: 0:43:29 Fracture zone		
Downhole view depth: 80 feet Downhole view time: 0:07:58 More competent rock Side view depth: ~75 feet Side view time: 0:43:14 Fracture ledge		
Downhole view depth: 85 feet Downhole view time: 0:08:35 Side view depth: 87 feet Side view time: 0:45:49 Contact coarser over finer-grained rock		
Downhole view depth: 87 feet Downhole view time: 0:08:48 Fracture at ~87 feet Side view depth: ~89 feet Side view time: 0:46:19 Quartz or calcite vein		
Downhole view depth: 90 feet Downhole view time: 0:09:10 Quartz or calcite vein Side view depth: 90 feet Side view time: 0:47:13 Quartz or calcite vein		
Downhole view depth: 95 feet Downhole view time: 0:09:51 Side view depth: 96feet Side view time: 0:49:45 Foliation on rock		

APPENDIX B

Televiewer log of WES Water-Supply Well Performed by Valley Drlling on April 10, 2006

Depth below Top of Casing (TOC), DVD Times, Comments	Downhole View	Sideways View
Downhole view depth: 100 feet Downhole view time: 0:10:27		
Downhole view depth: 103 feet Downhole view time: 0:10:49 Side view depth: 103 feet Side view time: 0:50:58		
Downhole view depth: 105 Downhole view time: 0:11:10 Side view depth: 105 feet Side view time: 0:51:22		
Downhole view depth: 110 feet Downhole view time: 0:11:42		
Downhole view depth: 115 feet Downhole view time: 0:12:25 Much suspended matter		
Downhole view depth: 120 feet Downhole view time: 0:13:08 Much suspended matter Side view depth: 119 feet Side view time: 0:54:09		

APPENDIX B

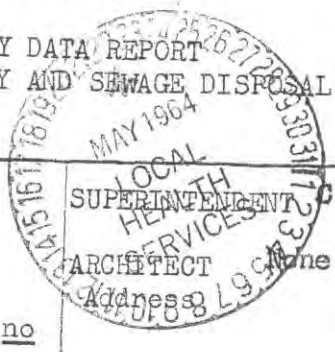
Televiewer log of WES Water-Supply Well Performed by Valley Drlling on April 10, 2006

Depth below Top of Casing (TOC), DVD Times, Comments	Downhole View	Sideways View
Downhole view depth: 125 feet Downhole view time: 0:13:40 Much suspended matter Quartz or calcite vein at 124.5 feet (not shown)		
Downhole view depth: 128 feet Downhole view time: 0:13:55 Well filled with sediment to 128 feet below TOC		

APPENDIX B

COMMONWEALTH OF VIRGINIA
STATE BOARD OF EDUCATION -- STATE BOARD OF HEALTH
Richmond 23216

PRELIMINARY DATA REPORT
SCHOOL WATER SUPPLY AND SEWAGE DISPOSAL



IN NO. Loud-70 DATE: 5-21-64

SCHOOL Waterford Elementary

SUPERINTENDENT C. M. Bussinger

COUNTY/CITY Loudoun

ARCHITECT None as yet

Enrollment:

Upon Completion 210

Ultimate estimated ~~210~~ 450

Address

Showers yes no

Kitchen yes no

WATER SUPPLY: 1. ____Public. Size of main _____", feeder, _____" and meter _____"

2. x Individual Well. Capacity 15 gal/min 1500 Storage tank (gals.)

I. EXISTING SEWAGE DISPOSAL:

1. x None

2. Results of percolation tests: ____Good ____Medium ____Doubtful x Suitable ____Unsuitable for subsurface drainage

3. Existing facilities:

(a) ___ Septic tank: _____gallons capacity. Influent line _____ (size) _____ (material)

(b) ___ Dosing tank: _____(None) _____(Single siphon) _____(Twin siphon) _____(Pumps)

(c) ___ Subsurf. distribution: ___lines at _____ft. each, equals _____total linear ft.

(d) ___ Sand filter: ___Rotary ___Intermittent ___2-bed ____3-bed Area_____Sq. ft.

(e) ___ Stabilization Pond _____Acres. Name of stream receiving effluent_____

(f) ___ Public Sewer. School sewer _____ (size) _____ (material). Street sewer _____ (size) _____ (material)

(g) ___ Other

I. RECOMMENDED SEWAGE DISPOSAL:

1. _____Existing system adequate (with showers) (without showers) with changes marked in (3) below.

2. _____Existing system to be abandoned. New system as outlined in (3) below.

3. x New individual facilities

(a) 2 Septic tanks of 2600 gallons capacity (Influent line 6 inches) (Effluent line 6 inches)

(b) 2 Dosing tanks with 6 inch (~~single siphon~~) (twin siphon) (~~pumps~~)

(c) 2 Subsurface drainage field: 56 lines at 100 ft. each, equals 5600 total lin. ft

(d) ___Sand filter: (Rotary) (Intermittent) (2-bed) (3-bed) Area _____sq.ft

(e) ___Stablization Pond _____Acres
Name of stream receiving effluent_____

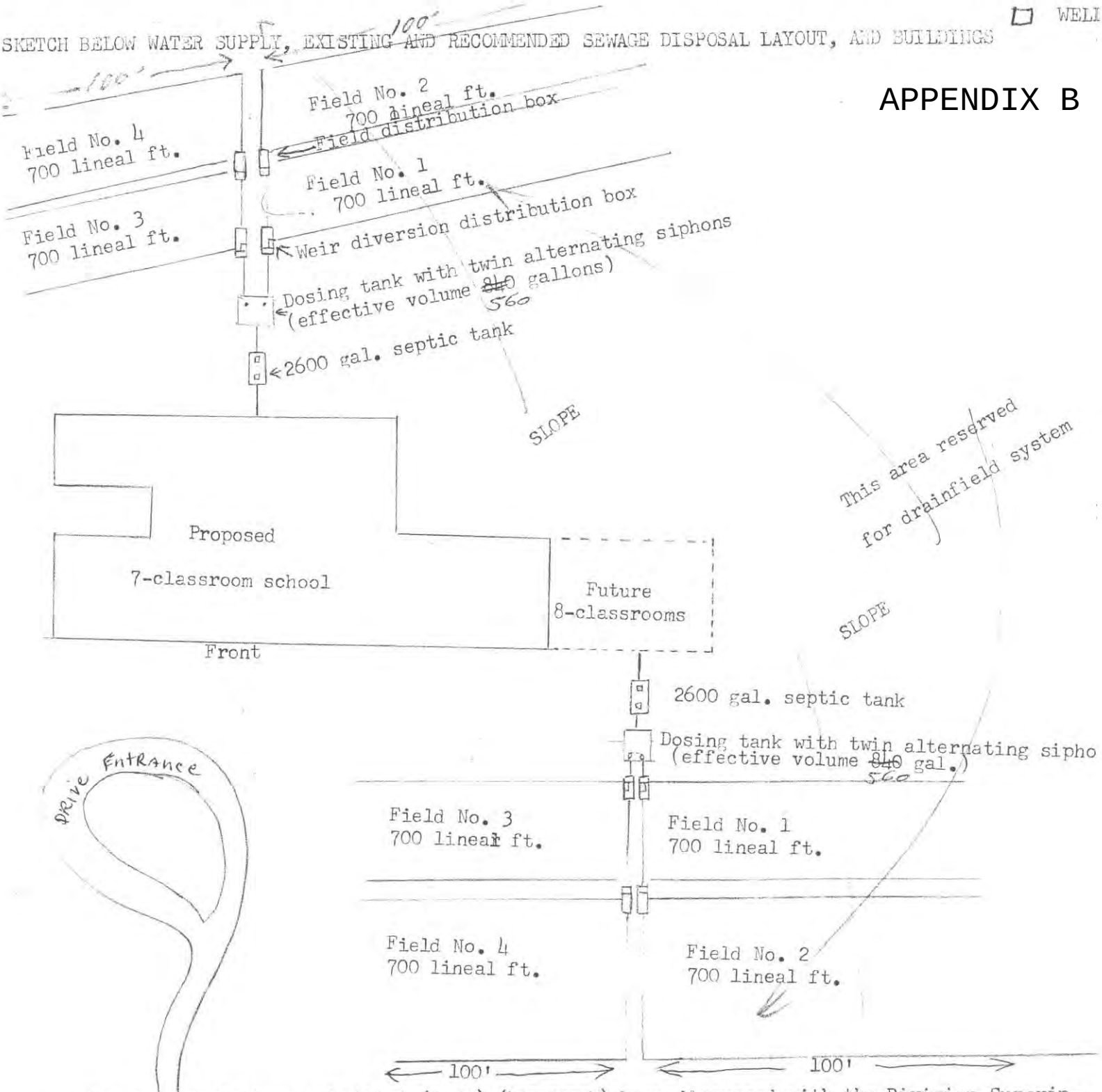
(f) ___Unsuitable for individual sewage disposal system

4. Public sewer available no Street sewer _____". School sewer _____". (size) (size)

☐ WELL

SKETCH BELOW WATER SUPPLY, EXISTING AND RECOMMENDED SEWAGE DISPOSAL LAYOUT, AND BUILDINGS

APPENDIX B



The recommendations submitted (have) (~~have not~~) been discussed with the Division Superintendent of Schools. This report does not contain details of equipment and is to be used as preliminary design data. It is not an approval.

Four sets of working drawings and specifications should be submitted to the DIVISION OF LOCAL HEALTH SERVICES, STATE DEPARTMENT OF HEALTH, RICHMOND VIRGINIA for the final approval of the State Department of Health and of the Water Control Board where applicable.

Local Health Director S. I. Strange State Health Authority _____

Date _____ Title _____ Date _____ Title _____

APPENDIX B

TAX MAP NUMBER 28:30

APPLICATION NUMBER _____ DATE 6-4-84

OWNER WATERFORD ELEM. SCHOOL

☐ SEWAGE DISPOSAL CONSTRUCTION PERMIT

LOC. /

This system is designed for a ____ bedroom house with a maximum use of ____ gallons per day.

Satisfactory bacteriological sample required prior to occupancy or well use. Required source capacity _____ gallons per day.

☐ WATER SUPPLY CONSTRUCTION PERMIT - Drilled Well

LOC. /

___ Class II A Public Non-Community Minimum case and grout 50 feet ☐

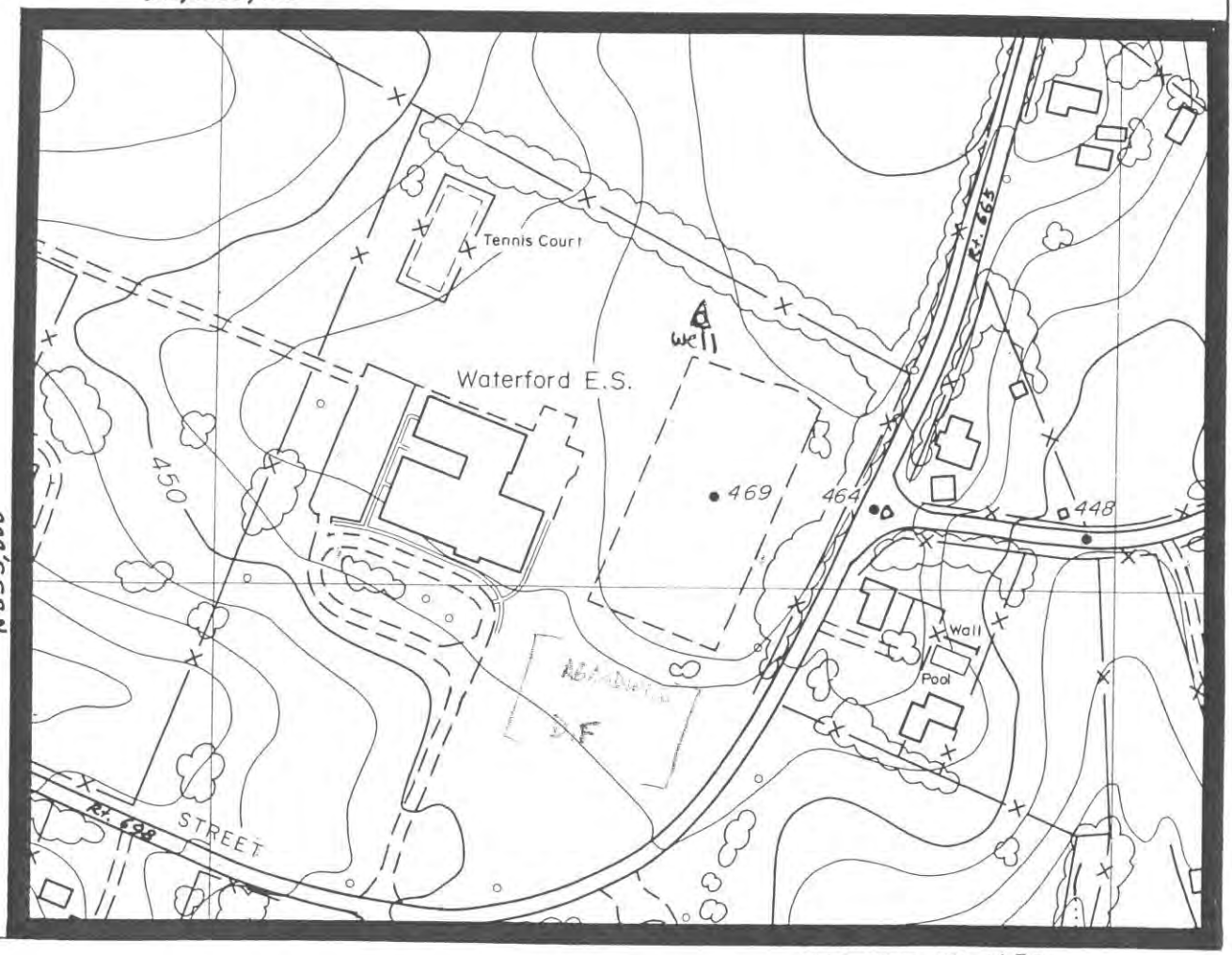
___ Class IIIA Private Minimum case and grout 20 feet, or bedrock + 10 feet, whichever is greater

___ Class IV Other

SCALE 1" = 200' (1: 2,400) PLANIMETRIC MAP 303

MAP SOURCE ☑ Loudoun County Photogrammetric Base Maps
☐ USGS 7-1/2 Minute Quadrangle Sheets, Enlarged

E2,253,000



ORDERED BY MJS

APPENDIX B

Geo TRANS

COMMONWEALTH of VIRGINIA

Environmental Engineering Field Office
400 S. Main St. 2nd Floor
Culpeper, VA 22701

Department of Health
Office of Drinking Water

Phone: (540) 829-7340
Fax: (540) 829-7337
www.vdh.virginia.gov

MAR 10 2006

Subject: Loudoun County
Water - Waterford Elementary School
PWSID# 6107775

Mr. William Kolster
Loudoun County Public Schools
1002 C Sycolin Rd
Leesburg VA, 20175

Dear Mr. Kolster:

We have received a copy of a letter from Robert Cohen of GeoTrans, Inc. outlining a "Project to Evaluate the Sustainability and Potential Impacts of Increased Groundwater Pumping at the Waterford Elementary School". This project is being carried out to determine the impact of a proposed increased enrollment at the school and address the concerns of neighboring Waterford residents whose private wells may be impacted.

We have reviewed our records for this water system, which show that it was permitted for a design capacity of 190 students and staff. We also have no information regarding the well's construction or yield and no information on the well pump capacity. According to the GeoTrans letter, the schools has "a current enrollment of approximately 225 students". Therefore, the school may be exceeding the currently permitted capacity of 190 students and staff.

According to the letter, the school is proposed to expand to 600 students and the proposed protocol includes pumping at up to 6,000 gpd, apparently based on section 12VAC5-590-690 of the Virginia Waterworks Regulations that establishes a design criteria for elementary schools without showers of 10 gpd per person. Please be advised that this design criteria also applies to faculty/staff as well as students. Based on a student to faculty/staff ratio of 10 to 1, we estimate a total of 660 students and faculty/staff at the elementary school and the waterworks must be capable of providing at least 6,600 gpd to the school. Therefore, the testing protocol should be revised to include pumping at least 6,600 gpd (or the maximum daily flow based on the design total students, faculty and staff at 10 gpd per person).

We further comment that the testing protocol does not establish the well yield by means of a 48-hour (or longer) yield and drawdown test. Since GeoTrans has been hired to complete the project identified above, and the school appears to be exceeding the waterworks design capacity, VDH

APPENDIX B

Subject: Loudoun County
Water - Waterford Elementary School
PWSID# 6107775

Office of Drinking Water recommends that Loudoun Public Schools increase the scope of the study to include the following:

1. A well drawdown and yield test of at least 48 hours duration. This test will document the well's yield and drawdown characteristics. Water levels should be monitored in neighboring wells.
2. A video camera inspection of the well to confirm casing depth, well depth, pump setting, and general condition. Currently, there is no well construction information available.

Based on the well yield and well construction information, VDH ODW can revise the operation permit's design basis to a gallons per day figure rather than a population.

Should Loudoun County Public Schools choose to expand the Waterford Elementary School beyond the current facility, the waterworks must also be brought into compliance with the current waterworks construction standards outlined in the *Virginia Waterworks Regulations.* Portions of the existing water system may be reused or revamped, and the items that would need to be addressed include but are not limited to:

1. The existing well casing currently terminates below ground level in a pit. The casing must be extended to at least 12 inches above the ground level in accordance with the *Waterworks Regulations.*
2. The hydropneumatic tank is buried and access to the system controls and soda ash chemical feed system is in a pit that is a confined space. The hydropneumatic tank and chemical feed system must be relocated above-ground.
3. There is currently no information available regarding the existing well's yield and construction details.

If you have any questions or if you need additional information, please contact me.

Sincerely,

Robert D Edelman

Robert D. Edelman, P.E.
District Engineer

cc: Mr. Evan Mohler (Loudoun County Public Schools)
Robert Cohen (GeoTrans, Inc., 56010 Manekin Plaza, Suite 100, Sterling, VA 20166)
Loudoun County Health Department
ODW - Central

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APPENDIX B

COMMONWEALTH of VIRGINIA

Environmental Engineering Field Office
400 S. Main St. 2nd Floor
Culpeper, VA 22701

Department of Health
Office of Drinking Water

Phone: (540) 829-7340
Fax: (540) 829-7337
www.vdh.virginia.gov

APR 12 2006

Subject: Loudoun County
Water - Waterford Elementary School
PWSID# 6107775

Robert M. Cohen
Principal Hydrogeologist
GeoTrans, Inc.
46010 Manekin Plaza, Suite 100
Sterling, VA 20166

Dear Mr. Cohen:

We have received your email asking for our thoughts and concurrence regarding a proposed pumping rate for a yield and drawdown test, needed to establish the yield for the existing well at the Waterford Elementary School.

Normally, the pumping rate for a yield and drawdown test is set based on a number of factors, including, but not limited to:

- The capacity of the pump and plumbing system.
- The expected demand of the waterworks, both in terms of gallons per day and instantaneous demand (gallons per minute).
- Consideration for reducing the amount of storage required by increasing the well pumping rate as much as practicable.
- The observed water levels in the well, usually limiting the pumping rate to avoid dewatering significant water-bearing zones.
- The yield of the well which becomes the limitation on the pumping rate for the well.

According to information you provided, the well is equipped with a Goulds model 18LS10422 submersible well pump. This pump is equipped with a one horsepower motor and has a recommended range of 6 to 28 gpm (TDH from 220 feet down to 190 feet). Based on the limited information available and numerous assumptions, we would expect the pump to deliver approximately 8 to 12 gpm under normal conditions and at the lower end of this range during an extended period of pumping, depending on the well drawdown.

The pumping rate (gpm) and resulting well water levels during normal operations should be observed to understand the current situation. This will help to further define the capacity of the existing pump and plumbing system.

APPENDIX B

Subject: Loudoun County
Water - Waterford Elementary School
PWSID# 6107775

Section 12VAC5-590-690 of the Virginia Waterworks Regulations establishes the design criteria for elementary schools without showers of 10 gpd per person. This design criteria also applies to faculty/staff as well as students. Based on a total of 660 persons at the elementary school and the waterworks must be capable of providing at least 6,600 gpd to the school. Most of this activity occurs over an eight-hour period, giving an average water demand of 13.75 gpm over this period. By increasing the well yield and pump rate to above this figure, significant reductions in the amount of storage needed will be realized.

Assuming that the yield and drawdown test was conducted at a pumping rate of 10 gpm and the drawdown was satisfactory, the yield of the well would be 10 gpm and the pumping rate should be limited to 10 gpm. The waterworks' permit design basis would become:

10 gpm x 1,440 min/day = 14,400 gal/day based both on pump capacity and well yield.

Note that if you chose to conduct the yield and drawdown test at a pumping rate of 6.9 gpm, then the yield of the well would be 6.9 gpm and the pumping rate would need to be limited to 6.9 gpm by means of a flow restricting device. Note that this is far to the left on the pump curve and a different well pump should be selected for this service.

The waterworks' permit design basis would become:

6.9 gpm x 1,440 min/day = 9,936 gpd based both on pump capacity and well yield.

Based on the above, we recommend targeting a higher pumping rate for the test, perhaps in the range of 8 to 15 gpm, considering the current pumping rate, and reducing the rate if too much drawdown is experienced or the pump can't maintain the targeted pumping rate.

If you have any questions or if you need additional information, please contact me.

Sincerely,

Robert D. Edelman

Robert D. Edelman, P.E.
District Engineer

cc: Mr. Evan Mohler (Loudoun County Public Schools)
Loudoun County Health Department
ODW - Central

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APPENDIX C

Abridged version of water-level data acquired in the WES water-supply well between July 2, 2006 and July 10, 2006.

Date and Time	Depth-to-Water (feet)	Minutes Since Pumping Began	Drawdown (feet)
7/2/06 12:00 AM	26.30	-5004	
7/2/06 1:00 AM	26.30	-4944	
7/2/06 2:00 AM	26.30	-4884	
7/2/06 3:00 AM	26.30	-4824	
7/2/06 4:00 AM	26.30	-4764	
7/2/06 5:00 AM	26.33	-4704	
7/2/06 6:00 AM	26.29	-4644	
7/2/06 7:00 AM	26.26	-4584	
7/2/06 8:00 AM	26.29	-4524	
7/2/06 9:00 AM	26.29	-4464	
7/2/06 10:00 AM	26.32	-4404	
7/2/06 11:00 AM	26.32	-4344	
7/2/06 12:00 PM	26.30	-4284	
7/2/06 1:00 PM	26.31	-4224	
7/2/06 2:00 PM	26.33	-4164	
7/2/06 3:00 PM	26.36	-4104	
7/2/06 4:00 PM	26.38	-4044	
7/2/06 5:00 PM	26.34	-3984	
7/2/06 6:00 PM	26.34	-3924	
7/2/06 7:00 PM	26.35	-3864	
7/2/06 8:00 PM	26.32	-3804	
7/2/06 9:00 PM	26.34	-3744	
7/2/06 10:00 PM	26.29	-3684	
7/2/06 11:00 PM	26.32	-3624	
7/3/06 12:00 AM	26.32	-3564	
7/3/06 1:00 AM	26.32	-3504	
7/3/06 2:00 AM	26.33	-3444	
7/3/06 3:00 AM	26.33	-3384	
7/3/06 4:00 AM	26.33	-3324	
7/3/06 5:00 AM	26.32	-3264	
7/3/06 6:00 AM	26.31	-3204	
7/3/06 7:00 AM	26.29	-3144	
7/3/06 8:00 AM	26.29	-3084	
7/3/06 9:00 AM	26.29	-3024	
7/3/06 10:00 AM	26.29	-2964	
7/3/06 11:00 AM	26.31	-2904	
7/3/06 12:00 PM	26.30	-2844	
7/3/06 1:00 PM	26.31	-2784	
7/3/06 2:00 PM	26.32	-2724	
7/3/06 3:00 PM	26.31	-2664	
7/3/06 4:00 PM	26.36	-2604	
7/3/06 5:00 PM	26.36	-2544	
7/3/06 6:00 PM	26.35	-2484	
7/3/06 7:00 PM	26.38	-2424	
7/3/06 8:00 PM	26.35	-2364	
7/3/06 9:00 PM	26.36	-2304	

APPENDIX C

Abridged version of water-level data acquired in the WES water-supply well between July 2, 2006 and July 10, 2006.

Date and Time	Depth-to-Water (feet)	Minutes Since Pumping Began	Drawdown (feet)
7/3/06 10:00 PM	26.34	-2244	
7/3/06 11:00 PM	26.34	-2184	
7/4/06 12:00 AM	26.37	-2124	
7/4/06 1:00 AM	26.35	-2064	
7/4/06 2:00 AM	26.38	-2004	
7/4/06 3:00 AM	26.38	-1944	
7/4/06 4:00 AM	26.37	-1884	
7/4/06 5:00 AM	26.37	-1824	
7/4/06 6:00 AM	26.38	-1764	
7/4/06 7:00 AM	26.38	-1704	
7/4/06 8:00 AM	26.38	-1644	
7/4/06 9:00 AM	26.39	-1584	
7/4/06 10:00 AM	26.39	-1524	
7/4/06 11:00 AM	26.41	-1464	
7/4/06 12:00 PM	26.41	-1404	
7/4/06 1:00 PM	26.43	-1344	
7/4/06 2:00 PM	26.44	-1284	
7/4/06 3:00 PM	26.46	-1224	
7/4/06 4:00 PM	26.45	-1164	
7/4/06 5:00 PM	26.47	-1104	
7/4/06 6:00 PM	26.46	-1044	
7/4/06 7:00 PM	26.48	-984	
7/4/06 8:00 PM	26.47	-924	
7/4/06 9:00 PM	26.47	-864	
7/4/06 10:00 PM	26.46	-804	
7/4/06 11:00 PM	26.46	-744	
7/5/06 12:00 AM	26.46	-684	
7/5/06 1:00 AM	26.48	-624	
7/5/06 2:00 AM	26.46	-564	
7/5/06 3:00 AM	26.46	-504	
7/5/06 4:00 AM	26.47	-444	
7/5/06 5:00 AM	26.50	-384	
7/5/06 6:00 AM	26.48	-324	
7/5/06 7:00 AM	33.70	-264	
7/5/06 8:00 AM	26.57	-204	
7/5/06 9:00 AM	26.56	-144	
7/5/06 10:00 AM	27.00	-84	
7/5/06 11:00 AM	26.70	-24	
7/5/06 12:00 PM	37.84	36	10.81
7/5/06 1:00 PM	31.42	96	4.38
7/5/06 2:00 PM	29.77	156	2.74
7/5/06 3:00 PM	40.46	216	13.43
7/5/06 4:00 PM	40.84	276	13.81
7/5/06 5:00 PM	30.95	336	3.92
7/5/06 6:00 PM	40.20	396	13.16
7/5/06 7:00 PM	40.96	456	13.93

APPENDIX C

Abridged version of water-level data acquired in the WES water-supply well between July 2, 2006 and July 10, 2006.

Date and Time	Depth-to-Water (feet)	Minutes Since Pumping Began	Drawdown (feet)
7/5/06 8:00 PM	39.72	516	12.68
7/5/06 9:00 PM	40.33	576	13.29
7/5/06 10:00 PM	41.24	636	14.21
7/5/06 11:00 PM	36.90	696	9.86
7/6/06 12:00 AM	41.06	756	14.02
7/6/06 1:00 AM	41.77	816	14.73
7/6/06 2:00 AM	41.01	876	13.97
7/6/06 3:00 AM	32.07	936	5.04
7/6/06 4:00 AM	41.73	996	14.70
7/6/06 5:00 AM	32.90	1056	5.87
7/6/06 6:00 AM	42.08	1116	15.05
7/6/06 7:00 AM	34.88	1176	7.84
7/6/06 8:00 AM	42.25	1236	15.21
7/6/06 9:00 AM	41.40	1296	14.36
7/6/06 10:00 AM	32.35	1356	5.32
7/6/06 11:00 AM	42.38	1416	15.35
7/6/06 12:00 PM	41.61	1476	14.58
7/6/06 1:00 PM	42.31	1536	15.27
7/6/06 2:00 PM	41.96	1596	14.92
7/6/06 3:00 PM	34.66	1656	7.62
7/6/06 4:00 PM	43.07	1716	16.04
7/6/06 5:00 PM	42.20	1776	15.17
7/6/06 6:00 PM	42.40	1836	15.37
7/6/06 7:00 PM	42.49	1896	15.46
7/6/06 8:00 PM	33.25	1956	6.21
7/6/06 9:00 PM	42.70	2016	15.66
7/6/06 10:00 PM	33.30	2076	6.26
7/6/06 11:00 PM	42.94	2136	15.90
7/7/06 12:00 AM	40.52	2196	13.49
7/7/06 1:00 AM	43.44	2256	16.40
7/7/06 2:00 AM	42.50	2316	15.46
7/7/06 3:00 AM	40.61	2376	13.57
7/7/06 4:00 AM	43.02	2436	15.98
7/7/06 5:00 AM	34.04	2496	7.01
7/7/06 6:00 AM	43.17	2556	16.14
7/7/06 7:00 AM	42.54	2616	15.50
7/7/06 8:00 AM	43.65	2676	16.62
7/7/06 9:00 AM	42.81	2736	15.77
7/7/06 10:00 AM	42.66	2796	15.63
7/7/06 11:00 AM	42.72	2856	15.68
7/7/06 12:00 PM	32.26	2916	5.23
7/7/06 1:00 PM	31.18	2976	4.14
7/7/06 2:00 PM	30.64	3036	3.61
7/7/06 3:00 PM	30.30	3096	3.27
7/7/06 4:00 PM	30.00	3156	2.96
7/7/06 5:00 PM	29.78	3216	2.74

APPENDIX C

Abridged version of water-level data acquired in the WES water-supply well between July 2, 2006 and July 10, 2006.

Date and Time	Depth-to-Water (feet)	Minutes Since Pumping Began	Drawdown (feet)
7/7/06 6:00 PM	29.56	3276	2.53
7/7/06 7:00 PM	29.42	3336	2.39
7/7/06 8:00 PM	29.26	3396	2.23
7/7/06 9:00 PM	29.15	3456	2.11
7/7/06 10:00 PM	29.02	3516	1.98
7/7/06 11:00 PM	28.90	3576	1.86
7/8/06 12:00 AM	28.80	3636	1.77
7/8/06 1:00 AM	28.72	3696	1.69
7/8/06 2:00 AM	28.65	3756	1.61
7/8/06 3:00 AM	28.59	3816	1.55
7/8/06 4:00 AM	28.50	3876	1.47
7/8/06 5:00 AM	28.49	3936	1.45
7/8/06 6:00 AM	28.42	3996	1.38
7/8/06 7:00 AM	28.35	4056	1.32
7/8/06 8:00 AM	28.29	4116	1.26
7/8/06 9:00 AM	28.24	4176	1.20
7/8/06 10:00 AM	28.20	4236	1.17
7/8/06 11:00 AM	28.16	4296	1.13
7/8/06 12:00 PM	28.13	4356	1.09
7/8/06 1:00 PM	28.10	4416	1.06
7/8/06 2:00 PM	28.08	4476	1.05
7/8/06 3:00 PM	28.08	4536	1.04
7/8/06 4:00 PM	28.05	4596	1.02
7/8/06 5:00 PM	28.03	4656	1.00
7/8/06 6:00 PM	28.02	4716	0.99
7/8/06 7:00 PM	28.00	4776	0.96
7/8/06 8:00 PM	27.97	4836	0.93
7/8/06 9:00 PM	27.95	4896	0.92
7/8/06 10:00 PM	27.92	4956	0.88
7/8/06 11:00 PM	27.87	5016	0.83
7/9/06 12:00 AM	27.88	5076	0.84
7/9/06 1:00 AM	27.86	5136	0.83
7/9/06 2:00 AM	27.84	5196	0.81
7/9/06 3:00 AM	27.83	5256	0.79
7/9/06 4:00 AM	27.82	5316	0.79
7/9/06 5:00 AM	27.81	5376	0.77
7/9/06 6:00 AM	27.78	5436	0.75
7/9/06 7:00 AM	27.75	5496	0.72
7/9/06 8:00 AM	27.73	5556	0.70
7/9/06 9:00 AM	27.72	5616	0.68
7/9/06 10:00 AM	27.70	5676	0.67
7/9/06 11:00 AM	27.67	5736	0.64
7/9/06 12:00 PM	27.69	5796	0.66
7/9/06 1:00 PM	27.69	5856	0.65
7/9/06 2:00 PM	27.68	5916	0.65
7/9/06 3:00 PM	27.68	5976	0.65

APPENDIX C

Abridged version of water-level data acquired in the WES water-supply well between July 2, 2006 and July 10, 2006.

Date and Time	Depth-to-Water (feet)	Minutes Since Pumping Began	Drawdown (feet)
7/9/06 4:00 PM	27.70	6036	0.66
7/9/06 5:00 PM	27.70	6096	0.67
7/9/06 6:00 PM	27.67	6156	0.64
7/9/06 7:00 PM	27.67	6216	0.64
7/9/06 8:00 PM	27.66	6276	0.63
7/9/06 9:00 PM	27.64	6336	0.61
7/9/06 10:00 PM	27.65	6396	0.61
7/9/06 11:00 PM	27.62	6456	0.58
7/10/06 12:00 AM	27.60	6516	0.57
7/10/06 1:00 AM	27.62	6576	0.58
7/10/06 2:00 AM	27.59	6636	0.56
7/10/06 3:00 AM	27.58	6696	0.54
7/10/06 4:00 AM	27.60	6756	0.56
7/10/06 5:00 AM	27.56	6816	0.52
7/10/06 6:00 AM	27.54	6876	0.50
7/10/06 7:00 AM	27.50	6936	0.47
7/10/06 8:00 AM	27.52	6996	0.49
7/10/06 9:00 AM	27.49	7056	0.46
7/10/06 10:00 AM	27.48	7116	0.44
7/10/06 11:00 AM	27.49	7176	0.46
7/10/06 12:00 PM	27.46	7236	0.43
7/10/06 1:00 PM	27.46	7296	0.43
7/10/06 2:00 PM	33.24	7356	6.21
7/10/06 3:00 PM	27.59	7416	0.56
7/10/06 4:00 PM	27.51	7476	0.47
7/10/06 5:00 PM	27.47	7536	0.44
7/10/06 6:00 PM	27.49	7596	0.45
7/10/06 7:00 PM	27.46	7656	0.43
7/10/06 8:00 PM	27.46	7716	0.43
7/10/06 9:00 PM	27.42	7776	0.38
7/10/06 10:00 PM	27.41	7836	0.37
7/10/06 11:00 PM	27.39	7896	0.36

APPENDIX C

GeoTrans Constant Pumping Rate Aquifer Test Data Sheet	Site and Pump Well ID: WES Supply Well		
Readings Left on DataLogger: NA	Pump ID (letter, GPM, HP, depth): 18 GPM Goulds		
Levelogger ID: In-Situ	Operator Name:		Test Date: Starts July 5
Initial DTW (feet below TOC): 24.6	Initial DTW Date & Time: 7-5-06 8:15 AM		W.L. Probe Used: SONIC

(1) Target flow rate through flowmeter in WES is 12.0 GPM.
(2) Measure and record reading on flowmeter in the school every two hours. Record the date/time when the flowmeter reading was taken. Adjust valve and flow rate if the measured flow drops below 11 gpm or rises above 13 gpm. Enter a comment on the sheet when/if the flow rate adjusted.
(3) GeoTrans to measure depth-to-water once per hour until midnight, and then at 3:00am and 6:00am in the early morning.
(4) Contact Bob Cohen (office 703-885-5440, [redacted]) if you have any problems or questions.

Date	Time	Depth-To-Water (Sonic Probe) in WES Well (feet)	Reading in Well Vault (Gallons)	Flowmeter Reading in School (Gallons)	Comment
			~~2778~~	~~62493~~	
7-5-06	11:16 AM	26.8	2778173	62493	W/ recovering
START	11:22 AM		"	"	START ~~12.5~~ 12.0
	~~1:00~~ 1:00			63747	
	~~3:02~~			~~63,747~~	
	3:02			65,333	~12.7 gpm
7-5-06	3:34	38.6	2781622		13.4 - reduced Q
	3:51			65,965	Finished Q adjusting
	4:34			66,487	~11.3 gpm
	5:34 PM			~~66,~~ 67,171	~11.7 gpm
	5:44	29.1	2783134		
	6:34			67,912	~12.3 gpm
	7:34			68,505	~11.8 gpm
	7:44	39.2	2784678		
	8:34			69,264	~11.2 gpm
	9:34			70,013	~12.1 gpm
	9:44	30.0	2786107	~~70,664~~	
	10:34			70,664	~11.7 gpm
	11:34			71,373	~11.5 gpm
	11:54 PM	31.6	2787439		
7-6-06	02:34 AM			73,469	~12.3 gpm
	2:44 AM	39.4	2789792		
	5:34 AM			75,641	~12.7 gpm
	5:44 AM	32.6	2791916		

APPENDIX C

GeoTrans Constant Pumping Rate Aquifer Test Data Sheet	Site and Pump Well ID: WES Supply Well		
Readings Left on DataLogger: NA	Pump ID (letter, GPM, HP, depth): 18 GPM Goulds		
Levelogger ID: In-Situ	Operator Name:		Test Date: Starts July 5
Initial DTW (feet below TOC):	Initial DTW Date & Time:		W.L. Probe Used: SONIC

(1) Target flow rate through flowmeter in WES is 12.0 GPM.
(2) Measure and record reading on flowmeter in the school every two hours. Record the date/time when the flowmeter reading was taken. Adjust valve and flow rate if the measured flow drops below 11 gpm or rises above 13 gpm. Enter a comment on the sheet when/if the flow rate adjusted.
(3) GeoTrans to measure depth-to-water once per hour until midnight, and then at 3:00am and 6:00am in the early morning.
(4) Contact Bob Cohen (office 703-885-5440, [redacted] if you have any problems or questions.

Date	Time	Depth-To-Water (Sonic Probe) in WES Well (feet)	Reading in Well Vault (Gallons)	Flowmeter Reading in School (Gallons)	Comment
7-6-06	7:30 AM			76,928	12.1
	9:30			78,335	12
	11:30			79,765	11.5
	1:30 PM			81,165	12
	3:20 PM			82,480	11.5
7-6	3:33 PM	41.7	2799123		DO phase
7-6	3:54 PM	31.6			recovery phase
	8:33 AM	RATE CALCULATION			~~19987 ÷ 1691 = 11.8~~
					20950 ÷ 1971 = 11.7
					~~Closet~~ 19987 ÷ 1678 = 11.9
7-6	4:32 PM		0	83,332	12.3
	4:36 PM	32.0	2799859		
	5:54 PM			85,354	11.3
	6:06 PM	41.2	2800905		
	7:33 PM			85,453	11.4
	7:38 PM	41.4	2802023		
	8:58 PM			86,449	11.5
	9:02 PM	42.0	2803032		
	10:39 PM			87,634	12.5
		32.6	2804244		
	11:59 PM			88,583	12.4
7-7-06	12:05 AM	40.7	2805273		
	3:01 AM			90,737	11.0
	3:11 AM	42.0	2807362		

APPENDIX C

4/8 - 7/12

GeoTrans Constant Pumping Rate Aquifer Test Data Sheet	Site and Pump Well ID: WES Supply Well		
Readings Left on DataLogger: NA	Pump ID (letter, GPM, HP, depth): 18 GPM Goulds		
Levelogger ID: In-Situ	Operator Name:		Test Date: Starts July 5
Initial DTW (feet below TOC):	Initial DTW Date & Time:		W.L. Probe Used: SONIC

(1) Target flow rate through flowmeter in WES is 12.0 GPM.
(2) Measure and record reading on flowmeter in the school every two hours. Record the date/time when the flowmeter reading was taken. Adjust valve and flow rate if the measured flow drops below 11 gpm or rises above 13 gpm. Enter a comment on the sheet when/if the flow rate adjusted.
(3) GeoTrans to measure depth-to-water once per hour until midnight, and then at 3:00am and 6:00am in the early morning.
(4) Contact Bob Cohen (office 703-885-5440, [redacted]) if you have any problems or questions.

Date	Time	Depth-To-Water (Sonic Probe) in WES Well (feet)	Reading in Well Vault (Gallons)	Flowmeter Reading in School (Gallons)	Comment
7-7-06	6:14			93,483	11.4
	6:18	41.0	2809726		
	7:04			93,658	~ 12.0 gpm
	8:00			94,308	~ 11.5 gpm
	8:10	~~42~~ 42.0	2810513	~~94,997~~	
	9:00			94,997	~ 12.4 gpm
	10:00	~~41.2~~		95,708	~ 12.4 gpm
	10:10	41.2	2812343		
	11:00			96,422	~ 11.1 gpm
	11:22		2813274	96,883	~ 12.3 gpm
	11:26	34.0			STOPPED TEST
	11:36	32.1			
	11:46	31.3			
	11:54	30.9			1
	12:06	30.9			
	12:16	30.6			
	12:26	30.2			
			12.19	11.95 AVG	

Including school

APPENDIX D

LCSA
LOUDOUN COUNTY SANITATION AUTHORITY
880 Harrison Street, SE • P.O. Box 4000 • Leesburg, Virginia 20177-1403 • www.lcsa.org

May 8, 2006

Mr. Robert Cohen, P.G.
Principal Hydrogeologist
GeoTrans, Inc.
46060 Manekin Plaza, Suite 100
Sterling, VA 20166

Re: Waterford Information

Dear Bob:

Per your request, please find attached the quarterly meter readings for residents of Waterford who were connected to LCSA's WWTP in the early 1980's. Please note that LCSA has a low level of confidence in the accuracy of the data presented herewith. The water meters were installed on the customers' well water lines and were regularly getting clogged and not reading accurately. LCSA eventually abandoned trying to meter the water.

Also attached to this letter is the Waterford Service area as defined by Loudoun County. Many of the lots within the service area are connected to the WWTP. The following table presents the number of connections to LCSA's WWTP:

Date	Connections
12/31/2000	95
12/31/2001	95
12/31/2002	95
12/31/2003	96
12/31/2004	99
12/31/2005	99

If you have any other questions or need additional assistance, please do not hesitate to contact me.

Sincerely,

Todd A. Danielson, P.E., BCEE
Manager of Community Systems

Attachments

L:\Systems\Waterford\060806cmtTrans.doc

Dale C. Hammes, P.E.
General Manager/Treasurer

Richard C. Thoesen, P.E.
Deputy General Manager

Administration 703-771-1095 • Metro 703-478-8016 • Fax 703-771-9223 • Customer Service 703-771-1092 • Metro 703-478-8677 • Fax 703-771-4141

APPENDIX D

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Henry A. Kitselman
Main Street
Waterford, Virginia

VILLAGE OF WATERFORD

Sewer only

SECT. WF LOT 1

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
3/4"	Badger	14336841			Residential
	ROM	2472119			ACCT. No. WF-1
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 8 '83	0 -		
NOV 9 '82	0 -		
AUG 10 '82	0 -		
MAY 11 '82	0 -		
FEB 9 '82	0 -		
NOV 10 '81	0 -		
AUG 11 '81	0	8+0 = 8	
JUL 1 '81	130	8+	
MAY 12 '81	122	13 -	
FEB 10 '81	109 -	9 -	
NOV 4 '80	100 -	14 -	
AUG 5 '80	86 -	13 -	
MAY 6 '80	73 -	12 -	
FEB 5 '80	61 -	9 -	
OCT 30 '79	52 -	15 -	
JUL 31 '79	37	16 -	
MAY 1 '79	27	11 -	
FEB 6 '79	10 -	7 -	
NOV 1 '78	3 -	3 -	
1-25-79	1 -		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Marie D. Hilton
Bond Street
Waterford, Virginia

VILLAGE OF WATERFORD

Sewer Only

SECT. WF LOT 2

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8 x 3/4"	Badger	14397194			Residential
	ROM	2472133			ACCT. No. WF-2
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
AUG 9 '83	0 -		
MAY 10 '83	0 -		
FEB 8 '83	0 -		
NOV 9 '82	0 -		
AUG 10 '82	0 -		
MAY 11 '82	0 -		
FEB 9 '82	0		
NOV 10 '81	0 -		
AUG 11 '81	0 -	2+0 = 2	
JUL 1 '81	36	2+	
MAY 12 '81	34	3 -	
FEB 10 '81	31 -	3 -	
NOV 4 '80	28 -	4 -	
AUG 5 '80	24 -	4 -	
MAY 6 '80	20 -	4 -	
FEB 5 '80	16 -	4 -	
OCT 30 '79	12 -	4	
JUL 31 '79	8	4 -	
MAY 1 '79	4 -	4 -	
1-25-79	0 -		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

4

Eleanor James
Bond Street
Waterford, Virginia

WATERFORD

SECT. LOT 4 Sewer only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
x 3/4"	Badger	14397204			Residential
	ROM	1806303			ACCT. No. WF-4
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
V 8 '83	0-		
9 '83	0-		
Y 10 '83	0-		
B 8 '83	0-		
OV 9 '82	0-		
G 10 '82	0-		
Y 11 '82	0-		
EB 9 '82	0-		
V 10 '81	0-		
G 11 '81	0	2+0=2	
JUL 1 '81	36	2+	
MAY 12 '81	34	4-	
EB 10 '81	30-	5-	
OV 4 '80	25-	5-	
UG 5 '80	20	4-	
AY 6 '80	16-	4-	
EB 5 '80	12-	6-	
CT 30 '79	6-	5-	
UL 31 '79	1-	0-	
29-79	1-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

8

Mary E. Wallace
Main Street
Waterford, Virginia

Village of Waterford

SECT. WF LOT 8 sewer only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4"	Badger	14236862			Residential
	ROM	2472142			ACCT. No. WF-8
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0-	2+0=2	
JUL 1 '81	34	2+	
MAY 12 '81	32	3-	
FEB 10 '81	29-	3-	
NOV 4 '80	26-	3-	
AUG 5 '80	23	4-	
MAY 6 '80	19-	2-	
FEB 5 '80	17-	3-	
OCT 30 '79	14-	3-	
JUL 31 '79	11	3-	
MAY 1 '79	8-	3-	
FEB 6 '79	5-	4-	
NOV 1 '78	1-	1-	
10-4-78	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Joseph W. Keating , Jr. 882-3217 # 9
Main Street 301-443-8122 HIS WK
Waterford, VA.

Village of Waterford

Sewer Only

SECT. WF LOT 9

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8 X 3/4	Badger	14397184			Residential
	ROM	1615925			ACCT. No. WF-9
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0-	0+0=0	
JUL 1 '81	9	0+	
MAY 12 '81	9	0-	
FEB 10 '81	9-	0-	
NOV 4 '80	9-	0-	
AUG 5 '80	9-	0-	CLEANED
MAY 6 '80	9-	0-	CLEANED NEW CHAMBER
FEB 5 '80	9-	0-	CLEANED METER
OCT 30 '79	9-	0-	CLEANED METER
JUL 31 '79	9-	9-	
4-23-79	0-		

first no strainer *

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

James Van Riper 882-3533 # 11
~~Salvatore N. Amani~~ 857-7727 Her wk
Main Street
Waterford, VA.

Village of Waterford

Sewer Only

SECT. WF LOT 11

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8 X 3/4	Badger	14397189			Residential
	R.O.M.	1806276			ACCT. No. WF-11
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0-	0+0=0	
JUL 1 '81	47	0+	
MAY 12 '81	47	1-	
FEB 10 '81	46-	0-	Cleaned
NOV 4 '80	46-	0-	Cleaned-
AUG 5 '80	46-	0-	empty >
5-06-80	46-	Left ON FOR NEW CUSTOMER	
5-6-80	46-	0-	DISCONTINUE
MAY 6 '80	46	9-	
FEB 5 '80	37	2-	CLEANED METE
OCT 30 '79	35-	9-	CLEANED METE
JUL 31 '79	26-	26-	
4-23-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

BILL FROM THIS METER SHEET

Anne C. Sweney 882-3772 — 13
Main Street
Waterford, Virginia

Village of Waterford

SECT. WF LOT 13 — Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
3/4"	Badger	1433684			Residential
	ROM	2472136			ACCT. No. WF-13
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	0+4=4	
-1-81	42	4+	
	[redacted]		
MAY 12 '81	38	2-	
FEB 10 '81	36 [redacted]	5-	
NOV 4 '80	31	7-	
AUG 5 '80	24-	6-	
[illegible]	[illegible]	3+	
MAY 6 '80	18-	5-	
FEB 5 '80	13-	0-	
FEB 5 '80	[illegible]	9-	
OCT 30 '79	13-	6-	
JUL 31 '79	7-	7-	
-14-79	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Total consumption from meter 14336862 (WF-8) to be deducted from meter 1433684 (WF-13) and remaining consumption to be billed to meter 1433684 (WF-13)

Anne Carter Sweney — 13
Main Street
Waterford, Va.

Village of Waterford

SECT. WF LOT 13 — Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4"	Badger	1433684			Residential
	ROM	2472136			ACCT. No. WF-13
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 8 '83			
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0-		
NOV 10 '81	0-		
AUG 11 '81	0-	6+0=6	
JUL 1 '81	60	6+	
MAY 12 '81	[illegible]	5-	
FEB 10 '81	57-	8-	
NOV 4 '80	49-	10-	
AUG 5 '80	39	10-	
MAY 6 '80	24-	7-	
FEB 5 '80	22-	3-	CLEANED METE
OCT 30 '79	19-	9-	
JUL 31 '79	10-	10-	
5-14-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

14

Wilfred Gleadall
Main Street
Waterford, VA. 22190

Village of Waterford

SECT. WF LOT 14 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8"	Badger	14336868			Residential
	ROM	2472125			ACCT. No. WF-14
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
NOV 8 '83	0-		
UG 9 '83	0-		
V 10 '83	0-		
EB 8 '83	0-		
OV 9 '82	0-		
UG 10 '82	0-		
AY 11 '82	0-		
B 9 '82	0		
OV 10 '81	0-		
UG 11 '81	0-	6+0=6	
UL 1 '81	153	6+	
AY 12 '81	147	18-	
EB 10 '81	129-	27-	
OV 4 '80	102-	15-	
UG 5 '80	87	16-	
Y 6 '80	71-	10-	
EB 5 '80	61-	19-	
T 30 '79	42-	17-	
UL 31 '79	25-	25	5 mo.
-8-79	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

15

J. Terence McCracken
Main Street
Waterford, Virginia

VILLAGE OF WATERFORD sewer only

SECT. WF LOT 15

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8 x 3/4	BadgeR	13500971			Residential
	ROM	1623118			ACCT. No. WF-15
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0		
AUG 11 '81	0	4+0=4	
JUL 1 '81	61	4+	
MAY 12 '81	57	3-	
FEB 10 '81	54-	7-	
NOV 4 '80	47-	5-	
AUG 5 '80	42-	7-	
MAY 6 '80	35	3-	
FEB 5 '80	32-	7-	
OCT 30 '79	25-	5-	
JUL 31 '79	20-	7-	
MAY 1 '79	13-	3-	
FEB 6 '79	10-	6-	
NOV 1 '78	4-	4-	
9-1-78	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Anne C. Sweney 882-3772 — 18
~~Jerry Thompson~~
Main Street
Waterford, Virginia

VILLAGE OF WATERFORD

Sewer only

SECT. WF LOT 18

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
3/4"	Badger	1433684O			Residential
	ROM	2472120			ACCT. No. WF-18
					SUFFIX No. 39

DATE	READING	CONSUMPTION	REMARKS
NOV 9 '82	8-		
AUG 10 '82	8-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0-	0+0=0	
JUL 1 '81	15	0+	
MAY 12 '81	15	0-	
FEB 10 '81	15-	0-	Empty!
NOV 4 '80	15-	0-	Empty!
AUG 5 '80	15	0-	Empty
MAY 6 '80	15	0-	Empty
FEB 5 '80	15	1-	
OCT 30 '79	14	0-	
AUG 31 '79	14	0-	
8-7-79	14-	Left on for new	Customer
7-7-79	13,900	6	DISCONTINUED
JUN 6 '79	8-	8-	
MAY '78	8-		
1-1-78	8-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Ray A. Downs
~~Jerry Fow~~
Main Street
Waterford, VA.

Village of Waterford

SECT. WF LOT 21 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8"	Badger	1448090L			Residential
	ROM	1623117			ACCT. No. WF-21
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
MAY 8 '84	0-		
8-8-83	0-	Reinstate	
7-15-83	0-		Discontinue
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0-	5+0=5	
JUL 1 '81	5-	5+	
MAY 12 '81	13-	8-	
FEB 10 '81	69-	13-	
NOV 4 '80	56-	9-	
AUG 5 '80	47	12-	
MAY 6 '80	35-	12-	
FEB 5 '80	23-	14-	
OCT 30 '79	9-	9-	
8-28-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Patrick Acheson
Main Street
Waterford, VA.

Village of Waterford

Sewer Only

SECT. W-F LOT 24

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
8x3/4	Badger	14480897			Residential
	R.O.M.	2644899			ACCT. No. WF-24
					SUFFIX No. [redacted] 1

DATE	READING	CONSUMPTION	REMARKS
AY 8 '84	0-		
EB [illegible] '84	0-		
OV 8 '83	0-		
UG 9 '83	0-		
AY 10 '83	0-		
EB 8 '83	0-		
OV 9 '82	0-		
UG 10 '82	0-		
AY 11 '82	0-		
EB 9 '82	0		
OV 10 '81	0-		
UG 11 '81	0-	5+0=5	
UL 1 '81	146	5+	
AY 12 '81	141	7-	
EB 10 '81	134-	32-	Adjusted
OV 4 '80	102-	36-	CK-LK [illegible]
UG 5 '80	96-	25-	
AY 6 '80	71-	19-	
EB 5 '80	22-	22-	
-25-79	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Alice Rigdon
~~Michael Lowery~~
~~Wendy Young~~
~~Eleanor Chamberlin~~ 882-3603
Main Street
Waterford, Va.

Village of Waterford

Sewer Only

SECT. WF LOT 25

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14480894			Residential
	ROM	0523096			ACCT. No. WF-25
					SUFFIX No. 17

DATE	READING	CONSUMPTION	REMARKS
NOV 9 '82	0-		
AUG 10 '82	0-		
5-17-82	0-	Left on for new customer	
5-17-82	0-	0-	Discontinue
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
9-29-81	0-	Left on for new customer	
9-29-81	0-	0-	Discontinued
AUG 11 '81	0-	0+0=0	
JUL 1 '81	18	0+	
MAY 12 '81	18	7-	
FEB 10 '81	11-	10-	
11-4-80	1-	Left on for new customer	
NOV 4 '80	1-	0-	Discontinued
AUG 5 '80	1-	0-	
MAY 6 '80	1-	0-	empty
FEB 5 '80	1-	0-	EMPTY
OCT 30 '79	1-	1-	
9-17-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

John T. Rollison NO PHONE
Main Street
Waterford, Va.

Village of Waterford Sewer Only

SECT. W-F LOT 27

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
x3/4	Badger	14480899			Residential
	ROM	2644894			Acct. No. WF-27
					Suffix No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
8 '84	0-		
7 '84	0-		
8 '83	0-		
9 '83	0-		
10 '83	0-		
B 8 '83	0-		
V 9 '82	0-		
G 10 '82	0-		
AY 11 '82	0-		
B 9 '82	0		
10 '81	0-		
11 '81	0	0+0=0	
L 1 '81	10	0+	
12 '81	10	0-	
10 '81	10-	1-	
4 '80	9-	2-	
5 '80	7-	2-	
6 '80	5-	3-	
5 '80	2-	2-	CLEANED METER
27-79	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Charles Anderson
Main Street
Waterford, VA.

Village of Waterford

SECT. WF LOT 28 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4"	Badger	14480903			Residential
	ROM	2472130			Acct. No. WF-28
					Suffix No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	5+0=5	
JUL 1 '81	85	5+	
MAY 12 '81	80	10-	
FEB 10 '81	70-	12-	
NOV 4 '80	58-	8-	
AUG 5 '80	50	15-	
MAY 6 '80	35-	14-	
FEB 5 '80	21-	15-	
OCT 30 '79	6-	6-	
9-12-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Douglass Lea
Main Street
Waterford, Virginia

Village of Waterford

SECT. WF LOT 29 SEWER ONLY

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8"	Badger	14480895			Residential
	ROM	2644890			ACCT. No. WF-29
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
AUG 6 '85	0		
MAY 9 '85	0-		
FEB 5 '85	0-		
NOV 6 '84	0-		
AUG 7 '84	0-		
MAY 8 '84	0-		
FEB [illegible] '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	7+0=7	
JUL 1 '81	45	7+	
MAY 12 '81	38	38-	14 mo.
[illegible]-80	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

L. Sullivan
Main Street
Waterford, Va.

Village of Waterford

382-3489

Sewer Only

SECT. WF LOT 31

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14480907			Residential
	ROM	2472131			ACCT. No. WF-31
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	8+0=8	
JUL 1 '81	54	8+	
MAY 12 '81	46	14-	
FEB 10 '81	32-	16-	
NOV 4 '80	16-	13-	
AUG 5 '80	3-	0-	PLUMBING CORREC
MAY 8 '80	3-	1-	
FEB 5 '80	2-	1-	
OCT 30 '79	1-	1-	
8-3-79	0-		

8/19/80 Has Strainer

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Ernest C. Long
~~Paul Rose~~
Main Street
Waterford, VA.

882-3473

Village of Waterford

Sewer Only

SECT. WF LOT 37

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
3x3/4	Badger	14336867			Residential
	ROM	2523104			Acct. No. WF-37
					Suffix No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
9 '83	0-		
AY 10 '83	0-		
EB 8 '83	0-		
NOV 9 '82	0-		
UG 10 '82	0-		
AY 11 '82	0-		
-1-82		Left on for new customer	
-1-82	0-		Discontinued
EB 9 '82	0		
V 10 '81	0-		
UG 11 '81	0	7+0=7	
L 1 '81	75	7+	
AY 12 '81	68	12-	
EB 10 '81	56-	14-	
V 4 '80	42	12-	
UG 5 '80	30-	14-	CLEANED REPLACED CHAMB
AY 6 '80	26-	13-	
5 '80	13	13-	
T 30 '79	0-	0-	EMPTY
28-79	0-		

1/9/80 FILTER SYSTEM

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

A. Russell Versaci
~~H. Nichols Clark~~

~~W. Bowman Cutter, III.~~
~~Arthur C. Hawes~~
Second Street
Waterford, VA.

Village of Waterford

Sewer Only

SECT. W-F LOT 51

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14480915			Residential
	R.O.M.	2523095			Acct. No. W-F-51
					Suffix No. [redacted] 1

DATE	READING	CONSUMPTION	REMARKS
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
9-29-82	0-	Reinstated for new customer	
8-17-82	0-		Discontinue
MAY 11 '82	0-		
FEB 9 '82	0		
11-10-81	0	Left on for new customer	
NOV 10 '81	0-		Discontinue
8-11-81	0	left on for new customer	
AUG 11 '81	0	0+0=0	Discontinue
JUL 1 '81	11	0+	
MAY 12 '81	11	1-	
FEB 10 '81	10-	1-	
NOV 4 '80	9-	2-	
AUG 5 '80	7-	2-	
MAY 6 '80	5-	5-	
1-31-80	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

55

Brent L. Chambers
Second Street
Waterford, Virginia

VILLAGE OF WATERFORD sewer only

ECT. WF LOT 55

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
x3/4	Badger	14336843			Residential
	ROM	2472121			ACCT. No. WF-55
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
EB 8 '83	0-		
V 9 '82	0-		
G 10 '82	0-		
Y 11 '82	0-		
EB 9 '82	0		
V 10 '81	0-		
UG 11 '81	0	6+0=6	
UL 1 '81	109	6+	
MAY 12 '81	103	9-	
B 10 '81	94-	10-	
OV 4 '80	84-	10-	
UG 5 '80	74-	13-	
AY 6 '80	61-	5-	
EB 5 '80	56	13-	
CT 30 '79	43-	11-	
UL 31 '79	32-	12-	
AY 1 '79	20	7-	
EB 6 '79	13-	8-	
V 1 '78	5-	5-	
14-78	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

57

Benjamin Morgan
Second Street
Waterford, Virginia

Village of Waterford sewer only

SECT. WF LOT 57

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8 x 3/4	Badger	13700591			Residential
	ROM	16159936			ACCT. No. WF-57
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	4+0=4	
JUL 1 '81	47	4+	
MAY 12 '81	43	3-	
FEB 10 '81	40-	4-	
NOV 4 '80	36-	4-	
AUG 5 '80	32-	6-	
MAY 6 '80	26	4-	
FEB 5 '80	22-	4-	
OCT 30 '79	18	5-	
JUL 31 '79	13	5-	
MAY 1 '79	8	3-	
FEB 6 '79	5-	3-	
NOV 1 '78	2	2-	
9-12-78	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

58

Raymond F. Bragg 882-3357
Second Street
Waterford, Va.

Village of Waterford — Sewer Only

SECT. — LOT 58

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
/8"	Badger	14397188			Residential
	ROM	2472132			ACCT. No. WF-58
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
NOV 8 '83	0-		
UG 9 '83	0-		
Y 10 '83	0-		
EB 8 '83	0-		
OV 9 '82	0-		
UG 10 '82	0-		
AY 11 '82	0-		
EB 9 '82	0		
V 10 '81	0-		
UG 11 '81	0	0+0=0	
UL 1 '81	40	8+	
AY 12 '81	40	0-	
EB 10 '81	40-	0-	Cleaned
OV 4 '80	40-	2-	Cleaned
UG 5 '80	38-	11-	
AY 6 '80	27-	5-	
EB 5 '80	22-	3-	CLEANED METER
CT 30 '79	19-	9-	
UL 31 '79	10-	10-	
-18-79	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

59

Randall James
Second Street
Waterford, VA.

Village of Waterford — Sewer Only

SECT. WF — LOT 59

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14397197			Residential
	R.O.M.	2472145			ACCT. No. WF-59
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
NOV 8 '83	0-		
UG 9 '83	0-		
AY 10 '83	0-		
EB 8 '83	0-		
OV 9 '82	0-		
UG 10 '82	0-		
AY 11 '82	0-		
EB 9 '82	0		
OV 10 '81	0-		
UG 11 '81	0	8+0=8	
UL 1 '81	130	8+	
AY 12 '81	122	16-	
EB 10 '81	106-	16-	
OV 4 '80	90-	15-	
UG 5 '80	75-	16-	
AY 6 '80	59-	14-	
EB 5 '80	45-	16-	
CT 30 '79	29-	16-	
UL 31 '79	13-	13-	
4-30-79	0-		

2-81 Has strainer

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Lucile MacCallum
Second Street
Waterford, Virginia

SEWER ONLY

Village of Waterford

SECT. WF LOT 61

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8"	Badger	14854352			Residential
	ROOM	3151072			ACCT. No. WF-61
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 5 '85	0-		
NOV 6 '84	0-		
AUG 7 '84	0-		
MAY 8 '84	0-		
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	4+0=4	
JUL 1 '81	32	4+	
MAY 12 '81	22	9-	
FEB 10 '81	19-	10-	
NOV 4 '80	9-	9-	
8-25-80	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

62

H. T. Edwards
Second Street
Waterford, Va.

Village of Waterford

Sewer Only

SECT. LOT 62

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4"	Badger	14397207			Residential
	ROM	2472147			ACCT. No. WF-62
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	1+0=1	
JUL 1 '81	14	1+	
MAY 12 '81	12	2-	
FEB 10 '81	11-	1-	
NOV 4 '80	10-	2-	
AUG 5 '80	8-	2-	
MAY 6 '80	6	1-	
FEB 5 '80	5	2-	
OCT 30 '79	3-	1-	
JUL 31 '79	2-	2-	
5-9-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

William J. Chewning
Second Street
Waterford, VA.

Village of Waterford

Sewer Only

SECT. WF LOT 63

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14480908			Residential
	ROM	2644887			ACCT. No. WF-63
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	12+0=12	
JUL 1 '81	122	12+	
MAY 12 '81	110	13-	
FEB 10 '81	97-	14-	
NOV 4 '80	83-	16-	
AUG 5 '80	47-	20-	
MAY 6 '80	30-	17-	
FEB 5 '80	10-	20-	
OCT 30 '79	0-	10-	
4-23-79			

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Mr. W. B. Morton III 882-2[illegible] 64
Second Street
Waterford, VA.

Village of Waterford

SECT. WF LOT 64 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14397201			Residential
	R.O.M.	1037115			ACCT. No. WF-64
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	15+0=15	
JUL 1 '81	117	15+	
MAY 12 '81	102-	6-	
FEB 10 '81	96-	18-	
NOV 4 '80	78-	15-	
AUG 5 '80	63-	0-	CLEANED
MAY 6 '80	63-	12-	
FEB 5 '80	51-	19-	
OCT 30 '79	32-	19-	
JUL 31 '79	13-	13-	
4-23-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

68

Nicholas M. Ratcliffe
Second Street
Waterford, Virginia

VILLAGE OF WATERFORD

SECT. WF LOT 68 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
8X3/4	Badger	14397196			Residential
	ROM	2472141			Acct. No. WF-68
					Suffix No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	6+0=6	
JUL 1 '81	104	6+	
MAY 12 '81	98	12-	
FEB 10 '81	86-	13-	
NOV 4 '80	73-	10-	
AUG 5 '80	63	11-	
MAY 6 '80	52-	13-	
FEB 5 '80	39	16-	
OCT 30 '79	23-	10-	
JUL 31 '79	13-	8-	
MAY 1 '79	5-	5-	
11-20-79	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Walter L. Riddle 882-3529
Second St.
Waterford, Va.

Village of Waterford

SECT. W-F LOT 69 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14480901			Residential
	R.O.M.	2644877			Acct. No. WF-69
					Suffix No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
MAY 8 '84	0-		
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	10+0=10	
JUL 1 '81	107	10+	
MAY 12 '81	97	22-	
FEB 10 '81	75-	24-	
NOV 4 '80	51-	19-	
AUG 5 '80	32	0-[redacted]-	CLEANED
MAY 6 '80	30-	13-	
FEB 5 '80	19	19-	
11-7-79	0-		

11/13/80 No strainer.

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

David Dyregrov
Second Street
Waterford, Virginia

Village of Waterford

SECT. WF LOT 72-A Sewer only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8"x3/4"	Badger	14854378			Residential
	ROM	3151085			ACCT. NO. WF-7201
					SUFFIX NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 5 '85	0-		
NOV 6 '84	0-		
AUG 7 '84	0-		
MAY 8 '84	0-		
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	5+0=5	
JUL 1 '81	26	5+	
MAY 12 '81	21	7-	
FEB 10 '81	14-	10-	
NOV 4 '80	4-	4-	
9-2-80	0		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Antonia Walker
Second Street
Waterford, Va.

Village of Waterford

SECT. WF LOT 73 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14480917			Residential
	ROM	2641885			ACCT. NO. WF-73
					SUFFIX NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
MAY 8 '84	0-		
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	6+0=6	
JUL 1 '81	64	6+	
MAY 12 '81	58	11-	
FEB 10 '81	47-	13-	
NOV 4 '80	34-	8-	
AUG 5 '80	26	11-	
MAY 8 '80	15	10-	
FEB 5 '80	5	5-	
12-12-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

D. Patrick Anderson
Second Street
Waterford, Va.

Village of Waterford

SECT. W-F LOT 74 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14480906			Residential
	ROM	2644895			ACCT. NO. WF-74
					SUFFIX NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
V 8 '84	0-		
EB 7 '84	8-		
V 8 '83	0-		
9 '83	0-		
V 10 '83	0-		
EB 8 '83	0-		
OV 9 '82	0-		
UG 10 '82	0-		
AY 11 '82	0-		
EB 9 '82	0		
V 10 '81	0-		
UG 11 '81	0	7+0=7	
UL 1 '81	58	7+	
AY 12 '81	51	11-	
10 '81	40-	12-	
V 4 '80	28-	0-	CLEANED
G 5 '80	28	8-	
AY 6 '80	20	13-	
5 '80	7-	7-	
-12-79	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Michael E. McGlauflin
~~Anne Michael~~
~~Charles Scott~~ 882-3536
Second Street
Waterford, Virginia

75

VILLAGE OF WATERFORD

SECT. WF LOT 75 sewer only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8 x 3/4	~~Badger~~	14397208			Residential
	ROM	2472134			ACCT. NO. WF-75
					SUFFIX NO. 74

DATE	READING	CONSUMPTION	REMARKS
11-12-82	0-	Reinstated	For new Custome
NOV 9 '82	0-		Discontinued
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
10-22-81	0-	Hetton forme customer	
10-21-81	0-	0-	Discontinue
AUG 11 '81	0-	0+0=0	
JUL 1 '81	18	0+	
MAY 12 '81	18	4-	
FEB 10 '81	14-	1-	Cleaned
NOV 4 '80	13-	0-	Cleaned
AUG 5 '80	13-	0-	CLEANED METE
MAY 6 '80	13-	8-	CLEANED METE
FEB 5 '80	13	0-	CLEANED METE
OCT 30 '79	13-	0-	CLEANED METE
JUL 31 '79	13-	8	
MAY 1 '79	5-	5-	
3-29-79	0-		

8/12/80 Has STRAINER

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Noah Robertson
Second Street
Waterford, VA.

Village of Waterford

Sewer Only

SECT. WF LOT 76

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
78"	Badger	14480898			Residential
	R.O.M.	2644879			ACCT. NO. WF-76
					SUFFIX-NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	3+0=3	
JUL 1 '81	30	3+	
MAY 12 '81	27	5-	
FEB 10 '81	22-	6-	
NOV 4 '80	16-	5-	
AUG 5 '80	11-	6-	
MAY 6 '80	5-	2-	
FEB 5 '80	3	2-	
OCT 30 '79	1-	1-	
11-9-79	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

K. M. Gonseth
Factory Street
Waterford, Va.

Village of Waterford

Sewer Only

SECT. WF LOT 79

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14480912			Residential
	R.O.M.	2644881			ACCT. NO. WF-79
					SUFFIX NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
MAY 8 '84	8-		
FEB 7 '84	8-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	4+0=4	
JUL 1 '81	61	4+	
MAY 12 '81	57	10-	
FEB 10 '81	47-	9-	
NOV 4 '80	38	8-	
AUG-5 '80	30-	12-	
MAY 6 '80	18	9-	
FEB 5 '80	9	9-	
11-13-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

80

Douglas Myers 882-3641
Factory Street
Waterford, Virginia

WATERFORD sewer only

SECT. LOT 80

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
x 3/4	Badger	14936846			Residential
	ROM	2472128			ACCT. No. WF-80
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
10 '83	0-		
EB 8 '83	0-		
V 9 '82	0-		
G 10 '82	0-		
Y 11 '82	0-		
EB 9 '82	0		
V 10 '81	0-		
UG 11 '81	0	3+0=3	
L 1 '81	70	3+	
AY 12 '81	67	4-	
EB 10 '81	63-	6-	
4 '80	57-	5-	
UG 5 '80	52-	3-	CKOK-
Y 6 '80	49	0-	CLEANED METER
5 '80	49	11-	
30 '79	38-	0-	CLEANED METER
31 '79	38-	15-	
1 '79	23-	16-	
B 6 '79	7-	7-	
21-78	0-		

8/12/80 Has STRAINER

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Robert L. Felton
Factory Street
Waterford, Va.

Village of Waterford

Sewer Only

SECT. WF LOT 80-A

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8 x 3/4"	Badger	14480910			Residential
	R.O.M.	2644896			ACCT. No. WF-8001
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0-		
NOV 10 '81	0-		
AUG 11 '81	0	11+0=11	
JUL 1 '81	142	11+	
MAY 12 '81	131	15-	
FEB 10 '81	116-	15-	
NOV 4 '80	101-	36-	
AUG 5 '80	65	29-	
MAY 6 '80	36-	13-	
FEB 5 '80	23-	14-	
OCT 30 '79	9-	9-	
8-30-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Wilbur H. Jewell
Factory Street
Waterford, Virginia 22190

Village of Waterford

SECT. WF LOT 81 SEWER ONLY

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8"	Badger	14397206			Residential
	R.O.M.#2523106				ACCT. NO. WF-81
					SUFFIX NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
NOV 6 '84	0-		
AUG 7 '84	0-		
MAY 8 '84	0-		
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	5+0=5	
MAY 12 '81	48	5+	
FEB 10 '81	43	7-	
NOV 4 '80	36-	12-	
AUG 5 '80	24-	12-	
5-03-80	12-	12-	
	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Wilma B. Dillon
High Street
Waterford, Virginia

VILLAGE OF WATERFORD

SECT. WF LOT 86 Sewer only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8"x3/4"	Badger	11470639			Residential
					ACCT. NO. WF-86
					SUFFIX NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 5 '85	0-		
NOV 6 '84	0-		
AUG 7 '84	0-		
MAY 8 '84	0-		
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	2+0=2	
MAY 12 '81	57	2+	
FEB 10 '81	55	26-	
NOV 4 '80	29-	28-	
5-28-80	1-	1-	Cleaned-5
	0-		

Has strainer per S.M. 11/7/80

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Mutual Fire Insurance 882-3232
High Street
Waterford, VA.

Village of Waterford

SECT. WF LOT 87 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
8"	Badger	14480902			
	R.O.M.	2644883			ACCT. No. WF-87
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 8 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	5+0=5	
JUL 1 '81	48	5+	
MAY 12 '81	43	9-	
FEB 10 '81	34-	8-	
NOV 4 '80	26-	7-	
AUG 5 '80	19-	8-	
MAY 6 '80	11-	8-	
FEB 5 '80	3-	0-	CLEANED METER
OCT 30 '79	3-	3-	
9-4-79	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Catoctin Presbyterian Church Parsonage
High Street
Waterford, Va.

Village of Waterford

SECT. WF LOT 88 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	14480905			Residential
	R.O.M.	1615933			ACCT. No. WF-88
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 8 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	10+0=10	
JUL 1 '81	168	10+	
MAY 12 '81	158	20-	
FEB 10 '81	138-	16-	
NOV 4 '80	122-	18-	
AUG 5 '80	104-	17-	CK-OK
MAY 6 '80	87-	48-	
FEB 5 '80	39-	31-	
OCT 30 '79	8-	8-	
9-12-79	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Waterford Foundation
Butcher's Row (Old School)
Waterford, Virginia

Village of Waterford

SECT. WF LOT 93 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
x3/4"	Badger	14854351			Residential
	R.O.M.	3151087			ACCT. NO. WF-93
					SUFFIX NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 5 '85	0-		
NOV 6 '84	0-		
AUG 7 '84	0-		
MAY 8 '84	0-		
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	1+0=1	
JUL 1 '81	12	1+	
MAY 12 '81	11	4-	
FEB 10 '81	7-	4-	
NOV 4 '80	3-	3-	
8-25-80	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Laird Johnson
~~Christopher Gooding~~
Butcher's Row
Waterford, Virginia

VILLAGE OF WATERFORD

SECT. WF LOT 96 Sewer only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8"x3/4"	Badger	14854353			Residential
	ROM	3151084			ACCT. NO. WF-96
					SUFFIX NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
5-30-84	0	Left ON	
5-30-84	0-	0-	Discontinued
AUG 7 '84	0		
MAY 8 '84	0-		
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	5+0=5	
JUL 1 '81	29	5+	
MAY 12 '81	24 [redacted]	10-	
FEB 10 '81	14-	9-	
NOV 4 '80	[redacted] 5	5-	
8-25-80	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Penny Keating

~~Charles Gill~~
Route 665
Waterford, Va.

Village of Waterford

Sewer Only

SECT. WF LOT 98

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
78x3/4	Badger	14480913			Residential
	ROM	2644882			ACCT. NO. WF-98
					SUFFIX NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
MAY 8 '84	0-		
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
8-11-81	0-	5+0=5	
7-1-81	53	5-	
5-15-81	48-	Left in for new customer	
1-25-80	48,000	3-	DISCONTINUED
NOV 4 '80	45-	13-	
AUG 5 '80	32	13-	
MAY 6 '80	19-	12-	
FEB 5 '80	7-	7-	
1-7-79	0-		

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Pearly L. Baumgardner
Route 665
Waterford, Virginia

Village of Waterford

SECT. WF LOT 99 Sewer Only

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8" x 3/4"	Badger	14854350			Residential
	R.O.M.	3151083			ACCT. NO. WF-99
					SUFFIX NO. [redacted]

DATE	READING	CONSUMPTION	REMARKS
FEB 5 '85	0-		
NOV 6 '84	0-		
AUG 7 '84	0-		
MAY 8 '84	0-		
FEB 7 '84	0-		
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
FEB 9 '82	0		
NOV 10 '81	0-		
AUG 11 '81	0	3+0=3	
JUL 1- '81	21	3+	
MAY 12 '81	15	6-	
FEB 10 '81	12-	7-	
NOV 4 '80	5-	5-	
8-25-80	0-		

APPENDIX D

METER READING RECORD

LOUDOUN COUNTY SANITATION AUTHORITY

NAME CHANGES

Paul Rode 104
~~Clarence L. Winecoff~~ 882-3696
1 Patrick Street Sewer Only
Waterford, Va.

Village of Waterford

SECT. WF LOT 104

SIZE	MAKE	NUMBER	IN	OUT	CLASSIFICATION
5/8x3/4	Badger	4397198			Residential
	R.O.M.	2523101			ACCT. No. WF-104
					SUFFIX No. [redacted]

DATE	READING	CONSUMPTION	REMARKS
NOV 8 '83	0-		
AUG 9 '83	0-		
MAY 10 '83	0-		
FEB 8 '83	0-		
NOV 9 '82	0-		
AUG 10 '82	0-		
MAY 11 '82	0-		
8-25-82	0-	Left on for new customer	
9-15-81			Disconting
Aug. 11, '81	0	6+0=6	
JUL 1 '81	52	6+	
MAY 12 '81	46	9-	
FEB 10 '81	37-	7-	
NOV 4 '80	30-	5-	
AUG 5 '80	25-	5-	
MAY 6 '80	20-	0-	CLEANED METE
FEB 5 '80	20-	6-	
OCT 30 '79	14-	8-	
JUL 31 '79	6-	6-	
4-30-79	0-		

8/12/80 HAS STRAINER

Waterford AMP adopted 10/19/87

d. Rural land within the Waterford planning area will be high priority for the donation, sale, transfer or proffer of open space conservation easements. The County will encourage private, State or Federal funding for acquisition of open space easements in this area.

e. If development is proposed, the County will encourage properly sited cluster residential developments for the purpose of preserving the farmland owners' agricultural operations and ensuring a permanent low density development pattern that is more compatible with the area's existing agricultural and scenic character.

f. Agricultural uses are the preferred land use in the Agricultural Conservation Area surrounding the village within the National Historic Landmark boundary. Agricultural uses will be encouraged and new residential uses which do not help achieve the goals of this plan will be discouraged. Right-to-farm policies, as provided for under the Code of Virginia, shall be in force.

5. Utilities

a. Sewer Service Area:

The Loudoun County Sanitation Authority (LCSA) will provide central sewer service by means of the Waterford sewage treatment plant to all existing and future development within the proposed Village Limit Line in accordance with its charter and established policies.

Service to development outside of this line will be allowed only if:

i. Overall permissible density of a tract of land is voluntarily reduced to a level which contributes towards achieving the primary goal of the plan; and

ii. Development is clustered in areas which have high visual absorption capacity; and

iii. Open space easements are placed on the balance of the property; and

iv. Appropriate safeguards such as restrictive easements are present to ensure that such extensions will only serve appropriately located development; and

v. Sufficient capacity is reserved so that all buildable lots of record within the Village Limit Line will be guaranteed access to and capacity in the sewer system; and

APPENDIX D

vi. Criteria for allowing such extensions are adopted by the County.

b. Connections

Future development within the proposed VLL shall be required to connect to the sewage treatment plant. The County encourages all owners of buildings within the proposed VLL that are not currently served by the treatment plant to connect for the purposes of improving public health and enhancement of the overall quality of the community. All expansion of existing structures with the VLL that are served by individual sewage systems and are located 300 feet or less from the public sewer line shall be required to connect to the public sewage treatment system.

c. Plant Expansion

The County will prohibit expansion of the current capacity of the sewage treatment plant. The LCSA and the County shall notify the State Water Control Board (SWCB) that no further connections to the plant will be allowed once the current capacity is reached and that the plant will not be expanded beyond its present capacity if the monthly average flow influent reaches 55,100 GPD or 95% of the total approved capacity of 58,000 GPD for three consecutive months within the time frame of this plan. (This action will be taken with the intent of satisfying the SWCB's Policy for Sewage Treatment Plant Loadings effective February 1, 1981 pursuant to Section 62.1 - 44.15(5) of the Code of Virginia.)

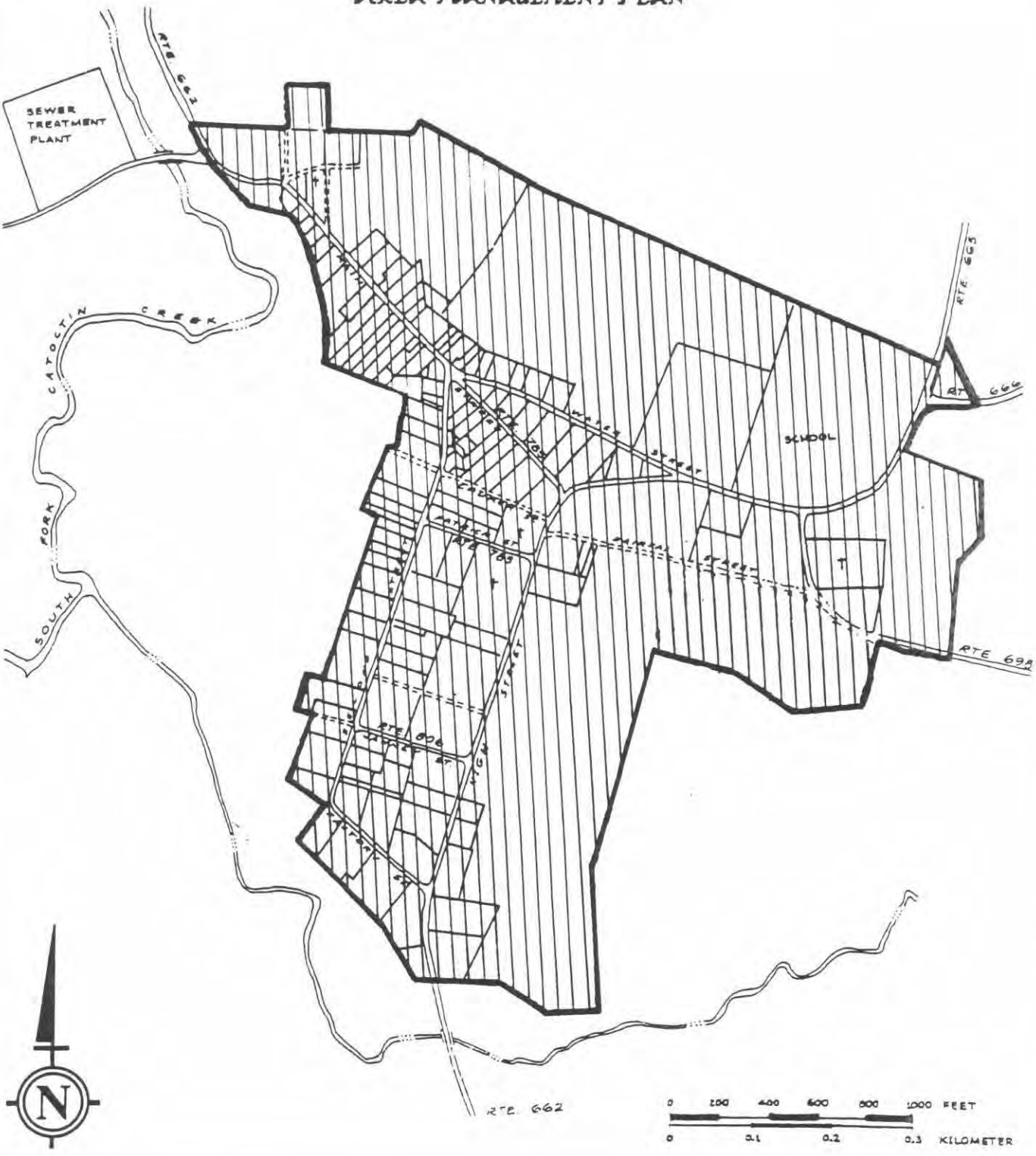
d. The County will prohibit individual package treatment plants, "Cyclet" type systems or pump and haul operations in this area except in cases where there is a severe health hazard due to the failure of an existing system and approval of a new system is recommended by the Health Department. Such severe hazards shall be dealt with on a case by case basis.

e. Communal water and wastewater systems will be allowed if:

i. Sewer line extensions cannot be appropriately safeguarded to ensure that such extensions will only serve appropriately located development; and

ii. Overall permissible density of a tract of land is voluntarily reduced to a level which constricutes towards achieving the primary goal of the plan; and

APPENDIX D



RURAL VILLAGE POLICY AREA AND PROPOSED VILLAGE LIMIT LINE

RURAL VILLAGE POLICY AREA

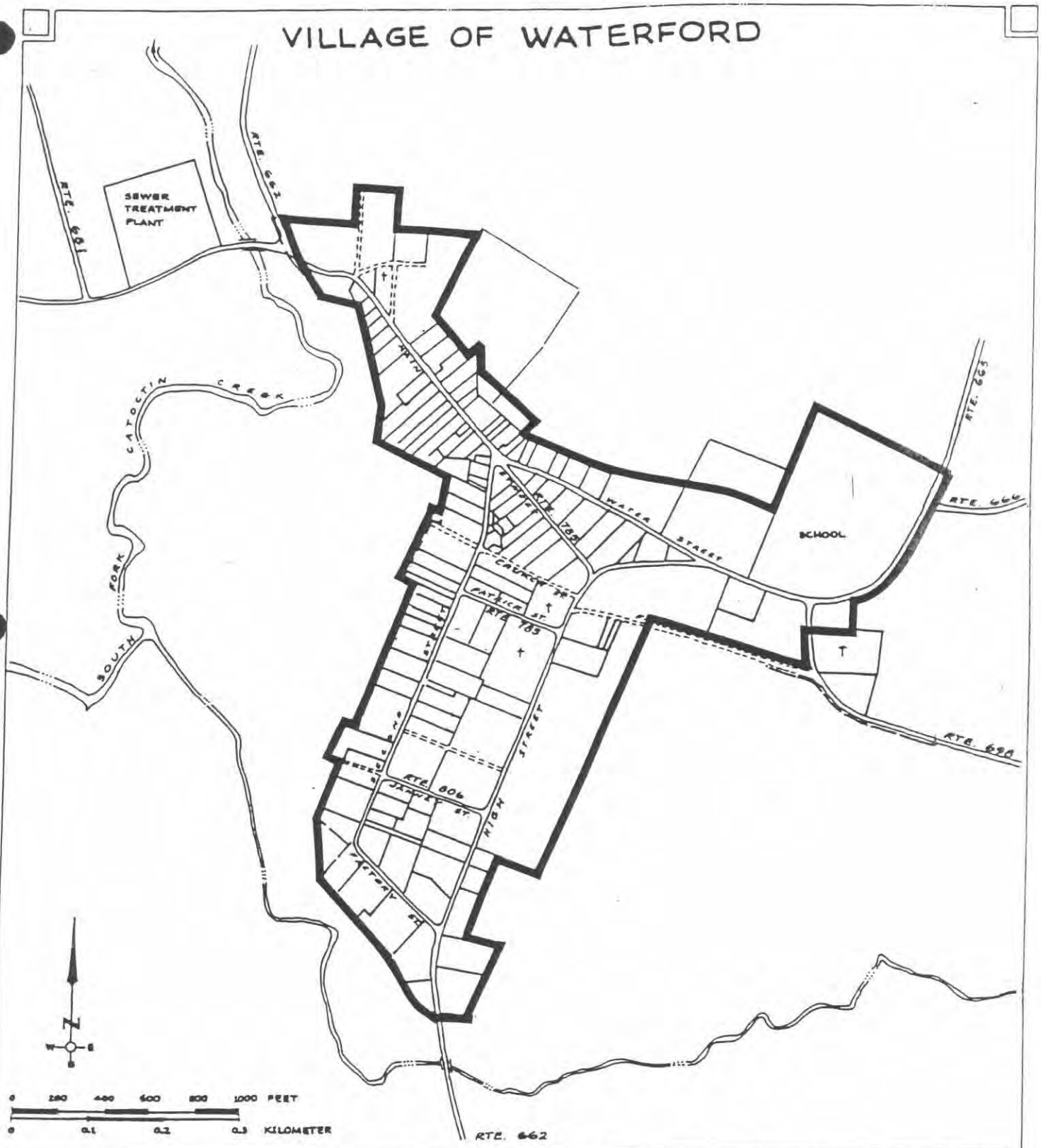
AGRICULTURAL CONSERVATION AREA

PROPOSED VILLAGE LIMIT LINE

FIGURE 33.

APPENDIX D

APPENDIX D



BOUNDARY OF ENGINEERING STUDY AREA FOR SEWAGE TREATMENT PLANT

FIGURE 15

APPENDIX D