

Little Spokane Groundwater Elevation & Stream Flow Monitoring Project

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Prepared for:
WRIA 55/57 Watershed
Implementation Team

Prepared by:
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Water Resources

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1.0 Introduction

This report describes work completed and presents data collected for the Little Spokane Groundwater Elevation and Stream Flow Monitoring project. This project was Task 14 of the Water Resource Inventory Area (WRIA) 55-57 Phase 4 Implementation Project funded by Washington Department of Ecology (Ecology) Grant G0700149.

The scope of this project was developed from recommendations found in the *WRIA 55 Groundwater Inventory and Mapping Project Report* (Spokane County, 2009). That project identified the following data collection opportunities and needs:

- Existing wells suitable for continuous temperature and water level monitoring;
- A set of wells with historic snap shot water level measurements taken as part of two groundwater studies completed in 1991 and 1996; and
- A lack of stream flow data to determine the location and magnitude of groundwater contributions to the Little Spokane River.

This project focused on the above opportunities and needs, and had the following 3 components:

1. instrumentation and continuous monitoring of five wells within the Little Spokane Watershed;
2. “snap shot” water level measurements of 21 water wells that were measured in previous groundwater studies; and
3. A seepage run on the Little Spokane River.

The scope of this project was to collect data. As funding allows data collection activities initiated in this project will continue. The project scope did not include in-depth analysis of the data. When the project scope was developed it was envisioned that this data would be combined with existing and future data to further refine the hydrogeologic conceptual model of the Little Spokane Watershed.

2.0 Project Component 1: Continuous Water Level Data Collection

2.1 Well Selection

Utilization of existing groundwater monitoring infrastructure is a cost effective way to collect water level data. Eight existing wells were identified within the Little Spokane River Watershed (Figure 2-1) for installation of data loggers. These wells included production wells that are no longer in use, emergency standby wells that are not in regular use, monitoring wells located near active production wells, and dedicated monitoring wells.

The goal of this project component was to gather water level data in wells in close proximity to the Little Spokane River to further understand the surface water/ground water interaction. In the process of identifying suitable wells three additional wells which are not in close proximity to the Little Spokane River were identified. These wells were added to the data collection effort because the additional cost to add these wells was minimal and water level information in other portions of the Little Spokane River Basin provide useful data such as aquifer response to recharge and withdrawals. Table 2-1 presents characteristics of each well included in the data collection effort. Appendix A includes the well logs for each well.

Table 2-1 Wells for Continuous Monitoring

| Well Name | Well Description | Elevation (ft msl ¹) | Well Depth (ft) | Screened Interval (ft bgs ²) | Aquifer |
|---|--|----------------------------------|-----------------|--|---------------------|
| Spokane County Colbert Landfill – North Glen | Monitoring well | 1671 | 45 | 35-45 | Upper Sand & Gravel |
| Whitworth Water Rivilla | Production well no longer in use | 1585 | 30 | 21-29 | Upper Sand & Gravel |
| Whitworth Water – Shady Slope | Emergency Standby well that is rarely used | 1635 | 130 | 90-120 | Upper Sand & Gravel |
| Whitworth Water – North Mt. View | Production well no longer in use | 1955 | 90 | 60-68 | Upper Sand & Gravel |
| Spokane County Water District 3 – River Estates | Monitoring well near a production well | 1715 | 122 | 54-100 | Upper Sand & Gravel |
| Spokane County Water District 3 – Pine River | Monitoring well near a production well | 1610 | 208 | 203-208 | Lower Sand & Gravel |
| Ecology – Chattaroy | Monitoring Well | 1980 | 242 | 193-242 | Upper Sand & Gravel |
| Ecology – Deer Park | Monitoring Well | 2180 | 350 | 87-350 | Basalt |

1 – Land-surface elevation above mean sea level

2 – below ground surface

2.2 Data Collection

Data was collected in accordance with the Quality Assurance Project Plan (QAPP) developed for this project and approved by Department of Ecology on September 10, 2009. The QAPP details the process and procedures utilized for this study. Below is a brief description of key components of the data collection efforts.

Data was collected by data loggers installed in the selected wells. The data loggers automatically take measurements at a specified interval, which in the case of this study was every hour. Two types of data loggers were used in this study; Diver by Schlumberger and Level Logger by Solinst. The Divers used in this study measure water level, temperature, and conductivity, and the Level Loggers measure water level and temperature. The three wells selected for conductivity measurements were Whitworth Water North Mt. View, Whitworth Water Rivilla, and Spokane County Water District 3 – Pine River.

The data loggers were installed in 5 wells on September 23, 2009. A data logger was installed in the Deer Park well on September 28, 2009. Upon installation manual water level measurements were taken to calibrate the data logger. Throughout the study manual water level measurements were taken to assess the accuracy of the data logger measurements and correct for any instrument drift. Table 2-2 presents the manual measurements, the corresponding data logger measurement and the deviation of the data logger measurement. The Whitworth Water – Shady Slope and the Ecology – Chattaroy wells have data loggers installed and maintained by Ecology Water Resources staff. Data for those wells are provided to Spokane County by Ecology.

Water level measurements were not taken at each well on each field visit for a variety of reasons. On September 28, 2009 only three wells were visited to check the technique used to install the data logger in the wells. On November 3, 2009 the Rivilla well was not measured

because a new lock had been installed at the well. On December 7, 2009 two wells were not visited due to a problem with the computer used to download the data from the data loggers.

Table 2-2 Manual Water Level vs. Data Logger Water Level

| Date & Measurement | Colbert Landfill North Glen | Whitworth Water Rivilla | Whitworth Water North Mt. View | Spokane County WD 3 River Estates | Spokane County WD 3 Pine River | Ecology Deer Park |
|-------------------------|-----------------------------|-------------------------|--------------------------------|-----------------------------------|--------------------------------|-------------------|
| September 28, 2009 | | | | | | |
| Manual Measurement | | 8.27 | 42.96 | | | |
| Data Logger Measurement | | 8.28 | 42.82 | | | |
| <i>Difference</i> | | 0.01 | -0.14 | | | |
| November 3, 2009 | | | | | | |
| Manual Measurement | 9.84 | | 43.31 | 20.63 | 22.74 | 40.54 |
| Data Logger Measurement | 9.82 | | 43.31 | 20.54 | 22.65 | 40.64 |
| <i>Difference</i> | -0.02 | | 0.0 | -0.09 | -0.09 | 0.10 |
| December 17, 2009 | | | | | | |
| Manual Measurement | | 8.05 | | 21.92 | 19.18 | 39.84 |
| Data Logger Measurement | | 8.14 | | 21.85 | 19.20 | 39.70 |
| <i>Difference</i> | | -0.09 | | -0.07 | 0.02 | -0.14 |
| March 19, 2010 | | | | | | |
| Manual Measurement | 9.67 | 7.85 | 42.49 | 20.14 | 16.27 | 39.51 |
| Data Logger Measurement | 9.64 | 7.85 ² | 42.52 | 20.06 | 15.92 ¹ | 39.53 |
| <i>Difference</i> | -0.03 | 0 | 0.03 | -0.08 | -0.35 | 0.02 |
| June 11, 2010 | | | | | | |
| Manual Measurement | 9.56 | 7.62 | 42.56 | 20.47 | 18.77 | 39.98 |
| Data Logger Measurement | 10.27 ³ | 7.60 | 42.52 | 20.56 | 18.89 | 40.02 |
| <i>Difference</i> | 0.71 | -0.02 | -0.04 | 0.09 | 0.12 | 0.04 |

note: measurements are depth to water from the top of casing or well completion. All values reported in feet.

1 – Spokane County Water District 3 working on nearby production well at the time of measurement

2 – Rivilla logger raised .15 feet sometime between Dec 17, 2009 and March 19, 2009 due to changes in well head. This measurement established a new baseline.

3 – On 4/20/10 the data logger was removed for water quality sampling and upon reinstallation was raised approximately ¾ of a foot. Data from this date forward was corrected based on measurements taken on June 11, 2010.

Changes in barometric pressure impact data logger water level measurements. To address this a data logger was kept at the Spokane County Public Works Building to measure changes in barometric pressure. This data was used to generate water level data that is compensated for changes in barometric pressure. Compensation is done with Levellogger software by Solinist. All data presented in this report has been compensated for barometric pressure.

2.3 Discussion of Results

Graphs depicting the changes in water level and temperature over the period of the study are included in Appendix B along with graphs showing the changes in conductivity of the three wells with Diver data loggers. Figure 2-2 shows the water level and temperature change graphs along with well location and seepage run data. While the scope of this project did not include in-depth analysis of the data some general observations can be made:

- The Whitworth Water Rivilla well and the Colbert Landfill North Glen well data indicate that water is apparently moving from the Little Spokane River to the groundwater in the vicinity of those wells. The temperature of each of those wells show a seasonal fluctuation while other wells in this study do not show this pattern. Also two substantial

increases in flow in the river during December and January corresponded with temporary increases in water level in each well.

- The Whitworth Shady Slope well and Water District 3 Pine River well both show large fluctuations in water levels (between 10 and 15 feet). Without more data it is difficult to interpret the large fluctuation. Both wells are relatively close to several large production wells so the response to summer withdrawals will be an important component to consider.
- The water level in the DOE Deer Park well rose almost 7 feet during the month of October and then fluctuated within a 6 inch interval over the winter and spring months. In late May some decline was beginning. As with the Whitworth Shady Slope and Water District 3 Pine River wells, data collected during the summer months will be an important component to consider.
- The DOE Chattaroy well and Whitworth Water North Mt. View well water level both increased over the study period. The Chattaroy well showed a steady increase while the North Mt. View well showed a potential response to discrete recharge events such as large amounts of precipitation over a short period of time.

3.0 Project Component 2: Snap Shot Water Level Measurements

The purpose of this project component is to assess changes in water levels within the Little Spokane Watershed over time. Two groundwater studies were conducted in the watershed that included measurements of water levels at domestic wells. The studies are the *Deer Park Ground-Water Characterization* (Deer Park study) completed by Emcon in 1992 on behalf of Spokane County, and *Aquifer Delineation and Baseline Groundwater Quality Investigation of a Portion of North Spokane County, Washington* (North Spokane Study) by Reanette Boese and John Buchanan in 1996. These studies provide historic snap shot water level data that is reliable. Static water level measurements are taken at the time a water well is drilled and included on the well log that is submitted to Ecology, but these measurements are often not an accurate representation of the static water level.

3.1 Well Selection

Wells were selected based on the following criteria:

- The well could be accurately located with the information provided in each study (referenced above);
- The current well owner contact information was publicly available; and
- The current well owner responded to our request and agreed to have a water level measurement taken.

The Deer Park study included water level measurements taken in 1991 and 1992 for 55 wells. There was sufficient information to determine the owner and location of 25 wells. Of those 25 wells 11 well owners responded to our request to allow a water level measurement of their well. The North Spokane study included water level measurements taken in 1996 for 37 wells.

There was sufficient information to determine the location and owner of all 37 wells, but two of the wells are located in the Spokane Valley Rathdrum Prairie Aquifer and 2 have been decommissioned since 1996. Of the 33 that could potentially be measured 10 well owners responded to our request to take a water level measurement of their well. Table 3-1 presents the wells that were measured for this project and Figure 3-1 shows the location of each well. Well logs are provided in Appendix C

Table 3-1 Selected Snap Shot Wells

| Study Well ID | Original Study | Original Study Well ID | Aquifer Description from Original Study | Well Log Data | | | | |
|---------------|----------------|------------------------|---|----------------|-------------|--------------------|-------|-------------------|
| | | | | Date Completed | Total Depth | Static Water Level | Yield | Screened Interval |
| 2 | Deer Park | Hytein | Basalt/Deep | 3/26/74 | 102 | 15 | 27.5 | 83-90 |
| 4 | Deer Park | Love | Basalt/Deep | 4/23/81 | 160 | 70 | 17.5 | 130-160 |
| 6 | Deer Park | Bunke | - | - | - | - | - | - |
| 8 | Deer Park | Helm | Basalt/Deep | 9/30/79 | 160 | 80 | 12.5 | 120-160 |
| 9 | Deer Park | Neff | Basalt/Deep | 1/30/76 | 260 | 30 | 37.5 | 73-260 |
| 16 | Deer Park | Wolf | Basalt/Deep | 2/6/77 | 260 | 0 | 60 | 80-260 |
| 19 | Deer Park | Booher | Basalt/Deep | 12/2/74 | 100 | 35 | 30 | 86-100 |
| 20 | Deer Park | McCann | Granite/Deep | 3/6/80 | 280 | 145 | 4.5 | 174-280 |
| 22 | Deer Park | Ramsay | Granite/Deep | 9/21/83 | 197 | 108 | 8 | 180-197 |
| 24 | Deer Park | Vielllette | Granite/Deep | 7/20/77 | 140 | 80 | 8 | 66-140 |
| 25 | Deer Park | DOE-33 | Basalt/Deep | 1/23/78 | 350 | 67 | 200 | 87-350 |
| 32 | North Spokane | 6404B02 | Lower Sand & Gravel | 5/26/93 | 65 | 15 | 20 | 35-65 |
| 34 | North Spokane | 6404N01 | Basalt | 11/24/93 | 125 | 70 | 40 | 105-125 |
| 40 | North Spokane | 7312P01 | Lower Sand & Gravel | 10/9/86 | 316 | - | 20 | 311-316 |
| 42 | North Spokane | 7315F02 | Lower Sand & Gravel | - | 244 | 95 | 20 | 239-244 |
| 46 | North Spokane | 7321C02 | Lower Sand & Gravel | 6/23/86 | 100 | 12 | 6 | 79-84 |
| 47 | North Spokane | 7321C01 | Lower Sand & Gravel | 3/29/90 | 185 | 66 | 60 | 175-185 |
| 51 | North Spokane | 7407P02 | Granite | 10/27/96 | 85 | | 15 | 65-85 |
| 55 | North Spokane | 7433P01 | Lower Sand & Gravel | 9/11/92 | 159 | 35 | 60 | 154-159 |
| 56 | North Spokane | 8222Q01 | Granite | 11/23/94 | 285 | 70 | 11 | 25-285 |
| 57 | North Spokane | 8225C01 | Lower Sand & Gravel | 9/21/92 | 290 | 20 | 22 | 280-290 |

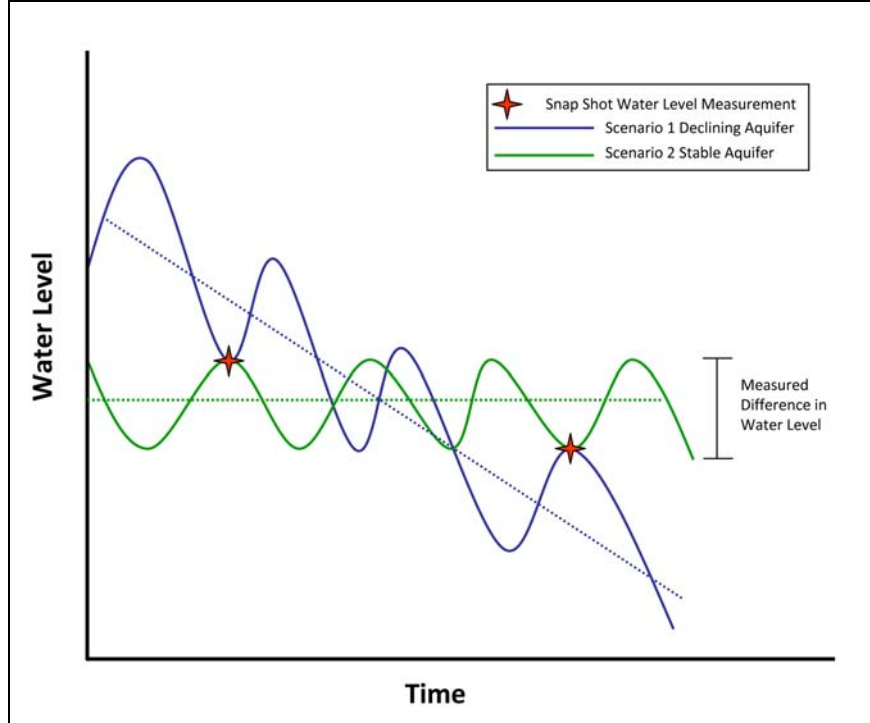
3.2 Data Collection

Data was collected in accordance with the Quality Assurance Project Plan (QAPP) developed for this project and approved by Department of Ecology on September 10, 2009. The QAPP details the process and procedures utilized for this study. Data was collected from the wells at the same time of year that it was collected during the original study. Refer to tables 3-2 and 3-3 for existing and new data.

3.3 Discussion of Results

As the terminology “snap shot” implies the measurements taken for this project component represent water level at one time and do not capture the variance of water level over time that most wells exhibit. Figure 3-2 below demonstrates the potential problem with basing conclusions on two snapshot measurements. Two measurements, represented by the red star, could represent two separate and different scenarios, one a declining aquifer and one a stable aquifer.

Figure 3-2 – Snap Shot Water Level Measurement Interpretation



The objective of this study component was to identify any trends that warrant further investigation. Many wells do exhibit fluctuations that follow an annual pattern, so new measurements were taken at the same time of year as the historical measurements used for comparison.

Of the 21 total wells measured water levels declined a potentially significant amount in 3 wells. All three are located in the Deer Park area. Two are completed in a basalt aquifer and one in a lower sand and gravel aquifer. It is important to note that well 2, which has a -78.69 foot difference with the measurement taken in November of 1992, is located 3500 feet north of well 9 which has a 4.69 foot increase over the measurement taken in 1991. Based on the well logs these wells appear to be within the same aquifer. This demonstrates the complexity of the aquifer systems and the need for additional information to draw conclusions on the cause of the difference in water level measurements in well 2.

Table 3-2 Deer Park Study Wells Results

| Study Well ID | Elev | Data from Original Study | | | | | | Data from Current Study | | | | |
|---------------|------|--------------------------|--------|----------|--------|---------|-------|-------------------------|-------|----------|--------|---------------|
| | | Date | DTW | Date | DTW | Date | DTW | Date | DTW | Date | DTW | Change |
| 2 | 2100 | 6/20/91 | 42.46 | 11/1/91 | 56 | 1/30/92 | 43.9 | 4/1/92 | 35.9 | 12/1/09 | 134.69 | -78.69 |
| 4 | 2147 | 6/25/91 | 44.1 | 10/29/91 | 44 | 1/29/92 | 44.2 | 4/1/92 | 44.3 | 12/1/09 | 38.89 | 5.11 |
| 6 | 2071 | 10/10/91 | 32.2 | 11/4/91 | 32.4 | 1/30/92 | 32.8 | 4/3/92 | 32.1 | 12/1/09 | 29.71 | 2.69 |
| 8 | 2090 | 6/18/91 | 63.95 | 11/1/91 | 53.7 | 1/29/92 | 47.6 | 4/2/92 | 51 | 12/1/09 | 52.34 | 1.36 |
| 9 | 2135 | 10/3/91 | 73.4 | 10/1/91 | 72 | 1/30/92 | 69.4 | 4/2/92 | 69 | 12/1/09 | 67.31 | 4.69 |
| 16 | 2200 | 6/18/91 | 16.8 | 10/28/91 | 18 | 1/28/92 | 18.3 | 4/1/92 | 18.1 | 12/17/09 | 33.02 | -15.02 |
| 19 | 2151 | 6/14/91 | 31.6 | 10/29/91 | 31.3 | 1/27/92 | 32.2 | 4/2/92 | 32.9 | 12/1/09 | 33.19 | -1.89 |
| 20 | 2130 | 6/14/91 | 148.94 | 10/29/91 | 149.5 | 1/27/92 | 149.4 | 4/1/92 | 149.7 | 12/1/09 | 146.52 | 2.98 |
| 22 | 2240 | 9/5/91 | 111 | 10/28/91 | 107.08 | 1/28/92 | 106.8 | 4/1/92 | 107.6 | 12/1/09 | 106.32 | 0.76 |
| 24 | 2198 | 9/21/91 | 76.9 | 10/28/91 | 76.7 | 1/27/92 | 76.7 | 4/1/92 | 76.1 | 12/1/09 | 71.99 | 4.71 |
| 25 | 2180 | | | | | 2/4/92 | 40.8 | 4/2/92 | 43.3 | 12/17/09 | 39.84 | 0.96 |

Table 3-3 North Spokane Study Wells Results

| Study Well ID | Elev | Data from Original Study | | Data from Current Study | | |
|---------------|------|--------------------------|--------|-------------------------|--------|---------------|
| | | Date | DTW | Date | DTW | Change |
| 32 | 1840 | 4/23/96 | 8.9 | 3/8/2010 | 10.56 | -1.66 |
| 34 | 1865 | 4/28/96 | 63 | 3/8/2010 | 62.55 | 0.45 |
| 40 | 1895 | 4/23/96 | 193.9 | 4/20/2010 | 184.6 | 9.3 |
| 42 | 1847 | 5/5/96 | 160.96 | 3/8/2010 | 160.33 | 0.63 |
| 46 | 1680 | 5/7/96 | 14.47 | 4/20/2010 | 15.15 | -0.68 |
| 47 | 1740 | 5/7/96 | 74.65 | 4/20/2010 | 72.65 | 2 |
| 51 | 2030 | 5/7/96 | 42.4 | 4/20/2010 | 43.23 | -0.83 |
| 55 | 1840 | 4/23/96 | 27.1 | 3/8/2010 | 27.61 | -0.51 |
| 56 | 2030 | 4/28/96 | 57.4 | 4/20/2010 | 57.02 | 0.38 |
| 57 | 2035 | 4/28/96 | 60.2 | 4/20/2010 | 85.44 | -25.24 |

4.0 Project Component 3: Little Spokane River Seepage Run

The objective of this project component was to assess the connection of ground and surface water in the Little Spokane River Basin north of the USGS Little Spokane River at Dartford gage. During low flow months groundwater contributions are critical to maintaining stream flow necessary to protect instream resources. When evaluating surface water quantities during the low flow season, the use of seepage runs (multiple stream flow measurements on a single stream or creek) can provide insight into the ground water and surface water interactions. A better understanding of the ground/surface water interactions will improve the understanding of the impacts of ground water withdrawals on surface water flows. The WRIA 55 Ground-Water Inventory and Mapping project completed in June 2009 concluded that adequate seepage run data for the Little Spokane above the Dartford gage did not exist and a new data collection effort was needed.

4.1 Little Spokane River System

The headwaters of the Little Spokane River are split approximately evenly between the West Branch of the Little Spokane River and the mainstem. Some studies suggest the mainstem may receive baseflow from the Pend Oreille River system in the form of inter-basin underflow. The West Branch of the Little Spokane River heads in the Diamond Lake drainage and flows through several lakes (Sacheen, Fan, Horseshoe, and Eloika) before merging with the main stem at approximately River Mile 33.

Above Dartford, the Little Spokane River flows are a combination of ground water contributions and tributaries flows (such as from Deadman and Dragoon Creeks). In the lower reach between the Dartford gage and the mouth, flow increases significantly as a result of groundwater discharge from the Spokane Valley Rathdrum Prairie Aquifer. The Little Spokane River has few artificial controls and the hydrograph responds to seasonal influences, such as snowpack melt.

4.2 Data Collection

The Spokane County Conservation District completed 14 stream flow measurements along the Little Spokane River mainstem on October 7, 2009 to evaluate ground water/surface water interactions (Figure 4-1). Along with the flow measurements, the rated flows at three established stream gaging sites were also obtained. The measurements, known as a seepage run, provide estimations of the amounts of ground water flow to the river or the losses from the surface waters to the ground water system.

The discharge measurements were done during the low flow period (late September through early October). Measurements were made five days after a small weather system increased the river flow, Figure 3-3. The measurements were made after the flow stabilized. No large scale irrigation was in operation prior to, or during the measurements. The Colbert landfill treatment discharge to the creek was 0.89 cfs.

Table 4-1 Measurement Site Types and Locations identified in the Approved QAPP

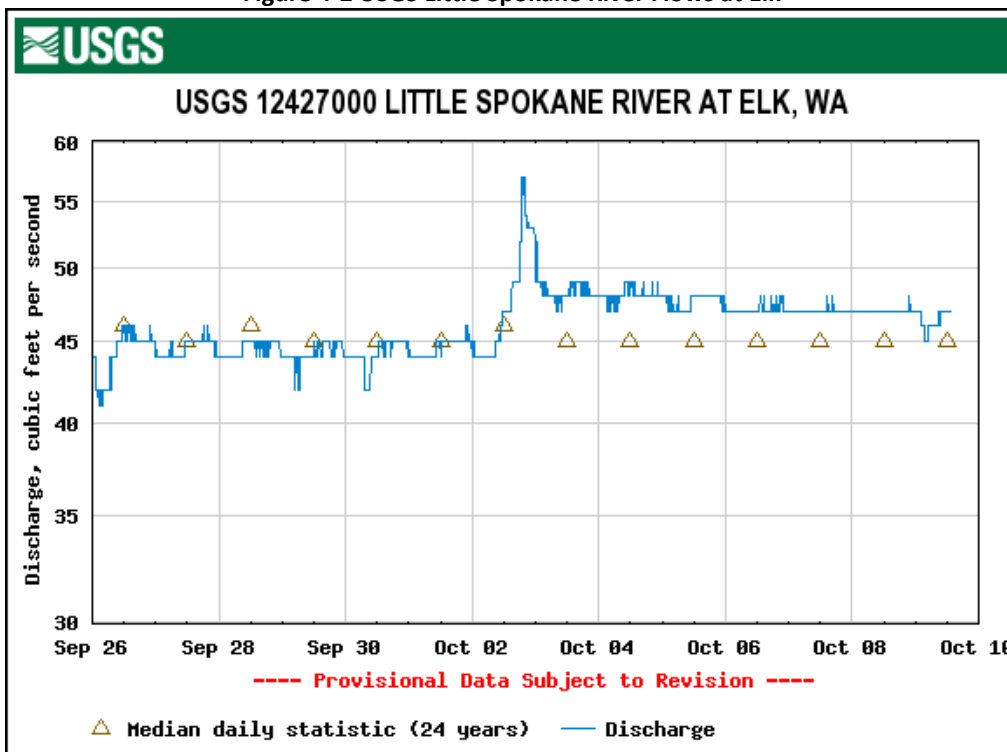
| Site | Type | Location |
|------|-----------|---|
| 5 | Main Stem | USGS ¹ Dartford gage – rated discharge |
| 6 | Tributary | Deadman Creek at mouth |
| 7 | Main Stem | Little Spokane River upstream of Deadman Creek |
| 8 | Main Stem | Little Spokane River downstream of Dragoon Creek |
| 9 | Tributary | Dragoon Creek at mouth |
| 10 | Tributary | Deer Creek at mouth |
| 11 | Main Stem | SCC ² Chattaroy gage – rated discharge |
| 12 | Tributary | Bear Creek at mouth |
| 13 | Main Stem | Little Spokane River upstream of Bear Creek |
| 14 | Main Stem | Little Spokane River at Milan |
| 15 | Main Stem | Little Spokane River downstream of West Branch |
| 16 | Tributary | West Branch Little Spokane River at mouth |
| 17 | Tributary | Otter Creek at mouth |
| 18 | Tributary | Dry Creek at mouth |
| 19 | Main Stem | USGS Elk gage – rated discharge |
| 20 | Main Stem | Little Spokane River at Scotia Road |

1-USGS is U. S. Geological Survey. 2-SCC is Spokane Community College

All sites were measured on a single day. Cross-sections were modified to meet the measurement requirements for depth and velocity outlined in Rantz and others. All sites identified in the QAPP (Table 4-1) were measured, with the following exceptions:

1. The measurement at Site 15, Little Spokane River downstream of West Branch, could not be waded. The Little Spokane River at Eloika Road immediately upstream of the West Branch confluence was substituted.
2. The outfall from Reflection Lake was added.

Figure 4-2 USGS Little Spokane River Flows at Elk



4.3 Discussion of Results

Flow measurements along the mainstem of the Little Spokane River increased downstream from the headwaters near Newport, Washington to the confluence with the Spokane River. The seepage run data were collected to differentiate between the contributions to the Little Spokane River from ground water or from tributaries. The flow measurements completed on October 7, 2009 do show significant ground water/surface water interactions, with both gaining and losing reaches (Figure 4-1).

For the Little Spokane River, the 2009 flows show significant increases from Scotia to Elk (River Mile 46.9 to 37.6). From Elk to Milan, although the Little Spokane River flow increases (47.0 cfs to 58.4 cfs), the contribution from tributaries was 25.4 cfs. The tributary surface flows were 43 percent of the measured flow at Milan. From Elk to Milan, after accounting for the surface water contributions from the tributaries, 14.0 cfs were lost from the Little Spokane River

mainstem to ground water. This is approximately 2.41 cfs per mile. After Milan, the flows increase to the Dartford gage with significant increases downstream of Colbert.

Table 4-2 Little Spokane River Discharge Measurement Summary

| River Mile | Description | Discharge (cfs) | Elevation (feet) |
|------------|--|-----------------|------------------|
| 46.9 | Little Spokane River at Scotia Road | 23.6 | 2130 |
| 37.6 | USGS Elk gage – rated discharge | 47.0 | 1870 |
| 34.6 | Dry Creek at mouth | 1.72 | NA |
| NA | Outlet Reflection Lake | 5.26 | NA |
| 33.5 | Otter Creek at mouth | 6.89 | NA |
| 33.2 | Little Spokane River upstream of West Branch | 54.7 | 1790 |
| 32.8 | West Branch Little Spokane River at mouth | 11.5 | NA |
| 31.8 | Little Spokane River at Milan | 58.4 | 1770 |
| 29.7 | Little Spokane River upstream of Bear Creek | 69.2 | 1715 |
| 27.8 | Bear Creek at mouth | 3.00 | NA |
| 23.1 | SCC Chattaroy gage – rated discharge | 76.0 | 1690 |
| 23.0 | Deer Creek at mouth | 0.767 | NA |
| 21.4 | Dragoon Creek at mouth | 20.0 | NA |
| 19.4 | Little Spokane River downstream of Dragoon Creek | 99.8 | 1655 |
| 19.3 | Colbert landfill discharge | 0.89 | NA |
| 14.5 | Little Spokane River upstream of Deadman Creek | 114 | 1615 |
| 13.0 | Deadman Creek at mouth | 9.22 | NA |
| 11.1 | USGS Dartford gage – rated discharge | 132 | 1585 |

Notes:

River miles are for main stem Little Spokane River only, and are measured from the mouth of the Little Spokane River (RM 0.0) upstream. Measurements are from USGS 7.5 minute topographic maps.

No discharge was measured at the USGS or SCC sites, the rated flows were used for the stations at Dartford, at Chattaroy, and at Elk.

cfs is cubic feet per second.

NM is not measured.

NA is not applicable.

Figure 4-3 Little Spokane River Discharge and Elevation at Select River Miles

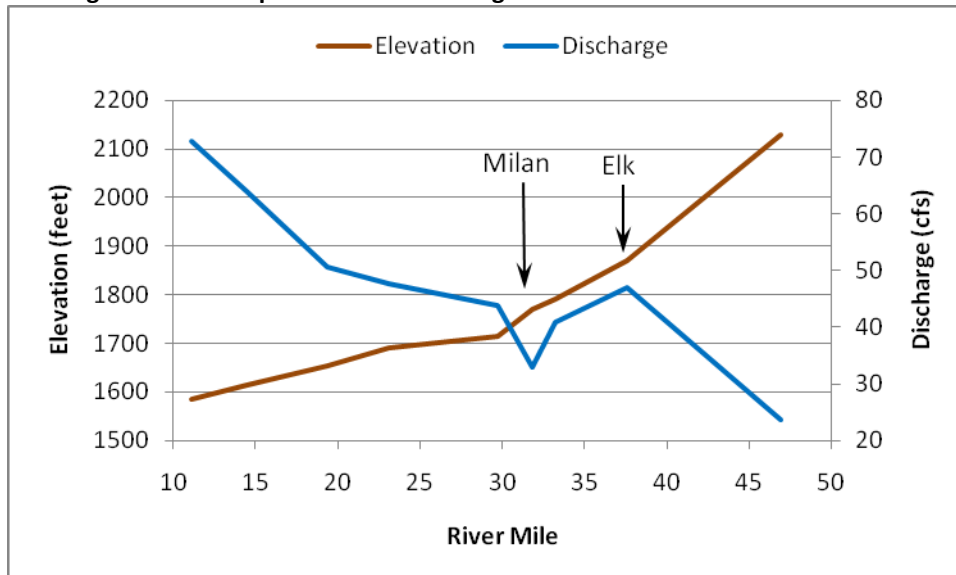


Table 4-3: Change in Little Spokane River Flow due to Ground Water/Surface Water Interactions

| Reach | Reach Length (miles) | Change in Flow due to Ground Water Interactions (Δ cfs) | Change in Flow per mile (cfs/mile) |
|---------------------------|----------------------|---|------------------------------------|
| Scotia to Elk | 9.3 | 23 | 2.5 |
| Elk to West Branch | 4.4 | -6.2 | -1.4 |
| West Branch to Milan | 1.4 | -7.8 | -5.6 |
| Milan to Bear Creek | 2.1 | 11 | 5.1 |
| Bear Creek to Chattaroy | 6.6 | 3.8 | 0.58 |
| Chattaroy to Colbert | 3.7 | 3.1 | 0.84 |
| Colbert to Deadman Creek | 4.9 | 13 | 2.7 |
| Deadman Creek to Dartford | 3.4 | 8.8 | 2.6 |

Notes: cfs is cubic feet per second.

Reach lengths are based on distance between measurements on the Little Spokane River mainstem as listed in Table 4-2

5.0 Recommendations for Future Work

There are two components we recommend for future work: 1. continued data collection, and 2. focused hydrogeologic study. Three data collection activities are recommended:

- Data collection at the seven continuous water level measurement sites should continue. Long term data sets are essential to understanding influences on water level. Data collection includes regular downloading of data and manual measurements for calibration.
- Accurate surveys of the well head and the river in close proximity to the well should be taken so the relative water levels can be accurately assessed.
- A second Little Spokane seepage run should be conducted in late summer/early fall to establish a higher degree of confidence in the identification of gaining and losing reaches of the river.

Three areas are suggested for focused hydrogeologic study:

- *The Deer Park area* – The only wells to show significant groundwater decline are located in the Deer Park area. The majority of the wells in that area, though, showed no decline and some showed increases. Therefore further study is needed to determine if these are localized issues, or indicate groundwater mining in the larger Deer Park area.
- *Losing Reaches of the Little Spokane River* – 5.4 miles of the Little Spokane River in the northern portion of Spokane County are losing water to the groundwater system. It is unclear whether this is a function of the geology in this area or a result of withdrawals from groundwater in the area.
- *Lower portion of the Spokane River* – The Water District 3 Pine River well and the Whitworth Water Shady Slope well both showed a 10-15 foot water level change over the course of this project and the Little Spokane River in the vicinity of these wells is gaining water from the groundwater system. In this same area are other production wells. Well logs show that the production wells are withdrawing water from a lower aquifer unit disconnected from the Little Spokane by a layer of clay. It is unclear how this lower unit is recharged and whether a connection to an upper aquifer in connection with the Little Spokane exists.



Figure 2-1
Continuous Groundwater Elevation
Measurement Locations

◆ Monitoring Locations



*Little Spokane Groundwater Elevation
 & Stream Flow Monitoring Project*

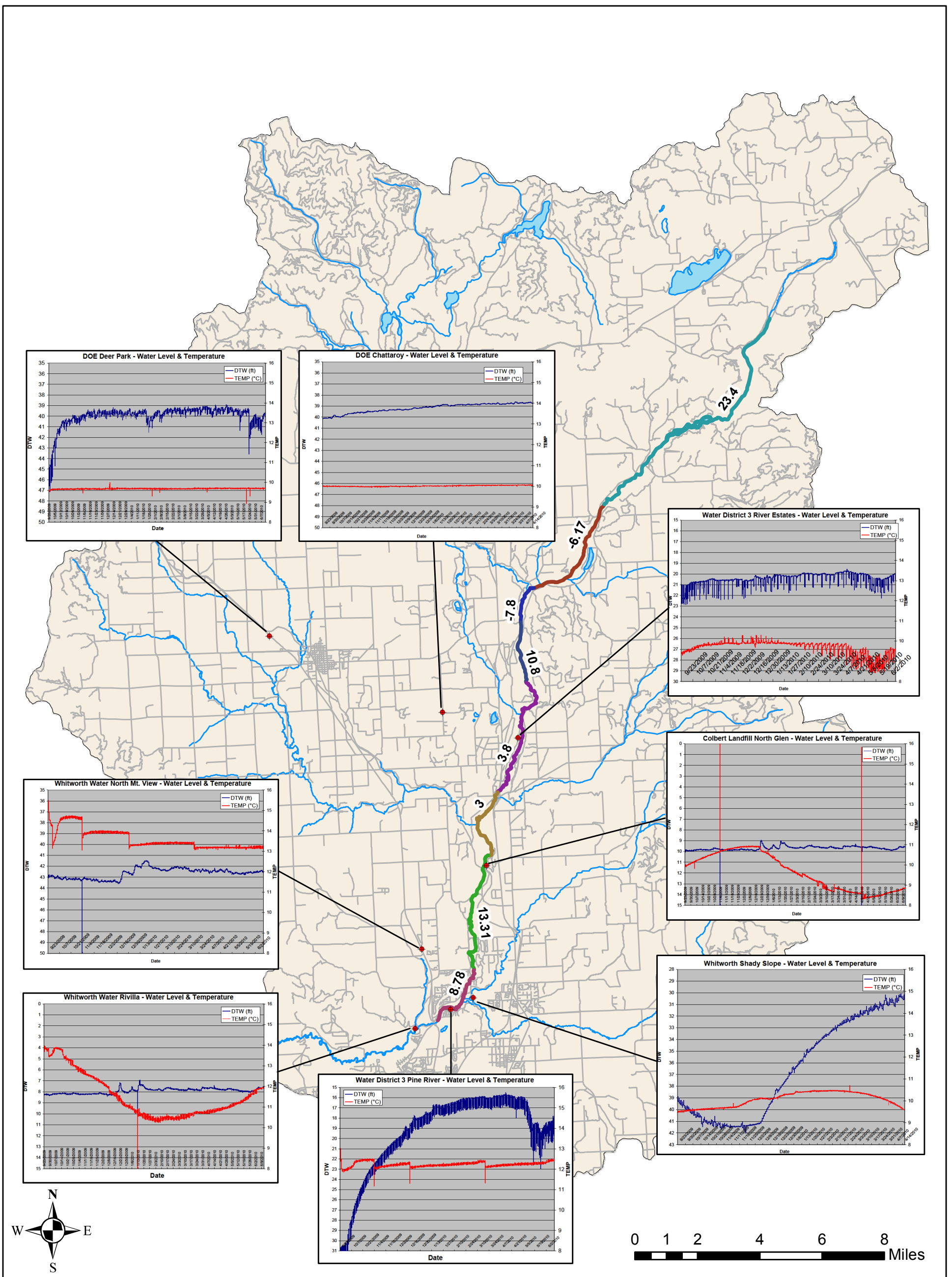
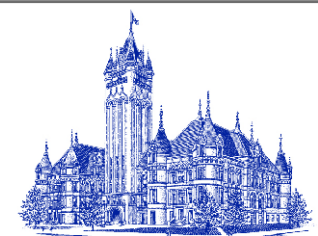


Figure 2.2 - Water Level & Temperature Changes with Seepage Run Data

Notes:
Water level and temperature changes over the study period (September 23 - June 11) are shown in each graph with a line drawn to the appropriate well location.

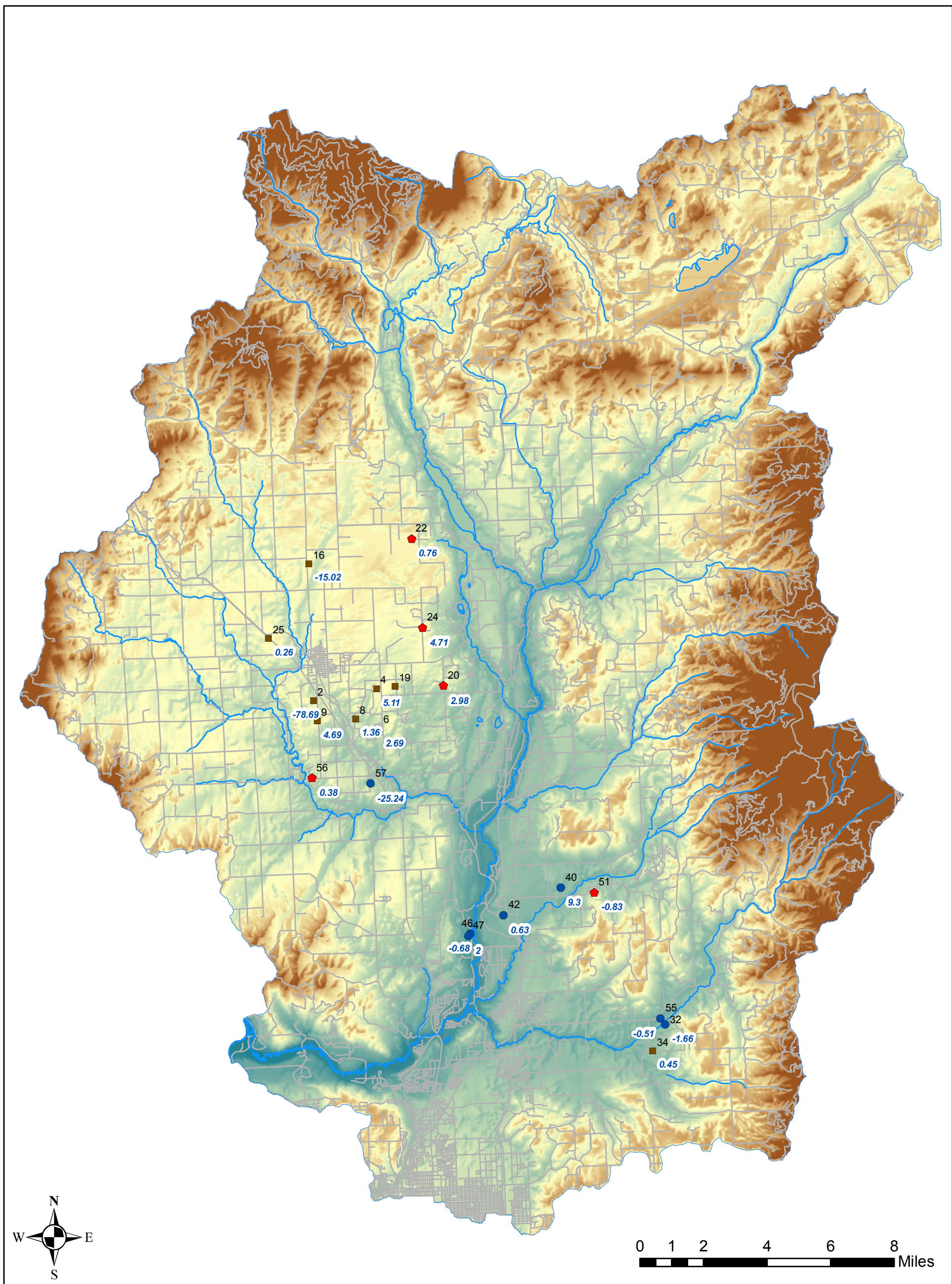
Water level changes are shown in blue and temperature changes are shown in red.
The y-axis of each graph has the same scale so changes in water level between sites are comparable.

Little Spokane seepage run data is depicted with changes in color with the associated groundwater contribution or loss in cfs along each reach.



SPOKANE COUNTY
WATER RESOURCES

Little Spokane Groundwater Elevation & Stream Flow Monitoring Project



**Figure 3-1
Snap Shot Measurement
Locations**

Notes:
 -Number in black are the study ID for each location.
 -Numbers in blue are the change in water level in feet from 1991/96 to 2009/10.
 See report for specific dates of the measurements.

Aquifer

- Basalt
- ◆ Granite
- Lower Sand and Gravel
- ▲ Unknown
- Upper Sand and Gravel



**Spokane County
Water Resources**

*Little Spokane Groundwater Elevation
& Stream Flow Monitoring Project*

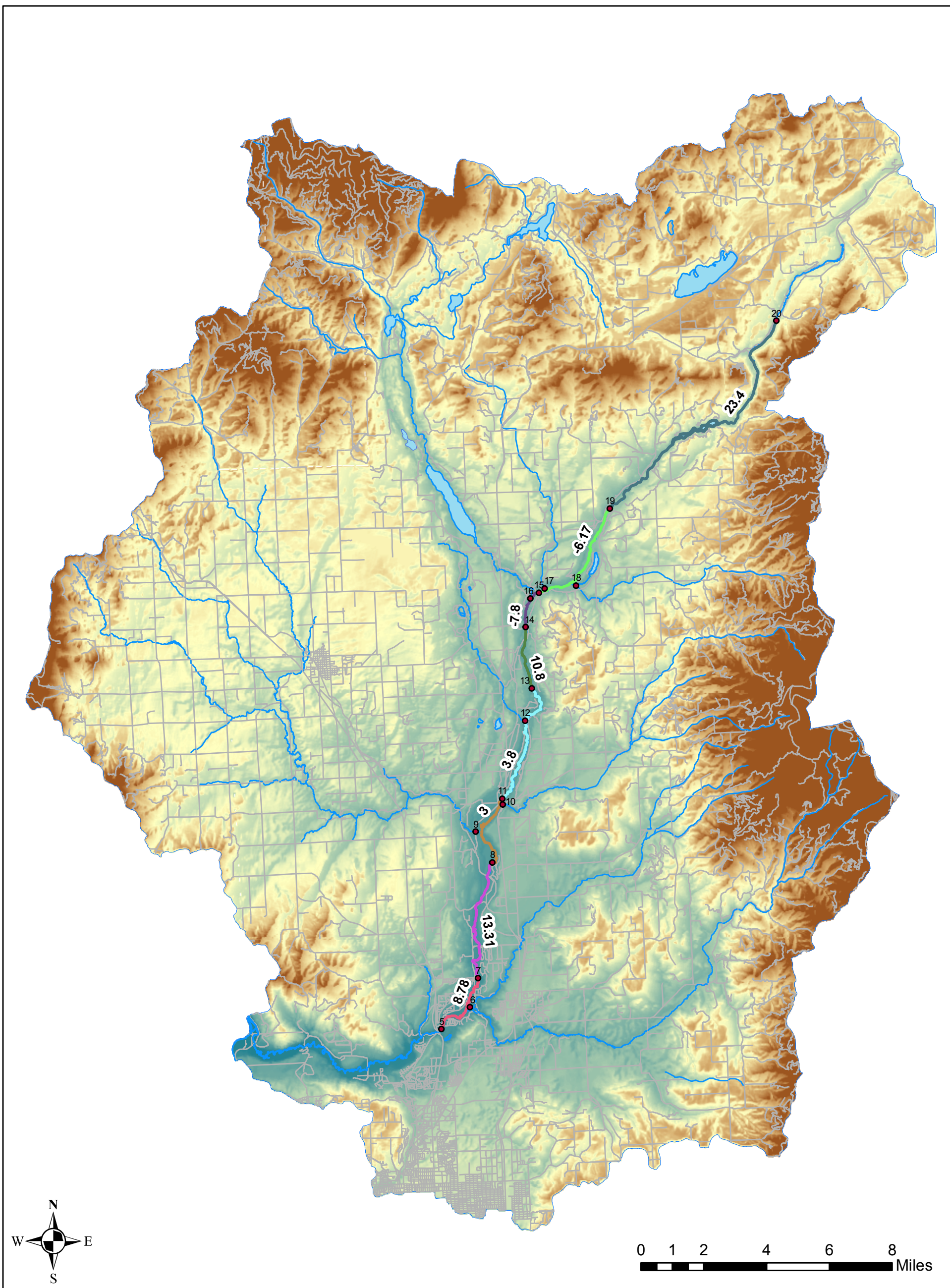


Figure 4-1
Little Spokane River Seepage Run - October 7, 2009

- Discharge Measurement Locations

Notes:
 Each stream reach evaluated is depicted with a different color.
 Streamflow gains or losses in cfs to and from groundwater are noted along each reach



*Little Spokane Groundwater Elevation
 & Stream Flow Monitoring Project*

Appendix A
Well Logs – Continuous Water Level Monitoring Locations

File Original and First Copy with Department of Ecology
Second Copy - Owner's Copy
Third Copy - Driller's Copy

WATER WELL REPORT

UNIQUE WELL ID # AGC028

STATE OF WASHINGTON

Water Right Permit No

89457

(1) OWNER Name Whitworth Water District #2 Address 10828 N. Waikiki Road, Spokane, WA.

(2) LOCATION OF WELL County Spokane SW 1/4 ne 1/4 Sec 33 T 27R N R 43R W

(2a) STREET ADDRESS OF WELL (or nearest address) N. 15212 Shady Slope Road, Spokane, WA.

(3) PROPOSED USE: Domestic Irrigation DeWater Industrial Test Well Municipal Other

(4) TYPE OF WORK: Owner's number of well (If more than one) 2
Abandoned New well Deepened Reconditioned Method Dug Cable Rotary Bored Driven Jetted

(5) DIMENSIONS: Diameter of well 12 inches
Drilled 130 feet Depth of completed well 130 ft

(6) CONSTRUCTION DETAILS: Casing installed 12 Diam from plus 2' 38' ft to ft
Welded Liner installed Threaded

Perforations: Yes No
Type of perforator used
SIZE of perforations in by in
perforations from ft to ft

Screens: Yes No
Manufacturer's Name Houston
Type 10" pipe size Model No 304 St
Diam 10 Slot size 40 from 90' ft to 115 ft
Diam 10 Slot size 25 from 115 ft to 120 ft

Gravel packed Yes No Size of gravel
Gravel placed from ft to ft

Surface seal Yes No To what depth? 41 ft
Material used in seal Bentinite to 8', neat cement to 0'
Did any strata contain unusable water? Yes No
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP Manufacturer's Name
Type HP

(8) WATER LEVELS: Land surface elevation above mean sea level ft
Static level 30 ft below top of well Date 1-10-01
Artesian pressure lbs per square inch Date
Artesian water is controlled by (Cap valve etc)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes by whom? Driller
Yield 512 gal/min with 38 ft drawdown after 12 hrs

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)
Time Water Level Time Water Level Time Water Level
Recovered to static level in 28 seconds

Date of test
Baker test gal/min with ft drawdown after hrs
Artest gal/min with stem set at ft for JAN 3 2001
Artesian flow gpm Date
Was a chemical analysis made? Yes No

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation Describe by color character, size of material and structure and show thickness of aquifer and the kind and nature of the material in each stratum penetrated with at least one entry for each change of information

Table with columns MATERIAL, FROM, TO. Rows include Top Soil, Sand & Gravel, 1" minus, brown clay, Coarse gravel & boulders, Sand & gravel 1" minus, some brown clay, Gravel 1" minus, some med. coarse sand, cemented with clay & boulders, Gravel 1" minus 10%, sand coarse 40%, sand fine & silt 40%, brown clay 10%, Boulders 6" minus with brown clay & med. to fine sand, Brown clay with very fine silt laid thru it, 3/8 minus gravel 40%, fine gravel 30%, coarse sand 30%, some silt, 3/8 coarse gravel 30%, coarse sand 50%, med. sand 20%, clay balls, Coarse sand 40%, med. sand 40%, fine sand 20%, some clay balls, Brown clay, some very fine sand, Coarse sand 20%, med. sand 40%, fine sand 40%, brown clay

Work Started Nov. 1 19 Completed Jan. 11 19

WELL CONSTRUCTOR CERTIFICATION continued

I constructed and/or accept responsibility for construction of this well, in compliance with all Washington well construction standards. Materials used the information reported above are true to my best knowledge and belief

NAME CJ WARREN & SON DRILLING (PERSON FIRM OR CORPORATION) (TYPE OR PRINT)

Address S 3005 Best Road, Veradale WA.

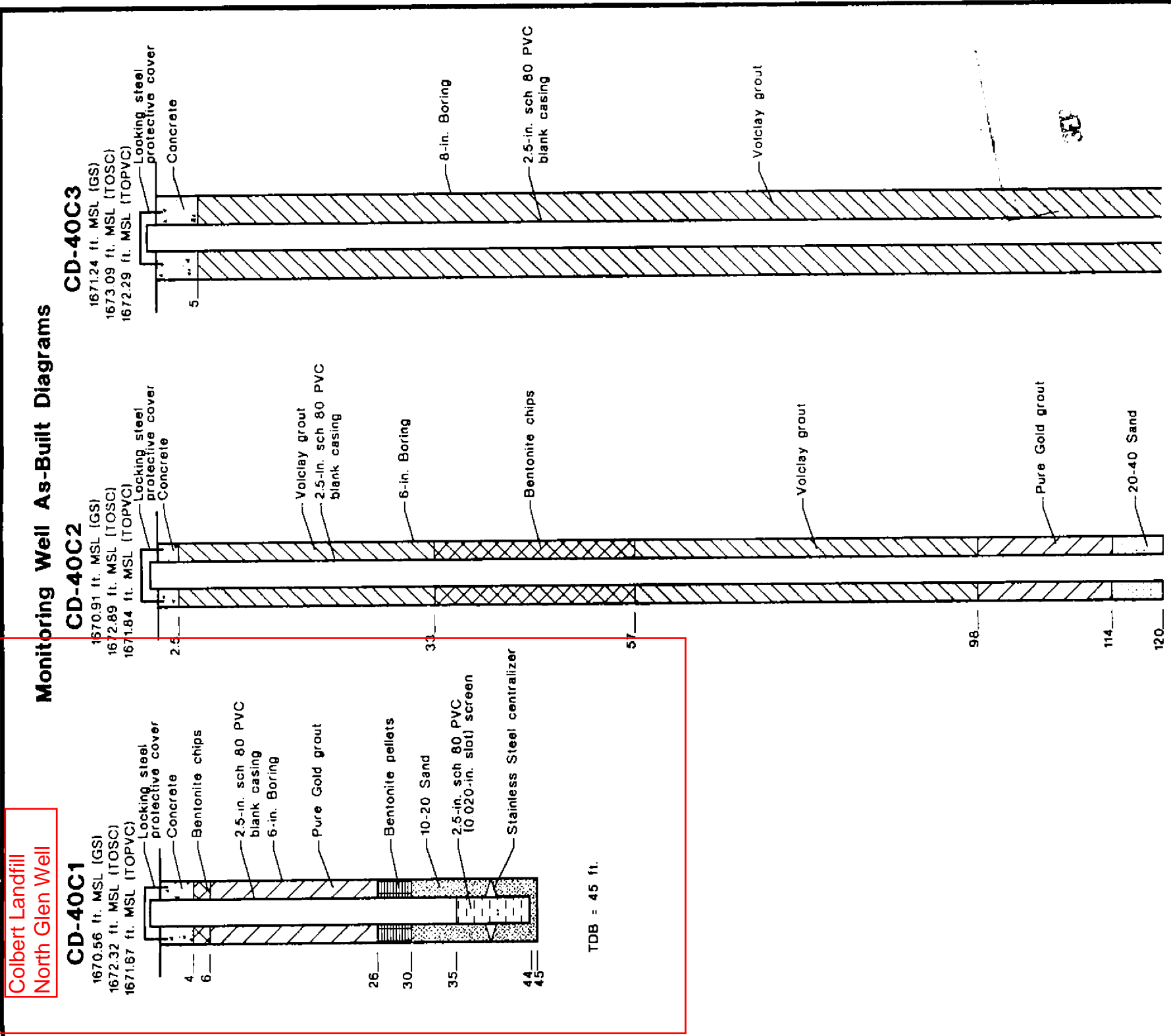
(Signed) [Signature] License No 0515 (WELL DRILLER)

Contractor's Registration No CJWARSD011JA Date Jan. 29 19

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at 407-6600. The TDD number is (206) 407-6006

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

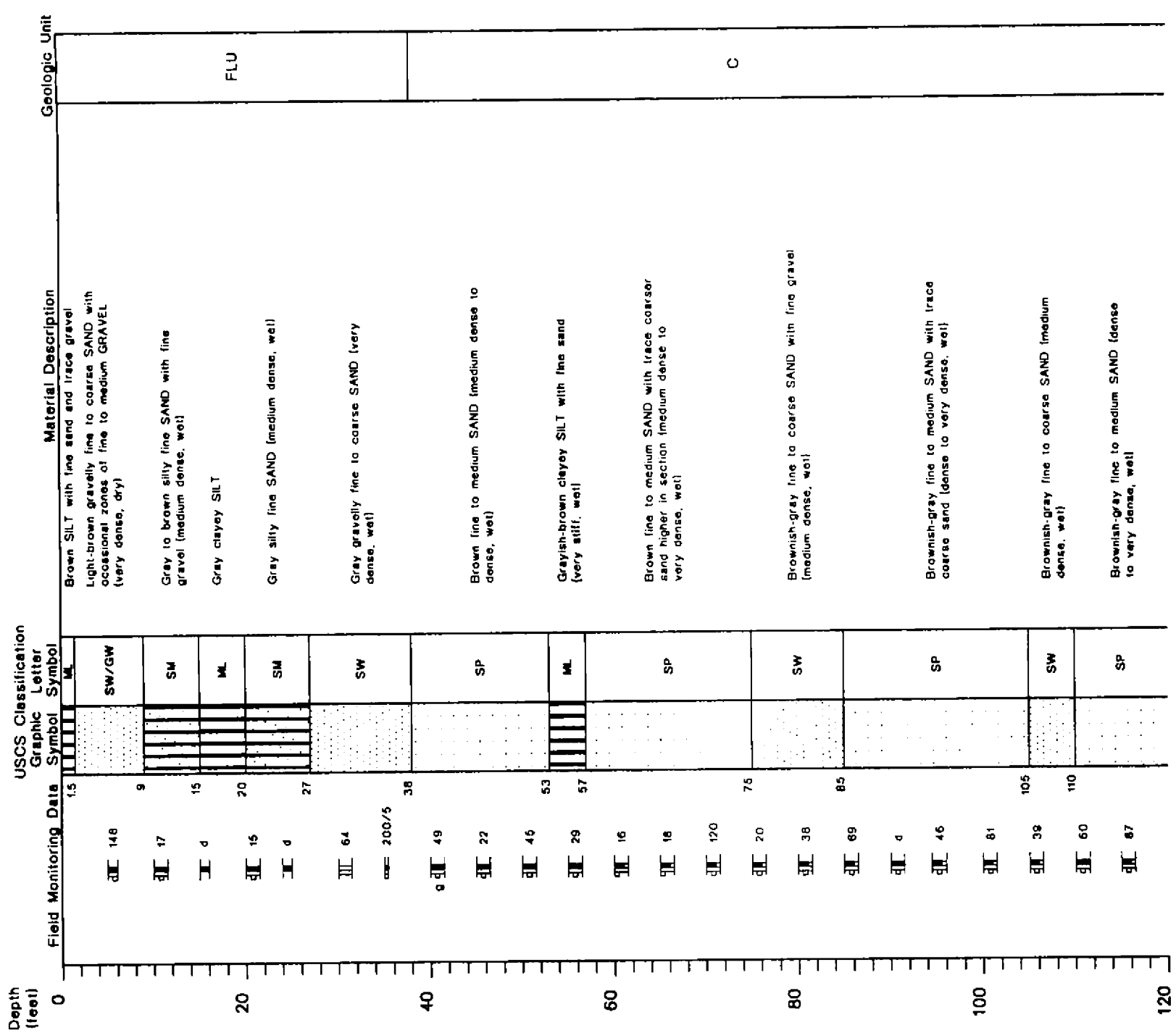


(Continued on next page)

(Continued on next page)

(Continued on next page)

Geologic Profile Boring CD-40C3



(Continued on next page)

WATER WELL LOG

N Mt View Well #2
Standing Well

OWNER: Name John Fleming Address _____ Zip _____
 (2) LOCATION OF WELL: County Spokane
 Bearing and distance from section or subdivision corner Lot 1 Blk 1 (Original Well) 1/4 Sec _____ T. _____ N. R. _____ W.M.

(3) PROPOSED USE: Domestic Industrial Municipal
 Irrigation Test Well Other

(4) TYPE OF WORK: Owner's number of well (if more than one) _____
 New well Method: Dug Bored
 Deepened Cable Driven
 Reconditioned Rotary Jetted

(5) DIMENSIONS: Diameter of well 8 inches.
 Drilled 90 ft. Depth of completed well 90 ft.

(6) CONSTRUCTION DETAILS:
 Casing installed: 8 " Diam. from 0 ft. to 60 ft.
 Threaded " Diam. from _____ ft. to _____ ft.
 Welded " Diam. from _____ ft. to _____ ft.

Perforations: Yes No
 Type of perforator used _____
 SIZE of perforations _____ in. by _____ in.
 perforations from _____ ft. to _____ ft.
 perforations from _____ ft. to _____ ft.
 perforations from _____ ft. to _____ ft.

Screens: Yes No
 Manufacturer's Name _____
 Type _____ Model No. _____
 Diam. _____ Slot size _____ from _____ ft. to _____ ft.
 Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes No Size of gravel: _____
 Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes No To what depth? _____ ft.
 Material used in seal _____
 Did any strata contain unusable water? Yes No
 Type of water? _____ Depth of strata _____
 Method of sealing strata off _____

7) PUMP: Manufacturer's Name _____
 Type: _____ H.P.

8) WATER LEVELS: Land-surface elevation _____ ft.
 static level 66 ft. below top of well Date _____
 Artesian pressure _____ lbs. per square inch Date _____
 Artesian water is controlled by _____ (Cap. valve, etc.)

9) WELL TESTS: Drawdown is amount water level is lowered below static level
 Is a pump test made? Yes No If yes, by whom? _____
 Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

| Time | Water Level | Time | Water Level | Time | Water Level |
|------|-------------|------|-------------|------|-------------|
| | | | | | |

Date of test _____
 Pump test 12 gal./min. with 16 ft. drawdown after 1 hr.
 Artesian flow _____ g.p.m. Date _____
 Temperature of water _____ Was a chemical analysis made? Yes No

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

| MATERIAL | FROM | TO |
|-------------------|------|----|
| Dirty sand | 0 | 30 |
| Clay and sand | 30 | 55 |
| Clay | 55 | 68 |
| Sand vein & water | 68 | 68 |
| Clay | 68 | 90 |

The water in this well flows from a narrow vein of sand between clay layers at the 68 ft. level.

Permitted

Work started Dec. 63, 19____. Completed Jan, 1964

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME D. E. BARTHOLOMEW
 (Person, Agent, or Firm) (Type or print)
 Address Nine Mile Falls, Wash.

[Signed] D. E. Bartholomew
 (Well Driller)

License No. _____ Date Jan, 1964

WATER WELL REPORT

Date Printed 15 Aug 2002

Unique Well ID No AGG618

Log No 14702

118135

State of Washington

Water Right Permit Number 8711020139

(1) OWNER SPOKANE WATER DIST NO 3 Address P O BOX 11187 Spokane WA 99211

(2) LOCATION OF WELL County SPOKANE NE 1/4 NW 1/4 Sec 23 T 28 R 43E WM

(2a) Street Address of well RIVER ESTATES RD

Tax Parcel No

(3) PROPOSED USE DOMESTIC

(4) TYPE OF WORK Owners s Well Number 1
NEW WELL (If more than one well)

(10) Well Log

Method CABLE

(5) DIMENSIONS Diameter of well 18 inches
Drilled 122 ft Depth of completed well 122 ft

Formation Describe by color character size of material and structure Show thickness of aquifers and the kind and nature of the material in each stratum penetrated Show at least one entry for each change in formation

(6) CONSTRUCTION DETAILS Casing installed WELDED

| Material | From | To |
|------------------------------|------|-----|
| BROWN SAND GRAVEL BOULDERS | 0 | 14 |
| SMALLER BOULDERS SAND/GRAVEL | 14 | 17 |
| HARD GRAVEL BOULDERS | 17 | 23 |
| SATURATED GRAVEL BOULDERS | 23 | 26 |
| GRAY SILT BOULDERS | 26 | 28 |
| BROWN SATURATED SAND/GRAVEL | 28 | 37 |
| GRAY SAND FINE SATURATED | 37 | 45 |
| GRAY SAND COARSE W/WATER | 45 | 48 |
| GRAY CLAY | 48 | 53 |
| GRAY SATURATED SAND | 53 | 58 |
| BROWN SAND COARSE SATURATED | 58 | 63 |
| BROWN CLAY SILT | 63 | 66 |
| COARSER BROWN SAND | 66 | 80 |
| CLAYEY BROWN SAND SATURATED | 80 | 98 |
| BROWN SAND COARSE SATURATED | 98 | 105 |
| GRAY SAND FINE | 105 | 112 |
| COARSER SAND W/WATER | 112 | 117 |
| CLAYEY SAND LESS WATER | 117 | 122 |

Liner installed NONE
14 Dia from +2 ft to 54 ft
14 Dia from 61 ft to 67 ft
16 Dia from 100 ft to 121 5 ft

Perforations used? No Used In

Type of perforator used

SIZE of perforations in by in
Perforations from ft to ft
Perforations from ft to ft
Perforations from ft to ft

Screens Yes K Pac Location

Manufacture s Name JOHNSON

Type SLOTTED Model No STAINLESS

Diam 14 slot size 040 from 67 ft to 100 ft

Diam 14 slot size 040 from 54 ft to 61 ft

Gravel packed No Size of Gravel 060

Gravel placed from 122 ft to 25 ft

Surface seal Yes To what depth 25 ft

Seal method Material used in seal CEMENT

Did any strata contain unusable water? No

Type of water Depth of strata

Method of sealing strata off

(7) PUMP Manufacture s name
Type NONE H P 0

Notes

(8) WATER LEVELS Land surface elevation
above mean sea level 0 ft

Static level 21 ft below top of well Date 05/20/2002

Artesian Pressure lbs per square inch Date

Artesian water controlled by

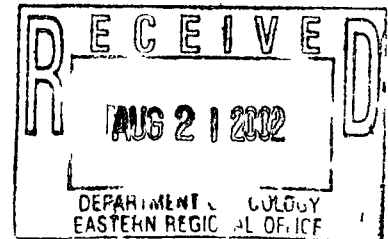
(9) WELL TEST Drawdown is amount water level is lowered below static level

Was a pump test made? Yes If yes by whom FOGLE PUMP

Yield gal/min with ft drawdown after
800 38 77 4

Recovery data Test Date 6/18/02
Time Water Level Time Water Level Time Water Level

Bailer test gal/min ft drawdown after hrs
Air test gal/min w/ stem set at ft for hours
Artesian flow gpm Date
Temperature of water Was a chemical analysis made No



Work started 05/10/2002 Completed 06/21/2002

WELL CONSTRUCTION CERTIFICATION

I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Materials used and the information reported are true to my best knowledge and belief.

JAMES F NOONAN License No 0362
(Driller/Licensed Engineer)

Trainee Name License No
NAME FOGLE PUMP & SUPPLY INC Shop AIRWAY HEIGHTS
ADDRESS PO BOX 1450

Airway Heights WA 99001

Phone 5092440846 Toll Free 8883439355

E Mail

FAX 5092442815 WEB Site WWW.FOGLEPUMP.COM

[SIGNED] James F Noonan License No 0362
(Driller/Licensed Engineer)

Contractor s Registration No Date Log Created 8/15/02

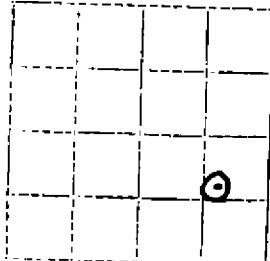
The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Appl.: 6502
 Permit 6145
 Cert.: 6017
WELL LOG

STATE OF WASHINGTON
 DEPARTMENT OF CONSERVATION
 DIVISION OF WATER RESOURCES

Record by Driller
 Source Driller's Record



Location: State of WASHINGTON
 County Spokane
 Area.....

Map
 Plat of Greenleaf Park Subdivision
 1/4 sec. 32 T. 27 N. R. 43 E.

Diagram of Section

Drilling Co. Clyde Reeder - Well Driller
 Address.....

Method of Drilling Bored Date May 5, 1961

Owner Washington Water Power Co.
 Address P. O. Drawer 1445, Spokane, Wash.

Land surface, datum 1600' ft. ^{above} ~~below~~
 SWL: 15.3' Date May 5, 1961 Dims: 6"x208'

| CORRE-LATION | MATERIAL | From (feet) | To (feet) |
|--------------|----------|-------------|-----------|
|--------------|----------|-------------|-----------|

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

| | | | |
|--|--|-----|-----|
| | Domestic supply and municipal | | |
| | Fill material | 0 | 9 |
| | Top soil | 9 | 10 |
| | Sand | 10 | 12 |
| | Sand & gravel | 12 | 19 |
| | Clay, sand, silt | 19 | 56 |
| | Clay, blue, & silt | 56 | 116 |
| | Sand, coarse, & silt | 116 | 187 |
| | Sand, coarse, & gravel in clay | 187 | 202 |
| | Gravite, broken | 202 | 208 |
| | Granite | 208 | |
| | Casing: 6" from 0' to 203' | | |
| | Sealed with concrete to 1' | | |
| | Yield: 330 gpm with 43' DD after 24 hrs. | | |
| | immediate recovery | | |
| | Date of test: May 5, 1961 | | |

File Original and First Copy with Department of Ecology
Second Copy - Owner's Copy
Third Copy - Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No

Permit No.

OWNER: Name D.A.E. (Observation) Address 103 E. Johnson
LOCATION OF WELL: County SPOKANE SW 1/4 NW 1/4 Sec. 16 T. 28 N. R. 43E, W.M.
Bearing and distance from section or subdivision corner 1400' S and 50' E from NW corner of Sec. 16

(3) PROPOSED USE: Domestic Industrial Municipal
Irrigation Test Well Other

(4) TYPE OF WORK: Owner's number of well (if more than one) _____
New well Method: Dug Bored
Deepened Cable Driven
Reconditioned Rotary Jetted

(5) DIMENSIONS: Diameter of well 6" inches.
Drilled 242 ft. Depth of completed well 242 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 193 ft.
Threaded Diam. from _____ ft. to _____ ft.
Welded Diam. from _____ ft. to _____ ft.
Perforations: Yes No
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes No
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ from _____ ft. to _____ ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes No To what depth? 18
Material used in seal BENTONITE
Did any strata contain unusable water? Yes No
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) PUMP: Manufacturer's Name _____
Type: _____ H.P. _____

(8) WATER LEVELS: Land-surface elevation above mean sea level 1980
Static level _____ ft. below top of well Date _____
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom? _____
Yield: gal/min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)
Time Water Level Time Water Level Time Water Level

Date of test _____
Baller test _____ gal/min. with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes No

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

| MATERIAL | FROM | TO |
|-----------------------------------|------|-----|
| SOLL, GREY | 0 | 3 |
| SAND, BRN, FINE TO MEDIUM | 3 | 37 |
| SAND, BRN, MED TO COARSE | 37 | 40 |
| SAND, BRN, MED TO COARSE W.B. | 40 | 57 |
| SAND, BRN, FINE, MED W/CLAY WATER | 57 | 83 |
| CLAY, GREY, FINE SAND | 83 | 86 |
| SAND, BRN, FINE, MED W/CLAY WATER | 86 | 91 |
| SAND, BRN, FINE W.B. | 91 | 127 |
| SAND, BRN, FINE TO MED. W.B. | 127 | 138 |
| SAND, BRN, FINE W.B. | 138 | 173 |
| CLAY, GREY, COARSE | 173 | 179 |
| CLAY, LT. BRN | 179 | 188 |
| CLAY, BRN, FINE W/BRN CLAY | 188 | 192 |
| GRAVITE, LT. BRN | 192 | 198 |
| CLAY, ALK GREY | 198 | 227 |
| GRAVITE, GREY | 227 | 242 |

Dear Park 7th Valley
4755 46 11722 50

Work started 20 JAN 1978 Completed 23 JAN 1978

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME B.I.B. WELL DRILLING
(Person, firm, or corporation) (Type, or print)

Address Rt 7, Barbours VAKINA WA 97903

[Signed] C. C.
(Well Driller)

License No. _____ 1978

2/7/78

(USE ADDITIONAL SHEETS IF NECESSARY)

File Original and First Copy with Department of Ecology
Second Copy - Owner's Copy
Third Copy - Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

DEER PARK
SPokane AREA
Application No
Permit No

OWNER: Name D.O. E (Observation) address 103 E Indian, Spokane.

LOCATION OF WELL: County Spokane - NW 1/4 SE 1/4 Sec 33 T29 N. R. 42E W.M.

Location and distance from section or subdivision corner 2700' N. and 1750' W from the SE corner of sec 33

(3) PROPOSED USE: Domestic Industrial Municipal
Irrigation Test Well Other

(4) TYPE OF WORK: Owner's number of well (if more than one) _____
New well Method: Dug Bored
Deepened Cable Driven
Reconditioned Rotary Jetted

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 350 ft. Depth of completed well 350 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 87 ft.
Threaded " Diam. from _____ ft. to _____ ft.
Welded " Diam. from _____ ft. to _____ ft.

Perforations: Yes No
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes No
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ from _____ ft. to _____ ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes No To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes No
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) PUMP: Manufacturer's Name _____
Type: _____ HP _____

(8) WATER LEVELS: Land-surface elevation 2180 ft. above mean sea level.
Static level 67' ft. below top of well Date 25 JAN 78
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom? _____
Yield: _____ gal/min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

| Time | Water Level | Time | Water Level | Time | Water Level |
|------|-------------|------|-------------|------|-------------|
| | | | | | |
| | | | | | |
| | | | | | |

Date of test _____
Bailer test 200 gal/min. with ALL ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes No

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

| MATERIAL | FROM | TO |
|--------------------------------|------|-----|
| SOLL, BRN, SANDY | 0 | 3 |
| SAND, BRN, FINE #1 BRN CLAY | 3 | 22 |
| CLAY, LT BRN | 22 | 37 |
| CLAY, GRAY | 37 | 56 |
| CLAY, LT BRN | 56 | 61 |
| SAND, BRN, MED | 61 | 68 |
| CLAY, LT BRN, DENSE | 68 | 84 |
| BASALT, BLK, MED DENSE | 84 | 99 |
| BASALT, BLK, FRACURED W/B ZONE | 99 | 112 |
| BASALT, BLK, MED DENSE | 112 | 187 |
| BASALT, BLK, CRUSCED W/B ZONE | 187 | 193 |
| BASALT, BLK, MED DENSE | 193 | 212 |
| CLAY, GRAY, MED DENSE | 212 | 350 |

YIELD WAS ESTIMATED

Deer Park 7 1/2
Clayton 7 1/2
475805 11730.30

Work started 23 JAN 78 Completed 25 JAN 78

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME B'S B WELL DRILLING
(Person, firm, or corporation) (Type or print)

Address RT 7, BOX 600A, YAKIMA WA 98923

(Signed) C. Cain
(Well Driller)

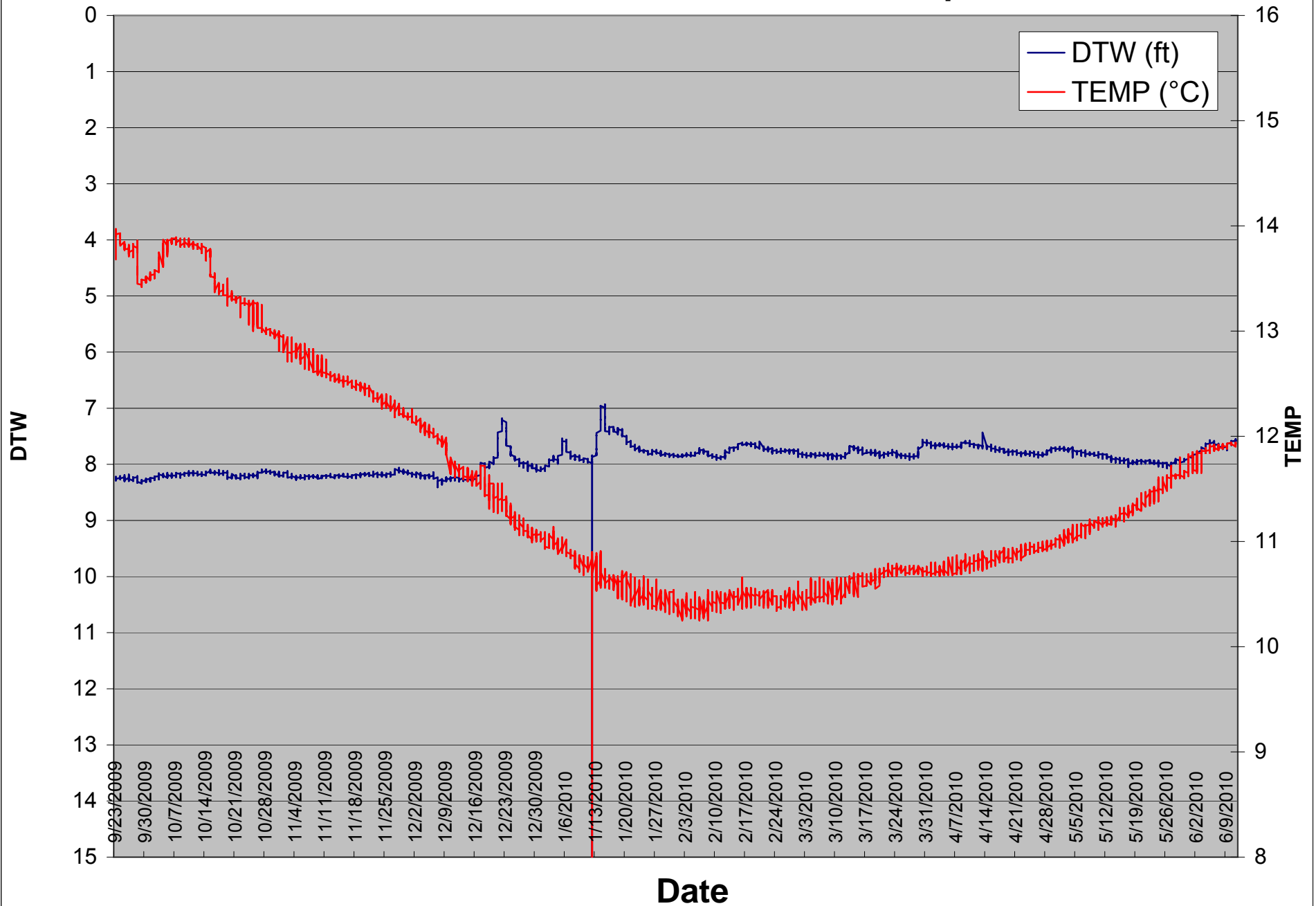
License No. 0700 Date 25 JAN 78

2/7/78

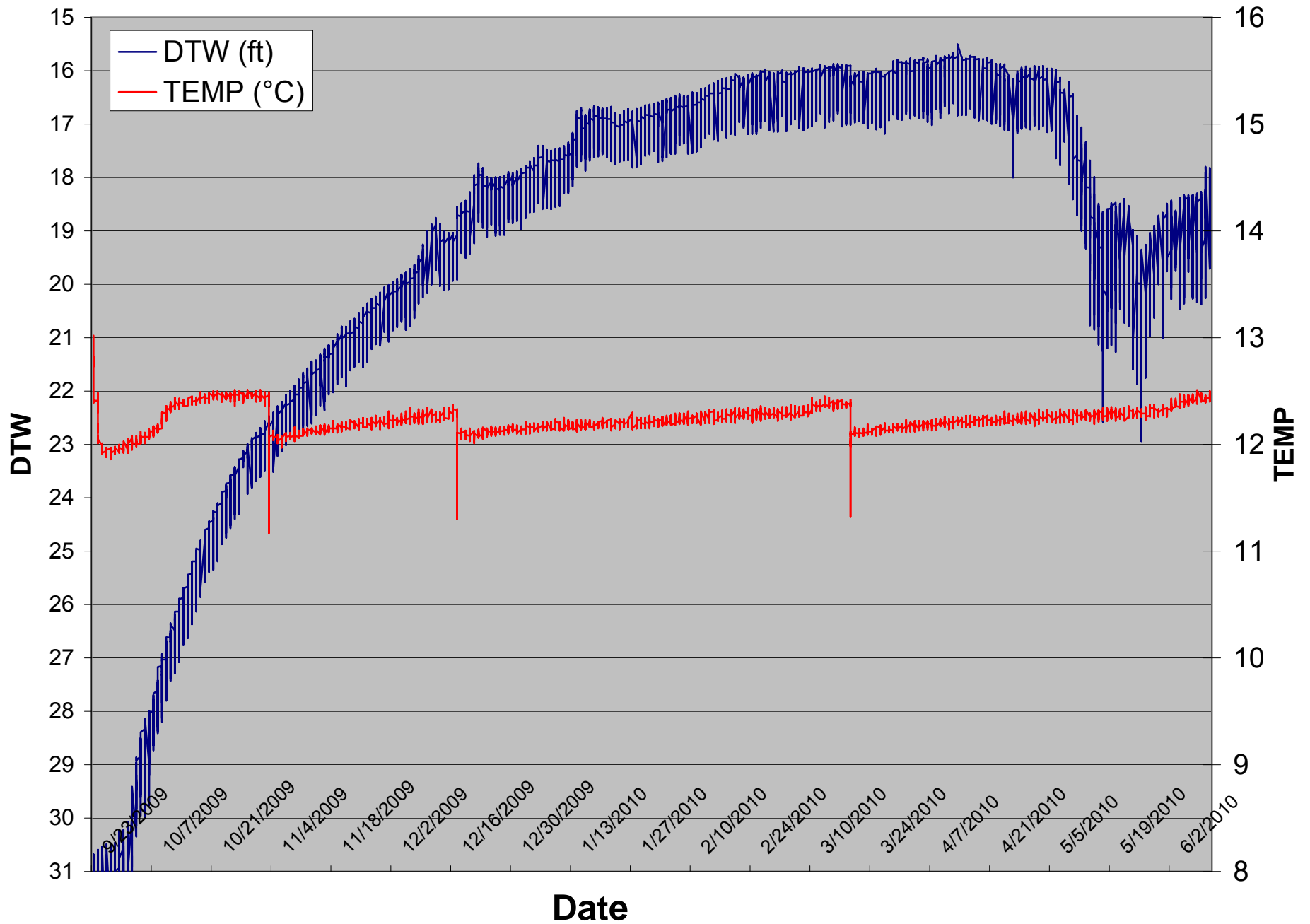
The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Appendix B
Water Level, Temperature & Conductivity Graphs

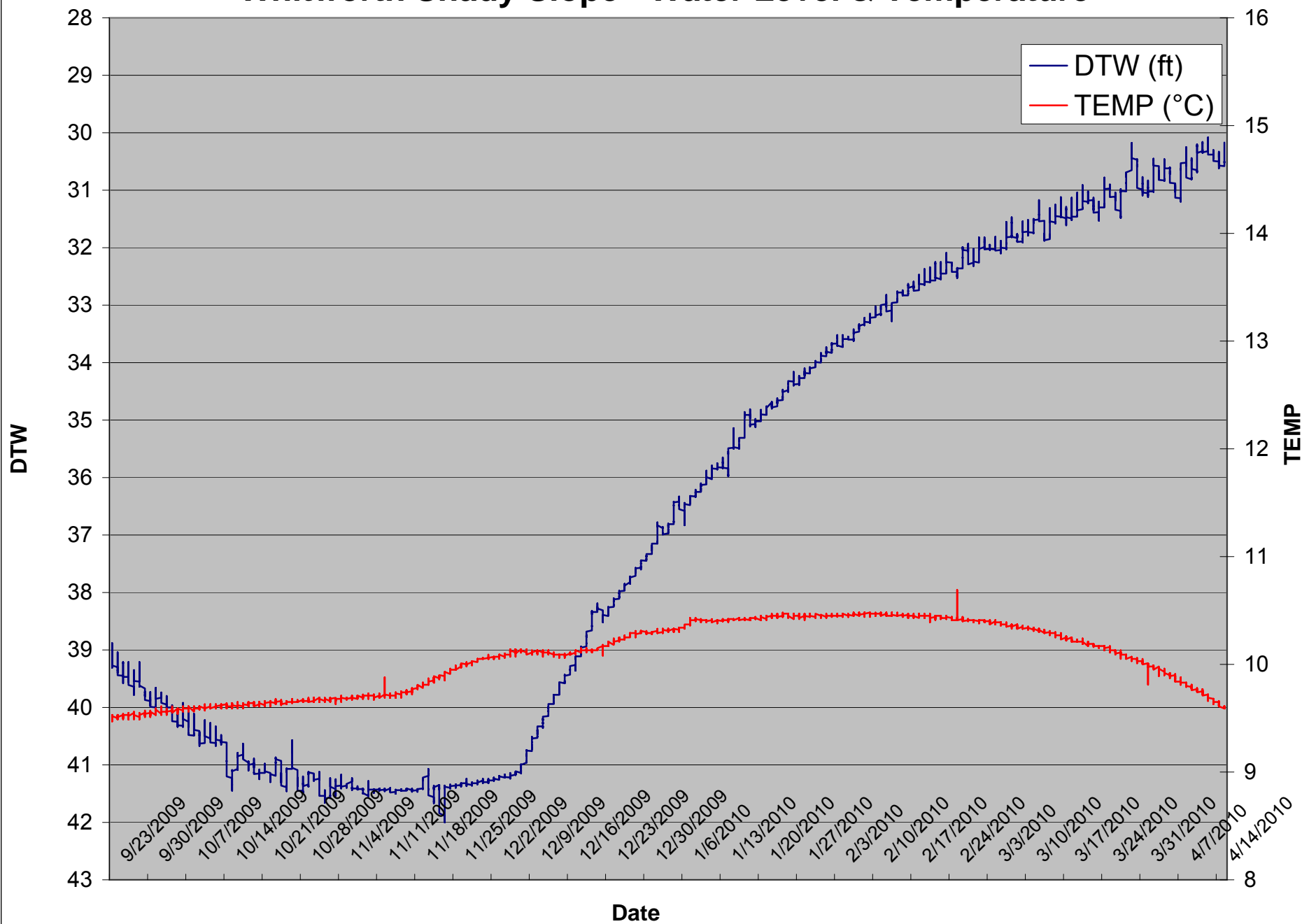
Whitworth Water Rivilla - Water Level & Temperature



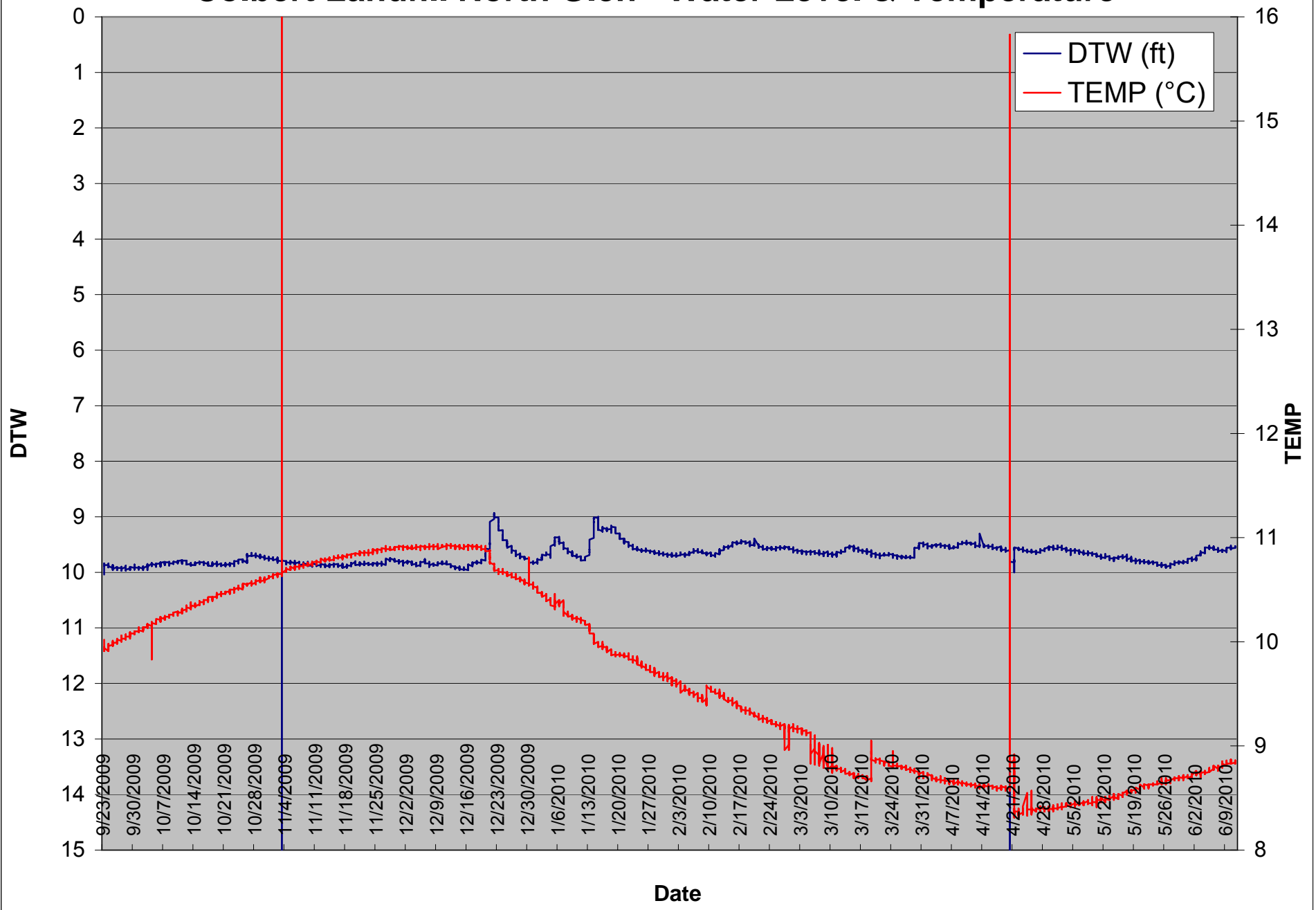
Water District 3 Pine River - Water Level & Temperature



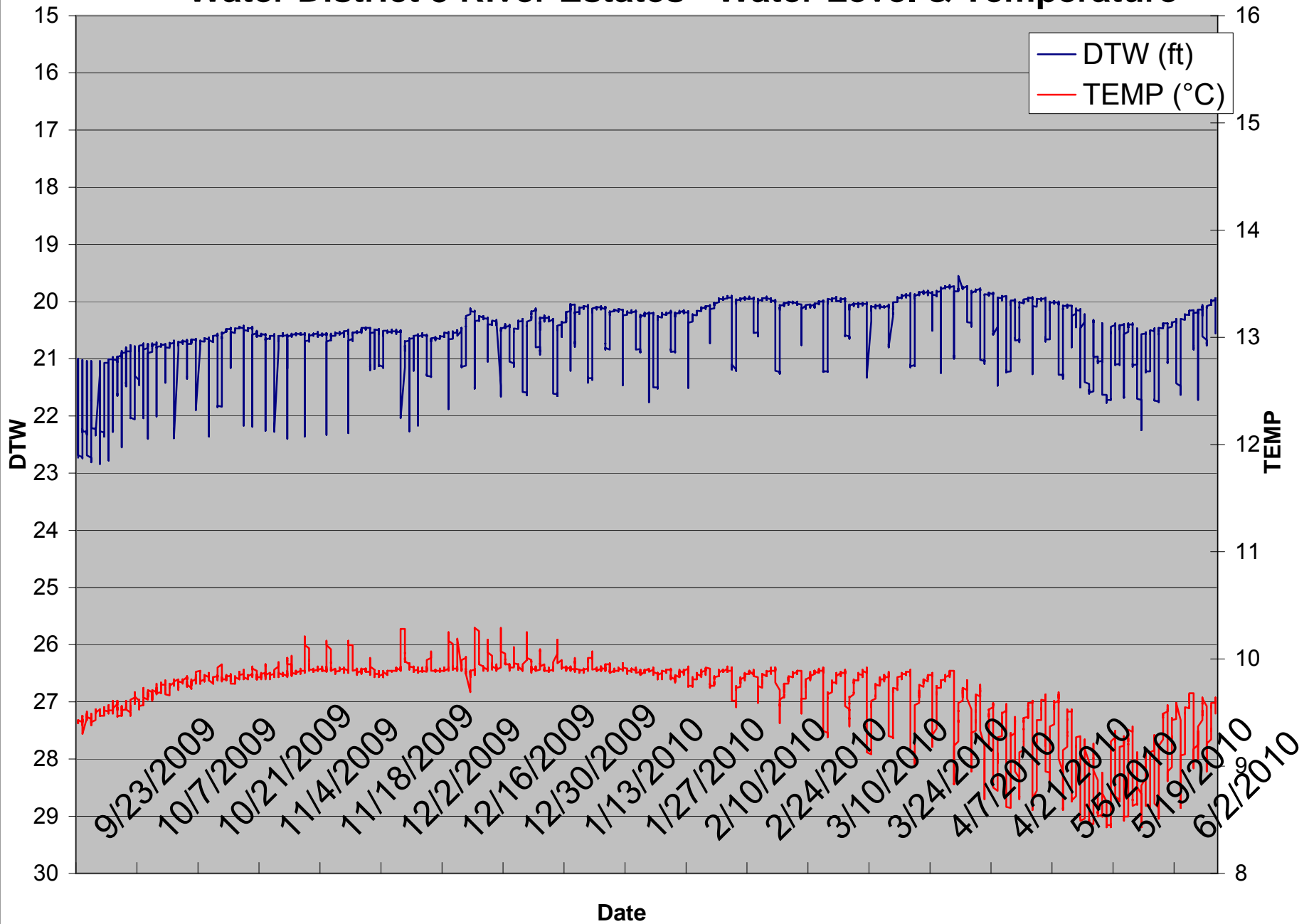
Whitworth Shady Slope - Water Level & Temperature



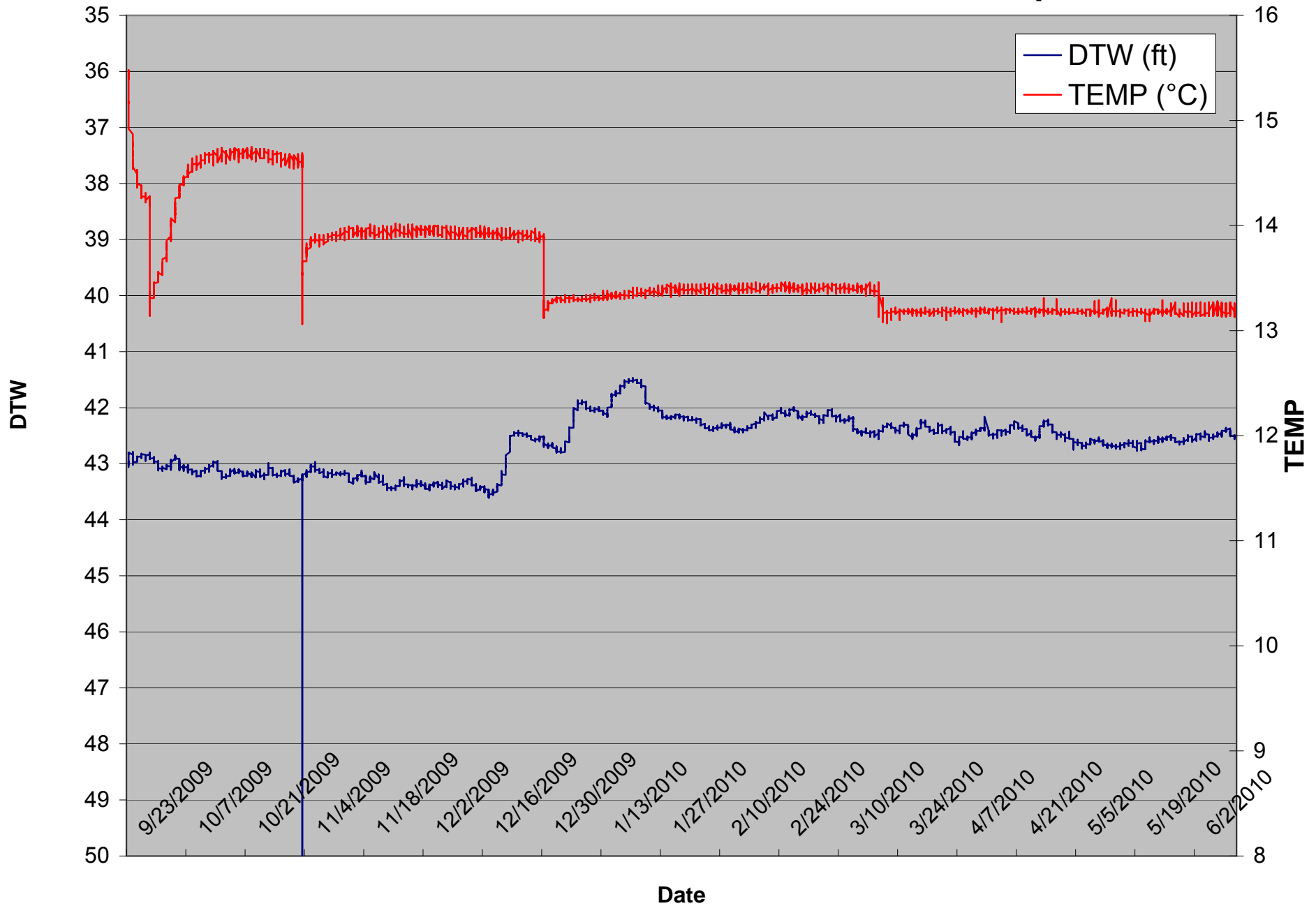
Colbert Landfill North Glen - Water Level & Temperature



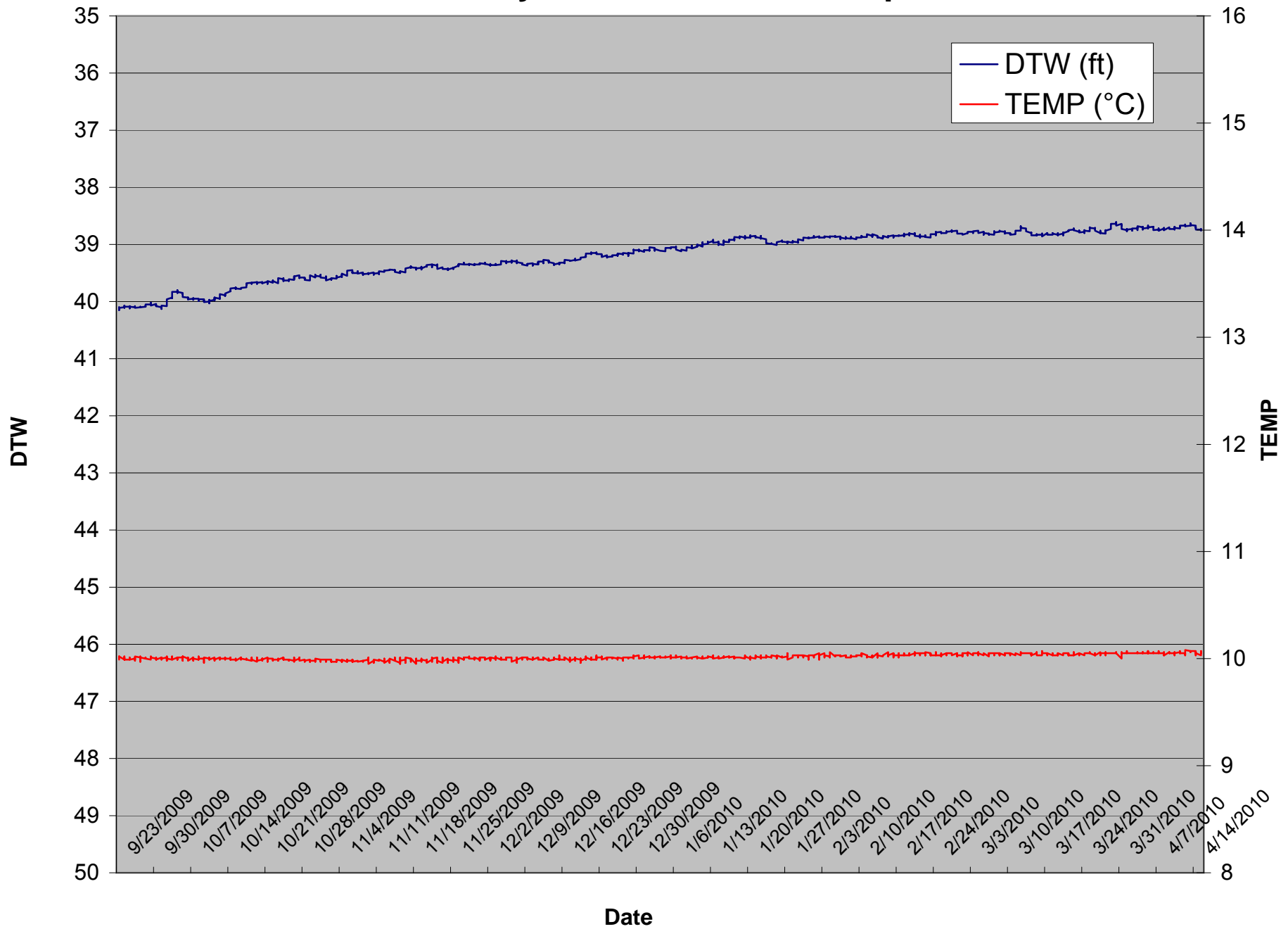
Water District 3 River Estates - Water Level & Temperature



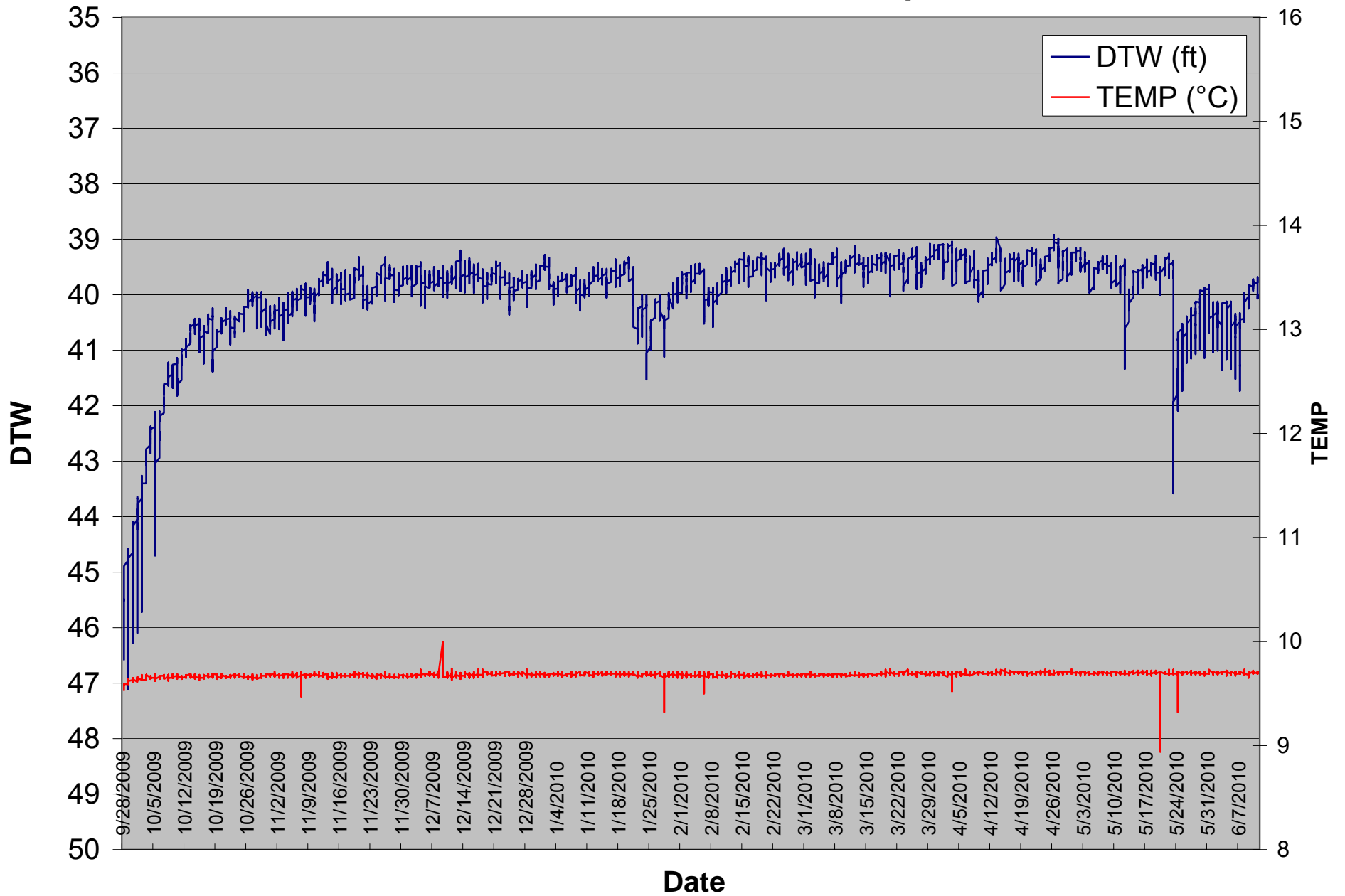
Whitworth Water North Mt. View - Water Level & Temperature



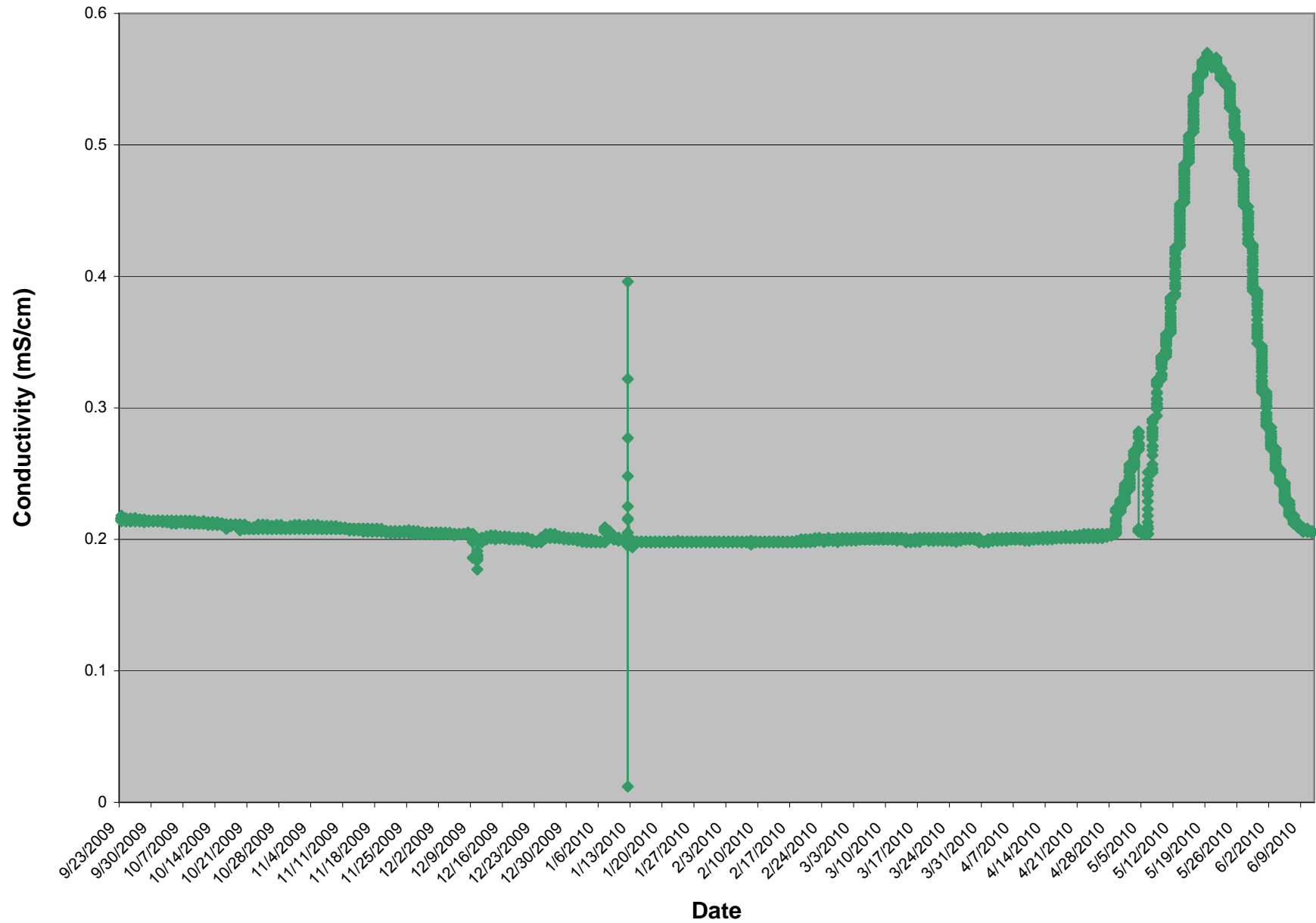
DOE Chattaroy - Water Level & Temperature



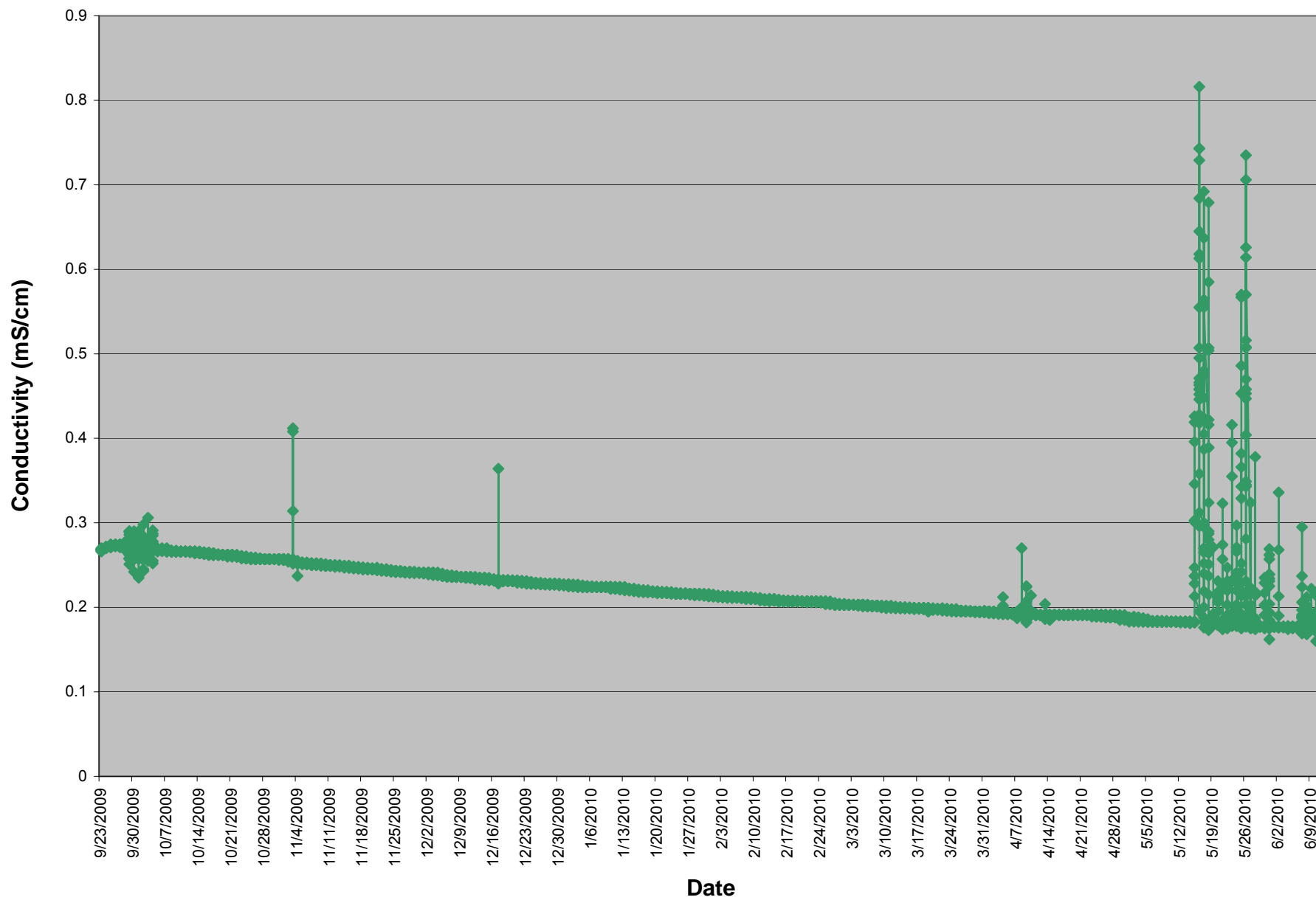
DOE Deer Park - Water Level & Temperature



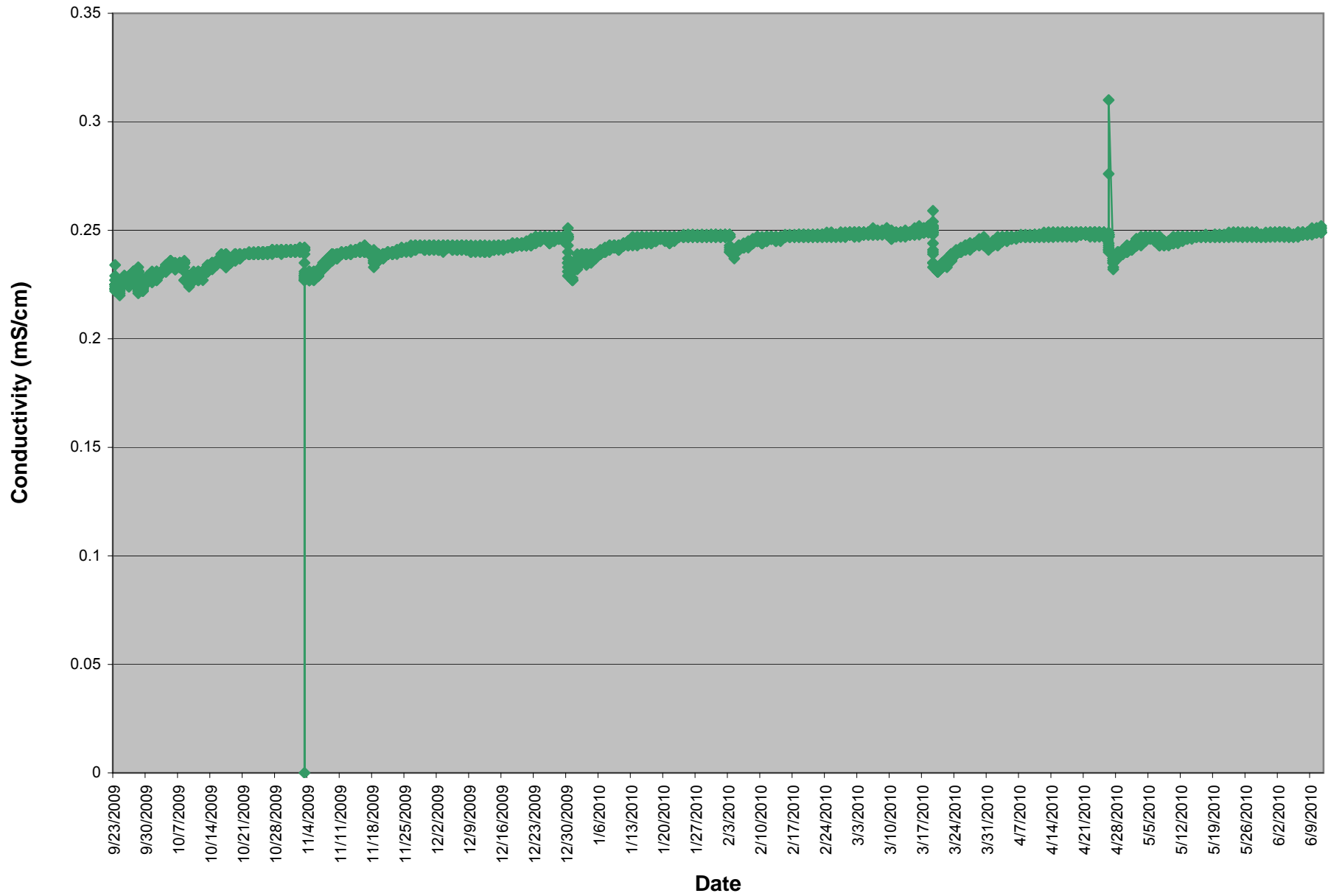
Whitworth Water Rivilla - Conductivity



Water District 3 Pine River - Conductivity



Whitworth Water North Mt. View - Conductivity



Appendix C
Well Logs – Snap Shot Water Level Measurement Locations

WATER WELL REPORT

STATE OF WASHINGTON

File Original and First Copy with
Department of Ecology
Second Copy - Owner's Copy
Third Copy - Driller's Copy

Application No.
Permit No.

(1) OWNER: Name Bill Love Address Cedar Rd - Deer Park WA 99006
LOCATION OF WELL: County Spokane - SE 1/4 NE 1/4 Sec 12 T.28 N. R.2E W.M.
Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic Industrial Municipal
Irrigation Test Well Other

(4) TYPE OF WORK: Owner's number of well (if more than one)
New well Method: Dug Bored
Deepened Cable Driven
Reconditioned Rotary Jetted

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 160 ft. Depth of completed well 160 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 71 ft. to 140 ft.
Threaded 4" Diam. from 130 ft. to 160 ft.
Welded " Diam. from " ft. to " ft.

Perforations: Yes No
Type of perforator used skill saw
SIZE of perforations 1/4 in. by 5 in.
30 perforations from 130 ft. to 160 ft.
perforations from " ft. to " ft.
perforations from " ft. to " ft.

Screens: Yes No
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes No Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes No To what depth? 40 ft.
Material used in seal Bentonic
Did any strata contain unusable water? Yes No
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: HP

(8) WATER LEVELS: Land-surface elevation 2150 ft.
Static level 70 ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom?

Yield: gal./min. with ft. drawdown after hrs.
" " " " "
" " " " "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)
Time Water Level Time Water Level Time Water Level
AIR TEST 15-20 GPM
Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes No

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

| MATERIAL | FROM | TO |
|------------|------|-----|
| top soil | 0 | 2' |
| sand | 2 | 40 |
| brown clay | 40 | 120 |
| gray clay | 120 | 140 |
| basalt | 140 | 160 |

RECEIVED

OCT - 1 1981

DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started 19 Completed 4-23-81 19

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME MINDEN WELL DRILLING, INC.
(Person, firm, or corporation) (Type or print)

Address Rt. 3, Box 100, Deer Park, WA 99006

[Signed] Ken Minden
(Well Driller)

License No. 971 Date 4-30-81 19

10/1/81 RM

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

STATE OF WASHINGTON

Permit 63-24782

(1) OWNER: Name: Jim Neff Address: 18303 Howard Spok. WA
(2) LOCATION OF WELL: County: Spokane NE 1/4 NE 1/4 Sec 15 T23N. R42W.M.

PROPOSED USE: Domestic [X] Industrial [] Municipal []
Irrigation [] Test Well [] Other []

(4) TYPE OF WORK: Owner's number of well (if more than one).....
New well [X] Method: Dug [] Bored []
Deepened [] Cable [] Driven []
Reconditioned [] Rotary [X] Jetted []

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 260 ft. Depth of completed well 260 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 1 ft. to 23 ft.
Threaded [] " Diam. from " ft. to " ft.
Welded [X] " Diam. from " ft. to " ft.

Perforations: Yes [] No [X]
Type of perforator used.....
SIZE of perforations " in. by " in.
perforations from " ft. to " ft.
perforations from " ft. to " ft.
perforations from " ft. to " ft.

Screens: Yes [] No [X]
Manufacturer's Name.....
Type..... Model No.....
Diam. Slot size from " ft. to " ft.
Diam. Slot size from " ft. to " ft.

Gravel packed: Yes [] No [X] Size of gravel:.....
Gravel placed from " ft. to " ft.

Surface seal: Yes [X] No [] To what depth? 18 ft.
Material used in seal Bentonite & Sand
Did any strata contain unusable water? Yes [] No [X]
Type of water?..... Depth of strata.....
Method of sealing strata off.....

(7) PUMP: Manufacturer's Name.....
Type:..... H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 2150 ft.
Static level 30 ft. below top of well Date.....
Artesian pressure lbs. per square inch Date.....
Artesian water is controlled by (Cap. valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes [] No [] If yes, by whom?.....
Yield: gal./min. with " ft. drawdown after " hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

| Time | Water Level | Time | Water Level | Time | Water Level |
|------|-------------|------|-------------|------|-------------|
| | | | | | |
| | | | | | |
| | | | | | |

of test 1-30-76
B.P. at " gal./min. with " ft. drawdown after " hrs.
Flow " g.p.m. Date.....
Temperature of water..... Was a chemical analysis made? Yes [] No []

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

| MATERIAL | FROM | TO |
|---------------|------|-----|
| Dirt | 0 | 2 |
| SAND | 2 | 55 |
| CLAY | 55 | 63 |
| Broken BASALT | 63 | 68 |
| Hard BASALT | 68 | 260 |

Handwritten notes: 18' 10' 15' 16'

Work started 1-22-76 Completed 1-30-76

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME: J. J. Drilling (Person, firm, or corporation) (Type or print)

Address: 13621 E 7th Spok. WA

[Signed] J. J. Drilling (Well Driller)

License No. 2215 Date: 1-30-76

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
 Second Copy - Owner's Copy
 Third Copy - Driller's Copy

1222 13 WATER WELL REPORT

Start Card No. W21566

UNIQUE WELL I.D. # ABE134

STATE OF WASHINGTON

Water Right Permit No. _____

OWNER: Name Arnold Scholl Address 10823 E. Kronquist Mead 99021

LOCATION OF WELL: County Spokane SW 1/4 SW 1/4 Sec 4 T 26 N. R 44 W.M.

STREET ADDRESS OF WELL (or nearest address) 10823 E. Kronquist Mead 99021

PROPOSED USE: Domestic Industrial Municipal
 Irrigation Test Well Other
 DeWater

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

| MATERIAL | FROM | TO |
|----------------------|------|-----|
| Clay White | 0 | 30 |
| Clay Gray | 30 | 48 |
| Clay Light Brn. | 48 | 77 |
| Sand coarse | 77 | 86 |
| Backed Clay | 86 | 107 |
| Basalt Fractured w/w | 107 | 125 |

TYPE OF WORK: Owner's number of well (if more than one) _____
 Abandoned New well Method Dug Bored
 Deepened Cable Driven
 Reconditioned Rotary Jetted

DIMENSIONS: Diameter of well 6 inches.
 Drilled 125 feet. Depth of completed well 125 ft.

CONSTRUCTION DETAILS:
 Casing installed: 6 Diam. from +2 ft. to 88 ft.
 Welded Diam. from _____ ft. to _____ ft.
 Liner installed Diam. from _____ ft. to _____ ft.
 Threaded Diam. from _____ ft. to _____ ft.

Perforations: Yes No
 Type of perforator used _____
 SIZE of perforations _____ in by _____ in.
 _____ perforations from _____ ft. to _____ ft.
 _____ perforations from _____ ft. to _____ ft.
 _____ perforations from _____ ft. to _____ ft.

Screens: Yes No
 Manufacturer's name _____
 Type P.V.C. Model No. _____
 diam. 4 Slot size 10 from 105 ft. to 125 ft.
 Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes No Size of gravel _____
 Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes No To what depth? 18 ft.
 Material used in seal Bentonite
 Did any strata contain unusable water? Yes No
 Type of water? _____ Depth of strata _____
 Method of sealing strata off _____

PUMP: Manufacturer's Name _____
 Type _____ H.P. _____

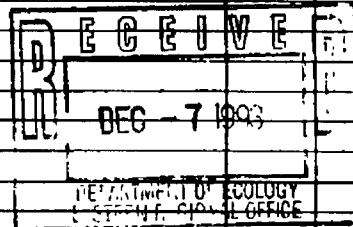
WATER LEVELS: Land-surface elevation _____ ft. above mean sea level
 Static level 70 ft. below top of well Date 11-27-93
 Artesian pressure _____ lb. per square inch Date _____
 Artesian water is controlled by _____ (Cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
 Was a pump test made? Yes No If yes, by whom? _____
 Yield _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

| Time | Water Level | Time | Water Level | Time | Water Level |
|------|-------------|------|-------------|------|-------------|
| | | | | | |

Date of test _____
 Bailor test _____ gal./min. with _____ ft. drawdown after _____ hrs.
 Arrest 40+ gal./min. with stem set at 125 ft. for 1 hrs.
 Artesian flow _____ g.p.m. Date _____
 Temperature of water _____ Was a chemical analysis made? Yes No



6" Drive Shoe Utilized

Work Started 11-24-93 19. Completed 11-28-93 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Top Top Well and Drilling
 (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
 Address 15911 Blawie Rd Elk 99009
 (Signed) Gregory Klatt License No 2037
 (TYPE SIGNATURE)

Contractor's Registration No. 71PTAWW101B Date 11-30-93

(USE ADDITIONAL SHEETS IF NECESSARY)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WATER WELL REPORT

STATE OF WASHINGTON

Application No

Permit No. 99005-

(1) OWNER: Name George Sullivan Address N. 19009 Little Spokane Dr., Spokane, WA

(2) LOCATION OF WELL: County Spokane N 1/2 of NE 1/4 NW 1, Sec. 21 T. 27 N., R. 43 W.M
bearing and distance from section or subdivision corner except E 20 ft.

(3) PROPOSED USE: Domestic Industrial Municipal
Irrigation Test Well Other

(4) TYPE OF WORK: Owner's number of well (if more than one) 1
New well Method: Dug Bored
Deepened Cable Driven
Reconditioned Rotary Jetted

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 100 ft. Depth of completed well 84 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from +1 ft. to 79 ft.
Threaded " Diam. from " ft. to " ft.
Welded " Diam. from " ft. to " ft.

Perforations: Yes No
Type of perforator used: _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes No
Manufacturer's Name Johnson
Type stainless steel Model No _____
Diam. 5" Slot size .025 from 79 ft to 84 ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes No To what depth? 20 ft.
Material used in seal bentonite
Did any strata contain unusable water? Yes No
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) PUMP: Manufacturer's Name _____
Type: _____ HP _____

(8) WATER LEVELS: Land-surface elevation above mean sea level _____
Static level 12 ft. below top of well Date 6/23/86
Artesian pressure _____ lbs per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes by whom? _____
Yield: _____ gal/min with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)
Time Water Level | Time Water Level | Time Water Level

Date of test _____
Pump test 6 gal/min with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes No

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

| MATERIAL | FROM | TO |
|--------------------------------|-----------------|------|
| Brown clay | 0 | 18' |
| Gray clay | 18' | 38' |
| Blue gray clay | 38' | 45' |
| Tan clay | 45' | 51' |
| White clay | 51' | 63' |
| Gray clay with sand | 63' | 72' |
| Sand with gray clay | 72' | 79' |
| Granite sand | 79' | 85' |
| Lenses | x85' | |
| Gray clay | 85' | 100' |

AUG 17 1986

Work started 6/19 1986 Completed 6/23 1986

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Bartholomew Drilling, Inc.
(Person, firm, or corporation) (Type or print)

Address N. 11525 Nine Mile Rd., Nine Mile Falls WA 99026

(Signed) Gary Bartholomew
(Well Driller)

License No. 0051 Date 8-6 1986

8/11/86 *[Signature]*

(USE ADDITIONAL SHEETS IF NECESSARY)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.



WATER WELL REPORT

Start Card No. 033091

STATE OF WASHINGTON

Study ID - 47

Water Right Permit No. _____

OWNER: Name George Sullivan (Mike) Address N19009 LITTLE SPOKANE DR., SPOKA

(2) LOCATION OF WELL: County Spo. NE 4 NW 1 Sec 21 T. 27 N. R 43 W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) _____

(3) PROPOSED USE: Domestic Industrial Municipal
 Irrigation Test Well Other
 DeWater

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

(4) TYPE OF WORK: Owner's number of well (if more than one) _____
 Abandoned New well Method: Dug Bored
 Deepened Cable Driven
 Reconditioned Rotary Jetted

| MATERIAL | FROM | TO |
|--|------|-----|
| top soil | 0 | 2 |
| clay white | 2 | 12 |
| clay brown-dec granite | 12 | 18 |
| clay white-dec granite | 18 | 44 |
| clay dark brown | 44 | 60 |
| clay dark brown | 60 | 70 |
| silty sand & clay-some water | 70 | 80 |
| set 10ft of 6 slot screen | | |
| could only develop 1gpm-pulled screens | | |
| clay brown | 80 | 110 |
| clay gray | 110 | 120 |
| clay white | 120 | 135 |
| clay lite brown | 135 | 175 |
| coarse granite sand & water | 175 | 185 |
| hard clay white with some granite sand | 185 | 195 |

(5) DIMENSIONS: Diameter of well 6 inches.
 Drilled 195 feet. Depth of completed well 185 ft.

(6) CONSTRUCTION DETAILS:
 Casing installed: 6 Diam. from +1 1/2 ft. to 173 ft.
 Welded Diam. from _____ ft. to _____ ft.
 Liner installed Diam. from _____ ft. to _____ ft.
 Threaded Diam. from _____ ft. to _____ ft.

Perforations: Yes No
 Type of perforator used _____
 SIZE of perforations _____ in by _____ in.
 _____ perforations from _____ ft. to _____ ft.
 _____ perforations from _____ ft. to _____ ft.
 _____ perforations from _____ ft. to _____ ft.

Screens: Yes No
 Manufacturer's Name Johnson
 Type stainless steel Model No. _____
 Diam. 6 Slot size 35 from 175 ft. to 185 ft.
 Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes No Size of gravel _____
 Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes No To what depth? 20 ft.
 Material used in seal bentonite
 Did any strata contain unusable water? Yes No
 Type of water? _____ Depth of strata _____
 Method of sealing strata off _____

(7) PUMP: Manufacturer's Name _____
 Type _____ H.P. _____

(8) WATER LEVELS: Land surface elevation _____ ft.
 Static level 66 ft. below top of well Date _____
 Artesian pressure _____ lbs. per square inch Date _____
 Artesian water is controlled by _____ (Cap valve etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
 was a _____ test made? Yes No Done by whom? _____
 Yield _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from water table level)
 Time Water Level Time Water Level Time Water Level

Date of test _____
 Bailor test _____ gal./min. with _____ ft. drawdown after _____ hrs.
 Arrest 60 gal./min. with stem set at _____ ft. for _____ hrs.
 Artesian flow _____ g.p.m. Date _____
 Temperature of water _____ Was a chemical analysis made? Yes No

Work started 3/19/90 Completed 3/29/90

WELL CONSTRUCTOR CERTIFICATION:
 I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME BARTHOLOMEW DRILLING, INC.
PERSON FIRM OR CORPORATION (TYPE OR PRINT)
N. 11525 NINE MILE RD.
 Address NINE MILE FALLS, WA 99026


(Signed) Ken Menden License No. 971
(WELL DRILLER)
 Contractor's Registration No. BARTHI 24903 Date 04/24/90

(USE ADDITIONAL SHEETS IF NECESSARY)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 

060895

Study ID - 57

Water Right Permit No. _____

OWNER: Name DONALD E. DINGMAN Address 26703 N. DENNISON ROAD DEER PARK WA

(1) LOCATION OF WELL: County SPOKANE NE 1/4 NW 1/4 Sec 25 T. 28 N. R. 42 W.M

(2a) STREET ADDRESS OF WELL (or nearest address) PARCEL # 28252 - 9049

(3) PROPOSED USE: Domestic Irrigation Industrial Municipal
 DeWater Test Well Other

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned New well Method: Dug Bored
Deepened Cable Driven
Reconditioned Rotary Jetted

(5) DIMENSIONS: Diameter of well 6" inches.
Drilled 300 feet Depth of completed well 290 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 5 Diam from +1.5 ft. to 36 ft.
Welded 4 Diam from +1.5 ft. to 290 ft.
Liner installed PVC
Threaded Diam from _____ ft. to _____ ft.
Perforations: Yes No
Type of perforator used _____
SIZE of perforations _____ in by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes No
Manufacturer's Name WESCO
Type _____ Model No. _____
Diam. 4" Slot size 10 from 280 ft. to 290 ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes No Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes No To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes No
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) PUMP: Manufacturer's Name _____
Type _____ H.P. _____

(8) WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 20 ft below top of well Date 9-24-92
Artesian pressure _____ lbs per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom? _____
Yield 22 gal./min. with _____ ft. drawdown after 1 hrs.
ESTIMATED AIR LIFT 22 GPM

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)
Time Water Level Time Water Level Time Water Level

Date of test _____
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest _____ gal./min. with slum set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes No

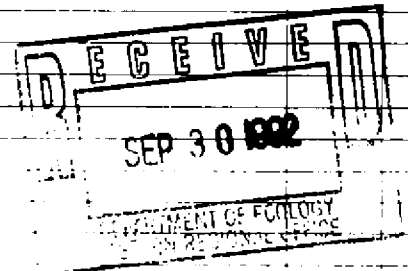
(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information

| MATERIAL | FROM | TO |
|------------------|------|-----|
| TOP SOIL GRAY | 0 | 3 |
| CLAY GRAY | 3 | 7 |
| SANDY CLAY BROWN | 7 | 37 |
| BASALT BLACK | 37 | 230 |
| CLAY BROWN | 230 | 270 |
| SAND WHITE | 270 | 300 |

WATER IN SAND 270 to 300

6" DRIVE SHOE UTILIZED



Work started 9-21-92 19 _____ Completed 9-24-92 19 _____

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME PONDEROSA DRILLING (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address EAST 6010 BROADWAY SPOKANE, WA 99212

(Signed) Marty Rugo License No. 2038

Contractor's WELL DRILLER (Marty Rugo)

Registration No. PO-ND-EI *248 JE Date Sept 25, 1992 19 _____

(USE ADDITIONAL SHEETS IF NECESSARY)



The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.