Appendix H
Wellhead and Watershed Protection Program

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Wellhead and Watershed Protection Program

INTRODUCTION

All federally defined Group A public water systems that use groundwater as their source are required to develop and implement a wellhead protection program.

The City of Bonney Lake provides potable water to approximately 20,000 people on the Lake Tapps plateau. Water is supplied from two wellfields (Ball Park Well No. 1 and Tacoma Point Wells Nos. 2 and 4) and two spring sites (Victor Falls Springs and Grainger Springs).

The City conducted a Wellhead Protection and Monitoring Program (WHPMP) in 1997 – 1998 (City of Bonney Lake, 1998). The objective of the WHPMP was to protect the quality and quantity of the City's groundwater supply. These efforts will help the City to avoid the need for and costs associated with treating or replacing the existing supply.

Phase II of the City's Wellhead Protection and Monitoring Program (WPMP) was implemented between 1998 and 2000 (City of Bonney Lake, 2000). The objectives of Phase II were; 1) to further characterize the City's groundwater resources, and 2) to scientifically define approaches to protect the quality and quantity of these resources.

WELLHEAD PROTECTION ELEMENTS

The DOH administers the Washington State wellhead protection program. The required elements for wellhead protection and watershed control programs are contained in WAC 246-290-135 which include:

- Description of the watershed (location, hydrology and land ownership);
- Documentation of source water quality trends;
- Identification of current watershed control measures and monitoring activities;
- Completed susceptibility assessment of each water source;
- Delineation of wellhead protection areas for each water source;
- An inventory of known and potential contaminant sources (this inventory list must be updated every two years);
- Documentation of the purveyor's notification to all owners/operators of known and potential sources of contamination within wellhead protection areas;
- Documentation of the purveyor's notification to regulatory agencies and local governments of the defined boundaries of the wellhead protection areas and the findings of the contaminant source inventory;

- A contingency plan to ensure that customers have an adequate supply of water in the event that contamination causes a temporary or permanent loss of the system's principal source of supply;
- Documentation of the purveyor's coordination with local emergency spill responders (i.e. police, fire and health departments) regarding wellhead protection area boundaries, source susceptibility and contingency plans.

This information can be found in the City's Wellhead Protection Program reports.

POTENTIAL FOR CONTAMINATION

DOH Susceptibility Assessments for Bonney's Lakes water supply sources are included in the Phase I report (City of Bonney Lake, 1998).

The City's water supply sources were also independently ranked by RH2 Engineering scientists with regard to the potential for contamination at each source. The qualitative rankings were assigned based upon the Phase I results. The Tacoma Point Wells were assigned a Low Potential Contamination Ranking because the wells are 300 feet deep and overlain by thick (200 feet) low transmissivity glacial sediments. No evidence of water quality contamination in these wells has been found.

The Ball Park Well was also assigned a Low Potential Contamination Ranking. Well log data indicates that a silt layer, approximately 50 feet thick, is present between the well screens and the ground surface. It is suspected that this silt layer is confined to the aquifer from which the Ball Park Well draws. Pump and water quality testing were conducted at the Ball Park Well prior to Phase I. Test data indicate that recharge at the Ball Park Well is much less robust than that observed at the Tacoma Point Wells. In addition, the water quality is distinctly different from the Tacoma Point Wells or the spring sources.

Grainger Springs, considered a single source, was given a Moderate Potential Contamination Ranking. The City owns and protects the forested and grassy area directly surrounding this shallow spring collection area. However, the recharge area for this source is rapidly undergoing urban development. State Route 410, several gas stations, septic systems and other potential contamination sources are presently upgradient from the springs.

Victor Falls Springs, considered three individual sources, were given High Potential Contamination Rankings. The three shallow spring collection areas have septic systems in proximity (approximately 80 percent of the surface area of one year time-of-travel (TOT) zone is in septic system use).

Source	Phase I Preliminary Contaminant Risk Ranking
Tacoma Point Well	Low
Ball Park Well	Low
Victor Falls	High
Grainger Springs	Moderate

Contaminant Source Inventory

Wellhead protection TOT zones were defined using the DOH's Calculated Fixed Radius (CFR) methodology and later modified based upon additional information. Potential sources of contamination throughout the TOT zones were inventoried in 1997 and 1998 and included facilities which generate or handle dangerous wastes, sites with underground storage tanks containing petroleum or chemical products, sites with reported leaking underground storage tanks, domestic and municipal abandoned wells, high density animal-keeping facilities, roads and septic systems.

Nitrates

Findings

From the summer of 1998 through the summer of 1999, nitrate concentrations at Grainger and Victor Falls Springs were monitored on an hourly basis by instruments installed in the water collection boxes. In addition, seven chain-of-custody samples were collected from each of the Victor Falls Springs between August, 1999 and July, 2000. These samples were analyzed at a laboratory for nitrates, chlorides and specific conductance. All springs were consistently below the MCL of 10 mg/L during the monitoring period.

Grainger Springs

Findings

The discharge of Grainger Springs correlates broadly with seasonal precipitation, but is not directly influenced by the water level of Lake Tapps. Comparison of data for lake level and stream flow below the springs show that, while lake level is rising, discharge at Grainger Springs may be falling. Leakage through the lakebed likely contributes to the maintenance of regional groundwater levels, but the contribution to recharge of Grainger Springs is strongly attenuated and delayed. Comparison of discharge and monthly rainfall data indicates direct and seasonal relationships.

Victor Falls Springs

Findings

The recharge area for the Victor Falls Springs lies entirely south and east of the springs, including a portion of the site for the Falling Water development and unincorporated Pierce County. Lake Tapps does not influence the discharge of the Victor Falls Springs. Comparison of spring discharge with daily rainfall indicates no direct correlation, but a strong seasonal relationship does exist. Discharge from the Victor Falls Springs will decline significantly during prolonged dry periods.

Tacoma Point

Findings

Three monitoring wells were installed about 1,000 feet from the Tacoma Point wells. The locations were selected based upon ability to define the groundwater gradient from Lake Tapps. Water levels were continuously recorded from February, 1999, until September, 1999. In addition, Tacoma Point Production Well No. 6 was installed and a pump test was conducted in June, 1999.

Water level data from wells indicate that groundwater flows northwest and away from Lake Tapps. Pump test data indicate that the Tacoma Point aquifer extends beneath Lake Tapps. Leakage from Lake Tapps into the aquifer makes delineation of a recharge area for the supply wells very difficult. Surprisingly, comparison of the level of Lake Tapps and water levels in the Tacoma Point monitoring wells did not show a direct relationship. This data suggest that Lake Tapps is not in direct hydraulic continuity with the Tacoma Point wells, even though bed leakage appears to contribute to recharge of the Tacoma Point wells. Similarly, daily rainfall showed no direct correlation with water levels in the monitoring wells; however, seasonal precipitation trends do correlate with groundwater level.

Contrasting year 2000 pumping rates at the Tacoma Point Wellfield with monitoring well water levels, displays a direct and rapid aquifer drawdown response. Continuous water level monitoring was ended in August 2000.

Wellhead Protection Ordinance

After completion of the Phase I and Phase II Wellhead Protection Reports, the City developed and adopted a wellhead protection ordinance which is currently in effect.

Wellhead Protection – Supporting Information

Figures, tables and appendices which are included in the City's wellhead protection reports address:

- Topography
- Groundwater Gradients
- Groundwater Nitrate Data
- Time-of-Travel Zones
- Potential Sources of Contamination

- Infiltration Potential
- Source Well Logs
- Department of Health Susceptibility Assessments
- Water Quality and Pump Test Data
- Contaminant Inventory Data

REFERENCES

City of Bonney Lake. June 1998. Wellhead Protection and Monitoring Program – Phase I.

City of Bonney Lake. November 2000. Wellhead Protection and Monitoring Program – Phase II.

City of Bonney Lake. March 2001. Wellhead Education and Nitrate Investigation – Phase III.