4.0 CONTAMINANT SOURCE INVENTORY

The Contaminant Source Inventory (CSI) identifies potential sources of contamination within the WHPAs and is required by DOH to be updated every two years. The CSI was completed by examining environmental databases provided by Environmental Data Resources, Inc. (EDR) and conducting a field reconnaissance (i.e., "windshield survey") of the WHPAs. The EDR database includes state and federal government and proprietary records concerning potential contaminant sources, including Ecology's Environmental Information Management (EIM) System. The CSI materials are listed in Appendix C and are included in an attached compact disk (CD) including Geographic Information Systems (GIS) data and the EDR reports. The following steps were conducted:

- Selected all sites from the larger database that were indicated to be within the new WHPAs.
- Eliminated duplicate records based on whether sites were listed under multiple names, different programs and/or at the same address.
- Characterized each site with respect to type of material and degree of threat.
- Sites that were added to or removed from the 2010 CSI were identified.
- Met with the City to discuss potential sites of concern prior to conducting the windshield survey.
- Conducted windshield survey of the WHPAs to confirm selected contaminant sources and identify additional contaminant sources.
- Conducted site reconnaissance of each production well or potential well site to note any potential for contamination within sanitary control areas.
- Created a geo-referenced GIS database, including parcel information, to assist the City in conducting the required two-year contaminant inventory updates, and scheduling and targeting public outreach efforts. Develop a contaminant spreadsheet for the Wellhead Protection Survey database (R11-WHPP 2010).

In addition to an evaluation of potential point sources of contamination, other sources of potential contamination vectors were also considered, including septic systems, home heating oil tanks and inactive water supply wells. Databases, including GIS coverage of these information sources, are included as electronic deliverables in Appendix C.

4.1 Identification of Potential Point Sources

The locations of sites were verified based on aerial imagery and address listings. Records of potential contaminant sources were examined for duplication and appropriately consolidated. A windshield survey was conducted on December 23, 2014 by Andrew Austreng and Chris Pitre of Golder. Records of sites confirmed within WHPAs were interpreted to provide an assessment of a site's potential to be a source of contamination. A site was designated as a potential source if known contaminant releases were listed as having occurred or if hazardous materials were present.

4.1.1 Known Releases

Sites with known contaminant releases were identified from available databases, including the Confirmed and Suspected Contaminated Sites (CSCS) List and Leaking Underground Storage Tank (LUST) List, which are provided by Ecology. A full listing of these records is included in the attached CD.

For some sites, a supervised cleanup of the contamination was completed to a prescribed level and a determination of No Further Remedial Action (NFA) has been issued by Ecology. Sites with NFA determinations were not considered to be a current source of contamination, as this designation signifies that Ecology has determined cleanup efforts have met the requirements of WAC 173-340 to protect public health. These sites were classified separately for the CSI and the City should consider reviewing the associated monitoring reports on file with Ecology. Future development of sites that received an NFA determination should consider the potential to mobilize residual contamination that may be present at these sites (e.g. consider implications of installing catch basins and dry wells).

4.1.2 Hazardous Sites

Available records were examined to identify sites that store, handle, or produce potential sources of contamination. A full listing of these records is included in the attached CD. State reported manifests and professional judgment was used to identify the type of contamination that a site could produce. The reported manner in which the hazardous material is used or stored on site was used to determine if the site posed a threat to wellhead protection (e.g. small or large quantity consumer use, industrial purposes, etc.). Sites that were deemed as potential contaminant sources were categorized by hazardous material type.

4.1.3 Windshield Survey

Sites that could not be properly located from desktop efforts (e.g. sites with inaccurate or missing addresses and/or inaccurate geographic coordinates, etc.) were confirmed during a windshield survey conducted on December 23, 2014. The survey focused on record discrepancies and on areas where known releases were reported in databases without any information regarding current site status. Emphasis was placed on identifying additional potential contaminant sources that may not have been included in database records. The sanitary control area of each well was evaluated on May 8, 2015 by Chris Pitre.

4.2 Inventory Findings

The results of the CSI are presented in Tables 4-1 through 4-9 and Figures 4-1 through 4-4. Sites of particular concern to wellhead protection (priority sites) were identified based on:

- Material/hazard type, nature of use, and presumed quantity.
- Location within the WHPA (time of travel).
- Sites where glacial till (till) is inferred as absent, where till acts as a confining layer for the aquifer.

- Sites with known releases.

Sites within 6-month and 1-year time of travel boundaries are presented at the beginning of respective site listings and should be monitored as a priority by the City.

4.2.1 Comparison to 2010 Contaminant Source Inventory

The findings of the current CSI were compared to the most recent CSI completed by the City and Thurston County in 2010 (HDR 2011). Sites were removed from the 2010 CSI list if one or more of the following conditions were met:

- A site has been decommissioned (e.g. the site is no longer in operation and potential contaminant source(s) has been removed).
- An NFA was issued for a decommissioned LUST or CSCS listed site (see Section 4.1.1).
- Redundant listings for the same site.
- The site was not a threat based on professional judgment (e.g., a *de minimus* spill of solvent during transportation at a location outside the storage facility).

Sites meeting the above conditions are listed in Tables 4-3 and 4-4.

Four underground storage tank (UST) sites were added to those listed in the 2010 CSI (Site Nos. 3, 5, 8, and 10) and three LUST sites were also added (Site Numbers 14, 16 and 17), and are included in Table 4-1 and Figure 4-1.

4.2.2 Underground Storage Tank Sites

A total of 18 sites with active USTs were identified within the WHPAs (Table 4-1; Figure 4-1). Six of these sites are listed as LUST sites and have received an NFA designation; some of these sites are actively monitored and the City should consider routine review of the monitoring reports. There are also 29 inactive UST sites that were identified within the WHPA Table (Table 4-3). Active UST sites include the following prioritized sites:

- Sites Nos. 1 through 3, located within the 6-month time-of-travel boundary of the Port (Sites 1 and 2) and Bush Middle School Wells (Site 3).
- Site No. 4 appeared non-operational during the windshield survey, though no decommissioning records were found – this site is located on the 6-month WHPA boundary of the Bush Middle School Wells.
- Site No. 6 is located within the 5-year WHPA of the planned Southwest Wellfield, in an area where till is inferred to be absent.

The oldest operating tank (Site No. 1, owned by the City of Tumwater) is most likely single-wall, dielectric steel tanks with sacrificial anodes for corrosion protection. More recently installed tanks (e.g. post-1995) likely include double-wall tanks with automated tank gauging (ATG) systems for leak detection. A site visit is recommended to confirm the status of this tank and routine monitoring should be considered.

A total of 13 inactive LUST sites were identified within the WHPA (Table 4-2) for which NFAs have been issued or that have been reported clean. LUST sites warranting additional review include the following:

- Site No. 13 (Restover Truck Stop) has been reported clean, but is located in an area where till is inferred as absent and the site has listed operational USTs. It is understood that the Chehalis Indian Tribe plans to develop the site as a casino complex.
- Site No. 16 has been designated as NFA, but its current operational status is unknown.

4.2.3 Hazardous Materials Generators/Handlers

Sites with hazardous materials that are potential contaminant sources were categorized by material type. A total of 65 sites were identified within the WHPA (Table 4-3; Figure 4-2). Hazardous sites warranting continued review include the following:

- Site Nos. 26, 27, and 64, classified as cleaners which may handle chlorinated solvents.
- Site Nos. 28, 30, 36, and 37, which have had handling violations and/or maintain large quantities of hazardous materials (i.e., greater than one metric ton per month).
- Site No. 75, which has confirmed releases of polycyclic aromatic hydrocarbon (PAHs) and is actively monitored.

The windshield survey completed on December 23, 2014 identified several businesses located in an area zoned as light residential that were not identified from desktop studies. Multiple non-operational automotive shops were identified along 93rd avenue southwest, in the vicinity of Tilley road (e.g. Airport towing, Classic Heartbeat); a monitoring well was identified at 800 93rd Avenue Southwest in the vicinity of these businesses. The City should review data obtained from the monitoring well and consider additional review of the automotive sites (e.g. site visit and contacting land owners).

The following sites were also identified during the windshield survey and are considered lower priority for review by the City:

- The Pacific Northwest Research Center (pesticides/insecticides), located at 3625 93rd Avenue Southwest.
- Knight Fire Protection (Chlorofluorocarbons, Polybrominated biphenyls, Halons), located at 9702 Lathrop Industrial Drive Southwest.
- WA Dept. of Fish and Wildlife Habitat Shop (petroleum products), located at 9628 Lathrop Industrial Drive Southwest.
- Extreme Excavation and Pacific West Landscape (petroleum products), both located at approximately 500 93rd Avenue Southeast.

These sites were designated as lower priority assuming that operators handle small quantities of trade materials. However, it is recommended that this assumption is confirmed by the City through a site visit or communication with the owner(s).

4.2.4 Palermo Wellfield Superfund Site

The Palermo Wellfield was listed as an EPA Superfund Site in 1997 (Site No. 26534), following detection of chlorinated solvents in the wells (i.e. trichloroethene [TCE] and tetrachloroethene [PCE]) beginning in 1993. The sources of contamination for TCE were determined to be the former Washington State Department of Transportation (WSDOT) Testing Laboratory and the current WSDOT Materials Laboratory. PCE contamination was determined to be from releases by Southgate Dry Cleaners (the City has confirmed the site no longer uses PCE).

Numerous remedial actions were initiated to protect public health as part of an Administrative Settlement and Order Consent (ASOC). This included an air stripping water treatment facility at the Palermo Wellfield, continued groundwater monitoring, soil vapor extraction for PCE, and installation of shallow drains. These remedial actions remain in place today, and TCE and PCE concentrations in drinking water from the Palermo Wellfield are reduced to below detection following treatment. A supplemental Remedial Investigation (RI) and Feasibility Study (FS) is being completed by WSDOT, which includes expanding a site-specific groundwater monitoring network. WSDOT and EPA have set milestone dates of December 1, 2016 and August 31, 2017 for delineating aquifer contamination and determining if the groundwater monitoring network is adequate (CH2M Hill 2013).

4.3 Other Potential Contaminant Sources

Potential contamination sources not listed in conventional database searches for contaminated sites include septic systems, home heating oil tanks, stormwater underground injection control (UIC) wells, and domestic water supply wells. This section summarizes these potential sources. Additionally, this section includes a discussion of contaminants of emerging concern, or CEC's.

4.3.1 Septic Systems

Nitrate releases from septic system effluent are a typical groundwater management concern. A drinking water standard of 10 milligrams per liter (mg/L) has been established for nitrate (as nitrogen). Typical loading rates to groundwater for nitrate from septic systems are usually less than 1 gram per person per day (EPA 2002, Table 4-5) but can be significantly increased if the septic system were to fail. Therefore, the issues related to nitrate releases from septic systems are often related to the density of and the frequency of system failure.

The approach for determining potential nitrate levels in the City's Wellfields was based on a simple mass balance mixing calculation. The density of septic systems in each WHPA was determined and the total estimated mass of nitrate (e.g. kilograms) released annually was then calculated based on loading rates estimated by EPA (2002). This annual mass of nitrate was then divided by the annual pumping volume (e.g. liters) to estimate an effective concentration (in milligrams per liter). The loading analysis presented in Figure 4-3 provides an approximation of the contribution of septic systems to the overall nitrate

concentrations observed in a wellfield. Septic systems were identified from the tax parcel database on file with the City. Properties with septic systems were imported into GIS assuming each septic system was located in the center of the tax parcel. Figure 4-3 shows the distribution of septic systems and includes a table summarizing potential mass releases within each WHPA. The density of septic systems is greatest near the BMS and the Southwest Wells, and there are septic systems within the 6-month travel time boundaries for these wells (Table 4-6 summarizes septic systems within the 6-month Time of Travel boundary for each WHPA). A full listing of properties listed as having septic systems with the WHPA is provided in the GIS database (see attached CD).

The loading analysis presented in Table 4-5 does not necessarily represent the nitrate concentration that would be observed in a monitoring well. It represents an aggregate or fully-mixed estimate of concentration. For example, nitrate concentrations in the Palermo Wellfield have remained constant over time and below 2 mg/L. However, nitrate in MW-96-16, located in the 1-year WHPA of the Palermo Wellfield, has an increasing trend from below 3 mg/L in 2003 to above 5 mg/L in 2012 (Thurston County 2013). There are no nitrate sources documented in the immediate vicinity to explain the presence of nitrate, but even so, the monitoring wells generally collect groundwater samples from the water table, which is the zone of primary impact from soluble contaminants introduced from ground surface, such as nitrate. The drinking water wells are screened well below the water table, and draw water from across a large interval screened across the aquifer. Therefore, elevated nitrate concentrations at the water table do not necessarily impair water quality above drinking water standards in the short term. Regardless, the City's continued due diligence in protecting groundwater quality is warranted to prevent widespread increase in groundwater nitrate concentrations that may affect drinking water quality in the long term.

Groundwater nitrogen concentrations can also become elevated as a result of application of fertilizer for landscape and/or agricultural activities. The City of Olympia identified landscape application of fertilizer as a probable source of nitrogen in groundwater in their Indian Summer well, and successfully reduced the concentration through use of a public outreach program (Donna Buxton, personal communication).

4.3.2 Domestic Heating Oil Tanks

A listing of properties with home heating oil tanks was provided by Thurston County assessor's office (Table 4-7 and Figure 4-3). A total of 16 home heating oil tanks were identified (15 in the Palermo WHPA and one in the Bush Middle School WHPA). The irregular distribution of heating oil tanks suggests the database obtained may be incomplete.

There are 6 tanks located within 1-year WHPA for the Palermo Wells (3 within the 6-month WHPA); the remaining tanks are located within the 5-year and 10-year WHPAs for the Palermo and Bush Middle School wells, respectively. A release from these tanks may affect water quality produced from the Palermo Wellfield. The air-stripping facilities installed at the Palermo Wellfield to remove chlorinated solvents will

be effective to a degree in removing the more volatile components of home heating oil, but will be less effective in removing heavier components such as polyaromatic hydrocarbons.

4.3.3 Stormwater (UIC) Wells

Stormwater UIC wells are used to increase the ability to reduce stormwater run-off by infiltration to shallow groundwater. UIC wells can create a shortened pathway for aquifer contamination from stormwater. Stormwater contaminants typically include oils & grease, heavy metals, and volatile organic compounds. The locations of shallow stormwater release wells (e.g. dry wells less than 5 feet deep) where obtained from Ecology's Underground Injection Control database (Table 4-8; Figure 4-3).

The potential for aquifer contamination related to stormwater infiltration is likely higher than depicted by the inventory of UIC wells in Ecology's database. There are likely unidentified stormwater infiltration facilities that are within the City's WHPA's. The City's Drainage Design and Erosion Control Manual contains sections relating to Minimum Requirements and Best Management Practices (BMP's) for infiltration. An analysis of aquifer protection provided through these BMP's was not conducted as part of this WHPP.

4.3.4 Department of Health - Listed Water Wells

Improperly constructed, poorly maintained, or improperly abandoned wells can provide a direct pathway for aquifer contamination. A listing of Group A and Group B water supply wells located within the WHPA was obtained from the DOH. Group A systems serve more than 15 connections or more than 25 people per day.) This listing includes both active and inactive wells (Table 4-9, Figure 4-4). Private domestic wells serving a single residence and resource protection wells (monitoring wells) are not included in this database but can be obtained from Ecology's Well Log Database; these wells can also provide a pathway for contamination. The City may consider including properties with private domestic wells in their public outreach program (Section 5.0)

4.3.5 Contaminants of Emerging Concern (CECs)

Contaminants of Emerging Concern (CECs), or simply "emerging contaminants", range from pharmaceuticals, personal care products and food additives, to compounds used in industrial and commercial applications. These compounds may not be removed during typical wastewater treatment processes and are flushed into waterways or infiltrated into groundwater throughout the world. Research on emerging contaminants is active in the Puget Sound region and there are multiple studies on-going that are measuring the presence of these contaminants and evaluating their impacts on ecosystems.

Septic systems are potential sources for CEC discharges of products (like personal care products) that are flushed into household drains. A loading analysis of CEC mass that could enter the City's Wellfields was not conducted as part of the WHPP since it is very difficult to estimate loading factors and very little research into this pathway is available. It is therefore important that outreach be made to minimize CECs in septic

effluent. The LOTT Clean Water Alliance is conducting a reclaimed water infiltration study to evaluate the potential impact of CEC's remaining in reclaimed water on groundwater and environmental resources. Part of this study will examine background conditions in ground and surface waters, and will include an extensive public involvement effort to share study findings and gather public feedback. LOTT also implements an active public outreach and education program that includes source control messages to minimize CEC inputs into wastewater. The outreach and education effort reaches residents served by the regional sewer system, as well as septic system owners throughout the region, including those within the City of Tumwater WHPA's. The City Police Department has also implemented a program to collect unused pharmaceuticals, and has properly disposed of over 680 pounds of prescription medication and other pharmaceuticals to date.

Another class of emerging contaminants are known as perfluorinated chemicals or PFC's. PFC's are a family of synthetic chemicals that have been used for decades as an ingredient to make products that resist heat, oil, stains, grease and water, and are resistant to natural breakdown in the environment. PFC's are found in nonstick cookware, stain-resistant carpets and fabrics and in coatings on some food packaging (especially microwave popcorn bags and fast food wrappers). There are many industrial applications that use PFC's, and, until 2002, they were routinely used as components of fire-fighting foam. Septic tanks are a potential source of PFC contaminants. The potential historic use of PFC's in fire-fighting foam along Interstate 5 or at the Regional Airport is a possible concern for the City of Tumwater. Similar to CEC's in septic systems, it is very difficult to estimate PFC loads to aquifers given the current state of research.

4.4 Sanitary Control Areas

The Sanitary Control Area (SCA) is defined as a 100-foot radius from the well, and is the protective area required by WAC 246-290-135. Public water systems should already tightly control this area to minimize any direct contamination at the wellhead. It should be managed to reduce the possibility of surface flows reaching the wellhead and traveling down the casing. All public water systems are encouraged to have a well house or a fenced area around each wellhead. This helps protect individual wells from any direct introduction of contaminants.

A field reconnaissance of the sanitary control areas of the City of Tumwater municipal supply wells was conducted by Chris Pitre on Friday, May 8, 2015. The following additional details were noted for each of the SCAs:

- **Southwest Wellfield:** Test Well TW-04-01 is located in an open area in the southwest corner of a soccer field complex. Ownership of this well has reverted to the property owner, the City intends to drill a production well on its property north of TW-04-01, and DOH has approved of the proposed site. The City should conduct an assessment of the SCA upon completion of the well and consider any possible contamination that may be associated with possible application of herbicides on the nearby soccer fields.

- **Bush Middle School Wells:** A diesel tank to serve an emergency generator is located within 100 feet west of Well #14. It is underlain by a secondary structure to contain any leak that may occur. Otherwise only vegetation is present within the sanitary control areas.
- **Port Wells 9 and 10:** The sanitary control area of Well 9 is fully vegetated with grass and trees. Well 10 is set back approximately 20 feet south from Tumwater Blvd., and the SCA consists primarily of a parking lot. Port Well 10 is therefore out of compliance with WAC 246-290-135 and is susceptible to nearby surface contamination. Although not located within the SCA of either well, housed within the building between Wells 9 and 10 is Windfall Lumber, which produces glued wood products. Inquiry with company staff present indicated that they used "eco-friendly" products, such as polyvinyl acetate. This business was not identified in the Contaminant Site Inventory.
- **Port Well 11:** This well is located in a grassed and treed green space set back more than 100 feet from bounding roads and other properties. No concerns were recognized.
- **Palermo Wellfield:** All wells are contained within a chain-link fended area, with the exception of Well 17, which is located within the Palermo Pocket Park, a children's play area, just outside of the fenced wellfield. City staff indicated that the fencing will be adjusted to contain Well 17 when it is put into production in the future. A fuel tank is installed at the wellfield for emergency power. The fuel tank is underlain by a secondary structure to contain any leak that may occur.

4.5 On-Going Inventory and Risk Management

The City contracts with Thurston County for this work. The program coordinates with other agencies such as the Tumwater Fire Department, Olympic Air Pollution Control Authority, and Ecology.

The City also participates in the development and review of the Thurston County Hazardous Waste Management Plan (Cascadia 2014). The County recently revised the Hazardous Waste Management Plan which serves as a document that guides local area cities as well as the county.

4.6 Conclusions and Recommendations

Based on the results of the CSI, there are contaminant sources within the City's Wellhead protection areas that warrant continued management and monitoring. There are 17 documented active and inactive sites with releases in the 1-yr WHPA and 18 possible hazardous waste generators in the 1-yr WHPA. The supplemental remedial investigation related to TCE and PCE at the Palermo Wellfield may reveal additional contamination concerns and should be monitored closely. Nitrate loading from septic systems does not appear to be a significant source of nitrate in the City's Wellfields at this time, but monitoring should continue. Stormwater infiltration, both from UIC wells and infiltration ponds remains a potential source of contamination that cannot be readily characterized with existing information. Emerging contaminants (both personal care products and PFC's) are another potential source of contamination that cannot be readily characterized with existing information.

The following recommendations are provided and are re-visited in Section 5.5, which discusses management strategies:

- **Priority sites:** Several sites have been flagged in Tables 4-1 and 4-3 in green shading for additional review, either on the basis of lack of information, or perceived higher risk. The City should contact the owners of these sites and possibly conduct site visits. It is recommended that sites within the 6-month time-of-travel boundary be addressed first, followed by other sites identified as priority.
- **Notify Potential Contaminant Source Property Owners:** Issue an educational, informative letter to all sites listed in Tables 4-1 and 4-3 that they are located in a WHPA and that they have been identified as a property of concern. (Addresses are included in the electronic deliverables in Appendix C.) The letter should emphasize the value of the groundwater supply to the City and citizens, and the stewardship in which the property owners share of the resource.
- **Development review of contaminated sites:** Cross reference all sites in Tables 4-1 through 4-4 with the City and County tax parcel database to trigger additional review for any development plans. Although sites may be have been cleaned up to state standards, residual contamination below state cleanup standards may be present that may be remobilized by development activities and/or modified stormwater runoff patterns.
- **Stormwater (UIC) Wells:** Conduct a comprehensive inventory of stormwater facilities in WHPA's and evaluate the effectiveness of BMP's promoted in the City's Drainage Manual.
- **Home Heating Oil Tanks:** Work with property owners and Ecology to facilitate the decommissioning the six home heating oil tanks within the Palermo Wellfield 1-year WHPA, and replacing the heating service with gas or other alternative heating service (Table 4-7).
- **Inactive Water Supply Wells:** Work with property owners and Ecology to facilitate the decommissioning of the DOH-listed inactive drinking water wells listed on Table 4-8.
- **New Water Connects to Existing Buildings:** When an existing residence is connected to City water service, the owner should be asked whether they previously obtained water from a well. If so, and if the use of the well is discontinued, work with the property and Ecology to decommission the well per WAC 173-160.
- **Contact Septic System Owners:** Contact owners of septic systems that are classified as non-conforming by Thurston County (i.e. permits are not valid due to lack of inspection), to provide education on maintenance and hazards of system failure. Public outreach should be considered in areas where septic system density is elevated (e.g. near Lakeland Well; Figure 4-3).
- **Emerging Contaminants:** Support the regional effort to expand public education on emerging contaminants to septic system owners in the City's WHPA's. In addition, conduct periodic monitoring for CECs, and include both personal care product indicators and PFC's. An inventory of historic fire response on I-5 and at the Regional Airport should be also prepared, noting specific contaminants that may have been released.
- **Update the CSI every two years:** The Contaminant site inventory should be updated every two years, per WAC 236-290.

In the past, the City and the County have provided an ongoing inventory where each eligible hazardous site is inspected approximately every 6 years by employing the Washington Risk Matrix (WRM), and it is recommended that the City reinstitute this program. The WRM assesses the overall activities of the business, focusing on the storage, handling, and disposal practices of hazardous materials and assigns an objective, numerical risk value to the business. The numerical value identified potential high-risk businesses and high risk sites receive inspections. Any new company within a WHPA receives an inspection during their first year of business. Any business not receiving a technical assistance visit in any

given year receives a self-reporting inventory form (Appendix E). These forms are used to update records on the business activities. If it is determined that the business has considerably altered business practices, City staff add that business to the next round of site visits to ensure that safe handling, storage, and disposal practices of hazardous materials continues uninterrupted.