

LOWER THAMES VALLEY ASSESSMENT REPORT

Municipal Drinking Water System Summary - Highgate Water Supply System

Assessment Reports compile and summarize information from the technical reports that have been completed on each of the municipal drinking water systems in the Thames-Sydenham and Region.

This **Municipal Drinking Water System Summary** provides an overview of information in the **Lower Thames Valley Assessment Report** related to this system. For more detailed information and mapping, please refer to the Lower Thames Valley Assessment Report at www.sourcewaterprotection.on.ca.

The information presented in the Assessment Report, including this system summary, will be used to develop Source Protection Plans as required by the Clean Water Act (2006). Source protection is the first barrier that helps provide safe drinking water for Ontario and focuses on protecting the source of the drinking water systems (raw, untreated water). The other barriers that help protect drinking water, including treatment, testing and distribution, are governed by the Safe Drinking Water Act, 2002.

Highgate Water Supply System Overview

System	Highgate Water Supply System			
Operating Authority	Municipality of Chatham-Kent Public Utilities Commission			
Classification of System	Drinking Water System – 1 (Large municipal residential)			
Pumping Rates (m³/day)		Maximum Annual	Average Annual	Average Monthly
	Well #1	23,387	15,609	1,301
	Well #2	38,218	32,663	2,722
Source	Groundwater Under the Direct Influence of Surface Water (GUDI)			
Location	The community of Highgate, north-east of Chatham, in the eastern portion of the Municipality of Chatham-Kent			
Description of Wells	2 pumping wells Water is from the overburden/bedrock contact aquifer Well screen depths are 49.5 and 51.8 metres below ground surface			
Approximate Population Served	500			
Area Served	Community of Highgate			

Wellhead Protection Areas

Wells are used to extract drinking water from aquifers in the ground. A Wellhead Protection Area, or WHPA, is an area delineated around a municipal wellhead, through which contaminants are reasonably likely to move toward or reach the well. Within a WHPA, certain activities and conditions (past activities) can pose a threat to the municipal drinking water supply.

Computer models and other tools are used to build a picture of the groundwater conditions around a well. In the Lower Thames Valley Source Protection Area, numerical groundwater models have been used to delineate WHPAs around the municipal wells (Figure 1). These models calculate the time it takes for water to travel through the aquifer to the well.

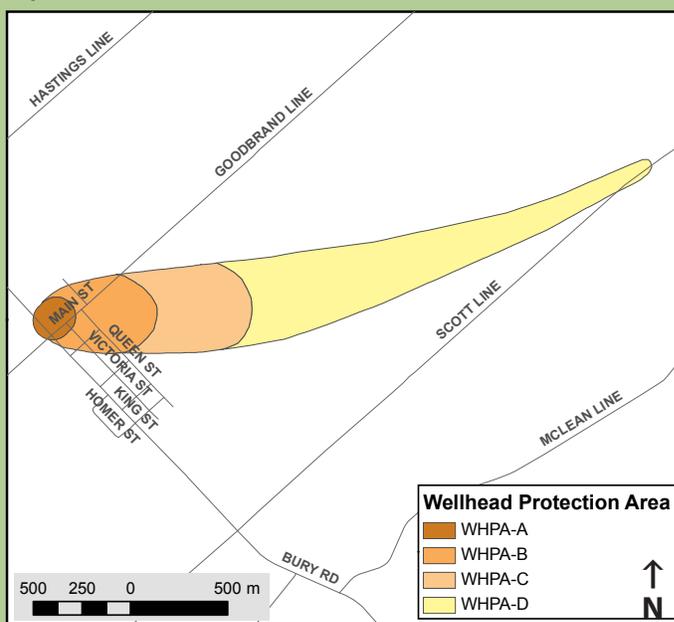


Figure 1. Highgate Wellhead Protection Area

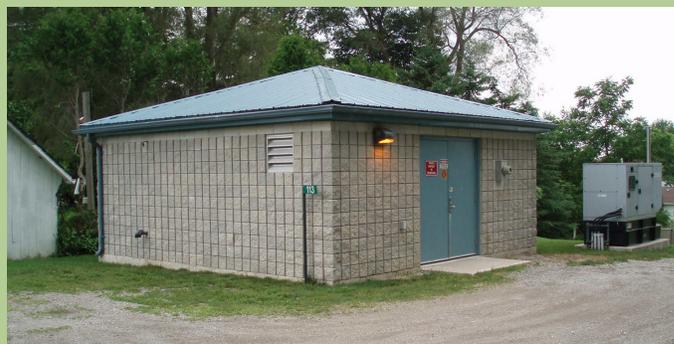
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Each WHPA is comprised of three areas based on this time of travel, and one area that is a fixed radius around the well.

- WHPA-A – 100 metre radius around the well
- WHPA-B – 2 year time of travel to the well, excluding the WHPA-A
- WHPA-C – 2 to 5 year time of travel to the well
- WHPA-D – 5 to 25 year time of travel to the well

Two other areas (WHPA-E and WHPA-F) can be delineated for groundwater wells that are under the direct influence of surface water (GUDI). The Highgate well supply system is currently GUDI. The MOE directed that the workplans for WHPA-E and WHPA-F for the Highgate system not be included in the Assessment Report as information available at this time indicates that the system does not meet the test in Rule 49 (3).



Vulnerability Assessment

The first step in assessing the vulnerability of the Highgate WHPA was to determine the intrinsic (inherent) vulnerability of the aquifer. The Intrinsic Susceptibility Index (ISI) method was used, which is an index of depth and permeability of the materials that offer protection to the aquifers against possible contamination. The ISI results in a score that can be categorized as high, moderate or low.

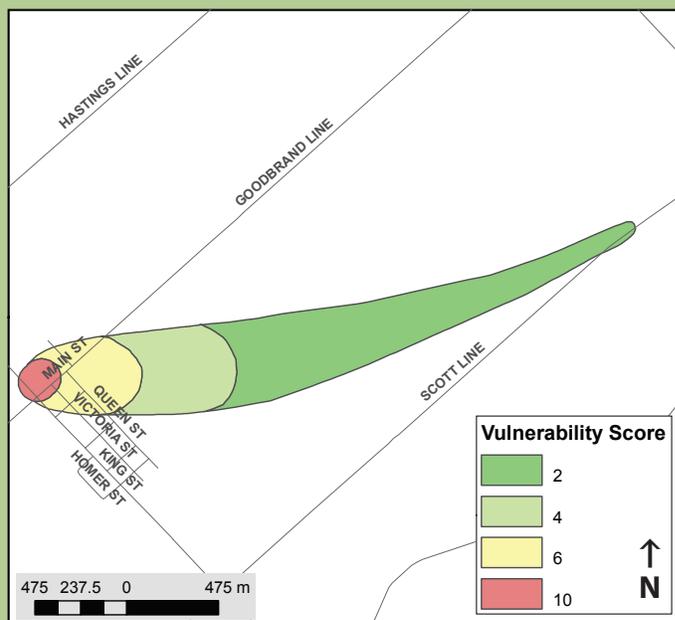
The ISI values were determined to be low, within and beyond the Highgate capture zones. Based on the WHPA zone and the ISI category, the Highgate wellhead vulnerable areas were assigned vulnerability scores of 2 to 10 (Figure 2).

Information on constructed transport pathways was also reviewed. These man-made constructions, such as oil wells, may circumvent the natural protective layers above a groundwater aquifer. In the Highgate WHPA, an increase in the vulnerability scores due to constructed transport pathways was not deemed necessary. Natural transport pathways such as fracturing and karst are already considered under the vulnerability assessment.

Peer Review of Vulnerability Assessment

The Source Protection Committee established a peer review committee to review the vulnerability assessment. This peer review committee included consultants and academics who are experts in surface water or groundwater modelling and vulnerability assessment. The committee reviewed the technical reports and met with the consultants and municipal staff involved with the work. The peer reviewers provided opinions as to whether the work met the appropriate rules and guidance and whether it was scientifically valid. They also provided comments that the consultants used to improve the documentation of their work.

Figure 2: Highgate WHPA Vulnerability Scores



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Issues

A drinking water issue is a parameter (substance) or pathogen (disease-causing microorganism) that is present at a level that may cause the deterioration of the quality of water used as a source of drinking water. An issue may also be identified when levels of that substance or organism show an increasing trend that may result in deteriorated quality of water used as a source of drinking water. The Safe Drinking Water Act (2002) identifies the parameters that can be considered. Parameters and pathogens are described in Section 5.0 - Issues Evaluation, of this Assessment Report.

Issues were identified by following the Thames-Sydenham and Region Issues Evaluation Methodology (May 14, 2009). The evaluation is a two step process. Firstly, in the screening step, raw (untreated) water quality data is compared to a benchmark and parameters or pathogens may be flagged if they meet the screening criteria.

For chemical, physical and radioactive parameters, the benchmarks are generally half the applicable human health based Ontario drinking water standards (Maximum Acceptable Concentrations, or MAC), and the full levels of the aesthetic objectives (AO) and operational guidelines (OG), and any plant operating authority concerns.

For parameters flagged through the screening, the second, identification step involves a review of trends and spikes, frequency and duration of occurrence, presence at or trending towards the applicable MAC, AO or OG benchmark, consideration of existing water treatment plant capabilities and discussions with the water treatment plant operating authority.

Pathogens are evaluated differently. A known pathogen of concern that is flagged through the screening process must be subject to a microbial risk assessment to identify it as an issue. This assessment involves pathogen characterization, exposure assessment and risk characterization.

If a drinking water quality issue is identified and is known to be wholly or partially due to anthropogenic (man-made) sources, the area and the activities contributing to the issue must also be identified. The activities that contribute to the identified issue are deemed to be significant risks to the drinking water source and must be mitigated through the Source Protection Plan.

Table 1 provides drinking water quality issues identified in the raw (untreated) water of the Highgate municipal wells. Parameters may be due to anthropogenic (man-made) sources, i.e., activities on land, or may be naturally occurring, or both. No pathogens were identified as issues in the raw (untreated) source water in the Lower Thames Valley SPA. Information on flagged parameters is provided in an Appendix to the Assessment Report.

It is important to note that the drinking water quality issues identified in Table 1 are based on raw (untreated) water quality and do not represent the quality of water after treatment. The operation of a water treatment plant, including treatment and distribution, is governed separately by the Safe Drinking Water Act (2002).

Table 1. Drinking Water Quality Issues Identified – Highgate Raw (Untreated) Water

Parameter	Description	Natural or Anthropogenic (man-made)
Fluoride	Since 2003, there have been 14 instances of fluoride concentrations in the raw water being above the treated water MAC benchmark of 1.5 mg/L, and a further six instances where concentrations were above 50% of the MAC benchmark. The highest fluoride level was 2.0 mg/L, and average value was 1.65 mg/L.	Naturally occurring
Methane	Between 2004 to 2008, raw water methane levels were typically 17 to 55 L/m ³ , regularly above the treated water AO of 3 L/m ³ .	Naturally occurring
Organic nitrogen	Since 2004, the available raw water data levels of organic nitrogen measured above the treated water OG of 0.15 mg/L, with a highest level of 0.5 mg/L. Dillon (2008) assessed the source of the organic nitrogen, summarizing the findings in the study: Highgate Municipal Water Supply System, Hydrogeological Information Review (Dillon 2008). The study concluded that the observed organic nitrogen is likely from the aquifer, which contains a high concentration of organic-rich shale material from the underlying Kettle Point Formation.	Naturally occurring

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Conditions

A condition is the result of a past activity that has the potential to pose a risk to a drinking water source. The Source Protection Committee is required to list as a drinking water threat any "condition" of which it is aware. The Technical Rules: Assessment Report identifies the types of situations that can be considered a condition. The situations pertaining to wellhead protection areas may be summarized as follows:

- the presence of a non-aqueous phase liquid in groundwater in a highly vulnerable aquifer, significant groundwater recharge area or wellhead protection area;
- the presence of a contaminant in groundwater in a highly vulnerable aquifer, significant groundwater recharge area or a wellhead protection area, if the contaminant is listed in Table 2 of the MOE publication 'Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act' (March 9, 2004); and is present at a concentration that exceeds the potable groundwater standard set out for the contaminant in that Table.

Based on limited data available for review, no conditions have been identified in this wellhead protection area. At the time of drafting of this Assessment Report, the Source Protection Committee has not completed an extensive investigation to determine whether there are any conditions that need to be reported. More work will be undertaken to identify and assess conditions and the Assessment Report will be amended if necessary.

Threats and Risk Assessment

Risk assessment is the process of assessing threats to drinking water, in order to determine their relative risk to the drinking water source. The Clean Water Act prescribes activities that may be considered drinking water threats. The activities associated with drinking water quality are summarized in the Threats and Risk Assessment Section of the Assessment Report.

The Ministry of the Environment has developed "Tables of Drinking Water Threats" to identify the level of risk associated with an activity. Threats related to pathogens and chemicals are considered in separate tables. Under the Clean Water Act, it is required to determine the number of locations at which a significant threat is thought to occur. Also, a list of activities that are or "would be" threats is to be included. Generally this is addressed by including all prescribed activities even if they are not currently occurring in an area. Activities not currently occurring in the vulnerable areas "would be" threats if the activities were to occur in the future. The circumstances that result in them being significant threats must also be included in the Assessment Reports.



The level of risk is dependent on the vulnerability score of the area where the activity takes place and the circumstances under which the activity occurs. An activity can only be identified as a threat if it occurs in a vulnerable area and the vulnerability score of the area is greater than 4. The circumstances to be considered include the type of material (chemical, pathogen or dense non-aqueous phase liquid), the quantity of material and whether the material might be released to surface water or groundwater.

Figures 3a, 3b and 3c show areas in the Highgate WHPA where activities "are or would be" low, moderate or significant threats. The level of threat is dependent upon the vulnerable area (WHPA-A, B, C or D) where the activity occurs, the vulnerability score and the circumstances associated with the activity. As per the MOE threats tables, dense non-aqueous phase liquids (DNAPLs) are a significant risk in WHPA-A, B and C.

Table 2 indicates the number of locations where significant threats could occur in the Highgate WHPA, based on current land use. Site-specific risk assessment is planned for 2010 in order to confirm the number of locations where a significant threat occurs. The outcome of that assessment will be part of an amended Assessment Report.

Table 2. Number of Locations where Significant Threats Could Occur

Chemicals	
WHPA-A	24
WHPA-B, C, D	0
Pathogens	
WHPA-A	24
WHPA-B, C, D	0
DNAPLs	
WHPA-A	1
WHPA-B	2
WHPA-C, D	0

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Figures 3a-c. Highgate Areas where Activities would be Drinking Water Threats

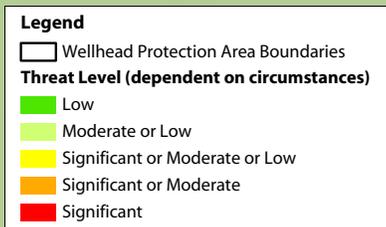


Figure 3b. Areas where activities related to pathogens would be threats

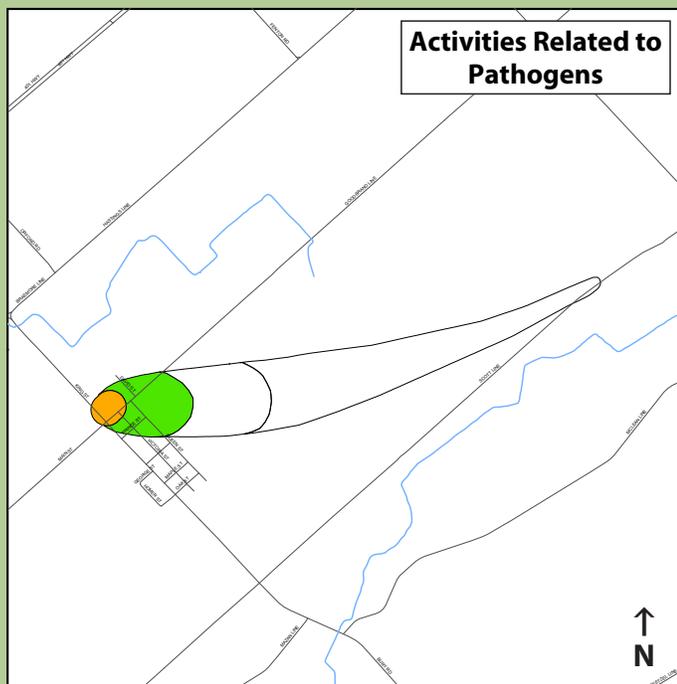


Figure 3a. Areas where activities related to chemicals would be threats

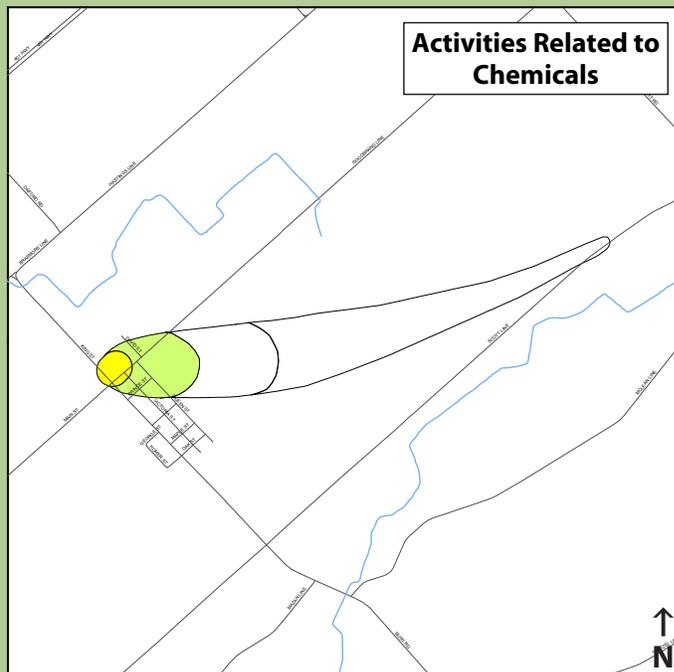
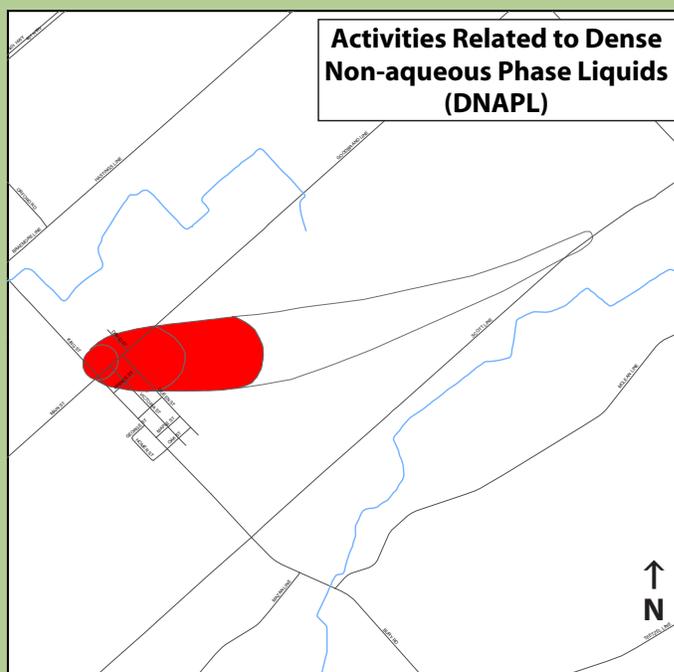


Figure 3c. Areas where activities related to DNAPLs would be threats



Data Gaps

There is no long-term (more than 10 years) groundwater quality data available for parameters specified in the Clean Water Act. Continued data collection in the future would aid in determining trends and would better facilitate future issues evaluation.

For more information contact your local Conservation Authority or visit our website



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