

# Upper Thames River Source Protection Area Assessment Report

## Flagged or Noted Parameters

In the Upper Thames River Source Protection Authority (SPA), the parameters flagged for further investigation as an issue are summarized by drinking water system in the Table A9-1a, 1b and 1c below. The raw (untreated) water quality data is compared to a benchmark and parameters may be flagged if they meet the screening criteria. The benchmarks for chemical, physical and radioactive parameters 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. The table also indicates whether the flagged parameter was later identified as an issue or not. Certain parameters are noted in the table based on comparison to a benchmark, but not flagged for further investigation. No pathogens are flagged or identified as issues in the raw (untreated) source water in the Upper Thames River SPA.

**Table A9-1a: Drinking Water Quality Parameters Flagged or Noted in the Upper Thames River Source Protection Area (Middlesex County and City of London)**

System (no. of wells)	Flagged or Noted Parameter	Brief Description of Screening	Identified as an Issue?
Birr (1 well)	Fluoride	Fluoride levels range from 1.1 to 1.5 mg/L (data from 2003 to 2008), and are at or below the MAC of 1.5 mg/L. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. The levels at the Birr well are considered to be a naturally elevated in the aquifer, and are generally below the MAC. Therefore, fluoride is not considered an issue, but remains flagged as a natural-based concern.	No
	Sodium	Sodium concentrations range from 34 to 44 mg/L (data from 2003 to 2008) and are above the Ministry of Health notification level of 20 mg/L, but below the AO of 200 mg/L. Sodium is therefore flagged as a concern but not considered an issue. Sodium is considered naturally high in the groundwater.	No
	Turbidity	The identified range of turbidity in the well was 0.21 to 4.2 NTU (data from 2003 to 2008). It is below the AO of 5 NTU. This parameter should continue to be monitored, as there is no filtration incorporated in this water system, and increasing turbidity can ultimately hinder the disinfection process. Middlesex-Centre investigated the turbidity spikes in 2003 by completing a water quality survey of private wells and the production well. The study concluded that elevated turbidity correlated with naturally elevated iron concentrations, silt produced from the aquifer and possibly the presence of iron bacteria. Turbidity is flagged as a concern but not considered an issue.	No
	pH	Based on data from 2001 and 2005, the raw water pH for the Birr well ranges between 8.19 and 8.52, which is near the upper limits of the OG range of 6.5 to 8.5. The measured pH is considered to be influenced by the natural conditions within the aquifer. It is flagged as a concern but not considered an issue as the value is generally within the range of the OG. A representative of the owner has noted that they have no concern with the current pH levels.	No

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System (no. of wells)	Flagged or Noted Parameter	Brief Description of Screening	Identified as an Issue?
	Total coliform	Total coliform was present in the raw (untreated) well water in 2003 to 2005 and in 2008. The highest concentration recorded was 23 colony forming units (cfu) per 100mL in 2004. However, the 2004 data is believed to be suspect (sampling or analysis error). Other results of samples containing total coliform were reported as being less than 9 cfu per 100mL. The levels reported are low and easily treatable with existing disinfection and therefore this parameter is not identified as an issue, but flagged as a natural based concern.	No
	Iron	Water drawn from the Birr well has historically been high in iron. Iron levels ranged from 0.65 to 2.3 mg/L (data from 2004 to 2008), above the AO of 0.3 mg/L. Recent upgrades to the water system have included an iron sequestering system to specifically deal with the elevated iron levels. The sequestering system is shown to adequately remove iron and hence iron is not considered to be an issue, but flagged as a concern. The source of the iron is deemed to be natural.	No
	Colour	The 2001 Engineer's Report states that the colour of the raw water often exceeds the ODWS aesthetic objective of 5 True Colour Units (TCU). Historical data located in the Appendices of the Engineer's Report indicates that the measured values of the water are in the range of 10 to 11TCU (June 14, 1994). No other data was available outside of the 2001 Engineer's Report. The source of the colour in the water may be attributed to the elevated iron levels in the raw water. Colour is flagged as a concern but not identified as an issue.	No
	Hardness	Hardness levels for the well range between 128 to 200 mg/L (data from 2005 to 2008), and are above the treated water OG of 80 to 100 mg/L. Hardness is naturally high in the aquifer and is considered a natural-based issue.	Yes
<b>Komoka (3 wells)</b>	Sodium	The Thames Watershed Characterization Report and other data note sodium levels in all three wells being above the 20 mg/L Ministry of Health notification limit between 2003 and 2008, ranging from 28 to 51 mg/L. Sodium levels did not go above the AO of 200 mg/L in all three wells. Sodium is therefore flagged as a concern collectively in all three wells as data available did not allow for reviewing parameters for each well separately. The source of the sodium is considered natural to the aquifer.	No
	Iron	Water drawn from the Birr well has historically been high in iron. Iron levels ranged from 0.2 to 0.37 mg/L (data from 2004 to 2008), with some levels above the AO of 0.3 mg/L. Recent upgrades to the water system have included an iron sequestering system to specifically deal with the elevated iron levels. The sequestering system is shown to adequately remove iron and hence iron is flagged as a concern, but not considered to be an issue. The source of the iron is deemed to be natural. Iron is flagged as a concern collectively in all three wells (data available did not allow for reviewing parameters for each well separately).	No

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System (no. of wells)	Flagged or Noted Parameter	Brief Description of Screening	Identified as an Issue?
	Manganese	The available historical data indicates that the level of manganese in the three wells exceeds the 0.05 mg/L AO. Typical reported concentrations have been in the range of 0.061 to 0.08 mg/L (data from 2004 to 2008). The levels may be due to the groundwater interacting with manganese minerals in the aquifer. As a result of its natural high concentration at levels in excess of the AO, it is flagged as a concern collectively in all three wells (data available did not allow for reviewing parameters separately for each well). This system has treatment in place to manage the operational and aesthetic concerns resulting from elevated manganese, and therefore the parameter is flagged as a concern but not considered an issue.	No
	Total coliform	Total coliform in the raw well water ranged between 0 to 7 colony forming units (cfu) per 100 mL in 2003 to 2008. The levels reported are low and easily treatable with existing disinfection and therefore this parameter is not identified as an issue, but flagged as a concern collectively in all three wells (data available did not allow for reviewing parameters separately for each well). The presence of total coliform in the Komoka wells raw (untreated) water is believed to be natural.	No
<b>Melrose (2 wells)</b>	Fluoride	Fluoride levels ranged between 0.8 to 0.97 mg/L (data from 2003, 2006 and 2007), greater than half of the MAC of 1.5mg/L, but less than the MAC. No rising trends were observed. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride is flagged as a concern collectively in both wells (as data available did not allow for reviewing parameters for each well separately).	No
	Sodium	The Thames Watershed Characterization Report notes sodium levels being above the 20 mg/L Ministry of Health notification limit between 2003 and 2006, ranging from 25 to 29.6 mg/L. Sodium levels did not go above the AO of 200 mg/L. Sodium is therefore flagged as a concern collectively, in both wells (data available did not allow for reviewing parameters separately for each well). The source of the sodium is considered natural to the aquifer.	No
	Iron	Water drawn from the Melrose wells has historically been high in iron and above the AO of 0.3 mg/L, ranging between 0.65 and 0.98 mg/L (data from 2004 to 2008). Recent upgrades to the water system have included an aerator for iron oxidization, to specifically deal with the elevated iron concentrations. Iron is flagged as a concern, collectively in both wells (data available did not allow for reviewing parameters separately for each well). The source of iron is considered natural.	No

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System (no. of wells)	Flagged or Noted Parameter	Brief Description of Screening	Identified as an Issue?
	Total coliform	Total coliform data of raw (untreated) water of both wells (well no. 2 and no. 3), for the years 2003 to 2006 was reviewed in the Thames Watershed Characterization Report. Also, data from 2007 and 2008 water reports were reviewed. For well no. 2, the levels were 0 to 5 colony forming unit (cfu) per 100 mL. For well no. 3, the levels ranged from 0 to 630 cfu per 100 mL. The levels reported are easily treatable with existing disinfection and therefore this parameter is not identified as an issue, but flagged as a natural based concern.	No
	Hardness	Hardness levels for both wells range between 130 to 240 mg/L (data from 2005 to 2008), and are above the treated water OG of 80 to 100 mg/L. Hardness is naturally high in the aquifer and is therefore considered a natural-based issue in both wells collectively (data available did not allow for reviewing parameters for each well separately).	Yes
	Turbidity	Turbidity ranges between 5.73 to 10.04 NTU (data from 2004 and 2006 to 2008). These levels are above the treated water AO of 5 NTU; turbidity is considered as a natural issue in both wells collectively (data available did not allow for reviewing parameters for each well separately). This parameter should continue to be monitored, as there is no filtration incorporated in this water system, and increasing turbidity can ultimately hinder the disinfection process.	Yes
<b>Dorchester (8 wells)</b>	Sodium	The Thames Watershed Characterization Report and other data note sodium levels being above the 20 mg/L Ministry of Health notification limit. Levels ranged from 29 to 50 mg/L (data from 2003 to 2006). Sodium levels did not go above the AO of 200 mg/L. Sodium is therefore flagged as a concern in all wells collectively (data available did not allow for reviewing parameters for each well separately). The source of the sodium may be natural, anthropogenic or both.	No
	Iron	While there is no data available on iron levels, it is known that iron is naturally present in the aquifer and is removed through the treatment process. Iron is flagged as a concern but not considered an issue.	No
	Turbidity	From raw water turbidity data of 2004 to 2008 (data available did not allow for reviewing parameters for each well), turbidity was as high as 3.6 NTU, which is greater than half of the AO of 5 NTU. The operating authority reports that the turbidity spike was the result of an analyzer calibration. Turbidity is sometimes greater than 1 NTU and, therefore, the possibility exists for interference with the disinfection system. The past two years have exhibited turbidity readings no higher than 0.26 NTU. Turbidity is flagged as a naturally occurring concern but not considered to be an issue.	No

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System (no. of wells)	Flagged or Noted Parameter	Brief Description of Screening	Identified as an Issue?
	Trihalomethanes (THMs)	From 2003 to 2008, levels of THMs are noted to be above half of the MAC of 0.1 mg/L. The data, ranging from 0.047 to 0.09 mg/L, does not appear to exhibit any consistent trend over time. Data from the Thames Watershed Characterization Report indicates that dissolved organic carbon (DOC) has been reported at elevated concentrations in the raw water. Elevated levels of DOC can cause THM levels to increase as a treatment by-product. THMs are flagged as a concern with a natural origin (because THMs are not introduced as a contaminant, but are produced as a result of a natural condition such as elevated organic carbon) in all wells collectively (data available did not allow for reviewing parameters for each well separately).	No
	Sulphide	Sulphide data was not reviewed but is flagged as an operating authority concern with the bedrock wells. The operating authority has reported that the bedrock water quality is elevated with naturally occurring sulphide.	No
Thorndale (2 wells)	Sodium	From the Thames Watershed Characterization Report and other data, sodium levels are above the 20 mg/L Ministry of Health notification limit. Levels ranged from 28 to 34 mg/L from 2004 to 2007. Sodium levels did not go above the AO of 200 mg/L. The operating authority's representative has indicated that a Sodium Fact Sheet, provided by the Middlesex London Health Unit (MLHU), is annually distributed to all Thorndale water system customers. Sodium is considered naturally high in the groundwater, and is therefore flagged as a natural-based concern in both wells collectively (data available did not allow for reviewing parameters for each well separately).	No
	Iron	Iron levels ranged between 0.4 to 1.03 mg/L, above the 0.3 mg/L AO. The source of the iron is deemed to be natural. Treatment at the well includes an iron sequestering system to specifically treat the elevated iron concentrations. Iron is flagged as a natural based concern in both wells collectively (data available did not allow for reviewing parameters for each well separately).	No
	<i>Escherichia coli</i> ( <i>E. coli</i> )	Data from 2003 to 2008 was reviewed. <i>E. coli</i> was present in the raw (untreated) well water in 2006, 2007 and 2008. <i>E. coli</i> ranged from 0 to 2 colony forming units (cfu) per 100 mL in 2006, 0 to 7 cfu per 100 mL in 2007 and 0 to 86 cfu per 100 mL in 2008. The operating authority's representative has indicated that an investigation was conducted in 2009 by Lotowater Technical Services Inc. to assess the small presence of <i>E. coli</i> and total coliform in the raw water. This report, which has been issued in draft, suggests that the bacteria are from within the aquifer rather than its detection in the raw water being a result of well construction issues. It is postulated that the bacteria may enter the aquifer as a result of potential transport pathways within the overlying protective till overburden. The current disinfection treatment adequately removes <i>E. coli</i> and total coliform from the water. <i>E. coli</i> is flagged as a concern but not identified as an issue.	No

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System (no. of wells)	Flagged or Noted Parameter	Brief Description of Screening	Identified as an Issue?
	Total coliform	Data from 2003 to 2008 was reviewed. Total coliform was present in the raw (untreated) well water at least once in each of 2004 to 2008. Total coliform ranged from 0 to 6 colony forming units (cfu) per 100 mL in 2004 to 2007, and from 0 to 118 cfu per 100 mL in 2008. The operating authority's representative has indicated that an investigation was conducted in 2009 by Lotowater Technical Services Inc. to assess the small presence of <i>E. coli</i> and total coliform in the raw water. This report, which has been issued in draft, suggests that the bacteria are from within the aquifer rather than its detection in the raw water being a result of well construction issues. It is postulated that the bacteria may enter the aquifer as a result of potential transport pathways within the overlying protective till overburden. The current disinfection treatment adequately removes <i>E. coli</i> and total coliform from the water. Total coliform is flagged as a concern but not identified as an issue.	No
	Fluoride	Fluoride in the raw water ranged between 1.2 and 1.92 mg/L, and has consistently been above the treated drinking water MAC of 1.5 mg/L between 2003 and 2006, and in 2008. In 2007, it was above the half MAC. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride concentrations are considered to be naturally high in the aquifer and is flagged as a concern in both wells collectively (data available did not allow for reviewing parameters for each well separately). A Fluoride Fact Sheet, provided by the Middlesex London Health Unit (MLHU), is distributed annually to all Thorndale water system customers.	Yes
City of London back up wells - Fanshawe wellfield (6 wells)	Sodium	Wells 1, 2, 3 and 6 have a maximum reported sodium concentration of 15.4 mg/L. All reported concentrations occur in 2004 or earlier. In 1997, Well 4 has reported concentrations above the Ministry of Health notification level of 20mg/L. Well 5 had sodium levels above the 20mg/L threshold in 1997, 2001, 2002 and 2004, and data suggests that concentration is trending upwards. Sodium levels in all wells did not go above the AO of 200 mg/L. The source of the sodium may be natural, anthropogenic or both. Sodium is flagged as a concern but not identified as an issue.	No
	Iron	Water drawn from the Fanshawe wells has historically been high in iron, with wells 1,4 and 5 iron levels above the AO of 0.3 mg/L in 1994, up to 0.49 mg/L in well 4. Wells 1, 3 and 4 have had iron levels greater than half of the AO 8 times since 2004, but still less than the AO. Wells 2 and 6 have never been reported to be above even half of the AO. There is no specific trend identified in the reported results. Since the iron levels above the AO only occurred in 1994 and these wells are for emergency back up use only, the owner's representative has no concerns with the current iron levels believed to be naturally occurring in the aquifer. Iron is flagged but not identified as an issue.	No

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System (no. of wells)	Flagged or Noted Parameter	Brief Description of Screening	Identified as an Issue?
	Total Dissolved Solids (TDS)	The Fanshawe wells 1, 2, 3, 4 and 6 are consistently above half of the TDS AO of 500 mg/L. Well 5 regularly is above the AO, with highest TDS level of 740 mg/L in 2005. The overall average for the wells is below the AO, at 392 mg/L. TDS levels are often naturally elevated in the groundwater aquifer, and reach levels of 1450 mg/L in the watershed. It is likely that the high levels are a result of natural geology and are flagged as a concern. The owner's representative has noted that due to the emergency use nature of the wells, they have no concerns with the levels of TDS.	No
	Turbidity	In Well 3, concentration (7.06 NTU) in 2007 is above the treated water AO of 5 NTU. The source would be iron or dissolved solids naturally occurring in the aquifer. This parameter should continue to be monitored, as there is no filtration incorporated in this water system, and increasing turbidity can ultimately hinder the disinfection process. Turbidity is identified as an issue.	Yes
	Hardness	Hardness levels for all the wells range between 150 to 449 mg/L (data from 1994 to 2008 for all wells except Well 2, for which data was from 2000 to 2008). These levels are above the treated water OG of 80 to 100 mg/L. Well 5 appears to have the highest reported hardness. Hardness is naturally high in the aquifer. Hardness is identified as an issue.	Yes
	Manganese	Concentrations in Wells 2, 3, 4, 5 and 6 are above the treated water AO of 0.05 mg/L at least once between 2000 and 2008, with a high level of 0.27 mg/L in Well 3 in 2005. Concentrations in Well 4 appear to be increasing. Elevated levels are typically due to interaction between the groundwater and manganese mineral deposits. Manganese is identified as an issue.	Yes
	Organic Nitrogen	Concentrations of organic nitrogen are regularly above the 0.15 mg/L treated water OG in all wells between 1994 and 2005. There is no specific trend to the data. Elevated concentrations appear to occur randomly but regularly in all wells, with a high of 1.2 mg/L in Well 3 in 2002. The source of the organic nitrogen could be anthropogenic, natural or both. Organic Nitrogen is identified as an issue.	Yes
<b>City of London back up wells – Hyde Park wellfield (1 well)</b>	Sodium	Sodium was tested in 2003 and 2004 and naturally occurring concentrations of 43 and 40.8 mg/L were reported respectively, which are above the Ministry of Health notification level of 20 mg/L. The Thames Watershed Characterization Report notes sodium levels being above the 20 mg/L notification limit once in 2003 and twice in 2004, ranging from 31.9 to 61.5 mg/L. Sodium levels did not go above the AO of 200 mg/L. Sodium is flagged as a concern.	No
	Chloride	Only two samples in 2005 had levels of 130 mg/L, just over half of the AO of 250 mg/L. No upward trend has been identified for chloride. Chloride concentrations are not an issue, but remain flagged as a naturally occurring concern at this time.	No

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**Table A9-1a: Drinking Water Quality Parameters Flagged or Noted in the Upper Thames River Source Protection Area (Middlesex County and City of London)**

System (no. of wells)	Flagged or Noted Parameter	Brief Description of Screening	Identified as an Issue?
	<i>Escherichia coli</i> ( <i>E. coli</i> )	Bacterial data from 2003 to 2005 and 2007 was available to review <i>E. coli</i> levels. <i>E. coli</i> occurred once in 2003 and twice in 2004, ranging between 1 and 9 colony forming units (cfu) per 100 mL. No total coliform was detected in these years, indicating possible sampling or analysis error ( <i>E. coli</i> is a type of coliform bacteria). The <i>E. coli</i> levels reported are low and easily treatable with existing chlorine disinfection and therefore this parameter is flagged as a concern but not identified as an issue.	No
	Hardness	The available data (2003 to 2008) indicate that the raw water hardness averaged 360 mg/L and was consistent throughout the data period. The average hardness level at the well exceeds the treated water OG of 80 to 100 mg/L. Hardness is considered naturally high in the groundwater, and is therefore considered a natural-based issue.	Yes
	Total Dissolved Solids (TDS)	Data from 2003 to 2008 show levels of total dissolved solids in the range of 486 to 591 mg/L with the average being 545 mg/L. Although the reported levels of TDS are above the treated water AO of 500 mg/L, they are not substantially over the limit. It is likely that the high levels are a result of natural geology and are identified as a natural-based issue.	Yes

**Table A9-1b: Drinking Water Quality Parameters Flagged or Noted in the Upper Thames River Source Protection Area (Oxford County)**

System	Flagged or Noted Parameter	Brief Description of Screening	Identified as an Issue?
<b>Beachville (1 well)</b>	Hardness	The hardness in the Beachville well is around 300 mg/L, above the OG range of 80 to 100 mg/L. The elevated levels are typical of groundwater in that region and are naturally occurring. It does not affect the treatment process and is flagged as a concern only.	No
<b>Embro (2 wells)</b>	Fluoride	The treated drinking water MAC for fluoride is 1.5 mg/L. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride in the both wells' raw (untreated) water has consistently been above half (1.2 mg/L) of the upper range (2.4 mg/L) of the Health unit notification level. Fluoride levels in both wells are up to 1.3 mg/L. Fluoride does not show an increasing trend and does not affect the treatment process. Fluoride concentrations are considered to be naturally high in the aquifer and are flagged as a concern in both wells.	No
	Iron	The raw (untreated) well water in the system exceeds the AO of 0.3 mg/L for iron. The raw water iron is around 1.0 mg/L in both wells. Iron is removed in the treatment process. Failure of the iron removal would not impact the disinfection process. No increasing trend is evident. Iron is considered to be naturally high in the aquifer and is flagged as a concern in both wells.	No

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	Hardness	The Embro wells' hardness concentration is typically around 430 to 470 mg/L, which is above the OG range of 80 to 100 mg/L. Hardness is naturally occurring and does not affect the treatment process. It is flagged as a natural based concern for both wells.	No
	Total Dissolved Solids (TDS)	Total Dissolved Solids (TDS) levels in the Embro wells are above the AO of 500 mg/L, and are around 640 mg/L. TDS does not impact health or the treatment process. No increasing trend is evident in the results. It is flagged as a natural based concern for both wells.	No
	Sodium	Occasionally the Sodium concentration is noted to marginally occur above the Ministry of Health notification level of 20 mg/L however the most recent results are below the level. All results are well below the objective of 200 mg/L. It is naturally occurring. No increasing trend is evident in the results.	No
<b>Hickson (1 well)</b>	Fluoride	The treated drinking water MAC for fluoride is 1.5 mg/L. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride in the well raw (untreated) water has been at half (1.2 mg/L) of the upper range (2.4 mg/L) of the Health unit notification level. Fluoride levels in the wells are around 1.2 mg/L. Fluoride does not show an increasing trend and does not affect the treatment process. Fluoride concentrations are considered to be naturally high in the aquifer and are flagged as a concern in the well.	No
	Iron	The raw (untreated) well water in the system exceeds the AO of 0.3 mg/L for iron. The raw water iron is around 0.29 to 0.41 mg/L in both wells. Iron is removed in the treatment process. Failure of the iron removal would not impact the disinfection process. No increasing trend is evident. Iron is considered to be naturally high in the aquifer and is flagged as a concern in both wells.	No
	Hardness	The hardness concentration is typically around 263 mg/L, which is above the OG range of 80 to 100 mg/L. Hardness is naturally occurring and does not affect the treatment process. It is flagged as a natural concern.	No
	Total coliform	Total coliform were found occasionally at very low levels. Levels ranged between 0 to 183 counts per 100 mL in 2003 to 2006 (Thames Watershed Characterization Report). Treatment adequately removes these levels of total coliform. It is flagged as a naturally occurring concern only.	No
<b>Ingersoll (7 wells)</b>	Fluoride	The treated drinking water MAC for fluoride is 1.5 mg/L. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride in all wells' raw (untreated) water has consistently been above half (1.2 mg/L) of the upper range (2.4 mg/L) of the Health unit notification level. Fluoride levels in all wells range from 1.4 to 2.5 mg/L. Fluoride does not show an increasing trend and does not affect the treatment process. Fluoride concentrations are considered to be naturally high in the aquifer and are flagged as a concern in all wells.	No

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Iron	Iron ranges between 0.35 and 0.58 mg/L at the wells no. 3 (Hamilton Road), 10 (Thompson Road) and 11 (Wallace Line). Iron does not affect treatment and no increasing trend is evident. It is only flagged as a natural based concern.	No
Hardness	All 7 wells have hardness levels that range from 282 to 492 mg/L, which is higher than the OG range of 80 to 100 mg/L. The hardness is naturally occurring in the groundwater, does not affect the treatment process, and is only flagged as a concern.	No
Total Dissolved Solids (TDS)	Total Dissolved Solids (TDS) levels are above the AO of 500 mg/L at well no. 2 (Merritt Street), well no. 5 (Canterbury Street), well no. 7 (West Street) and well no. 8 (Dunn's Road). The concentration ranges from 470 to 863 mg/L. TDS does not impact health or the treatment process. No increasing trend is evident in the results, and it is only flagged as a concern.	No
Organic Nitrogen	Organic Nitrogen levels in the system are above the aesthetic objective of 0.15 mg/L at well no. 5 (Canterbury Street), well no. 8 (Dunn's Road) and well no. 10 (Thompson Road). Concentrations range from 0.16 to 0.31 mg/L. Organic nitrogen can be associated with unpleasant taste and high levels can reduce the effectiveness of chlorine as a disinfectant. It is flagged as a concern.	No
Tetrachloroethylene	In 1993 the Ontario Ministry of the Environment, (MOE) conducted an investigation on a private industrial well located near Thomas and Ingersoll Street for trichloroethylene (TCE) contamination. Traces of the chemical were detected in Well 7 at West Street and traces of tetrachloroethylene were detected at Well 2 at Merritt Street. A clean up and monitoring program has been followed by the industry. No TCE has been detected in samples reviewed for issues evaluation. The industry's consultant provided test results from 2008 and no TCE was detected. The affected site is regularly monitored. TCE and tetrachloroethylene are flagged as concerns.	No
Trichloroethylene	In 1993 the Ontario Ministry of the Environment, (MOE) conducted an investigation on a private industrial well located near Thomas and Ingersoll Street for trichloroethylene (TCE) contamination. Traces of the chemical were detected in Well 7 at West Street and traces of tetrachloroethylene were detected at Well 2 at Merritt Street. A clean up and monitoring program has been followed by the industry. No TCE has been detected in samples reviewed for issues evaluation. The industry's consultant provided test results from 2008 and no TCE was detected. The affected site is regularly monitored. TCE and tetrachloroethylene are flagged as concerns.	No
Colour	The well no. 8 (Dunn's Road well) has color levels of 10 True Colour Units (TCU), which is above the AO of 5 TCU. All other wells have colour levels below the AO. Color is flagged as a concern.	No
Total coliform	Microbiological results are consistently good and indicate no concerns at the majority of the wells. There are infrequent, low level positive results for Total Coliform and <i>E. coli</i> in the raw water at well no. 5 (Canterbury Street). Total coliform is flagged as a concern.	No
<i>E. coli</i>	Microbiological results are consistently good and indicate no concerns at the majority of the wells. There are infrequent, low level positive results for Total Coliform and <i>E. coli</i> in the raw water at well no. 5 (Canterbury Street). <i>E. coli</i> is flagged as a concern.	No

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	Sodium	The sodium concentration is noted to be above the Ministry of Health notification level of 20 mg/L, with levels of 29 to 97 mg/L in all wells. All results are well below the objective of 200 mg/L. It is naturally occurring. No increasing trend is evident in the results.	No
	Hydrogen Sulphide	All wells in Ingersoll are above the treated water AO of 0.05 mg/L for hydrogen sulphide between 2001 and 2009. Levels are reported as ranging from 0.26 to 6.02 mg/L. It is believed that the levels in Ingersoll source water are significantly higher than some of these results indicate, as the parameter easily volatilizes in air. Complaints on hydrogen sulphide-related odors are historically received by the Operating Authority. When not removed from the water prior to disinfection, the hydrogen sulphide can cause significant water quality and treatment issues (it reacts with chlorine causing a turbidity spike and potentially interrupting the disinfection process). The hydrogen sulphide is a naturally occurring parameter in the groundwater. It is flagged as a concern.	Yes
<b>Innerkip (2 wells)</b>	Iron	Iron in the well raw (untreated) water is above the AO of 0.3 mg/L for Iron. The concentration is around 0.97 to 2.13 mg/L. The iron levels do not interfere with the treatment process. No increasing trend is evident. Iron is flagged as a natural based concern in both wells.	No
	Hardness	The hardness concentration is typically around 860 mg/L, which is above the OG of 80 to 100 mg/L. This parameter is naturally occurring in the groundwater and does not pose a health risk nor does it impact the treatment process. It is flagged as a natural based concern in both wells.	No
	Total Dissolved Solids (TDS)	Total Dissolved Solids (TDS) levels are above the AO of 500 mg/L and are 1280 to 1370 mg/L. TDS does not impact health or the treatment process. No increasing trend is evident in the results. It is flagged as a natural based concern in both wells.	No
	Sulphate	Sulphates concentrations range from 500 to 720 mg/L, which is above the AO of 500 mg/L. Sulphates are an aesthetic concern and are naturally occurring in the groundwater, and this parameter is flagged as a concern in both wells.	No
<b>Lakeside (1 well)</b>	Fluoride	The treated drinking water MAC for fluoride is 1.5 mg/L. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride in the well's raw (untreated) water has consistently been above half (1.2 mg/L) of the upper range (2.4 mg/L) of the Health unit notification level. Fluoride levels are typically 1.6 mg/L. Fluoride does not show an increasing trend and does not affect the treatment process. Fluoride concentrations are considered to be naturally high in the aquifer and are flagged as a concern in the well.	No
	Iron	Iron in the well raw (untreated) water is above the AO of 0.3 mg/L for Iron. The concentration is around 0.54 mg/L. The iron levels do not interfere with the treatment process. No increasing trend is evident. Iron is flagged as a natural based concern.	No
	Hardness	The hardness concentration is typically around 185 mg/L, which is above the OG of 80 to 100 mg/L. This parameter is naturally occurring in the groundwater and does not pose a health risk nor does it impact the treatment process. It is flagged as a natural based concern.	No

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	Color	The AO for color is 5 True Color Units (TCU). The source typically has a value of 8 TCU. There is no evidence of upwards trending and the parameter does not impact the treatment process. It is flagged as a natural based concern.	No
	Organic Nitrogen	Organic Nitrogen levels in the system are above the aesthetic objective of 0.15 mg/L at concentrations of 0.28 mg/L. Organic nitrogen can be associated with unpleasant taste and high levels can reduce the effectiveness of chlorine as a disinfectant, however there is no history of unpleasant taste. It is flagged as a concern.	No
<b>Mt. Elgin (2 wells)</b>	Fluoride	The treated drinking water MAC for fluoride is 1.5 mg/L. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride in both wells' raw (untreated) water has consistently been above half (1.2 mg/L) of the upper range (2.4 mg/L) of the Health unit notification level. Fluoride levels in both wells are typically 1.4 mg/L. Fluoride does not show an increasing trend and does not affect the treatment process. Fluoride concentrations are considered to be naturally high in the aquifer and are flagged as a concern in both wells.	No
	Hardness	The hardness concentration is typically around 220 mg/L, which is above the OG of 80 to 100 mg/L. This parameter is naturally occurring in the groundwater and does not pose a health risk nor does it impact the treatment process. It is flagged as a natural based concern.	No
	Sodium	The Sodium concentration is noted to occur marginally above the Ministry of Health notification level of 20 mg/L at levels of 24 mg/L. The results are well below the objective of 200 mg/L. It is naturally occurring. No increasing trend is evident in the results.	No
<b>Tavistock (3 wells)</b>	Iron	Iron in each of the wells raw (untreated) water is above the AO of 0.3 mg/L for Iron. The concentration is around 0.6 to 0.9 mg/L. The iron levels do not interfere with the treatment process. No increasing trend is evident. Iron is flagged as a natural based concern.	No
	Hardness	The hardness concentration is typically around 280 to 380 mg/L, which is above the OG of 80 to 100 mg/L. This parameter is naturally occurring in the groundwater and does not pose a health risk nor does it impact the treatment process. It is flagged as a natural based concern.	No
	Organic Nitrogen	The organic nitrogen level in the wells is above the AO of 0.15 mg/L, with concentrations of 0.3 mg/L. Organic nitrogen can be associated with unpleasant taste and high levels can reduce the effectiveness of chlorine as a disinfectant. There is no history of objectionable taste that is sometimes associated with organic nitrogen. It is flagged as a concern.	No
	Total coliform	Microbiological results are consistently good in Wells 1 and 3. Well 2, which is a standby well, has occasional low level positive results for Total Coliform in the raw water. Typically this is due to infrequent pumping of the well while it is in rotational or standby operation. It is flagged as a concern.	No

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<b>Thamesford (3 wells)</b>	Fluoride	The treated drinking water MAC for fluoride is 1.5 mg/L. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride in the raw (untreated) water of well no. 2 is above half (1.2 mg/L) of the upper range (2.4 mg/L) of the Health unit notification level. Fluoride levels in well no. 2 ranges from 1.5 to 2.2 mg/L. Fluoride does not show an increasing trend and does not affect the treatment process. Fluoride concentrations are considered to be naturally high in the aquifer and are flagged as a concern in well no. 2.	No
	Hardness	The hardness concentration in all wells is typically around 365 to 550 mg/L, which is above the OG of 80 to 100 mg/L. This parameter is naturally occurring in the groundwater and does not pose a health risk nor does it impact the treatment process. It is flagged as a natural based concern.	No
	TDS	Total Dissolved Solids (TDS) levels are above the AO of 500 mg/L in well no. 3, ranging from 628 to 827 mg/L. TDS does not impact health or the treatment process. No increasing trend is evident in the results. It is flagged as a natural based concern in well no. 3.	No
	Organic Nitrogen	The organic nitrogen level in the wells is above the AO of 0.15 mg/L, with concentrations of 0.16 to 0.19 mg/L in well no. 1 and 3. Organic nitrogen can be associated with unpleasant taste and high levels can reduce the effectiveness of chlorine as a disinfectant. There is no history of objectionable taste that is sometimes associated with organic nitrogen. It is flagged as a concern in well no. 1 and 3.	No
	Total coliform	Microbiological results are consistently good at Wells 1 and 3. Well 2 has occasional low level Total Coliform and <i>E. coli</i> results due to being operated infrequently. These parameters are flagged as a concern.	No
	<i>E. coli</i>	Microbiological results are consistently good at Wells 1 and 3. Well 2 has occasional low level Total Coliform and <i>E. coli</i> results due to being operated infrequently. These parameters are flagged as a concern.	No
	Sodium	The Sodium concentration is noted to occur above the Ministry of Health notification level of 20 mg/L in all wells. In Wells 1 and 2 the concentration ranges from 22 to 27 mg/L and in Well 3 it ranges from 45 to 51 mg/L. The results are well below the objective of 200 mg/L. It is naturally occurring. No increasing trend is evident in the results.	No
	Nitrates	The nitrate levels are above half of the treated water MAC (nitrate MAC being 10 mg/L) in Wells 1 and 2 since 1999. In 2008 the results ranged from 4.71 to 9.76 mg/L. One result of 10.2 mg/L was reported in December 2007. Nitrate is not typically a naturally occurring parameter in groundwater at levels around the MAC of 10 mg/L and may be from anthropogenic sources. The treatment process combines the high nitrate water with water from Well 3 to control nitrate levels in the distribution system. If Well 3 were to fail or be offline for long periods of time, supply could be compromised.	Yes
	Manganese	The raw water in Wells 1 and 2 has levels of manganese above the treated water AO of 0.05 mg/L, with concentrations of 0.14 to 0.35 mg/L (data 2001 to 2009). No increasing trend is evident. The treatment facility removes manganese through an oxidation and filtration process. Failure of this process could potentially result in decreased clarity of the water, which would impact the effectiveness of the UV disinfection.	Yes

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<b>Woodstock (10 wells)</b>	Fluoride	The treated drinking water MAC for fluoride is 1.5 mg/L. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride in the raw (untreated) water of well no. 9 is above half (1.2 mg/L) of the upper range (2.4 mg/L) of the Health unit notification level. Fluoride level in well no. 9 is typically 1.4 mg/L. Fluoride does not show an increasing trend and does not affect the treatment process. Fluoride concentrations are considered to be naturally high in the aquifer and are flagged as a concern in well no. 9.	No
	Iron	Iron at well 6, 7 and 9 are above the iron AO of 0.3 mg/L. The concentration is around 0.6 to 3.8 mg/L. Iron does not interfere with the treatment process. No increasing trend is evident. Iron is flagged as a concern at well no. 6, 7 and 9.	No
	Hardness	The hardness concentration in all wells is typically around 349 to 567 mg/L, which is above the OG of 80 to 100 mg/L. This parameter is naturally occurring in the groundwater and does not pose a health risk nor does it impact the treatment process. It is flagged as a natural based concern in all wells.	No
	Total Dissolved Solids (TDS)	Total Dissolved Solids (TDS) levels in well no. 6, 7 and 9 are above the AO of 500 mg/L. TDS does not impact health or the treatment process. No increasing trend is evident in the results. It is flagged as a natural based concern in well no. 6, 7 and 9.	No
	Manganese	The concentration of Manganese in Well 7 is equal to the objective of 0.05 mg/L. It is naturally occurring and does not interfere with the treatment process. It is flagged as a natural based concern in well no. 7.	No
	Organic Nitrogen	The Organic Nitrogen level in the system is above the aesthetic objective of 0.15 mg/L at wells 6, 7, 8, 9 and 11. Concentrations range from 0.37 to 0.75 mg/L. Organic nitrogen can be associated with unpleasant taste and high levels can reduce the effectiveness of chlorine as a disinfectant. There is no history of objectionable taste that is sometimes associated with organic nitrogen. It is flagged as a concern at well no. 6, 7, 8, 9 and 11.	No
	Hydrogen Sulphide	Wells 7 and 9 are above the treated water AO of 0.05 mg/L for hydrogen sulphide. It is believed that the levels are significantly higher than some of these results indicate, as the parameter easily volatilizes in air. Complaints on hydrogen sulphide-related odors are historically received by the Operating Authority on well no. 7. When not removed from the water prior to disinfection, the hydrogen sulphide can cause significant water quality and treatment issues (it reacts with chlorine causing a turbidity spike and potentially interrupting the disinfection process). Well 9 combines with water from other wells prior to entering the distribution system and odors are not noticeable. The hydrogen sulphide is a naturally occurring parameter in the groundwater. It is flagged as a concern in well no. 7 and 9.	No
	Sodium	The Sodium concentration is noted to occur above the Ministry of Health notification level of 20 mg/L in all wells. In wells 6, 7 and 9, the concentration ranges from 36 to 53 mg/L. The results are well below the objective of 200 mg/L. It is naturally occurring. No increasing trend is evident in the results.	No

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	Nitrates	Nitrate occurs in the Thornton wellfield (Wells 1, 3, 5, 8 and 11) and Tabor wellfield (Wells 2 and 4) of the Woodstock well supply. Nitrate levels in Wells 1, 2, 3, 5, 8 and 11 are routinely above half of the treated water MAC (nitrate MAC is 10 mg/L). In Well 4, the concentration is typically below the half MAC threshold but has occasionally been marginally above the half MAC. In 2008 the concentration ranged from 3.7 to 11.5 mg/L in the raw water. Well 3 typically has the highest nitrate concentrations. Data for all wells is 2001 to 2009. Nitrate is not typically a naturally occurring parameter in groundwater at levels around the MAC and may be from anthropogenic sources.	Yes
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**Table A9-1c: Drinking Water Quality Parameters Flagged in the Upper Thames River Source Protection Area (Perth County, City of Stratford and Town of St. Marys)**

System	Flagged Parameter	Brief Description of Screening	Identified as an Issue?
<b>Mitchell (4 wells)</b>	Sodium	Sodium levels in all wells are above the Ministry of Health notification level of 20 mg/L, going up to 47 mg/L in 2007. Sodium levels did not go above the AO of 200 mg/L. Elevated levels of sodium are believed to be naturally occurring in the aquifer.	No
	Iron	As reported in the Thames Watershed Characterization Report, iron levels were 0.44 mg/L and 0.5 mg/L in 2005 and 2006, and therefore above the 0.3 mg/L AO (data available did not allow for reviewing parameters for each well). The iron is deemed to be naturally elevated in the aquifer. Treatment at the wells includes iron sequestering system to specifically treat the elevated iron concentrations. Iron is flagged as a natural based concern in all wells.	No
	Fluoride	Fluoride levels in all wells are above the treated water AO of 1.5 mg/L. Levels ranged from 1.6 to 1.9 mg/L between 2003 and 2008. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride is believed to be naturally occurring in the aquifer.	Yes
<b>Shakespeare (1 well)</b>	Iron	As reported in the Thames Watershed Characterization Report, iron levels were 1.05 mg/L and 0.52 mg/L in 2005 and 2006, and therefore above the 0.3 mg/L AO. The iron is deemed to be naturally elevated in the aquifer. Treatment at the well includes an iron sequestering system to specifically treat the elevated iron concentrations. Iron is flagged as a natural based concern.	No
	Fluoride	Fluoride levels are above half of the treated water AO of fluoride but below the AO itself (1.5 mg/L). Levels ranged from 0.8 to 0.92 mg/L between 2003 and 2007. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride is believed to be naturally occurring in the aquifer.	No
	Arsenic	In 2005 to 2007, arsenic was detected at levels of 0.012 mg/L, slightly lower than half of the MAC (the MAC being 0.025 mg/L). There is no increasing trend and arsenic is believed to be naturally occurring in the aquifer.	No

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**Table A9-1c: Drinking Water Quality Parameters Flagged in the Upper Thames River Source Protection Area (Perth County, City of Stratford and Town of St. Marys)**

System	Flagged Parameter	Brief Description of Screening	Identified as an Issue?
<b>Sebringville (1 well)</b>	Sodium	Sodium levels in all wells are above the Ministry of Health notification level of 20 mg/L, but below the AO of 200 mg/L. In 2003 to 2006 and in 2008, sodium levels ranged from 26.9 to 31 mg/L. The slightly elevated levels of sodium are believed to be naturally occurring in the aquifer.	No
	Iron	From the limited iron data, iron levels are slightly above the OG of 0.3 mg/L, at 0.35 mg/L (in 2005) and 0.4 mg/L (in 2008). There is no specific iron removal treatment for the well, but an operations manager at the Ontario Clean Water Agency (OCWA), who maintains the wells, has indicated that there are no treatment difficulties due to the iron levels, and will continue to monitor iron levels. Iron is flagged as a natural based concern.	Yes
	Fluoride	Fluoride levels are above the treated water AO of fluoride, 1.5 mg/L. Levels ranged from 2.06 to 2.74 mg/L between 2003 and 2008. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride is believed to be naturally occurring in the aquifer.	Yes
<b>St. Pauls (1 well)</b>	Sodium	Sodium levels in all wells are above the Ministry of Health notification level of 20 mg/L, but below the AO of 200 mg/L. In 2003 to 2006, the Thames Watershed Characterization Report notes that sodium levels ranged from 22.4 to 24.6 mg/L. The slightly elevated levels of sodium are believed to be naturally occurring in the aquifer.	No
	Iron	From the limited iron data, iron levels are slightly above the OG of 0.3 mg/L, at 0.5 mg/L (in 2005) and 0.59 mg/L (in 2006). Treatment at the well includes an iron sequestering system to specifically treat the elevated iron concentrations. Iron is flagged as a natural based concern.	No
	Fluoride	Fluoride levels are above the treated water AO of fluoride, 1.5 mg/L. Levels ranged from 1.59 to 1.69 mg/L between 2003 and 2006. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride is believed to be naturally occurring in the aquifer.	Yes
<b>Stratford (11 wells)</b>	Sodium	Sodium levels in all wells are above the Ministry of Health notification level of 20 mg/L, but below the AO of 200 mg/L. In 2003 to 2006, the Thames Watershed Characterization Report notes that sodium levels ranged from 17 to 32 mg/L. In 2008, sodium levels ranged between 21 and 26 mg/L for all wells. The slightly elevated levels of sodium are believed to be naturally occurring in the aquifer.	No
	Iron	At the Romeo well field (comprised of 6 wells), iron levels are slightly above the OG of 0.3 mg/L, at 0.35 mg/L (in 2005) and 0.34 mg/L (in 2006). Treatment for the Romeo well field includes an iron sequestering system to specifically treat the elevated iron concentrations. Iron is flagged as a natural based concern.	No

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**Table A9-1c: Drinking Water Quality Parameters Flagged in the Upper Thames River Source Protection Area (Perth County, City of Stratford and Town of St. Marys)**

System	Flagged Parameter	Brief Description of Screening	Identified as an Issue?
	Fluoride	Fluoride levels in all wells are at or above the treated water AO of fluoride, 1.5 mg/L. Levels ranged from 1.5 to 2.6 mg/L between 2004 and 2008. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride is believed to be naturally occurring in the aquifer.	Yes
<b>St. Marys (3 wells)</b>	Sodium	For all 3 wells, the sodium levels were less than the Ministry of Health notification level of 20 mg/L in 2003 to 2006. Sodium ranged from 43 to 61 mg/L in 2008. The elevated levels of sodium are believed to be naturally occurring in the aquifer, and are below the AO of 200 mg/L.	No
	Fluoride	For all 3 wells, the fluoride levels ranged from 1.01 to 1.23 (2003 to 2006), 1.09 to 1.2 mg/L (2008). These levels are greater than half of the AO, but less than the AO of 1.5 mg/L. At concentrations between 1.5mg/L and 2.4 mg/L the Ministry of Health and Long-Term Care require that the local Medical Officer of Health is notified to raise awareness to control excessive exposure from other sources. Fluoride is believed to be naturally occurring in the aquifer.	No
	Nitrate	Nitrates at the St. Marys Well no. 1 ranged between 0 to 6.1 mg/L from 2000 to 2006, with some of these levels being higher than half of the MAC. No values in this time period went above the full MAC of 10 mg/L. The St. Marys wells are groundwater under the influence of surface water (GUDI) and therefore the source of nitrates may possibly be anthropogenic. Nitrates are flagged as a concern but not identified as an issue.	No
	<i>E. coli</i>	From the raw water quality analysis in the Thames Watershed Characterization Report, the raw (untreated) water drawn from well No. 1 had four occurrences of <i>E. coli</i> between 2003 and 2005, with low counts of 1 per 100 mL. The St. Marys wells are groundwater under the influence of surface water (GUDI) and therefore the source of <i>E. coli</i> may possibly be anthropogenic. The current disinfection treatment adequately removes <i>E. coli</i> and total coliform from the water. It is flagged as a concern but not identified as an issue.	No