APPENDIX – S (SPRINGWATER)

GENIVAR CONSULTANTS LP (FORMERLY JAGGER HIMS) TECHNICAL MEMORANDUMS

Springwater:

- Technical Memorandum O1 - Drinking Water Issues Evaluation

DILLON CONSULTING LIMITED: WELL HEAD TIME OF TRAVEL CAPTURE ZONE PEER REVIEW EVALUATION RESULTS

- Dillon Consulting Limited WHPA Peer Review Report Memo
- Wellhead Time of Travel Capture Zone Peer Review Evaluation Results
    - Table 1: Anten Mills
    - Table 2: Del Trend
    - Table 3: Midhurst
    - Table 4: Minesing
    - Table 5: Phelpston
    - Table 6: Snow Valley
    - Table 7: Vespra Downs

GENIVAR

TECHNICAL MEMORANDUM O1

Date:	August 5, 2010
To:	Don Goodyear, P.Geo. – South Georgian Bay Lake Simcoe Protection Region
From:	Sarah Dignard/Lloyd Lemon, P.Geo.
Project No.:	071948.10
Subject:	Drinking Water Issues Evaluation – Springwater Township of Springwater

OBJECTIVE:

To document the Drinking Water Issues Evaluation for the groundwater supply for the Township of Springwater in the South Georgian Bay Lake Simcoe Source Protection Region.

OVERVIEW:

Work has been completed to meet the requirements of Technical Rules 114 through 117 of the Technical Rules: Assessment Report, *Clean Water Act, 2006* as provided by the Ontario Ministry of the Environment on December 12, 2008, and as amended in November 2009. The Drinking Water Issues Evaluation portion focuses on identifying recurring water quality impacts or situations with a possibility of impacting drinking water sources in the short-term. This work results in a preliminary list of identified issues.

The approach for the Drinking Water Issues Evaluation is described in more detail in "Technical Memorandum A5 - Drinking Water Issues Evaluation Methods". The steps included:

Step 1: Assemble Available Data

Step 2: Review Data and Identify Potential Drinking Water Issues

Step 3: Evaluate Drinking Water Issues

Step 4: Identify Contributing Area for Drinking Water Issues

Step 5: Prepare List of Drinking Water Issues

Municipal Wells and Aquifers

The Township of Springwater Water Supply consists of several individual water works, including the groundwater wells at the Anten Mills Water Supply, the Del Trend Water Supply, the Elmvale Water Supply, the Hillsdale Water Supply, the Midhurst Water Supply, the Minesing Water Supply, the Phelpston Water Supply, the Snow Valley Highlands Water Supply and the Vespra Downs Water Supply.

Anten Mills Water Supply

The Anten Mills Water Supply serves the Community of Anten Mills in the Township of Springwater. The system services 70 residential units. Raw water is obtained from three drilled wells. Well #1 is comprised of a 150mm steel casing drilled to a depth of 66.4 metres with a 150mm screen extending from 66.4 metres to 65.9 metres. Water is obtained via a submersible pump rated at 6.9 L/sec. Well #2 is comprised of a 150mm steel casing drilled to a depth of 66.1 metres with a 150mm screen extending from 66.1 metres to 69.5 metres. Water is obtained via a submersible pump rated at 6.4 L/sec. Well #3 is comprised of a 219mm diameter steel casing drilled to a depth of 67 m. Water is obtained via a

submersible pump rated at 15.15 L/s. Well 1 is permitted to pump at a maximum rate of 290 L/min (418 m^3/day), Well 2 is permitted to pump at a maximum rate of 250 L/min (360 m^3/day), and Well 3 is permitted to pump at a maximum rate of 909 L/min (780 m^3/day). The wells can operate up to a maximum combined taking of 1,558 m^3/day from the system. Raw water is treated with sodium hypochlorite. The system services a population of approximately 650.

Del Trend Water Supply

The Del Trend Water Supply obtains its water from three drilled wells located adjacent to the pumphouse. The system services a population of approximately 611. Well #1 is comprised of a 150mm steel casing extending to a depth of 68.6 metres below ground level. The screen extends from 68.6 metres to 73.2 metres. Well #2 is comprised of a 200mm steel casing extending to 64 metres below ground level. A 200mm screen extends from 64 metres to 68.6 metres. Well #3 is comprised of a 200mm steel casing extending to 61.3 metres below ground level. A 200mm screen extends from 61.3 metres to 71.3 metres. Each well is equipped with a submersible well pump which delivers a maximum flow of 5.63 L/sec for wells 1 and 2, and 9.1 L/sec for well #3. Wells 1 and 2 are permitted to pump at a maximum rate of 324 L/min (467 m^3/day) and Well 3 is permitted to pump at a maximum rate of 546 L/min (786 m^3/day). The wells can operate up to a maximum combined taking of 1,074 m^3/day from the system. Raw water is treated with sodium hypochlorite and sodium silicate for iron and manganese sequestration.

Elmvale Water Supply

The Elmvale Water Supply obtains its water from two 300mm steel cased drilled wells drilled to depths of 54.3 metres and 56.6 metres respectively. Screens with 0.51 mm openings were set from 48.1 to 54.3 metres below ground in Well #1, and from 48.8 to 56.6 metres in Well #2. Each is equipped with vertical turbine pumps with a maximum pumpage rate of 26.5 L/sec. Wells 1 and 2 are permitted to pump at maximum rates of 1,600 L/min (2,273 m^3/day). The wells can operate up to a maximum combined taking of 4,546 m^3/day from the system. The system services approximately 955 units. Raw water is treated with sodium hypochlorite.

Hillsdale Water Supply

The Hillsdale Water Supply obtains its water from three drilled wells. Well #1 is comprised of a 150 mm diameter 97.5 m drilled well into bedrock. Well #2 is comprised of a 150 mm diameter 26.5 drilled well into an overburden aquifer. Well #3 is comprised of a 200 mm diameter 27.43 m deep drilled well into the same overburden aquifer as well #2. Well 1 is permitted to pump at a maximum rate of 654 L/min (285 m^3/day), Well 2 is permitted to pump at a maximum rate of 342 L/min (493 m^3/day) and Well 3 is permitted to pump at a maximum rate of 456 L/min (657 m^3/day). The wells can operate up to a maximum combined taking of 1,434 m^3/day from the system. The Hillsdale Water Supply system services approximately 333 units, including residential units, several businesses and a public school. Raw water is treated with sodium hypochlorite.

Midhurst Water Supply

The Midhurst Water Supply obtains its water from four drilled wells with 150 mm steel casings, that are located at three separate sites. Wells #2 and #3 are located adjacent to the Idlewood pump house and are equipped with submersible well pumps capable of pumping 7.7 L/sec and 33.3 L/sec. Well #4 is located adjacent to the Greenpine pump house and is equipped with a submersible well pump capable of pumping 22.7 L/sec. Well #2 is permitted to pump at a maximum rate of 430 L/min (622 m^3/day), Well 3 is permitted to pump at a maximum rate of 2,000 L/min (2,900 m^3/day), Well #4 is permitted to pump at a maximum rate of 1,360 L/min (2,000 m^3/day), and Well #5 is permitted to pump at a maximum rate of 1,140 L/min (1,068 m^3/day). The wells can operate up to a maximum combined taking of 6,479 m^3/day from the system. Raw water is treated with sodium hypochlorite and sodium silicate for iron sequestration.

Minesing Water Supply

The Minesing Water Supply obtains its water from four drilled wells with 150 mm steel casings. Well #2 is drilled to a depth of 35.7 m and is equipped with a submersible well pump capable of pumping at a rate of 3.79 L/sec. Well #3 is drilled to a depth of 35.1 m and is equipped with a submersible pump capable of pumping at a rate of 3.79 L/sec. Well #4 is drilled to a depth of 38.1 m and is equipped with a submersible well pump capable of pumping at a rate of 4.78 L/sec. Wells 2 and 3 are permitted to pump at a maximum rate of 227 L/min (327 m^3/day) while Well 4 is permitted to pump at a maximum rate of 287 L/min (412 m^3/day). The wells can operate up to a maximum combined taking of 739 m^3/day from the system. Well 1 was only recently connected to the system and limited information was provided on this well. Raw water is treated with sodium hypochlorite. The system services an estimated population of 627.

Phelpston Water Supply

The Phelpston Water Supply obtains its water from two drilled wells. Well #1 comprises of a 200 mm diameter, 40 m deep well equipped with a submersible pump rated at 6.3 L/s. Well #2 comprises of a 150 mm diameter, 47 m deep well equipped with a submersible pump rated at 7.5 L/s. Well 1 is permitted to pump at a maximum rate of 380 L/min (547 m^3/day) while Well 2 is permitted to pump at a maximum rate of 455 L/min (655 m^3/day). The wells can operate up to a maximum combined taking of 1,202 m^3/day from the system. Raw water is treated with sodium hypochlorite. The system services the a population of 270 (90 units) at the Shamrock Meadows Subdivision in the Community of Phelpston.

Snow Valley Highlands Water Supply

The Snow Valley Highlands Water Supply consists of four wells: Well #1, Well #2, Well #3, and Well #4. Wells #1 and #2 were constructed in 1988 and 1989, respectively. The Snow Valley Highlands Water Supply was drilled into a confined sand/gravel aquifer, encountered at a depth of 50 m below ground level (bgl). Well 1 was drilled to a depth of 66.3 mbgl and screened from 59.4 mbgl to 65.5 mbgl. Well #2 was drilled to a depth of 67.4 mbgl and screened from 60.9 mbgl to 67.1 mbgl. Well #3 was drilled to a depth of 72.5 mbgl. Well #4 was drilled to a depth of 72.5 mbgl. Well #1 is permitted to pump at a maximum rate of 786 L/min (1,132 m^3/day). Well #2 is permitted to pump at a maximum rate of 1,044 L/min (1,503 m^3/day). Well #3 is permitted to pump at a maximum rate of 1,135 L/min (1,634 m^3/day) and Well #4 is permitted to pump at a maximum rate of 1,135 L/min (1,634 m^3/day). Raw water is treated with sodium hypochlorite and sodium silicate for iron and manganese sequestration.

Vespra Downs Water Supply

The Vespra Downs Water Supply obtains its water from two drilled wells located at 13 Parr Blvd and supplies water to homes along Parr Blvd. The wells are identified as Well #1 and Well #2 and are equipped with a submersible well pump and flow meter. Wells #1 and #2 were constructed in 1993 and 1991, respectively. The Vespra Downs Water Supply was drilled into a confined sand/gravel aquifer, encountered at a depth of 57 m below ground level (mbgl). Well #1 was drilled to a depth of approximately 70.4 mbgl and screened from 58.2 mgbl to 64.3 mbgl. Well #2 was drilled to a depth of approximately 60.7 mbgl and screened from 57.6 mbgl to 60.7 mbgl. Wells #1 and #2 are permitted to pump at maximum rates of 313 L/day (450 m^3/day). The production wells can operate up to a maximum combined taking of 900 m^3/day. Raw water is injected for disinfection with sodium hypochlorite and sodium silicate is injected for iron sequestering. The system services an estimated population of 540 (12 units).

Step 1: **Assemble Available Data**

The data sources that were reviewed to identify potential issues included:

- Anten Mills Water Supply Annual Report (2003, 2004, 2005, 2006);
- Amended Certificate of Approval for Anten Mills Water Supply (2004);
- Permit To Take Water at Anten Mills Water Supply (2005);
- Anten Mills Water Facility Monthly Process Data Report (2005, 2006);
- Anten Mills Laboratory Report (2005);
- Del Trend Water Supply Annual Report (2003, 2004, 2005, 2006);
- Amended Certificate of Approval for Del Trend Water Supply (2007);
- Permit To Take Water at Del Trend Water Supply (2007);
- Del Trend Water Facility Monthly Process Data Report (2005);
- Del Trend Laboratory Report (2005, 2006);
- Del Trend Subdivision Water Supply Drinking Water System Inspection Report (2006);
- Elmvale Water Supply Annual Report (2003, 2004, 2005, 2006);
- Elmvale Wastewater Treatment Plant Annual Operating Report (2006);
- Certificate of Approval for Elmvale Water Supply (2003);
- Permit to Take Water at Elmvale Water Supply (2001);
- Elmvale Water Facility Monthly Process Data Report (2005, 2006);
- Elmvale Laboratory Report (2005);
- Elmvale Water Supply Drinking Water System Inspection Report (2006);
- Hillsdale Water Supply Annual Report (2003, 2004, 2005, 2006);
- Certificate of Approval for Hillsdale Water Supply (2006);
- Permit to Take Water at Hillsdale Water Supply (2004);
- Hillsdale Water Facility Monthly Process Data Report (2005, 2006);
- Hillsdale Laboratory Report (2005);
- Hillsdale Water Supply Drinking Water System Inspection Report (2006);
- Midhurst Water Supply Annual Report (2003, 2004, 2005, 2006);
- Certificate of Approval for Midhurst Water Supply (2005);
- Permit to Take Water at Midhurst Water Supply (2005);
- Midhurst Water Facility Monthly Process Data Report (2005);
- Midhurst Laboratory Report (2005, 2006);
- Midhurst Water Supply Drinking Water System Inspection Report (2006);
- Minesing Water Supply Annual Report (2003, 2004, 2005, 2006);
- Minesing Water Facility Monthly Process Data Report (2005, 2006);
- Minesing Laboratory Report (2005);

- Phelpston Water Supply Annual Report (2005, 2006);
- Certificate of Approval for Phelpston Water Supply (2004);
- Permit to Take Water at Phelpston Water Supply (2007);
- Phelpston Water Facility Monthly Process Data Report (2005, 2006);
- Phelpston Laboratory Report (2005);
- Phelpston Water Supply Drinking Water System Inspection Report (2007);
- Snow Valley Water Supply Annual Report (2003, 2004, 2005, 2006);
- Certificate of Approval at Snow Valley Drinking Water System (2007);
- Permit to Take Water at Snow Valley Water Supply (2006);
- Snow Valley Water Facility Monthly Process Data Report (2005, 2006);
- Snow Valley Laboratory Report (2005);
- Snow Valley Highlands Water Supply Annual Report (2005, 2006);
- Snow Valley Highlands Wastewater Treatment Plant Annual Operating Report (2006);
- Snow Valley Highlands Water Facility Monthly Process Data Report (2005, 2006);
- Snow Valley Highlands Laboratory Report (2005);
- Snow Valley Highlands Well Supply Drinking Water System Inspection Report (2006);
- Sunnidale Water Supply Annual Report (2006);
- Sunnidale Water Facility Monthly Process Data Report (2005, 2006);
- Vespra Downs Water Supply Annual Report (2007, 2008);
- Watershed Characterization Report; and
- Operator Interview.

Ms. Jen Bitten, Process and Compliance Technician of the Georgian Bay Hub for the Ontario Clean Water Agency, was interviewed to obtain operator insight into potential issues identified in the published data as well as identifying potential issues that may not have been identified in published data to date.

Step 2: **Review Data and Identify Potential Drinking Water Issues**

A set of tables (O1 series of tables) have been prepared to document a series of potential issues from the raw and treated water at the Township of Springwater as identified from various data sources. The O1 series of tables relate to the well systems as follows:

Table Number	Township of Springwater Water Works	Water Type	Water Source
O1-1A	Anten Mills	Raw	Well #1
O1-1B			Well #2
O1-1C			Well #3
O1-1D		Treated*	
O1-2A	Del Trend	Raw	Well #1
O1-2B			Well #2

Table Number	Township of Springwater Water Works	Water Type	Water Source
O1-2C			Well #3
O1-2D		Treated*	
O1-3A	Elmvale	Raw	Well #1
O1-3B			Well #2
O1-3C		Treated*	
O1-4A	Hillsdale	Raw	Well #1
O1-4B			Well #2
O1-4C			Well #3
O1-4D		Treated*	
O1-5A	Midhurst	Raw	Well #2
O1-5B			Well #3
O1-5C		Treated (Well #2 and #3)	
O1-5D		Raw and Treated	Well #4
O1-5E		Raw and Treated	Well #5
O1-6A	Minesing	Raw	Well #2
O1-6B			Well #3
O1-6C			Well #4
O1-6D		Treated*	
O1-7A	Phelpston	Raw	Well #1
O1-7B			Well #2
O1-7C		Treated*	
O1-8A	Snow Valley Highlands	Raw	Well #1
O1-8B			Well #2
O1-8C		Treated (Well #1 and #2)	
O1-8D		Raw	Well #4
O1-8E		Treated (Well #3 and #4)	
O1-9	Vespra Downs	Raw and Treated	Well #1 and Well #2

* The treated water data collected may reflect the use of any or all wells in that particular water system.

Tables O1-1 through O1-9 are designed to document:

1) The source reports or data that result in the identification of a parameter as a potential Drinking Water Issue;
2) Results of comparison of observed parameter concentrations to relevant benchmarks and situations where:

   Parameter concentrations exceed the primary benchmark established by the Ontario Drinking Water Quality Standard (ODWQS);

a. Parameter concentrations exceed a locally established benchmark value (typically a background concentration);
b. Parameter concentrations exceed the established method detection limit (MDL) [typically applied for organic chemical parameters];

3) Professional judgment on the reliability of the data based on the number of measurements and the relative consistency of the observed occurrence;

4) The nature of observed trends in parameter concentrations;

5) Input from local System Operators and other Stakeholders as to the significance of the parameter as a Drinking Water Issue;

6) Whether treatment is in place for the observed parameters and its effectiveness; and

7) The nature of the source of the parameter listed as a potential issue.

Trends were determined through graphing municipal water supply system water quality data. Parameters listed on the preliminary list of drinking water threats for each well have been assessed graphically for trends. The available data has been provided between 2003 and 2008. In the case of most parameters for the Springwater Water Supply, there was insufficient data available to establish a trend.

Step 3: **Evaluate Drinking Water Issues**

The O1 series of tables have been developed to identify Drinking Water Issues in accordance with the "Decision Process for Identification and Evaluation of Drinking Water Issues" as presented in Figure A5-1 of "Technical Memorandum A5 - Drinking Water Issues Evaluation Methods".

The positive or negative responses entered in the O1 series of tables correspond to the steps in the decision process. Professional judgment was built into the decision process in the evaluation of data reliability to identify anomalous conditions and in the consideration of operational insights. Trend analysis was used to identify parameters that are projected to exceed the ODWQS within approximately 50 years. The O1 series of tables also allow for the identification of the source of the potential Drinking Water Issue, whether treatment is in place, and its effectiveness.

For each of the water works systems, all of the parameters identified in the O1 tables are not considered to be Drinking Water Issues. Parameters common to most systems in the Township of Springwater that were removed from consideration include:

- Coliforms and E.Coli are typically absent but can be observed on rare occasions in low numbers. The presence of coliforms and E.Coli in the raw water is not persistent or indicative of deterioration of raw water quality. Disinfection is in place and is effective.
- Other organic parameters present in trace concentrations, such as benzene, monochlorobenzene, 1,2-dichloroethane, carbon tetrachloride and vinyl chloride originate from unknown sources but are not considered to represent Drinking Water Issues as these compounds are rarely observed, do not show increasing trends, and concentrations are well below ODWQS values.
- Other organic parameters are present in trace concentrations at Hillsdale, Anten Mills, Del Trend and Elmvale, such as 1,1-dichloroethylene, alachlor, aldrin and dieldrin, carbaryl, carbofuran, cyanazine, temephos, terbufos, bendiocarb, bromoxynil, dimethoate and prometryne. These parameters are associated with herbicides, pesticides and insecticides but specific source has not been identified. The systems that identified these parameters are within areas used specifically for agriculture. They are not considered to represent Drinking Water Issues as these compounds are observed rarely, do not show increasing trends, and concentrations are well

below ODWQS values. Reduction of pesticide and herbicide use in the contributing watershed would be beneficial to the drinking water quality.

- The rare to occasional exceedances of turbidity ODWQS values are associated with instances of system maintenance or power failures. This parameter is not considered to result in the deterioration of the water quality.
- Organic parameters such as trihalomethanes, are present in trace concentrations in treated water as byproducts of disinfection by chlorination. Concentrations are typically well below ODWQS values and do not display increasing trends.

***Step 4:* Identifying Contributing Area for Drinking Water Issues**

No parameters were identified as Drinking Water Issues at the Springwater Water Supply.

***Step 5:* Prepare List of Drinking Water Issues**

No parameters were identified as Drinking Water Issues at the Springwater Water Supply.

LAL/SJD:nah

Table O1-1A **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Anten Mills
Drinking Water Source: Well #1
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable												
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-1B **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Anten Mills
Drinking Water Source: Well #2
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
E. Coli				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-1C **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Anten Mills
Drinking Water Source: Well #3
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable												
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-1D **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Anten Mills
Drinking Water Source: Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria					Y				Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms					Y				Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Chemicals					Y																									
Alachlor					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Aldrin + Dieldrin					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Benzene					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Carbaryl					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Carbofuran					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Cyanazine					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Monochlorobenzene					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Temephos					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Terbufos					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Trihalomethane					Y					Y		Y		Y			N	Y	Y			Y		N	NO		Y			

Table O1-2A **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Del Trend
Drinking Water Source: Well #1
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-2B **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Del Trend
Drinking Water Source: Well #2
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
E. Coli				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-2C **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Del Trend
Drinking Water Source: Well #3
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years						
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable								Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
E.Coli				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-2D **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Del Trend
Drinking Water Source: Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria					Y				Y							Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms					Y				Y							Y	Y	N	Y			Y		Y	NO			Y	Y	Y
Chemicals																														
1,2-dichloroethane					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Alachlor					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Aldrin + Dieldrin					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Bendiocarb					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Benzene					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Bromoxynil					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Carbaryl					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Carbofuran					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Carbon Tetrachloride					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Cyanazine					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Dimethoate					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Monochlorobenzene					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Prometryn					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Temephos					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Trihalomethanes					Y					Y		Y	Y				N	Y	Y			Y		N	NO		Y			
Vynil Chloride					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		

Table O1-3A **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Elmvale
Drinking Water Source: Well #1
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years						
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable								Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-3B **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Elmvale
Drinking Water Source: Well #2
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years						
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable								Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-3C **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Elmvale
Drinking Water Source: Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria					Y				Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Chemicals																														
1,2-dichloroethane					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Alachlor					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Aldrin + Dieldrin					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Benzene					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Bromoxynil					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Carbaryl					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Carbofuran					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Cyanazine					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Monochlorobenzene					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Prometryn					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Temephos					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Trihalomethanes					Y					Y		Y		Y			N	Y	Y			Y		N	NO		Y			
Vynil Chloride					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		

Table O1-4A **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Hillsdale
Drinking Water Source: Well #1
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years						
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable								Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-4B **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Hillsdale
Drinking Water Source: Well #2
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-4C **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Hillsdale
Drinking Water Source: Well #3
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable												
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-4D **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Hillsdale
Drinking Water Source: Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable												
Chemicals																														
1,1-dichloroethylene					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
1,2-dichloroethane					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Alachlor					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Aldrin + Dieldrin					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Bromoxynil					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Carbofuran					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Cyanazine					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Monochlorobenzene					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		
Trihalomethanes					Y					Y		Y		Y			N	Y	Y			Y		N	NO		Y			
Vinyl Chloride					Y					Y		Y				Y	Y	N	Y			Y		N	NO			Y		

Table O1-5A **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Midhurst
Drinking Water Source: Well #2
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	N	Y	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	N	Y	Y			Y		N	NO			Y	Y	Y

Table O1-5B **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Midhurst
Drinking Water Source: Well #3
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-5C **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Midhurst
Drinking Water Source: Well 2 and 3 Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years						
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable								Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria					Y				Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms					Y				Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-5D **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Midhurst
Drinking Water Source: Well #4 and Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y	Y			Y	Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-5E **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Midhurst
Drinking Water Source: Well #5 and Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years						
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable								Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms					Y				Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-6A **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Minesing
Drinking Water Source: Well #2
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-6B **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Minesing
Drinking Water Source: Well #3
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-6C **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Minesing
Drinking Water Source: Well #4
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-6D **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Minesing
Drinking Water Source: Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria					Y				Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms					Y				Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Chemicals																														
Trihalomethanes					Y					Y		Y		Y			N	Y	Y			Y		N	NO		Y			
Turbidity					Y				Y			Y				Y	Y	N	Y			Y		N	NO		Y			

Table O1-7A **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Phelpston
Drinking Water Source: Well #1
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2005-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-7B **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Phelpston
Drinking Water Source: Well #2
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2005-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable												
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Coliforms				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-7C **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Phelpston
Drinking Water Source: Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2005-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence						Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years						
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable								Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria					Y				Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y
Chemicals																														
Trihalomethanes					Y					Y		Y	Y				N	Y	Y			Y		N	NO		Y			
Turbidity					Y				Y			Y				Y	Y	N	Y			Y		N	NO		Y			

Table O1-8A **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Snow Valley
Drinking Water Source: Well #1
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-8B **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Snow Valley
Drinking Water Source: Well #2
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Background Bacteria				Y				Y				Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-8C **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Snow Valley
Drinking Water Source: Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2003-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Chemicals																														
Trihalomethanes					Y					Y		Y		Y			N	Y	Y			Y		N	NO		Y		Y	Y

Table O1-8D **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Snow Valley Highlands
Drinking Water Source: Well #4
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2005-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Pathogens																														
Coliforms					Y				Y			Y				Y	Y	N	Y			Y		N	NO			Y	Y	Y

Table O1-8E **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Snow Valley Highlands
Drinking Water Source: Treated Water
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2005-2006
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Chemicals																														
Trihalomethanes					Y					Y		Y	Y				Y	N	Y			Y		N	NO		Y			

Table O1-9 **Evaluation of Drinking Water Issues**

Municipality: Township of Springwater
Community: Vespra Downs
Drinking Water Source: Well #1 and Well #2 - raw and treated
Issues Review Date: October 20 2009

Information Sources:
Watershed Characterization:
Annual Water Quality Reports: 2007-2008
Interview (person/title/date): Jen Bitten / Process and Compliance Technician / October 16, 2009

Parameter	Identified From							Compare Water Quality Data to Benchmarks				Confirm Data Reliability							Evaluate Trends					Operational Consideration	Drinking Water Issue	Source of Issue			Treatment	
													Confirm Presence																	
	Watershed Characterization	Operator Interview	Annual Water Quality Reports	Raw Water Quality Data	Treated Water Quality Data	PGMN Data	Other	Raw Water Quality Exceeds ODWQS	Treated Water Quality Exceeds ODWQS	Above Detection Limit	Above Local Background	Sufficent Data	Persistent (Always, <90%)	Majority of Tests (40-90%)	Occasionally (5 - 40%)	Rarely (<5%)	Anomalous Circumstance	Data Reliable	Trend Reviewed	Increasing	Reducing	Constant/Uncertain	Will Exceed ODWQS within 50 Years			Natural	Threat (Known)	Threat (Unknown)	In Place	Effective Mitigation
Chemicals																														
Trihalomethanes					Y				Y			Y	Y				N	Y	Y			Y		N	NO		Y			
Turbidity					Y				Y			Y			Y		Y	N	Y			Y		N	NO		Y			

July 29, 2010

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Attention: Mr. Don Goodyear, Source Protection Manager

WHPA Peer Review Report

Dear Mr. Goodyear:

Dillon Consulting Limited (Dillon) was retained by the Lake Simcoe Region Conservation Authority (LSRCA) to conducted Peer Reviews of well head protection area (WHPA) mapping for 86 municipal groundwater systems. These systems are located in the South Georgian Bay Lake Simcoe Source Protection Region. External management of the project was conducted by Mr. Dave Ketcheson, P.Eng of Azimuth Environmental Consulting Inc. The results of the peer review are issued in the form of digital spreadsheet files that are attached to this letter. The project scope and peer review methodology is summarized in the letter herein.

PROJECT SCOPE

LSRCA retained Dillon to conduct a 'high level' peer review of the WHPAs that were largely delineated as part of previous WHPA or regional groundwater studies, at a time prior to the finalization of the Director Rules. In general, WHPA delineation was based on an assortment of different model types, including fixed radius, 2-D analytical solutions and numerical 3-D flow modeling. In general, more sophisticated models were applied to those systems where more data was available. The focus of the peer review was on whether the methodologies were consistent with those outlined in the Directors Rules, rather than a more traditional technical modeling critique. Evaluations also identified critical issues or deficiencies that would have implications on subsequent steps in the source protection process, so that these may be addressed as part of the Assessment Report. The review also identify long-term opportunities for improvement in subsequent rounds of the process, recognizing the various levels of effort applied in WHPA delineation across the region (i.e., analytical vs. numerical methods), and the availability of data in the various WHPA settings.

Peer reviewers were Rob Kell, M.A.Sc., P.Eng, P.Geo.; Jeff Hachey, M.Sc. and Darin Burr, M.Sc. P.Geo, all hydrogeologists with Dillon.

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Evaluation of the WHPAs was performed in a systematic fashion following a "score card" approach. The score card contained both objective and subjective criteria that were evaluated for each system. This template approach enabled reviewers to maintain a level of consistency during the reviews, and was suited to the "high level" nature of the evaluation. The criteria that were evaluated is listed below:

Objective Criteria	**Subjective Criteria**
Was modeled pumping rate appropriate?	Complexity of geological Setting
Were approved models and methods used?	Appropriateness of Flow Model
	Reasonableness of input parameters
	Adequate incorporation of natural flow field
	Model Calibration
	Incorporation of Uncertainty

For each criterion, a score between 1 and 10 was awarded. In general, a score <5 for any of the criteria would be given if a critical concern was identified that would either significantly affect the reliability of the WHPAs, or is a contravention of the elements of the Directors Rules. An exception for this rule would be the evaluation of the uncertainty criterion. Failure to adequately incorporate uncertainty into the model results was not deemed a requirement of the Director Rules and therefore would not necessarily cause the system to "fail". Details on conditions that would cause an unacceptable evaluation at the criteria level are presented in the score card sheets.

All systems were given a "pass", "fail" or "conditional pass" result, depending upon the analysis results. A "pass" ranking was given for those systems were the methodology was generally consistent with the Director Rules, and no critical deficiencies were noted. A "conditional pass" was granted, where the potential for considerable uncertainty in the results existed, but either little data was available to improve the accuracy of the results, or it was the reviewer's opinion that the uncertainty on the results would not significantly alter the enumeration of land parcels that may contain significant threats.

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Following criteria scoring, the individual scores were weighted, and summed to produce an overall system score (between 1 and 10) for the WHPA delineation. Higher the score, the more favorable are the results of the evaluation. Please note that this scoring is a relative ranking between the systems, and is not to be interpreted as any type of marking. For example, a score of 6 does not mean a 60% mark, but rather is a system whose delineated WHPAs are deemed more conservatively robust (in lieu of available data) than a system that receives a score of 5. Theoretically, a system evaluated via fixed radius that is very conservative could receive a higher system score than a detailed numerical model result that is not conservative, as the risk of under-representing the area where significant threats may be lower.

RESULTS

The results of the evaluation are presented on digital Excel™ spreadsheets for each system, and are grouped by township or separated municipality name. Rationale for the individual criteria evaluations, along with the criterion scores, overall system scores and recommendations for future improvement are presented on the individual sheets.

LIMITATIONS

This report was prepared exclusively for the purposes, project and site location(s) outlined in the report. The report is based on information provided to, or obtained by Dillon Consulting Limited ("Dillon") as indicated in the report, and applies solely to site conditions existing at the time of the assessment. Although a reasonable assessment was conducted by Dillon, Dillon's assessment was by no means exhaustive and can not be construed as a certification or acceptance of the reviewed reports. Rather, Dillon's report represents a reasonable review of available information within an agreed work scope, schedule and budget. Further review and updating of the peer review reports will be required as local and site conditions, and the regulatory and planning frameworks, change over time.

This report was prepared by Dillon for the sole benefit of our Client. The material in it reflects Dillon's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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CLOSURE

We appreciate the opportunity to work with LSCRCA on this assignment. If you have any questions about this report, please contact the undersigned.

Yours sincerely,

DILLON CONSULTING LIMITED

Darin Burr, M.Sc., P.Geo.
Project Manager

DTB:amb
Encl.

Table 1: ANTEN MILLS - WELL HEAD TIME OF TRAVEL CAPTURE ZONE PEER REVIEW EVALUATION RESULTS

GENERAL

System Name:	**Anten Mills Well Supply**
Reviewed Report:	**South Simcoe Groundwater Study, WHPA-Township of Springwater, Appendix L**
Terms of Reference:	**Ontario Ministry of the Environment and Energy, 2001; Groundwater Studies, 2001/2002, Technical Terms of Reference, November 2001.**
Model Type:	**Regional FEFLOW (Based on Regional Kempenfelt Bay)**
Score:	**6.0**
Pass:	**Yes**
Critique Ref:	**Group 1 Peer Review Score Card Results_030210**

System Characteristics

Hydrogeological Complexity	Medium, confined below 6 to 8 m of aquitard; however, becomes unconfined to east. A shallower aquifer is present that is used for private wells
Spatial variability in Aquifer Vulnerability	Medium
Known water Quality Issues	None

EVALUATION RESULTS

Criterion		Awarded Score	General Comments	Comments / Recommendations	
				Critical Deficiencies	Long-term opportunities
Objective Criteria					
1. Were reasonable pumping rates used and documented?		7	Modelled at average permitted rate (259 m3/d), which is about 30% of 2002 Average demand rate (86 m3/d) and one-third of maximum permitted rate Modelled rate is deemed adequate.	None	Determine committed population requirements to ensure that it is within permitted rate. Confirm with municipality that modelled rates represent likely conditions. Should pumping regime change, then model should be updated.
2. Were rule-approved models and methods used?		Pass	3D Numerical flow model is an approved modelling approach	None	Perform continuous updating and verification/validation of the model data to ensure it is representative of local conditions
Subjective Criteria					
3a. Is geological setting complex?	10	7	Medium to medium low complexity. Overburden aquifer is confined in area of well field, but becomes unconfined to east within WHPA	None	
3b. Is Geological Model / Understanding Adequate for assessment method selected?	10	6	Yes - variety of data used in assessment regional information (geology mapping, WWIS). However, no additional site investigations performed, and few wells penetrate to the pumped aquifer, and the report states that there is limited understanding of the geological properties in the deep aquifer system. As a result, a lower score was given	None	Improve delineation of hydrogeology through additional borehole investigations, especially in areas within capture zone
4. Is Flow Model Complexity Appropriate?	10	7	3D regional flow model used accounting for general stratigraphy of area. It is noted that model is regional, so unknown if it adequately addressed local situation. More information would be needed to improve score.	None	Accuracy of model can be improved through additional information, such as water level data within alignment of capture zones, more information on model calibration within capture zones.
5. Are model input parameters (recharge, porosity, K) reasonable?	5	6	Generally yes - K values are based on pumping test, and have been assigned spatial variability in model. Recharge value (100 mm/year) reasonable and deemed conservative. Report does state that there is limited understanding of the hydrogeological properties in the pumped aquifer, and therefore a lower score is provided	None	Improve estimates of recharge rates, possibly using the results of source protection water budget data. Perform additional investigations of pumped aquifer to improve understanding of hydrogeological properties.

6. Was natural flow field adequately incorporated into model? (Numerical Model)	10	7	Model was calibrated to natural flow field at least on the regional level. Capture zones (Fig 2.4.2.) generally correlates with observed potentiometric surface (Fig 2.2.3). Explanation of the boundary conditions appears reasonable	None	Limited wells located within portions of the study area, therefore accuracy of flow model in these areas could be improved by water level information in this area
7. Was natural flow field adequately incorporated into model? (Analytical Model)	10	N/A			
8. Was the Model Calibrated?	5	5	Calibrated to MOE Water Well Record data. Report states that many of these wells were screened in shallow aquifers rather than the deeper municipal aquifer, and therefore, the score is reduced. It is also not clear if calibration statistics are local to well field or are for the regional scale. Calibration/sensitivity simulations were completed by varying porosity, K, and recharge. The model RMS was 5.5%, which meets requirements (<10%).	None	Calibration could be improved through additional water level data from within the capture zone
9. Was Uncertainty considered in the analysis?	5	1	Capture zones were determined based on a single (best) model setup, and uncertainty not considered in results.	None	Incorporate the results of the sensitivity analysis into capture zone development.
10. What is the Uncertainty?		High	Uncertainty is deemed high	None	

Table 2: DEL TREND - WELL HEAD TIME OF TRAVEL CAPTURE ZONE PEER REVIEW EVALUATION RESULTS

GENERAL

System Name:	**Midhurst Well Supply (Del Trend Subdivision)**
Reviewed Report:	**South Simcoe Groundwater Study, WHPA-Township of Springwater, Appendix L**
Terms of Reference:	**Ontario Ministry of the Environment and Energy, 2001; Groundwater Studies, 2001/2002, Technical Terms of Reference, November 2001.**
Model Type:	**Regional FEFLOW (Based on Regional Kempenfelt Bay)**
Score:	**4.8**
Pass:	**Yes**
Critique Ref:	**Group 1 Peer Review Score Card Results_030210**

System Characteristics

Hydrogeological Complexity	High - multiple aquifers, with shallow aquifers affected by surficial topography, and deeper aquifers affected by regional trends
Spatial variability in Aquifer Vulnerability	High - ranging from low to high across WHPAs
Known water Quality Issues	None

EVALUATION RESULTS

Criterion		Awarded Score	General Comments	Comments / Recommendations	
				Critical Deficiencies	Long-term opportunities
Objective Criteria					
1. Were reasonable pumping rates used and documented?		10	Modelled rate was average permitted rate for each wells	None	Confirm with municipality that modelled rates represent likely conditions. Should pumping regime change, then model should be updated.
2. Were rule-approved models and methods used?		Pass	3D Numerical flow model is an approved modelling approach	None	Perform continuous updating and verification/validation of the model data to ensure it is representative of local conditions
Subjective Criteria					
3a. Is geological setting complex?	10	6	High complexity involving multiple aquifers. Wells pump from aquifer A3. The deeper aquifer is associated with tunnel valley aquifers. A slightly higher score is given to this system than the other Midhurst systems as only one aquifer is pumped, and the aquifer is regionally confined	None	Most wells in area intercept the shallower A1 aquifer. Additional data from aquifer A3 would be beneficial
3b. Is Geological Model / Understanding Adequate for assessment method selected?	10	5	Yes - variety of data used in assessment of the regional information (geology mapping, WWIS). However, no additional site investigations performed, and few wells penetrate to the pumped aquifer, and the report states that there is limited understanding of the geological properties in the deep aquifer system. As a result, a lower score was given	None	Improve delineation of hydrogeology through additional borehole investigations, especially in areas within capture zone
4. Is Flow Model Complexity Appropriate?	10	5	3D regional flow model used accounting for general stratigraphy of area. It is noted that model is regional, so unknown if it adequately addressed local situation. Furthermore, stratigraphy is complicated, and it does not appear that pumped aquifer is fully characterized. More information would be needed to improve score.	None	Accuracy of model can be improved through additional information, such as water level data within alignment of capture zones, additional data on hydrogeological properties/extent of layered aquifers and aquitards, and more information on model calibration within capture zones.
5. Are model input parameters (recharge, porosity, K) reasonable?	5	5	Generally yes - K values are based on pumping test, and have been assigned spatial variability in model. Recharge value (125 to 250 mm/year) reasonable and deemed conservative. Report does state that there is limited understanding of the hydrogeological properties in the pumped aquifer, and therefore a lower score is	None	Improve estimates of recharge rates, possibly using the results of source protection water budget data. Perform additional investigations of pumped aquifer to improve understanding of hydrogeological properties.

			provided		
6. Was natural flow field adequately incorporated into model? (Numerical Model)	10	5	Model was calibrated to natural flow field at least on the regional level. Report states that little data is available on conditions in deeper aquifers, therefore calibration to actual water levels is likely uncertain. No figure is presented that shows observed water levels in aquifer; however, it appears that gradients in pumped aquifer maybe more affected by regional conditions than local conditions. Explanation of the boundary conditions appears reasonable	None	Limited wells located within portions of the study area, therefore accuracy of flow model in these areas could be improved by water level information in this area
7. Was natural flow field adequately incorporated into model? (Analytical Model)	10	N/A			
8. Was the Model Calibrated?	5	5	Calibrated to MOE Water Well Record data. Report states that many of these wells were screened in shallow aquifers rather than the deeper municipal aquifer, and therefore, the score is reduced. It is also not clear if calibration statistics are local to well field or are for the regional scale. Calibration/sensitivity simulations were completed by varying porosity, K, and recharge. The model RMS was 5.5%, which meets requirements (<10%).	None	Calibration could be improved through additional water level data from within the capture zone
9. Was Uncertainty considered in the analysis?	5	1	Capture zones were determined based on a single (best) model setup, and uncertainty not considered in results.	None	Incorporate the results of the sensitivity analysis into capture zone development.
		High	Uncertainty is deemed high	None	
10. What is the Uncertainty?		High	Uncertainty is deemed high	None	

Table 3: MIDHURST - WELL HEAD TIME OF TRAVEL CAPTURE ZONE PEER REVIEW EVALUATION RESULTS

GENERAL

System Name:	**Midhurst Well Supply (Wells 1, 2, 3, 4 and Carson Road)**
Reviewed Report:	**South Simcoe Groundwater Study, WHPA-Township of Springwater, Appendix L**
Terms of Reference:	**Ontario Ministry of the Environment and Energy, 2001; Groundwater Studies, 2001/2002, Technical Terms of Reference, November 2001.**
Model Type:	**Regional FEFLOW (Based on Regional Kempenfelt Bay)**
Score:	**4.6**
Pass:	**Yes**
Critique Ref:	**Group 1 Peer Review Score Card Results_030210**

System Characteristics

Hydrogeological Complexity	High - multiple aquifers, with shallow aquifers affected by surficial topography, and deeper aquifers affected by regional trends
Spatial variability in Aquifer Vulnerability	High - ranging from low to high across WHPAs
Known water Quality Issues	None

EVALUATION RESULTS

Criterion		Awarded Score	General Comments	Comments / Recommendations: Critical Deficiencies	Comments / Recommendations: Long-term opportunities
Objective Criteria					
1. Were reasonable pumping rates used and documented?		10	Modelled rate was average permitted rate for each wells	None	Confirm with municipality that modelled rates represent likely conditions. Should pumping regime change, then model should be updated.
2. Were rule-approved models and methods used?		Pass	3D Numerical flow model is an approved modelling approach	None	Perform continuous updating and verification/validation of the model data to ensure it is representative of local conditions
Subjective Criteria					
3a. Is geological setting complex?	10	5	High complexity involving multiple aquifers. Well 1 pumps from aquifer A1, while Wells 2, 3 and 4 pump from aquifer A3. The deeper aquifer is associated with tunnel valley aquifers. Carson Rd well pumps from A3. Aquifer A3 is confined, but aquifer A1 is unconfined.	None	Most wells in area intercept the shallower A1 aquifer. Additional data from aquifer A3 would be beneficial
3b. Is Geological Model / Understanding Adequate for assessment method selected?	10	5	Yes - variety of data used in assessment regional information (geology mapping, WWIS). However, no additional site investigations performed, and few wells penetrate to the pumped aquifer, and the report states that there is limited understanding of the geological properties in the deep aquifer system. As a result, a lower score was given	None	Improve delineation of hydrogeology through additional borehole investigations, especially in areas within capture zone
4. Is Flow Model Complexity Appropriate?	10	5	3D regional flow model used accounting for general stratigraphy of area. It is noted that model is regional, so unknown if it adequately addressed local situation. Furthermore, stratigraphy is complicated, and it does not appear that pumped aquifer is fully characterized. More information would be needed to improve score.	None	Accuracy of model can be improved through additional information, such as water level data within alignment of capture zones, additional data on hydrogeological properties/extent of layered aquifers and aquitards, and more information on model calibration within capture zones.
5. Are model input parameters (recharge, porosity, K) reasonable?	5	5	Generally yes - K values are based on pumping test, and have been assigned spatial variability in model. Recharge value (125 to 250 mm/year) reasonable and deemed conservative. Report does state that there is limited understanding of the hydrogeological properties in the pumped aquifer, and therefore a lower score is	None	Improve estimates of recharge rates, possibly using the results of source protection water budget data. Perform additional investigations of pumped aquifer to improve understanding of hydrogeological properties.

			provided		
6. Was natural flow field adequately incorporated into model? (Numerical Model)	10	5	Model was calibrated to natural flow field at least on the regional level. Report states that little data is available on conditions in deeper aquifers, therefore calibration to actual water levels is likely uncertain. No figure is presented that shows observed water levels in aquifer; however, it appears that gradients in pumped aquifer maybe more affected by regional conditions than local conditions. Explanation of the boundary conditions appears reasonable	None	Limited wells located within portions of the study area, therefore accuracy of flow model in these areas could be improved by water level information in this area
7. Was natural flow field adequately incorporated into model? (Analytical Model)	10	N/A			
8. Was the Model Calibrated?	5	5	Calibrated to MOE Water Well Record data. Report states that many of these wells were screened in shallow aquifers rather than the deeper municipal aquifer, and therefore, the score is reduced. It is also not clear if calibration statistics are local to well field or are for the regional scale. Calibration/sensitivity simulations were completed by varying porosity, K, and recharge. The model RMS was 5.5%, which meets requirements (<10%).	None	Calibration could be improved through additional water level data from within the capture zone
9. Was Uncertainty considered in the analysis?	5	1	Capture zones were determined based on a single (best) model setup, and uncertainty not considered in results.	None	Incorporate the results of the sensitivity analysis into capture zone development.
10. What is the Uncertainty?		High	Uncertainty is deemed high	None	

concern that regional model calibration insufficient for local system
uncertainty was assessed, but not incorporated into capture zones
report states that little information is available on pumped aquifer, most wells in area are in a shallower aquifer
Overall, very complex system, and not that much local data on pumped aquifer, therefore overall score is low.

Table 4: MINESING - WELL HEAD TIME OF TRAVEL CAPTURE ZONE PEER REVIEW EVALUATION RESULTS

GENERAL

System Name:	**Minesing Well Supply**
Reviewed Report:	**North Simcoe Groundwater Study, WHPA-Township of Springwater, Appendix J**
Terms of Reference:	**Ontario Ministry of the Environment and Energy, 2001; Groundwater Studies, 2001/2002, Technical Terms of Reference, November 2001.**
Model Type:	**Regional FEFLOW (Based on Regional Kempenfelt Bay)**
Score:	**5.5**
Pass:	**Yes**
Critique Ref:	**Sent to Client_Group 1 Peer Review Score Card Results_060110**

System Characteristics

Hydrogeological Complexity	Medium - Localized overburden aquifer with discontinuous confining layers. Confining layer may be absent locally.
Spatial variability in Aquifer Vulnerability	Medium
Known water Quality Issues	Some - Elevated nitrate detected in wells (Golder 2005), however below ODWS.

EVALUATION RESULTS

Criterion		Awarded Score	General Comments	Comments / Recommendations	
				Critical Deficiencies	Long-term opportunities
Objective Criteria					
1. Were reasonable pumping rates used and documented?		8	The Minesing water supply system serves approximately 219 units (as of 2002) and is supplied by three wells located in a single wellfield. The Minesing wells are operated under PTTW No. 93-P-3016. The WHPA zones were established using the following future pumping rates for each well: Well #1 = 109 m3/d; Well#2 = 109 m3/d; Well #3 = 137 m3/d. Future pumping rates were based on an average 8-hour per day operation at the maximum rate. The combined total modeled withdrawal from the system was 355 m3/day. The pumping rate is deemed acceptable as it is planned future rate (and is larger than the 2002 combined average use rate for all wells).	None	Determine committed population requirements to ensure that it is within permitted rate. Confirm with municipality that modelled rates represent likely conditions. Should pumping regime change, then model should be updated.
2. Were rule-approved models and methods used?		Pass	3D Numerical flow model is an approved modelling approach	None	Perform continuous updating and verification/validation of the model data to ensure it is representative of local conditions
Subjective Criteria					
3a. Is geological setting complex?	10	6	Medium complexity. Overburden aquifer appears to be localized, and appears to be bounded in areas by fine-grained deposits in the low-lying Minesing Swamp. Based on cross sections (Golder, 2005), the aquifer is typically overlain by confining materials except in the vicinity of the wellfield, where well records suggest that it is unconfined. The underlying, regional A3 aquifer may be connected to the aquifer utilized by the Minesing wells, particularly towards Snow Valley. A large portion of recharge is presumed to occur locally. Due to local variations in overburden, a more locally scaled model may be preferred.	None	

3b. Is Geological Model / Understanding Adequate for assessment method selected?	10	6	Yes - variety of regional data used in assessment (geology mapping, WWIS), however, report states that there is limited understanding of the geological properties in the deep aquifer system. Aquifer type is partially confined, with thickness of overlying confining layer in the area around the production wells presumed to be minimal. Variations in confining layer thickness in the vicinity of the production wells may increase aquifer susceptibility within shorter ToT zones. Also, nitrate has been detected at elevated concentrations (albeit, below the ODWS) in the past at the wellfield (Golder, 2005) indicating potential impacts from anthropogenic sources. Local variations in hydraulic conductivity should be adequately represented with layered conductivity approach, however a more locally scaled model is preferred. As a result, a lower score was given.	None	Improve delineation of hydrogeology through additional borehole investigations, especially in areas within capture zone
4. Is Flow Model Complexity Appropriate?	10	6	3D regional flow model used accounting for general stratigraphy of area. It is noted that model is regional, so unknown if it adequately addressed local situation. More information to validate the use of regional stratigraphy at the local scale would be needed to improve score.	None	Accuracy of model can be improved through additional information, such as water level data within alignment of capture zones, more information on model calibration within capture zones.
5. Are model input parameters (recharge, porosity, K) reasonable?	5	6	Generally yes - aquifer hydraulic property values are based on pumping test data, and have been assigned spatial variability in model. Recharge values (100 and 230 mm/yr) appear reasonable based on conditions within model domain. Aquifer hydraulic properties and recharge were the subject of model calibration/sensitivity analysis. However, given this, report does state that there is limited understanding of the hydrogeological properties in the pumped aquifer, in particular the potential interconnectivity between the Minesing aquifer and lower aquifer A3. Finally, a note at the bottom of table 6.3 states that vertical conductivity may be up to two orders of magnitude lower than corresponding horizontal conductivity. One order of magnitude difference is typical in modeling, and it may be beneficial to present all conductivity values including horizontal/vertical conductivity ratio.	None	Improve estimates of recharge rates, possibly using the results of source protection water budget data. Perform additional investigations of pumped aquifer to improve understanding of hydrogeological properties.
6. Was natural flow field adequately incorporated into model? (Numerical Model)	10	6	Yes - observed head values were used to calibrate the model, however it should be noted that large regional scale models often lead to acceptable calibration residuals without optimizing parameters. Capture zones (Fig 6.4.2.) generally correlates with observed potentiometric surface (Fig 6.2.3). It is noted that some surface water features (Nottawasaga River and its tributaries) were assigned as constant head boundaries. "Stream" or "river" boundary conditions may be more appropriate to represent these features. Boundary conditions generally appear acceptable.	None	Limited wells located within portions of the study area, therefore accuracy of flow model in these areas could be improved by water level information in this area
7. Was natural flow field adequately incorporated into model? (Analytical Model)	10	N/A			
8. Was the Model Calibrated?	5	5	Model was calibrated regionally (713 wells) to MOE Water Well Record data, however not specific to aquifer near the wellfield. It is also unclear if calibration statistics are local to well field or are for the regional scale. Calibration/sensitivity simulations were completed by varying porosity, K, and recharge. The model RMS was 5.5%, which meets requirements (<10%), however a complete set of calibration statistics would be preferred to assess model accuracy.	None	Calibration could be improved through additional water level data from within the capture zone. Also, calibration at the local scale would be more appropriate than that at a regional scale.
9. Was Uncertainty considered in the analysis?	5	1	Uncertainty analysis was performed, by multiplying and dividing aquifer hydraulic properties by a factor of 1.5, however it does not seem as though the results from the uncertainty analysis was incorporated into 2- or 10-year capture zones. Capture zones seem to be based on a single (best) model setup. Uncertainty envelope is presented for 25 year capture zone.	None	Incorporate the results of the sensitivity analysis into capture zone development for ALL zones (2-, 10-, 25-year ToT zones).
10. What is the Uncertainty?		High	Uncertainty is deemed high	None	

Table 5: PHELPSTON - WELL HEAD TIME OF TRAVEL CAPTURE ZONE PEER REVIEW EVALUATION RESULTS

GENERAL

System Name:	**Phelpston Water Supply**
Reviewed Report:	**Township of Springwater - Community of Phelpston Wellhead Protection Area, Golder, 2005.**
Terms of Reference:	**Ontario Ministry of the Environment and Energy, 2001; Groundwater Studies, 2001/2002, Technical Terms of Reference, November 2001.**
Model Type:	**Regional 3-D Modflow**
Score:	**5.5**
Pass:	**Yes**
Critique Ref:	**Sent to Client_Peer Review Score Card Results_052010_1**

System Characteristics

Hydrogeological Complexity	Medium, confined deep aquifer. Confining layer is spatially variable, but consistent
Spatial variability in Aquifer Vulnerability	Medium
Known water Quality Issues	None - No known water quality issues have been reported.

EVALUATION RESULTS

Criterion		Awarded Score	General Comments	Comments / Recommendations: Critical Deficiencies	Comments / Recommendations: Long-term opportunities
Objective Criteria					
1. Were reasonable pumping rates used and documented?		7	The community of Phelpston is serviced by two (2) wells (wells #1, and #2), completed into a confined overburden aquifer. Due to their proximity, wells #1 and #2 were modelled as one point sink. The relevant ToT zones (2- to 25-year) were established using forecasted pumping rates (299 m3/day for wells #1 and #2 combined). Future pumping rates were based on the expected usage of the wells, due to the expansion of the subdivision. The method for attaining the long term (i.e.future) pumping rates is not obvious. The PTTW maximum taking from the wells is 655 m3/day. The pumping rate, however, is deemed acceptable, however a lower score is assigned as a result of a lack of information.	None	Should pumping regime change, or unplanned expansion of subdivision is proposed, then model should be updated. Clear calculation of future demands may be beneficial, in case pumping regime changes and new projections are required.
2. Were rule-approved models and methods used?		Pass	3-D Numerical Solution is permissible	None	Perform continuous updating and verification/validation of the model data.
Subjective Criteria					
3a. Is geological setting complex?	10	6	Medium complexity. The Phelpston well field is constructed into a confined overburden aquifer. Based on cross section found in Golder 2005 (Section A-A' and B-B'), well field is constructed in aquifer A2, which is in an area where the thickness of the confining layer is locally variable, however is continuous. Based on review of previous reports, it is believed that the intermediate overburden aquifer (A2) in the vicinity of the well field is in direct hydraulic contact with the shallow overburden aquifer (A1) present in the area. Based on cross sections, it may be possible that significant confining material is not present in recharge areas, potentially increasing potential aquifer vulnerability.	None	Further aquifer and confining layer delineation recommended, especially upstream in major recharge areas.
3b. Is Geological Model / Understanding Adequate for assessment method selected?	10	5	Aquifer type is confined, with varying thickness of overlying confining layer in the area around the production wells, as well as upgradient from wells in recharge areas. Report states that only 1 layer is active in the model (the upper most layer), representing aquifer A2. As a result, it does not appear that the confining layer and shallow overburden aquifer (A1) were incorporated into the model domain. Given this, local variations in hydraulic conductivity will not be represented with layered conductivity approach derived from surficial isopachs. Model set-up may be adequate, however is	None	Improve geological model by additional borehole/well construction gathered on a local scale. Also, incorporation of possible interconnectivity of aquifers A1 and A2, as well as confining layer into flow model may be beneficial.

			simplistic given the nature of the hydrostratigraphy.		
4. Is Flow Model Complexity Appropriate?	10	6	Yes - 3D numerical flow model used (MODFLOW),at a local scale; moderate complexity of aquifer, however this complexity is not built into the model domain. Overall, the chosen model is deemed adequate.	None	Additional monitoring wells positioned upgradient of well field would be beneficial to validate model. Incorporation of confining layer into model may be appropriate by contouring layer isopachs and importing into MODFLOW.
5. Are model input parameters (recharge, porosity, K) reasonable?	5	6	K values are based on a reference found in report cited as "Wilson, 1995". It is unclear what this reference represents, and if this information is derived on a site specific basis or if this is a published value of hydraulic conductivity for similar materials. Further, hydraulic conductivity has not been assigned spatial variability in model. A 10:1 ratio between horizontal:vertical conductivity has been assigned, which is appropriate. Other hydraulic parameters appear to be assumed, presumably from a lack of available of data. Recharge value of 100 mm/yr has been assigned. The spatial coverage of MOE wells in the area is not presented. Lower score given as a result of lack of information, as well as omission of reference in reference section of report for "Wilson, 1995".	None	Additional field work would improve estimates. Also, explanation of method used for determining hydraulic conductivity may be warranted. Assigning spatially variable hydraulic conductivity, and incorporation of confining layer into the model may be appropriate.
6. Was natural flow field adequately incorporated into model? (Numerical Model)	10	5	Yes - natural flow field was consulted (and presumably based on MOE WWIS database), as there is a discussion relating to the flow fields in the A2 aquifer. However, as noted above, well coverage in the area is not shown, making it difficult to assess the incorporation of local water levels to the model. Also, it is unclear if/how surface water bodies were represented in MODFLOW model domain. This could affect direction and shape of capture zones. Constant head boundaries assigned in model domain based on equipotential lines. This may/may not be warranted, and specified head values at these locations may be more appropriate. Recharge level of 100 mm/yr assigned which seems reasonable. Lower score given as a result of lack of information.	None	Run model simulations calibrating to local data, and test validity of constant head boundaries. Sensitivity analysis could also include adjusting boundary conditions
7. Was natural flow field adequately incorporated into model? (Analytical Model)	10				
8. Was the Model Calibrated?	5	5	Model was calibrated locally, although the number of calibration points is not clearly identified. It is not clear what (if any) calibration parameters were used during the calibration process. The calibration statistics outlined in the report were: standard error of estimate = 0.2 m; RMS = 10.1%, for the model. Again, the amount of local wells from the MOE database is not known, as well as their proximity to the Phelpston wellfield. There is no discussion of parameter adjustment and/or sensitivity, therefore accuracy of the calibration can be questioned. Lower score given as a result of a lack of local information.	None	Local calibration should be substantiated with figure showing locations of MOE calibration well locations. A complete layout of calibration statistics could also be presented. Discussion relating to calibration process could also be beneficial to reviewers. Consideration could be given to alternate calibration techniques.
9. Was Uncertainty considered in the analysis?	5	5	Limited uncertainty analysis, performed by using "shape factors" which increase the length and width of capture zones by 20%, which may be arbitrary. A more rigorous uncertainty analysis may be beneficial, especially given the simplistic nature of the flow model, and the lack of local information. Also, figures only show 2-year, and 25-year capture zones, with all other zones not presented. Low score given as a result of lack of information.	None	Perform uncertainty analysis at the local scale by varying input variables, and consider uncertainty in flow field, and applying these results to established capture zones. Apply results of sensitivity analysis to create "composite" capture zone areas.
10. What is the Uncertainty?		High	Designation not provided in report, but Dillon recommends that it be assessed as high	None	

Table 6: SNOW VALLEY - WELL HEAD TIME OF TRAVEL CAPTURE ZONE PEER REVIEW EVALUATION RESULTS

GENERAL

System Name:	**Snow Valley**
Reviewed Report:	**North Simcoe Groundwater Study, WHPA-Town of Springwater, Appendix J , Golder 2005; Snow Valley Wellhead Protection Area Modelling, Golder 2007.**
Terms of Reference:	**Ontario Ministry of the Environment and Energy, 2001; Groundwater Studies, 2001/2002, Technical Terms of Reference, November 2001.**
Model Type:	**Regional 3-D FEFLOW**
Score:	**6.4**
Pass:	**Yes**
Critique Ref:	**Sent to Client_Peer Review Score Card Results_052010_1**

System Characteristics

Hydrogeological Complexity	Medium, confined deep aquifer. Confining layer is spatially variable, but consistent
Spatial variability in Aquifer Vulnerability	Medium
Known water Quality Issues	None - No known water quality issues have been reported.

EVALUATION RESULTS

Criterion		Awarded Score	General Comments	Comments / Recommendations: Critical Deficiencies	Comments / Recommendations: Long-term opportunities
Objective Criteria					
1. Were reasonable pumping rates used and documented?		7	The community of Snow Valley is serviced by four (4) wells (wells #1, #2, #3, and #4), completed into a confined overburden aquifer. Due to their proximity, wells #1 and #2 were modelled as one sink, and wells #3 and #4 were modelled as one other separate sink. The remaining ToT zones (2- to 25-year) were established using future pumping rate (305 m3/day for wells #1 and #2 combined and 1,108 m3/day for wells #3 and #4 combined). Future pumping rates are based on long term average yields, however the method for attaining the long term (i.e. future) pumping rates is not obvious. The pumping rate, however, is deemed acceptable as it is the lesser of planned or permitted rates.	None	Should pumping regime change, or unplanned expansion of subdivision is proposed, then model should be updated. Clear calculation of future demands may be beneficial, in case pumping regime changes and new projections are required.
2. Were rule-approved models and methods used?		Pass	3-D Analytical Solution is permissible	None	Perform continuous updating and verification/validation of the model data.
Subjective Criteria					
3a. Is geological setting complex?	10	7	Medium complexity. The Snow Valley wellfield is constructed into a confined overburden aquifer. Based on cross section found in Golder 2007 (Section A-A' and B-B'), wellfield is constructed in aquifer A3, which is in an area where the thickness of the confining layer is locally variable, however is continuous and present upgradient (i.e. in recharge areas). Also, it is believed that the intermediate overburden aquifer (A2) in the vicinity of the wellfield is in direct hydraulic contact with the shallow overburden aquifer (A1) present in the area, however as mentioned above there seems to be significant confining material between aquifers A2 and A3.	None	Further aquifer and confining layer delineation recommended.
3b. Is Geological Model / Understanding Adequate for assessment method selected?	10	6	Aquifer type is confined, with varying thickness of overlying confining layer in the area around the production wells, as well as upgradient from wells in recharge areas. Although not explicitly stated, it is assumed that results from the 2007 modelling exercise are based on the same isopachs as presented in the 2004 modelling results (Golder, 2004). Given this, local variations in hydraulic conductivity should be adequately represented with layered conductivity approach, however a more locally scaled model is preferred. Also, it is noted that the locations of wells found in the MOE WWIS used for calibration are not shown in the 2007 modelling report. Due to this, assessing if an adequate amount of local information is incorporated into the regional model is difficult. Regardless, a locally scaled model with local calibration points would be preferable.	None	Improve geological model by additional borehole/well construction gathered on a local scale.

4. Is Flow Model Complexity Appropriate?	10	7	Yes - 3D numerical flow model used (FEFLOW), however at a more regional scale; moderate complexity of aquifer, model is deemed adequate.	None	Additional monitoring wells positioned upgradient of well field would be beneficial to validate model. Verification of regional model results with results generated on a local scale may also be beneficial, or additional modeling at the local scale could be investigated.
5. Are model input parameters (recharge, porosity, K) reasonable?	5	6	Generally yes - K values are based on pumping test data, and have been assigned spatial variability in model. However it is noted that conductivity is reported as transmissivity, instead of hydraulic conductivity. Also, it is noted in the 2004 modelling (Golder) that vertical hydraulic conductivity may be up to two orders of magnitude lower than the corresponding horizontal hydraulic conductivity. Usually, a 10:1 ratio between horizontal:vertical conductivity is assigned. Other hydraulic parameters appear reasonable relative to availability of data. Recharge values (variable between 100 to 225 mm/yr) may be high, however was a parameter used in a sensitivity analysis. As noted above, there is no figure identifying locations of MOE WWIS well coverage in the area.	None	Additional field work would improve estimates.
6. Was natural flow field adequately incorporated into model? (Numerical Model)	10	6	Yes - natural flow field was consulted (and presumably based on MOE WWIS database), as there is a discussion relating to the flow fields in the A3 aquifer. However, as noted above, well coverage in the area is not shown, making it difficult to assess the incorporation of local water levels to the model. Also, it is unclear how surface water bodies were represented in the FEFLOW model domain. This could affect direction and shape of capture zones. Overall, boundary conditions seem acceptable.	None	Run model simulations calibrating to local data, and test validity of drain assumption. Sensitivity analysis could also include adjusting boundary conditions
7. Was natural flow field adequately incorporated into model? (Analytical Model)	10				
8. Was the Model Calibrated?	5	6	Model was calibrated regionally (713 wells), and not specific to the aquifer near the well field. It should be noted that large regional scale models often lead to acceptable calibration residuals without optimizing parameters. Calibration parameters noted include boundary conditions, hydraulic conductivity, and recharge. Conductivity, porosity, and recharge were the subject of model sensitivity analysis. The only calibration statistic outlined in the 2004 report was that RMS was 5.5%, for the regionally scaled model. Again, the amount of local wells from the MOE database is not known, and therefore local accuracy of the regional calibration may be questioned. The 2007 modelling report, states that changes made to the model altered the local calibration statistics around Snow Valley, with RMS improving slightly from 12.65% to 12.36%. Information relating to "local" calibration in the 2004 modeling report is lacking. Given that the RMS is above the "acceptable" threshold of 10%, a more locally scaled model is preferred. Lower score given as a result of a lack of local information.	None	Model should be calibrated to the local hydrogeological system rather than the regional system. Additional calibration methods could be utilized to check solution uniqueness. Consideration could be given to alternate calibration techniques.
9. Was Uncertainty considered in the analysis?	5	6	A more rigorous uncertainty analysis was performed, instead of using "shape factors" which increase the length and width of capture zones by 20% as in previous models. Sensitivity of capture zones to changes in porosity, hydraulic conductivity, and recharge were evaluated. It is unclear if capture zones produced during model sensitivity runs were used to create "composite" capture zones (except in the case of the 25-year capture zone with uncertainty as shown in Figure 7 (Golder 2007)). Low score given as a result of lack of information relating to applying uncertainty analysis to lower ToT capture zones (WHPA-B and WHPA-C zones).	None	Perform uncertainty analysis at the local scale by varying input variables, and consider uncertainty in flow field, and applying these results to established capture zones.
10. What is the Uncertainty?		High	Designation not provided in report, but Dillon recommends that it be assessed as high	None	

Table 7: VESPRA DOWNS - WELL HEAD TIME OF TRAVEL CAPTURE ZONE PEER REVIEW EVALUATION RESULTS

GENERAL

System Name:	**Vespra Downs**
Reviewed Report:	**North Simcoe Groundwater Study, WHPA-Town of Springwater, Appendix J , Golder 2005; Technical Memorandum-Springwater Municipal Supply Wells Capture Zone and Equipotential Surface Review, April, 2010.**
Terms of Reference:	**Ontario Ministry of the Environment and Energy, 2001; Groundwater Studies, 2001/2002, Technical Terms of Reference, November 2001.**
Model Type:	**Regional 3-D FEFLOW**
Score:	**6.6**
Pass:	**Yes**
Critique Ref:	**Sent to Client_Peer Review Score Card Results_052010_1**

System Characteristics

Hydrogeological Complexity	Medium, confined deep aquifer. Confining layer is spatially variable, but consistent
Spatial variability in Aquifer Vulnerability	Medium
Known water Quality Issues	Some - Turbidity has exceeded ODWS AO and MAC in the past

EVALUATION RESULTS

Criterion	Awarded Score	General Comments	Comments / Recommendations: Critical Deficiencies	Comments / Recommendations: Long-term opportunities
Objective Criteria				
1. Were reasonable pumping rates used and documented?	10	Vespra Downs subdivision is serviced by two (2) wells (wells #1 and #2), completed into a deeper confined overburden aquifer (identified as aquifer A3 in Golder reports). Well #1 is the primary well servicing the subdivision, while well #2 is a standby well. Due to their proximity and associated pumping schedules, wells #1 and #2 were modelled as one point sink into the regional Barrie FEFLOW model. ToT capture zones (2- to 25-year) were established using estimated future pumping rates (168 m3/day for wells #1 and #2 combined). Future pumping rates are based on average permitted rates, and are forecasted rates for the system at least 25 years into the future (Golder, 2010 Technical Memorandum). The method for determining the long term (i.e.future) pumping rates is not obvious. The pumping rate, however, is deemed acceptable as it is the lesser of planned or permitted rates.	None	Should pumping regime change, or unplanned expansion of subdivision is proposed, then model should be updated. Clear calculation of future demands may be beneficial, in case pumping regime changes and new projections are required.
2. Were rule-approved models and methods used?	Pass	3-D Analytical Solution is permissible	None	Perform continuous updating and verification/validation of the model data.
Subjective Criteria				
3a. Is geological setting complex?	7	Medium complexity. The Vespra Downs subdivision well field is constructed into a confined overburden aquifer. Based on cross section found in Golder 2005 (Section L8-L8' and L9-L9'), well field is constructed in aquifer A3, which is in an area where the thickness of the confining layer is locally variable, however is continuous and present upgradient (i.e. in recharge areas). Also, it is believed that the intermediate overburden aquifer (A2) in the vicinity of the well field is in direct hydraulic contact with the shallow overburden aquifer (A1) present in the area, however as mentioned above there seems to be significant confining material between aquifers A2 and A3. Recharge is presumed to be from the Algonquin Highlands, as well as from the Vespra Highlands as identified in Golder (2010). Geological complexity should be adequately represented in the Barrie FEFLOW regional model	None	Further aquifer and confining layer delineation recommended.

3b. Is Geological Model / Understanding Adequate for assessment method selected?	7	Aquifer type is confined, with varying thickness of overlying confining layer in the area around the production wells, as well as upgradient from wells in recharge areas. The Vespra Downs wellfield was added to the subregional Kempenfelt Bay FEFLOW model. The hydrogeology of this model is based on isopachs as presented in the 2005 modelling results (Golder, 2005). Given this, local variations in hydraulic conductivity should be adequately represented with layered conductivity approach, however a more locally scaled model is preferred. Also, it is noted that the locations of wells found in the MOE WWIS used for calibration are not shown in the 2005 modelling report. Due to this, assessing if an adequate amount of local information is incorporated into the regional model is difficult. Regardless, a locally scaled model with local calibration points would be preferable, especially given that system was added to an existing model. It is noted, however, that local geology was checked against the modelled stratigraphy when wells were imported, and deemed adequate (Golder, 2010).	None	Improve geological model by additional borehole/well construction gathered on a local scale.
4. Is Flow Model Complexity Appropriate?	7	Yes - 3D numerical flow model used (FEFLOW), however at a more regional scale; moderate complexity of aquifer, model is deemed adequate.	None	Additional monitoring wells positioned upgradient of well field would be beneficial to validate model. Verification of regional model results with results generated on a local scale may also be beneficial, or additional modeling at the local scale could be investigated.
5. Are model input parameters (recharge, porosity, K) reasonable?	7	Generally yes - K values are based on pumping test data, and have been assigned spatial variability in model. Hydraulic data derived from pumping test at Vespra Downs wells was checked against existing model hydraulic conductivity and deemed adequate without making any significant changes to hydraulic conductivity values (Golder, 2010). However it is noted that pumping test data is reported as transmissivity (T=K*b), instead of hydraulic conductivity. Other hydraulic parameters from the 2004 modelling report appear reasonable relative to availability of data. Also, it is noted in the 2004 modelling (Golder) that vertical hydraulic conductivity may be up to two orders of magnitude lower than the corresponding horizontal hydraulic conductivity. Usually, a 10:1 ratio between horizontal:vertical conductivity is assigned. Recharge values (variable between 100 to 225 mm/yr) may be high, however was a parameter used in a sensitivity analysis..	None	Additional field work would improve estimates.
6. Was natural flow field adequately incorporated into model? (Numerical Model)	6	Yes - natural flow field was consulted (and presumably based on MOE WWIS database), as there is a discussion relating to the flow fields in the A3 aquifer. However, as noted above, well coverage in the area is not shown, making it difficult to assess the incorporation of local water levels to the model. Also, it is unclear how surface water bodies were represented in the FEFLOW model domain. This could affect direction and shape of capture zones. Overall, boundary conditions seem acceptable.	Yes	Run model simulations calibrating to local data, and test validity of drain assumption. Sensitivity analysis could also include adjusting boundary conditions
7. Was natural flow field adequately incorporated into model? (Analytical Model)				

8. Was the Model Calibrated?	6	Model was calibrated regionally (713 wells), and not specific to the aquifer near the well field. It should be noted that large regional scale models often lead to acceptable calibration residuals without optimizing parameters. Calibration parameters noted include boundary conditions, hydraulic conductivity, and recharge. Conductivity, porosity, and recharge were the subject of model sensitivity analysis. The only calibration statistic outlined in the 2004 report was that RMS was 5.5% (<10% is deemed adequate), for the regionally scaled model. Again, the amount of local wells from the MOE database is not known, and therefore local accuracy of the regional calibration may be questioned. Details of the technical memo (Golder, 2010) do not include any discussion on the effect of model updates on model calibration. Moderate score given as a result of a lack of local information. It is noted that capture zones reach steady state prior to a 10 year time of travel. Verifying these results with increased care with respect to calibration/uncertainty analysis may be beneficial.	None	Model should be calibrated to the local hydrogeological system rather than the regional system. A figure presenting locations of MOE wells used as calibration points may be beneficial. A complete description of calibration statistics could be presented to aid potential reviewers. Alternate calibration could be used to check solution uniqueness.
9. Was Uncertainty considered in the analysis?	6	A more rigorous uncertainty analysis was performed, instead of using "shape factors" which increase the length and width of capture zones by 20% as in previous models. Sensitivity of capture zones to changes in porosity, hydraulic conductivity, and recharge were evaluated by increasing/decreasing values by a factor of 1.5 and observing effects on capture zones. It is unclear if capture zones produced during model sensitivity runs were used to create "composite" capture zones. Also, it is noted that updated capture zones have very different shape and direction than those produced in 2004. This is assumed to be a result of more accurate hydraulic conductivity distribution and boundary conditions in numerical model (FEFLOW) versus analytical model (WHPA). Given the updated capture zone shape, a re-evaluation of land uses within new capture zones could be undertaken. Moderate score given as a result of lack of information relating to applying uncertainty analysis to various ToT capture zones.	None	Perform uncertainty analysis at the local scale by varying input variables, and consider uncertainty in flow field, and applying these results to established capture zones to create "composite" capture zones.
10. What is the Uncertainty?	High	Designation not provided in report, but Dillon recommends that it be assessed as high	None	