

STAFF REPORT

File No. SPC Report - #06/11

Date: February 14, 2011
To: Source Protection Committee
From: Jennifer Stephens, Project Manager
Prepared by: Shan Mugalingam, Water Resources Engineer
RE: SGRA/HVA Edge Matching

Significant Groundwater Recharge Areas (SGRAs) and Highly Vulnerable Aquifers (HVAs) have been identified as two of the four vulnerable areas under the *Clean Water Act* (2006). Therefore, each Source Protection Region (SPR) or Area (SPA) is required to delineate these vulnerable areas for inclusion in the Assessment Reports (AR) prepared. A number of methodologies and approaches are acceptable to use to identify these vulnerable areas. Each SPR/SPA has the flexibility to choose one methodology over another.

The Trent Conservation Coalition Source Protection Region (TCC SPR) is bordered to the east by the Quinte Source Protection Area. On its western boundary, the TCC SPR lies adjacent to the South Georgian Bay-Lake Simcoe (SGBLS) Source Protection Region (Lake Simcoe & Couchiching/Black River Source Protection Area) and the Credit Valley-Toronto and Region-Central Lake Ontario (CTC) Source Protection Region (Central Lake Ontario Source Protection Area).

Durham Region (which falls within three SPRs) and South Georgian Bay-Lake Simcoe Source Protection Region retained GENIVAR to undertake a review of the HVA and SGRA methodologies employed and determine whether there is consistency on the western boundary of the TCC.

In particular, this would be three boundaries:

- Kawartha – Haliburton SPA within TCC SPR and Lake Simcoe and Couchiching/Black River SPA within SGBLS SPR
- Kawartha-Haliburton SPA within TCC SPR and Central Lake Ontario SPA within CTC SPR, and
- Ganaraska Region SPA within TCC SPR and Central Lake Ontario SPA within CTC SPR

TCC technical staff completed the review of edge matching methodologies on the eastern boundary of TCC. In particular, this would be two boundaries:

- Lower Trent SPA within TCC SPR and Quinte SPA
- Crowe Valley SPA within TCC SPR and Quinte SPA

Contact between Kawartha – Haliburton SPA within TCC SPR and Lake Simcoe and Couchiching/ Black River SPA within SGBLS SPR

The summary below is based on content from three resources:

- Technical Memorandum A – Durham Region Groundwater Vulnerability and Highly Vulnerable Aquifer Edge Matching Review dated Dec 14, 2010
- Technical Memorandum E – Durham Region Significant Groundwater Recharge Area Edge Matching Review dated Jan 14, 2011; and
- Technical Memorandum A – SGBLS/TCC Edge Matching Review dated Jan 14, 2011

Five steps were employed by GENIVAR to complete the edge matching assessment:

Step 1: Obtain Digital Component Maps.

Step 2: Review Methodologies.

Step 3: Prepare Digital Compilation Map along contact.

Step 4: Evaluate Compilation Map; Identify Inconsistencies and Data Gaps.

Step 5: Identify Opportunities for Addressing Inconsistencies and Data Gaps.

HVA Methodology

In the *southern* portion of the SGBLS SPR, groundwater vulnerability was determined using an Aquifer Vulnerability Index (AVI) approach based on the interpreted regional hydrostratigraphic surfaces. The SGBLS applied a conservative K-Factor value to determine the AVI for each hydrostratigraphic unit. Aquifers were assigned a K-Factor value of 1; aquitards were assigned a K-Factor value of 4. A minimum aquifer thickness of 1.5 m was required and the water table was required to be present above the bottom of the “aquifer layer” in order for the layer to be considered as an aquifer.

In the *northern* portion of the SGBLS SPR, groundwater vulnerability was determined using an adaptation of the Aquifer Vulnerability Index (AVI) approach that reflects the vulnerability based on overburden thickness and mapped surficial geology. This method was chosen due to reduced data availability. Areas where overburden thickness was estimated to be less than 6 m were assigned high vulnerability. The depth of 6 m was selected as this is the minimum thickness of low permeability material that could generate high vulnerability. Areas where the overburden thickness was estimated to be more than 6 m and the surficial geology was shown to be primarily granular material were also assigned high vulnerability.

In the TCC SPR, groundwater vulnerability was determined using an Intrinsic Susceptibility Index (ISI) approach (except for Oak Ridges Moraine areas). This approach calculates ISI scores for individual wells and then uses a contouring package to create zones of high, medium and low vulnerability. The AVI approach was used to delineate groundwater vulnerability within the Oak Ridges Moraine area to be compatible with the approach used in the Oak Ridges Moraine Conservation Plan (ORMCP).

Each of these approaches was permissible under the Technical Rules.

SGRA Methodology

In the SGBLS SPR, SGRAs were determined using one of the methods required under Rules 44(1), 45, and 46. Recharge data, from available numerical models was used to determine average recharge rates for the sub-watersheds and to calculate a threshold value. The threshold recharge values varied between the different sub-watersheds. Considerable variability existed not only within sub-watersheds, but also within SPAs. In the SGBLS SPR, SGRAs were considered on the

landscape to reflect the potential that SGRA were connected to wells and surface water intakes used for private water supply.

In the TCC SPR, SGRA were determined using one of the acceptable methods as per Rules 44(2), 45, and 46. Recharge was estimated from surficial geology mapping and verified using the Conservation Authorities Moraine Coalition York-Peel-Durham-Toronto (CAMC-YPDT) regional groundwater flow model. The threshold recharge was based on annual average water budget surplus obtained by discretizing the SPR into three zones (Northern, Central, and Southern). The SGRA was considered on the landscape to reflect the potential that the SGRA was connected to wells and surface water intakes used for private water supply. The method applied was considered to be reasonable based on the large geographic area and the available data.

Conclusion

Generally, GENIVAR's review of the compatibility of HVA and SGRA features along the Lake Simcoe & Couchiching/Black River SPA/Kawartha-Haliburton SPA contact is very positive despite the different methodologies adopted by the two regions. GENIVAR states that "the mapped vulnerability and SGRA along the contact is reasonably consistent and continuous across the contact". In addition to several minor discrepancies, only twelve (12) significant zones/locations along the contact were identified, where the HVA feature was seen to change abruptly across the contact. The distribution of SGRA features across the contact was identified to be quite similar and only a single significant zone along the contact was identified, where the SGRA is seen to change abruptly across contact.

GENIVAR concludes by saying "It may be more reasonable to address the consistency issue through requirements for on-site work in conjunction with planning applications than to attempt to create a more consistent mapping that will retain a relatively high degree of uncertainty on a local scale".

Contact between Kawartha – Haliburton SPA within TCC SPR and Central Lake Ontario SPA within CTC SPR

The summary below is based on content from two resources:

- Technical Memorandum A – Durham Region Groundwater Vulnerability and Highly Vulnerable Aquifer Edge Matching Review dated Dec 14, 2010
- Technical Memorandum E – Durham Region Significant Groundwater Recharge Area Edge Matching Review dated Jan 14, 2011; and

Five steps were employed by GENIVAR to complete the edge matching assessment:

Step 1: Obtain Digital Component Maps.

Step 2: Review Methodologies.

Step 3: Prepare Digital Compilation Map along contact.

Step 4: Evaluate Compilation Map; Identify Inconsistencies and Data Gaps.

Step 5: Identify Opportunities for Addressing Inconsistencies and Data Gaps.

HVA Methodology

The groundwater vulnerability in the SGBLS and CTC SPRs was determined through a similar approach by applying an aquifer vulnerability index (AVI) method using interpreted hydrostratigraphic surfaces. The one difference between the method used in the SGBLS and CTC SPRs is that the method used in the SGBLS SPR assumed that water must be present in the "aquifer" layer in which the AVI is calculated. This step was not applied in the CTC SPR.

In the TCC SPR, groundwater vulnerability was determined using an Intrinsic Susceptibility Index (ISI) approach (except for Oak Ridges Moraine areas). This approach calculates ISI scores for individual wells and then uses a contouring package to create zones of high, medium and low vulnerability. The AVI approach was used to delineate groundwater vulnerability within the Oak Ridges Moraine area to be compatible with the approach used in the Oak Ridges Moraine Conservation Plan (ORMCP).

Each of these approaches was permissible under the Technical Rules.

SGRA Methodology

In the CTC SPR, SGRA were determined using one of the methods outlined in Rules 44(1), 45, and 46. Recharge data from available numerical models was used to determine average recharge rates for the watersheds and then calculate a threshold value. The threshold recharge values varied between the different sub-watersheds. Considerable variability existed not only within sub-watersheds, but also within SPAs. In the CTC SPR, identified SGRA were excluded in urban areas where the water supply is provided from municipal supplies obtained from Lake Ontario. In the CTC SPR, SGRA were considered on the landscape to reflect the potential that the SGRA was connected to wells and surface water intakes used for private water supply.

In the TCC SPR, SGRA were determined using one of the acceptable methods as per Rules 44(2), 45, and 46. Recharge was estimated from surficial geology mapping and verified using the Conservation Authorities Moraine Coalition York-Peel-Durham-Toronto (CAMC-YPDT) regional groundwater flow model. The threshold recharge was based on annual average water budget surplus obtained by discretizing the SPR into three zones (Northern, Central, and Southern). The SGRA was considered on the landscape to reflect the potential that the SGRA was connected to wells and surface water intakes used for private water supply. The method applied was considered to be reasonable based on the large geographic area and the available data.

Conclusion

Groundwater vulnerability appears to change abruptly for a distance of approximately roughly 10 km along the northern boundary of the Town of Oshawa. Additionally, there are three (3) zones along the contact, the vulnerability to the north appears to be moderate to low (TCC SPR) and the vulnerability to the south appear to be high (CTC SPR). The distribution of SGRA is identified consistently along the majority of this contact. Two (2) significant zones are identified where the SGRA is seen to change abruptly at the contact.

GENIVAR concludes by saying “It may be more reasonable to address the consistency issue through requirements for on-site work in conjunction with planning applications than to attempt to create a more consistent mapping that will retain a relatively high degree of uncertainty on a local scale”.

Contact between Ganaraska Region SPA within TCC SPR and Central Lake Ontario SPA within CTC SPR

The summary below is based on content from two resources:

- Technical Memorandum A – Durham Region Groundwater Vulnerability and Highly Vulnerable Aquifer Edge Matching Review dated Dec 14, 2010
- Technical Memorandum E – Durham Region Significant Groundwater Recharge Area Edge Matching Review dated Jan 14, 2011; and

Five steps were employed by GENIVAR to complete the edge matching assessment:

Step 1: Obtain Digital Component Maps.

Step 2: Review Methodologies.

Step 3: Prepare Digital Compilation Map along contact.

Step 4: Evaluate Compilation Map; Identify Inconsistencies and Data Gaps.

Step 5: Identify Opportunities for Addressing Inconsistencies and Data Gaps.

HVA & SGRA Methodologies

The HVA and SGRA methodologies adopted are the same as described under the section: “Contact between Kawartha-Haliburton SPA within TCC SPR and Central Lake Ontario SPA within CTC SPR”.

Conclusion

The groundwater vulnerability is variable and reasonably consistent along and across this contact. Five (5) significant local zones exist where the vulnerability is seen to change abruptly at the contact. The distribution of SGRA appears to correspond fairly well along and across the contact. Three (3) significant local zones where the SGRA is seen to change abruptly at the contact are identified.

GENIVAR concludes by saying “It may be more reasonable to address the consistency issue through requirements for on-site work in conjunction with planning applications than to attempt to create a more consistent mapping that will retain a relatively high degree of uncertainty on a local scale”.

Contact between Lower Trent SPA within TCC SPR and Quinte SPA

The following description is based on TCC/Quinte Edge Matching Review Memo, prepared by TCC Technical Staff dated Oct 25, 2010.

HVA Methodology

Quinte Source Protection Area used TR 37(1) for groundwater vulnerability assessment with the following assumptions:

1. All bedrock aquifers with less than 1.5m of overburden, or with overburden that are highly permeable, are unconfined aquifers, and
2. Shallow bedrock aquifers and areas with less than 1.5m overburden are mapped as highly vulnerable aquifers

MOE water well records form the foundation of this analysis. A few well points determined as having moderate vulnerability (i.e. where the wells intercepted isolated deposits of clay, silt, or till), were not considered to be continuous enough to warrant delineating an area of moderate vulnerability.

TCC Source Protection Region used a combination of TR 37(1) and TR 37(2) for groundwater vulnerability assessment for the Palaeozoic region and TR 37(1) for the Precambrian region. The results from the combination methodology was calibrated to “ground truthed” areas within the Palaeozoic region (i.e. results generated from TR 37(2) was found to be appropriate within the Oak Ridges Moraine Planning Area and the results generated from TR 37(1) was found to be appropriate within the rest of the Palaeozoic Region). The following assumption was used in the Precambrian region (with the concurrence of the MOE Director):

Areas of thin drift or exposed bedrock (i.e. drift thickness less than or equal to 1.5 m) with sparse or no well coverage were assigned to be highly vulnerable

The vulnerability analysis was based on several databases of well records (consolidated in the Conservation Authorities Moraine Coalition (CAMC) database) as well as Bedrock Topography and Drift Thickness mapping products produced by the Ontario Geological Survey (OGS). The following additional steps were incorporated to arrive at the final groundwater vulnerability mapping product:

1. Discrete areas less than 0.01 km² were eliminated. The areas filtered out were assigned to the most frequent vulnerability value among the surrounding area, and
2. Groundwater vulnerabilities were increased (where appropriate) to account for the presence of transport pathways (i.e. wells that are more than 10 years old, pits, and quarries)

The groundwater vulnerability polygons that are assigned as “highly vulnerable” with a corresponding vulnerability score of 6 were delineated as HVA.

SGRA Methodology

Quinte Source Protection Area used TR 44(2) to delineate the SGRA subject to the following screening steps:

1. Areas less than 1 km² are not considered to be large enough to be significant,
2. Water table elevation contours were used to exclude areas of groundwater discharge, and
3. Surficial Geology mapping was used to exclude areas of deposits of sand and gravel

In order to identify surficial areas contributing to a recharge that is greater than the threshold (as provided in TR 44(2)), a GIS based water budget model was used that considers three main physical features of the region: topography, land cover, and soil permeability for recharge assessment. Furthermore, all identified recharge areas were overlaid with cold water streams and domestic wells to determine the “significant” groundwater recharge areas (i.e. the recharge areas that are hydrologically connected to either a drinking water source or an area of ecological significance).

TCC used TR 44(2) to delineate the SGRA subject to the following screening steps:

1. Areas less than 0.01 km² were removed based on the resolutions of the input data sources used in the analysis, and
2. Water table elevation contours (i.e. areas where water table was less than 2m below ground surface) were used to exclude areas of groundwater discharge

In order to identify surficial areas contributing to a recharge that is greater than the threshold (as provided in TR 44(2)), a 3-dimensional regional groundwater flow model developed by the Conservation Authorities Moraine Coalition (CAMC) was used within the Palaeozoic region. The model estimated recharge rates were correlated to the surficial geology units and this mapping was used to identify the required recharge areas within the Precambrian region. Furthermore, all identified recharge areas were overlaid with domestic wells to determine the “significant” groundwater recharge areas (i.e. the recharge areas that are hydrologically connected to a drinking water source).

Conclusion

The HVA mapping resulting from the groundwater vulnerability assessment shows significant differences across the regional boundary (i.e. the boundary between Lower Trent SPA within TCC SPR and Quinte SPA), particularly in the vicinity of the Oak Lake area. These significant differences can be attributed to:

1. Differences in assessment methodologies adopted by, and assumptions made by the two source protection region/areas, and
2. Differences in the basic physiography and geology present within the two SPA/SPRs.

There is a significant density of SGRA polygons in the vicinity of Oak Lake in both regions' mapping (i.e. Lower Trent SPA within TCC SPR and Quinte SPA). Though these SGRA polygons do not match perfectly across the regional boundary in the strictest sense, over-all, there is a general consistency across the regional boundary (i.e. boundary between the Lower Trent SPA/TCC SPR and Quinte SPA).

Contact between Crowe Valley SPA within TCC SPR and Quinte SPA

The following description is based on TCC/Quinte Edge Matching Review Memo, prepared by TCC Technical Staff dated Oct 25, 2010.

HVA & SGRA Methodologies

The HVA and SGRA methodologies adopted are the same as described under "contact between Lower Trent SPA within TCC SPR and Quinte SPA".

Conclusion

The HVA mapping across the contact boundary between Crowe Valley SPA within the TCC SPR and Quinte SPA is consistent with few exceptions (i.e. very small areas (less than 2 km²)).

The SGRA mapping across the contact boundary between Crowe Valley SPA within TCC SPR and Quinte SPA corresponds with each other (i.e. no SGRA polygons are located in this contact region).

Staff Recommendation:

The observations of the Groundwater Vulnerability/Highly Vulnerable Aquifer and Significant groundwater Recharge Area Edge Matching Review conducted on the western and southern boundary of TCC by GENIVAR and on the eastern boundary of TCC by TCC technical staff, be accepted by the Source Protection Committee for inclusion in the updated Trent and Ganaraska Assessment Reports (for the Kawartha-Haliburton, Lower Trent, Crowe Valley, and Ganaraska Source Protection Areas).



STAFF REPORT

File No. SPC Report-03/11

Date: February 14, 2011

To: Source Protection Committee

From: Jennifer Stephens, Project Manager

Prepared by: Shan Mugalingam, Water Resources Engineer

RE: Review of IPZ-2 Delineations for the Sixteen (16) Type-C and Type-D Surface Water Sourced Drinking Water System Intakes within the Trent River Watershed

XCG Consultants Ltd. was contracted by the Trent Conservation Coalition (TCC) to review the IPZ-2 delineations for sixteen Type-C and Type-D surface water drinking water systems with respect to the recent revision of Technical Rule 65. (2) of the Ministry of the Environment (MOE) Technical Rules for the preparation of the Assessment Report, as per the Clean Water Act, 2006 (November 16, 2009).

A review of the sixteen intake protection zones completed by XCG revealed that the changes to the technical rule 65(2) would affect the IPZ-2 delineation for Peterborough, Campbellford, Trenton, Fenelon Falls and Lindsay Intakes. XCG evaluated storm sewer sheds for these drinking water systems to determine the upstream 2-hour travel distance from the intake. Sewer flow velocity based on Manning's Equation was used for this analysis.

Except for the Peterborough intake, IPZ-2 for the other relevant intakes (Campbellford, Trenton, Fenelon Falls, and Lindsay) was changed due to the truncation of the storm sewer-sheds within the IPZ-2 zones to the residual 2-hr time of travel. The time of travel analysis conducted for the Peterborough storm sewer-shed indicated that the entire sewer-shed belonged to the IPZ-2 zone. XCG also adjusted IPZ-3 zones for the affected intakes, so as to be compatible with the changed IPZ-2 zones. Over-all, no changes to the vulnerability scores of the IPZ-2 zones were made as a result of the changes to the delineation.

A review of significant threats within the changed IPZ-2 zones identified no change to the enumeration of significant threats, except for the Trenton intake. Review of the significant threats identified for the Trenton intake indicated that there were two significant threats previously identified in the area where IPZ-2 was reduced. Table 1 illustrates the revised significant threat counts for Trenton.

Table 1: Enumeration of Significant Threats for the Trenton Drinking Water System

Prescribed Drinking Water Threat (PDWT)*	Score to Trigger a Significant Threat			
	Vulnerability Score = 10		Vulnerability Score = 9	
	Affected Parcels**	No. of PDWT	Affected Parcels**	No. of PDWT
1. The establishment, operation or maintenance of a waste disposal site within the meaning of Part V of the Environmental Protection Act.			1	1
2. The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.	1	1	1	1
3. The application of agricultural source material to land.			3(3)	3(3)
4. The storage of agricultural source material.			2(2)	2(2)
10. The application of pesticide to land.	1	1	5(4)	5(4)
11. The application of road salt.	4	4		
15. The handling and storage of fuel.	1	1		
21. The use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard. O. Reg. 385/08, s. 3.			7(6)	7(6)
Total Number of Affected Parcels	5	7	12	19

Note:

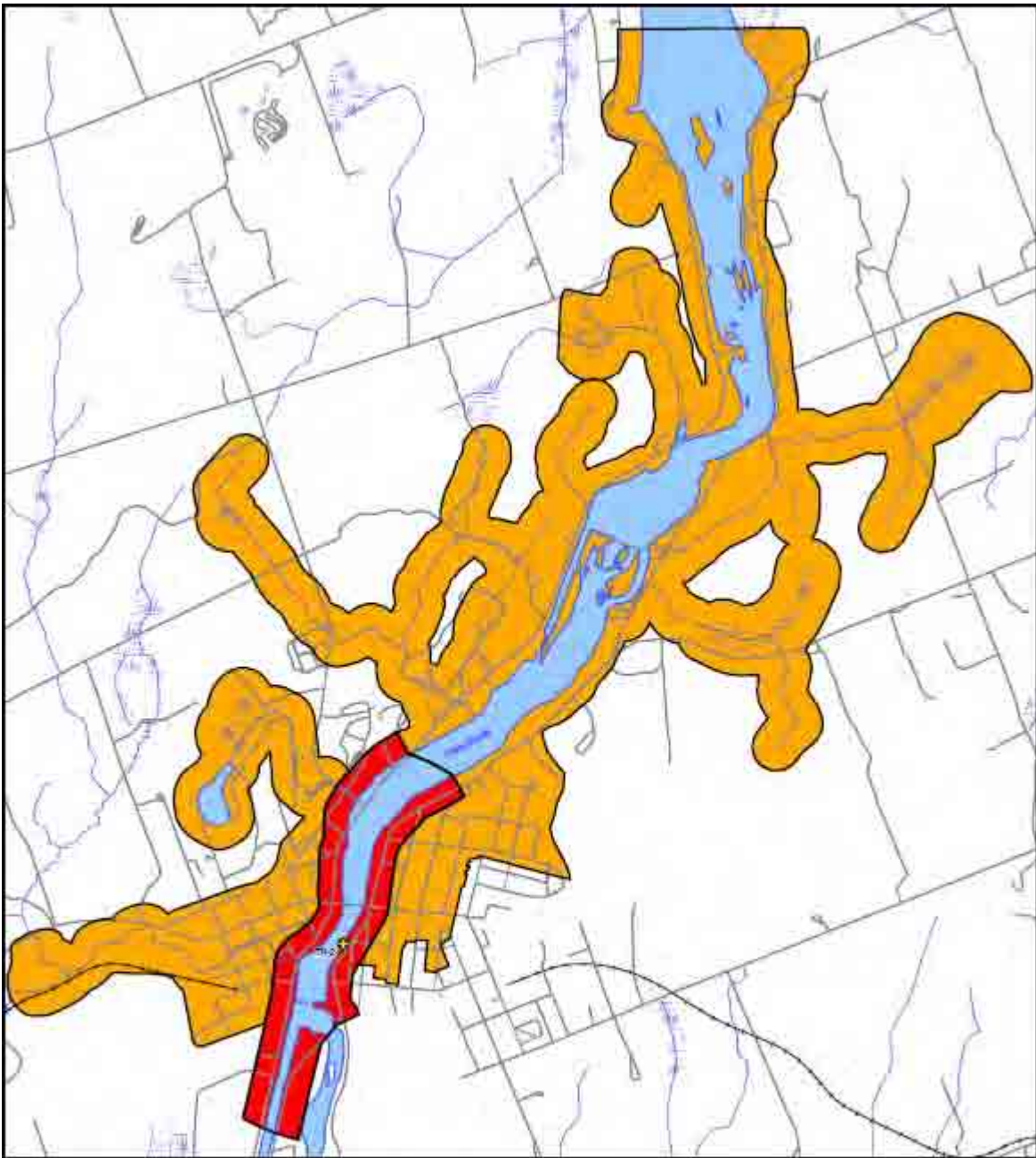
* *Prescribed Drinking Water Threats, Clean Water Act (2006) – O. Reg. 287/07, 1.1(1)*

** *"Affected parcels" represents the number of parcels on which a specific activity may be taking place. Some parcels may have more than one activity on-site.*

The above table and the series of eight maps which follow have been taken from the final XCG memo, dated December 07, 2011: *IPZ-2 Modifications for the Sixteen Surface Water Drinking Water Systems.*

Staff Recommendation:

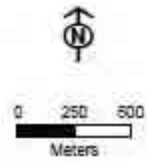
That the results of the modified IPZ-2 delineations corresponding to the sixteen surface water drinking water systems completed by XCG Consultants Ltd., as presented in *IPZ-2 Modifications for the Sixteen Surface Water Drinking Water Systems*, December 2010, be accepted by the Trent Conservation Coalition Source Protection Committee for inclusion in the Updated Trent Assessment Report for the Kawartha-Haliburton, Otonabee-Peterborough, and Lower Trent Source Protection Areas.

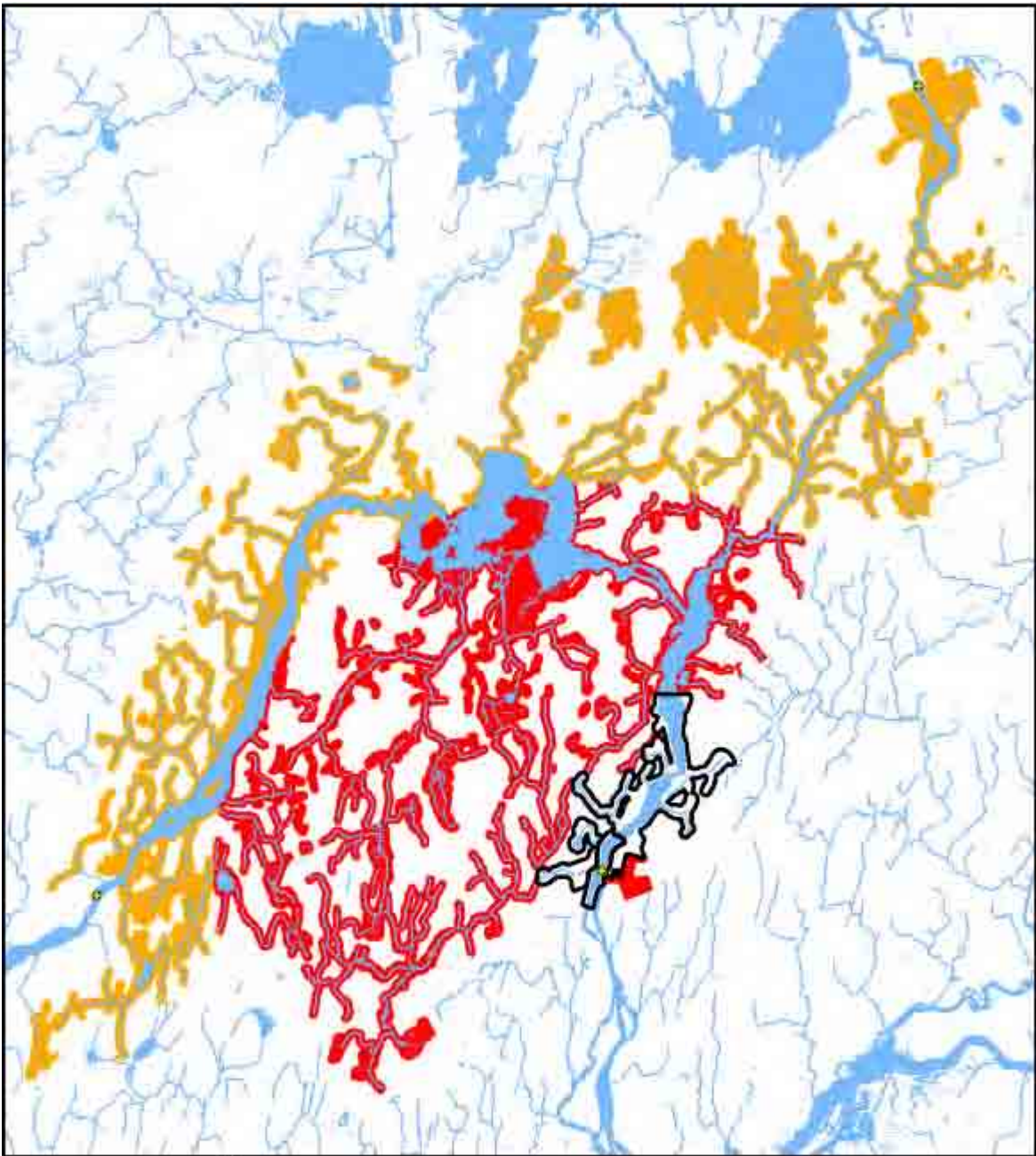


**Campbellford
IPZ-1 & IPZ-2
Vulnerability**

-  Surface Water Intakes
-  Roads
-  Railways
-  Waterbodies
-  Wetland Areas
-  Streams

- Vulnerability**
-  10
 -  9





Campbellford
IPZ-3
Vulnerability



IPZ-1



IPZ-2

Waterbodies



Streams

Vulnerability

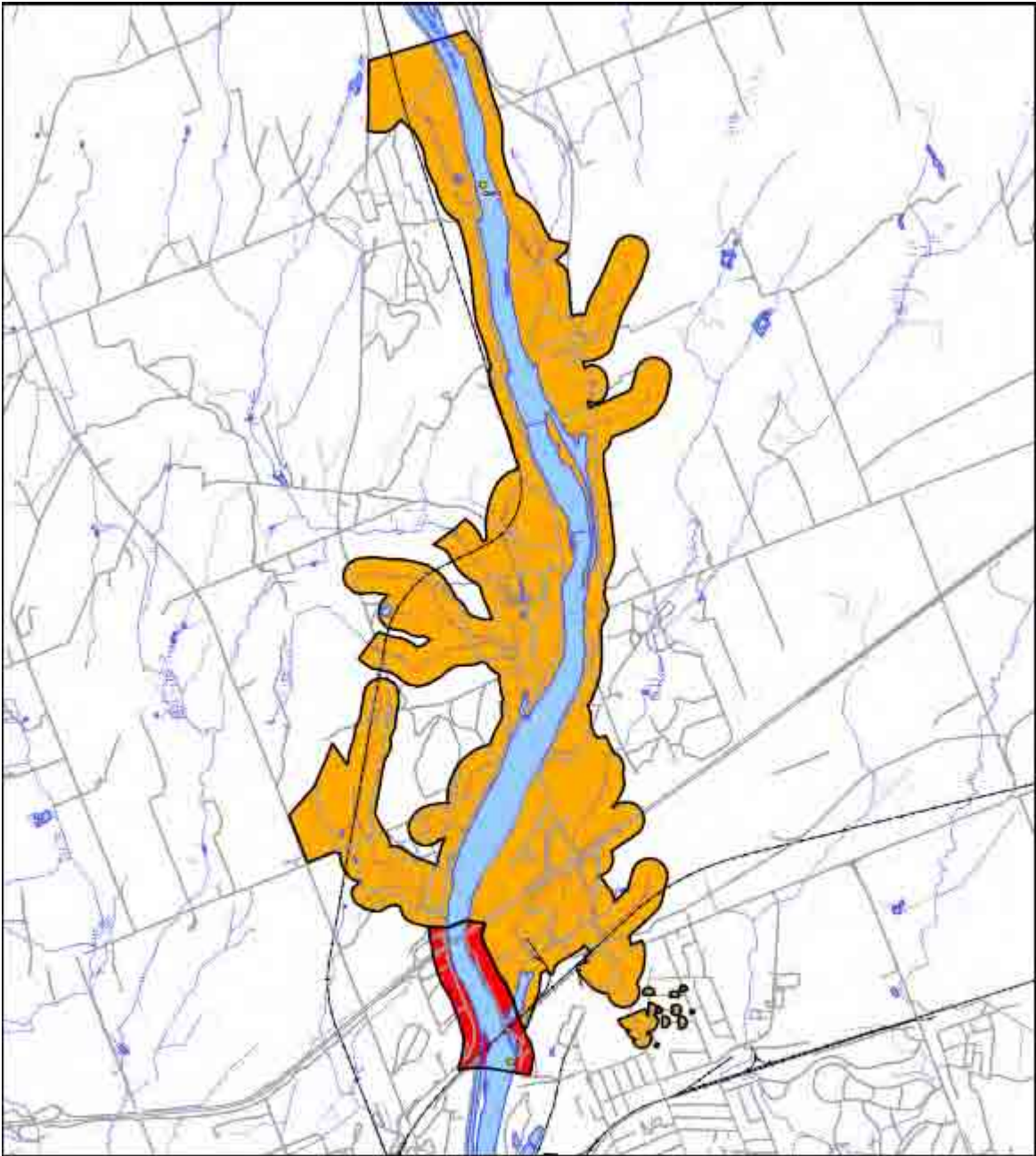


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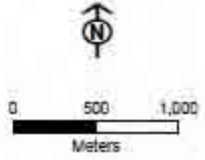


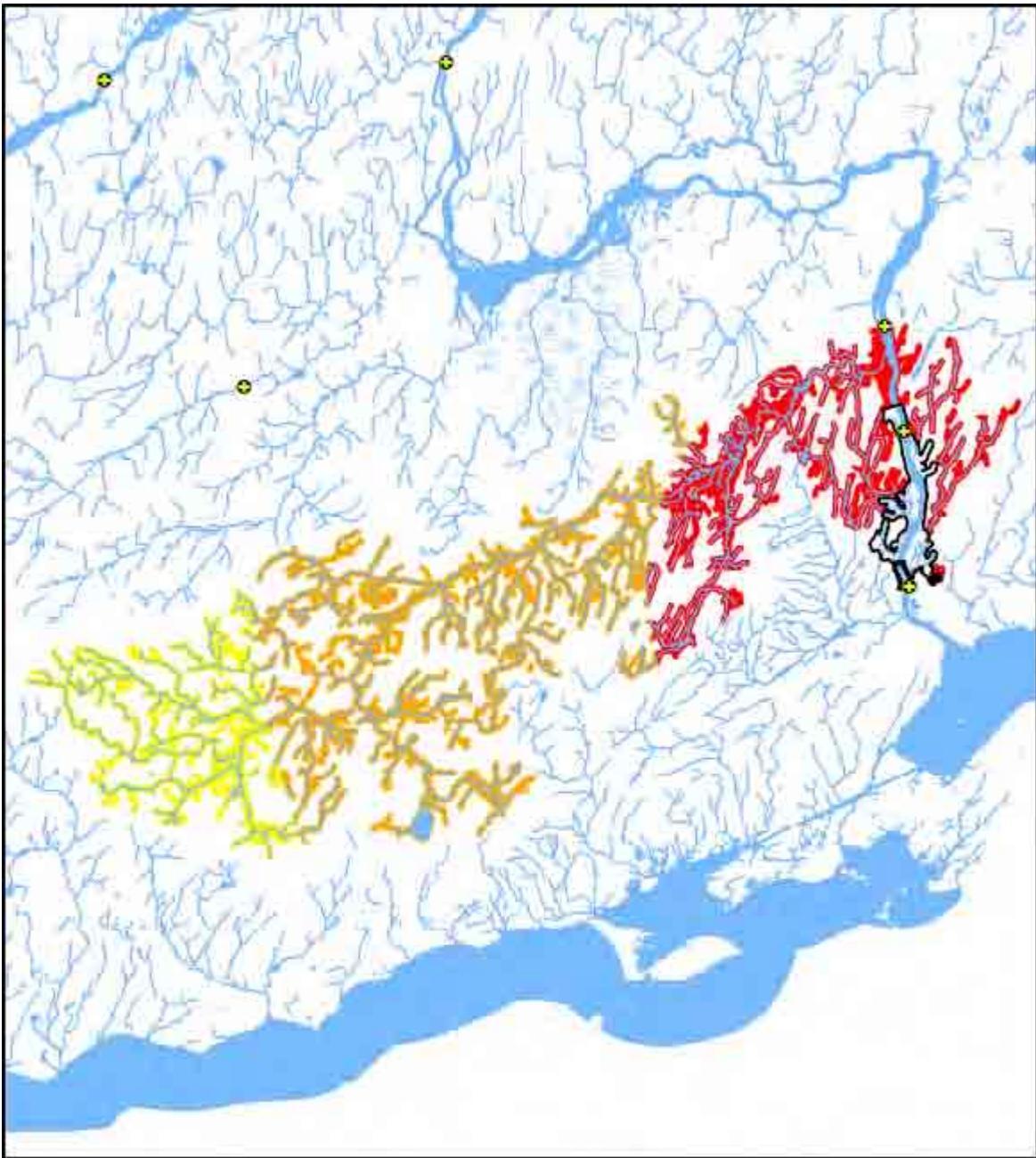


Trenton
IPZ-1 & IPZ-2
Vulnerability

-  Surface Water Intakes
-  Roads
-  Railways
-  Waterbodies
-  Wetland Areas
-  Streams

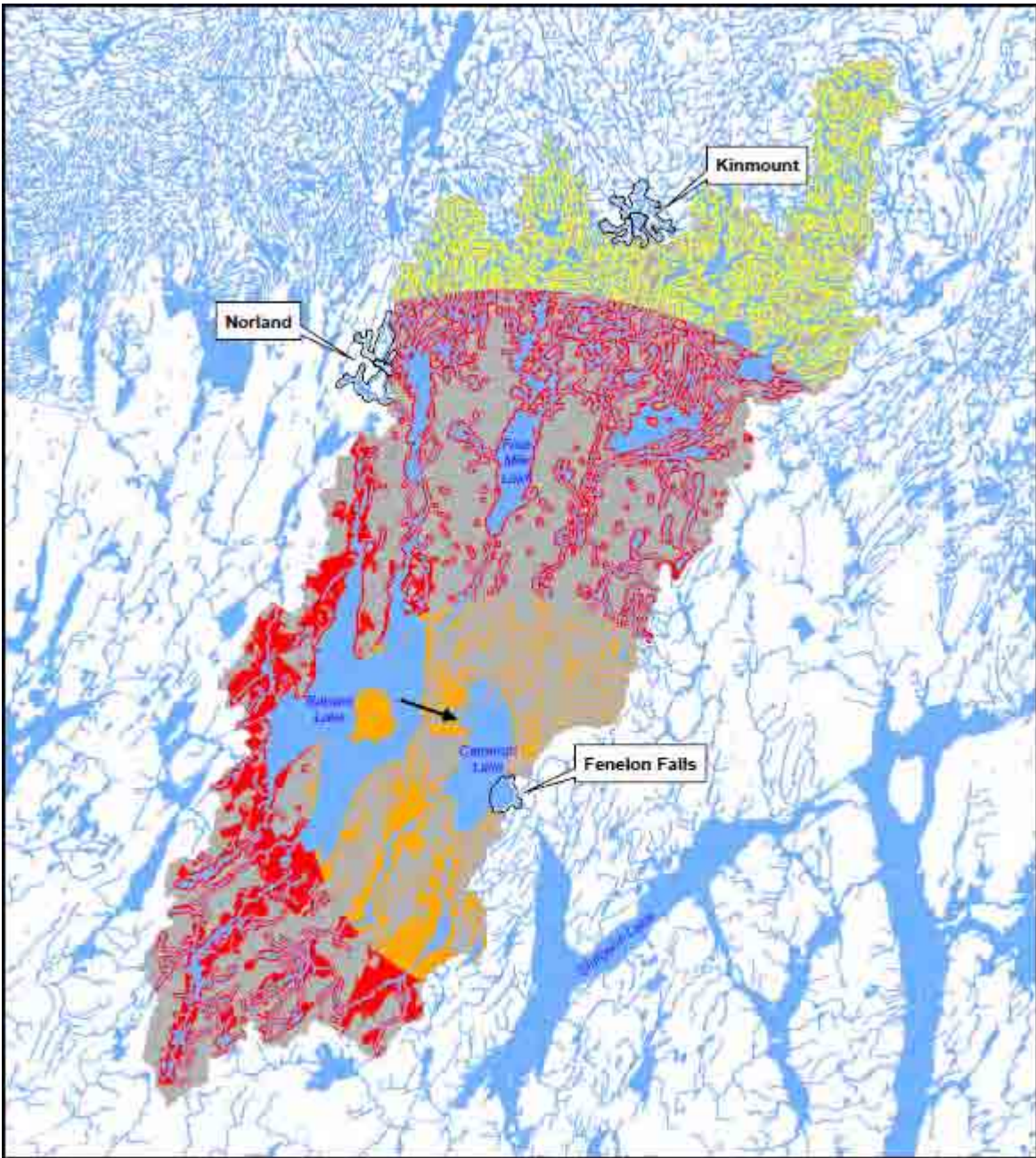
- Vulnerability**
-  10
 -  9



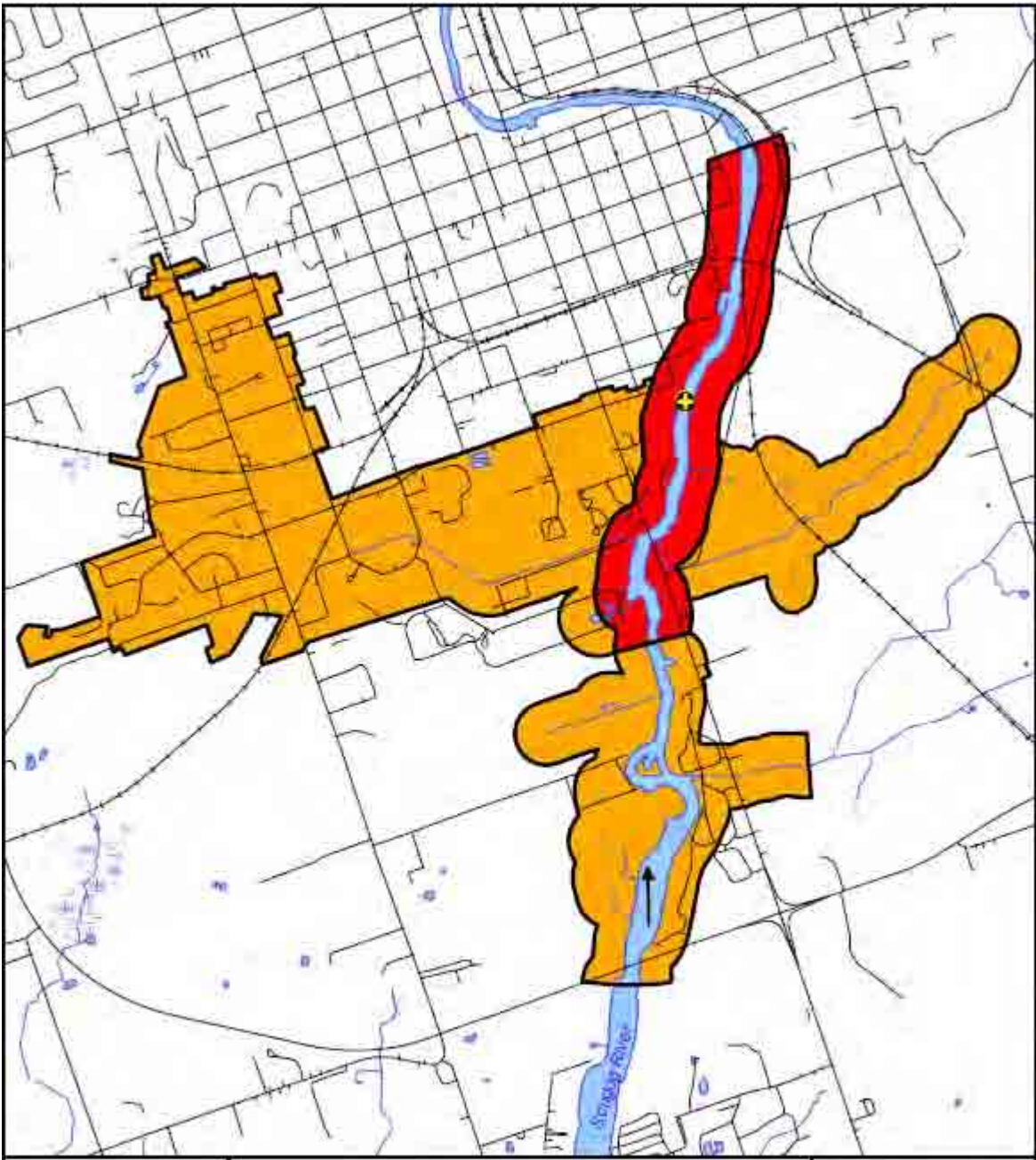


<p>Trenton IPZ-3 Vulnerability</p>	<table border="0"> <tr> <td data-bbox="503 1470 535 1533"> </td> <td data-bbox="544 1470 592 1501">IPZ-1</td> <td data-bbox="771 1470 885 1501"> Vulnerability </td> <td data-bbox="771 1501 836 1533"> </td> <td data-bbox="771 1533 836 1564">1</td> </tr> <tr> <td data-bbox="503 1533 535 1564"> </td> <td data-bbox="544 1533 592 1564">IPZ-2</td> <td data-bbox="771 1564 836 1596"> </td> <td data-bbox="771 1596 836 1627">2</td> </tr> <tr> <td data-bbox="503 1596 535 1627"> </td> <td data-bbox="544 1596 641 1627">Waterbodies</td> <td data-bbox="771 1627 836 1659"> </td> <td data-bbox="771 1659 836 1690">3</td> </tr> <tr> <td data-bbox="503 1659 535 1690"> </td> <td data-bbox="544 1659 609 1690">Streams</td> <td data-bbox="771 1690 836 1722"> </td> <td data-bbox="771 1722 836 1753">4</td> </tr> <tr> <td></td> <td></td> <td data-bbox="771 1753 836 1785"> </td> <td data-bbox="771 1785 836 1816">5</td> </tr> </table>		IPZ-1	Vulnerability		1		IPZ-2		2		Waterbodies		3		Streams		4				5	<p> </p> <p> 0 2,000 4,000 Meters </p>
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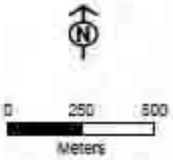
<p>Fenelon Falls IPZ-3 Vulnerability</p>	<table border="0"> <tr> <td></td> <td>IPZ-1</td> <td>Vulnerability</td> <td></td> <td>4.5</td> </tr> <tr> <td></td> <td>IPZ-2</td> <td></td> <td></td> <td>2.7</td> </tr> <tr> <td></td> <td>Waterbodies</td> <td></td> <td></td> <td>1.8</td> </tr> <tr> <td></td> <td>Streams</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>Kinmount Watershed</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>Direction of Flow</td> <td></td> <td></td> <td></td> </tr> </table>		IPZ-1	Vulnerability		4.5		IPZ-2			2.7		Waterbodies			1.8		Streams					Kinmount Watershed					Direction of Flow				<p></p> <p>0 3,000 6,000 Meters</p>
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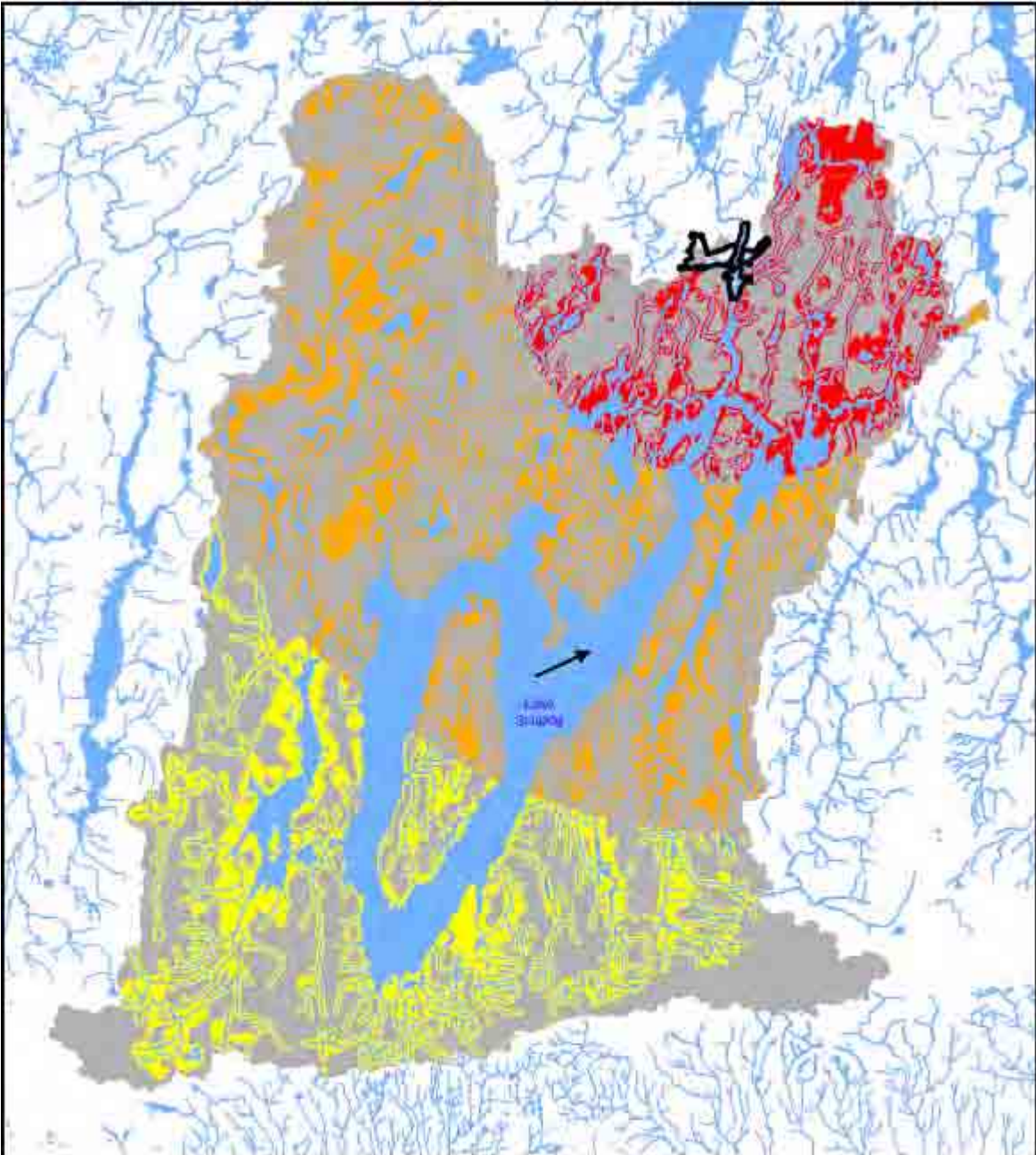


Lindsay
IPZ-1 & IPZ-2
Vulnerability

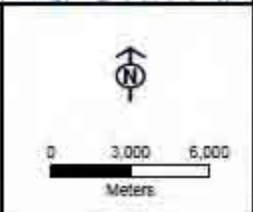
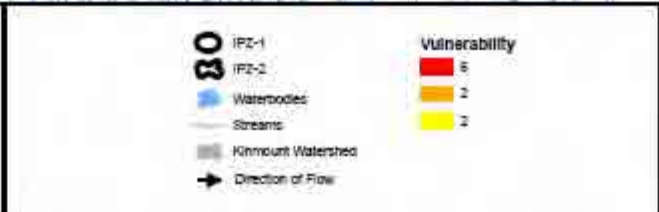
- Surface Water intakes
- Roads
- Railways
- Waterbodies
- Wetland Areas
- Streams

- Vulnerability**
- 10
 - 9





Lindsay
IPZ-3
Vulnerability



STAFF REPORT

File No. SPC Report-05/11

Date: February 14, 2011

To: Source Protection Committee

From: Jennifer Stephens, Project Manager

Prepared by: Shan Mugalingam, Water Resources Engineer

RE: Groundwater Vulnerability, Issues, and Threats Assessment for the new Groundwater Sourced Lutterworth Pines Drinking Water System

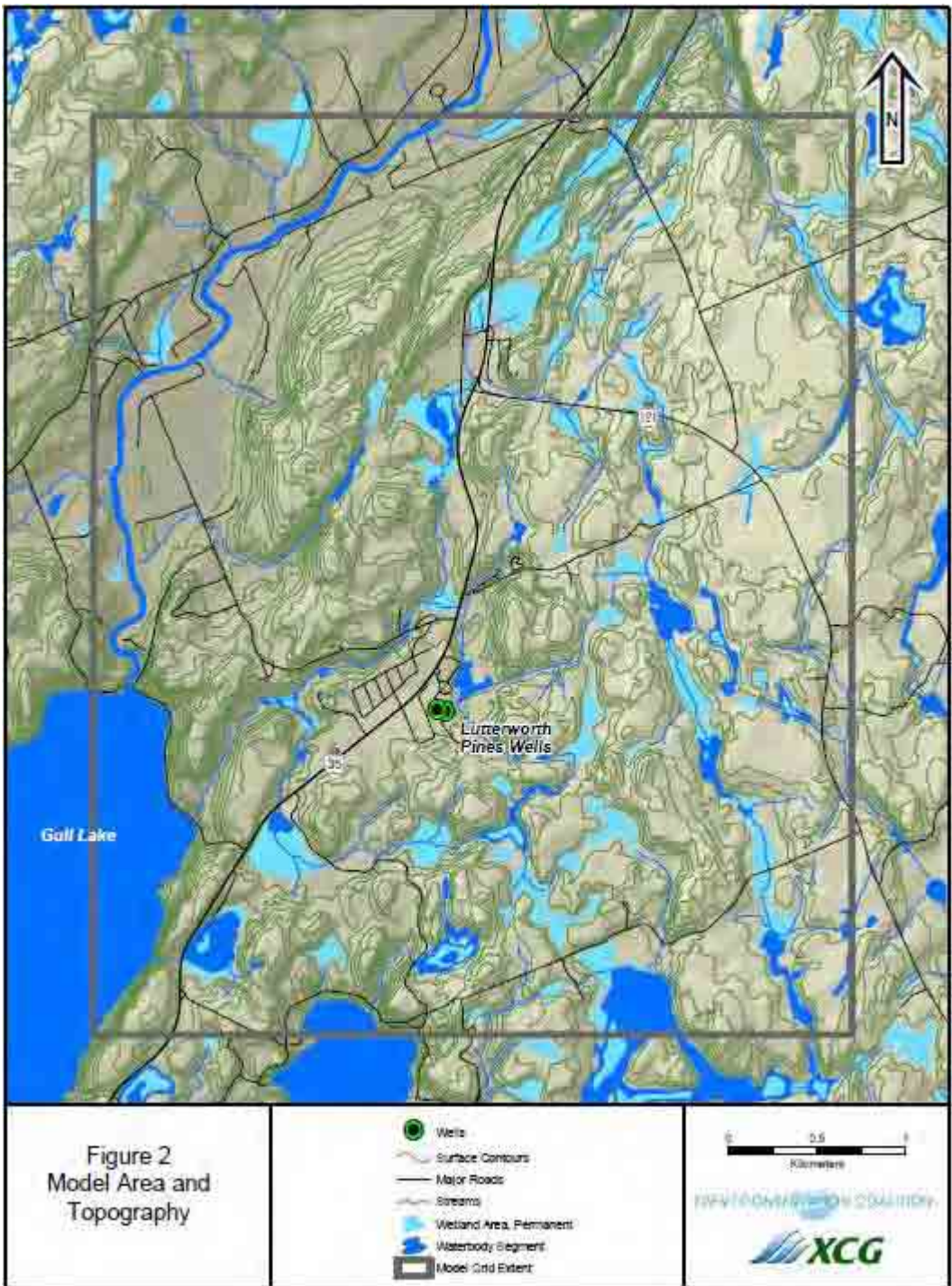
XCG Consultants Ltd. was contracted by the Trent Conservation Coalition to undertake the vulnerability, issues and threats assessments for the new Lutterworth Pines municipal groundwater systems located within the Municipality of Minden Hills.

Vulnerability

The draft technical memo #1 (Vulnerability Assessment of the Lutterworth Pines Municipal Well Supply) dated Dec 21, 2010 was peer reviewed by Stan Denhoed P. Eng., Harden Environmental Ltd. Only minor revisions were required following the peer review exercise and incorporated in the revised technical memo #1 dated January 2011.

A number of maps and tables have been extracted from this technical memo for inclusion in this report. The model area and topography in relation to the well supply is shown in Figure 2. The delineation of the wellhead protection areas (WHPAs), vulnerability zones, and vulnerability scoring are illustrated in Figures 17, 19, and 20; respectively.

The delineations of the WHPAs are considered to have very high uncertainty. The uncertainty ranking for the delineation of the WHPAs and vulnerability scores is high (except for WHPA-A) (Tables 1, 2), primarily as a result of the limited technical data available for modeling.



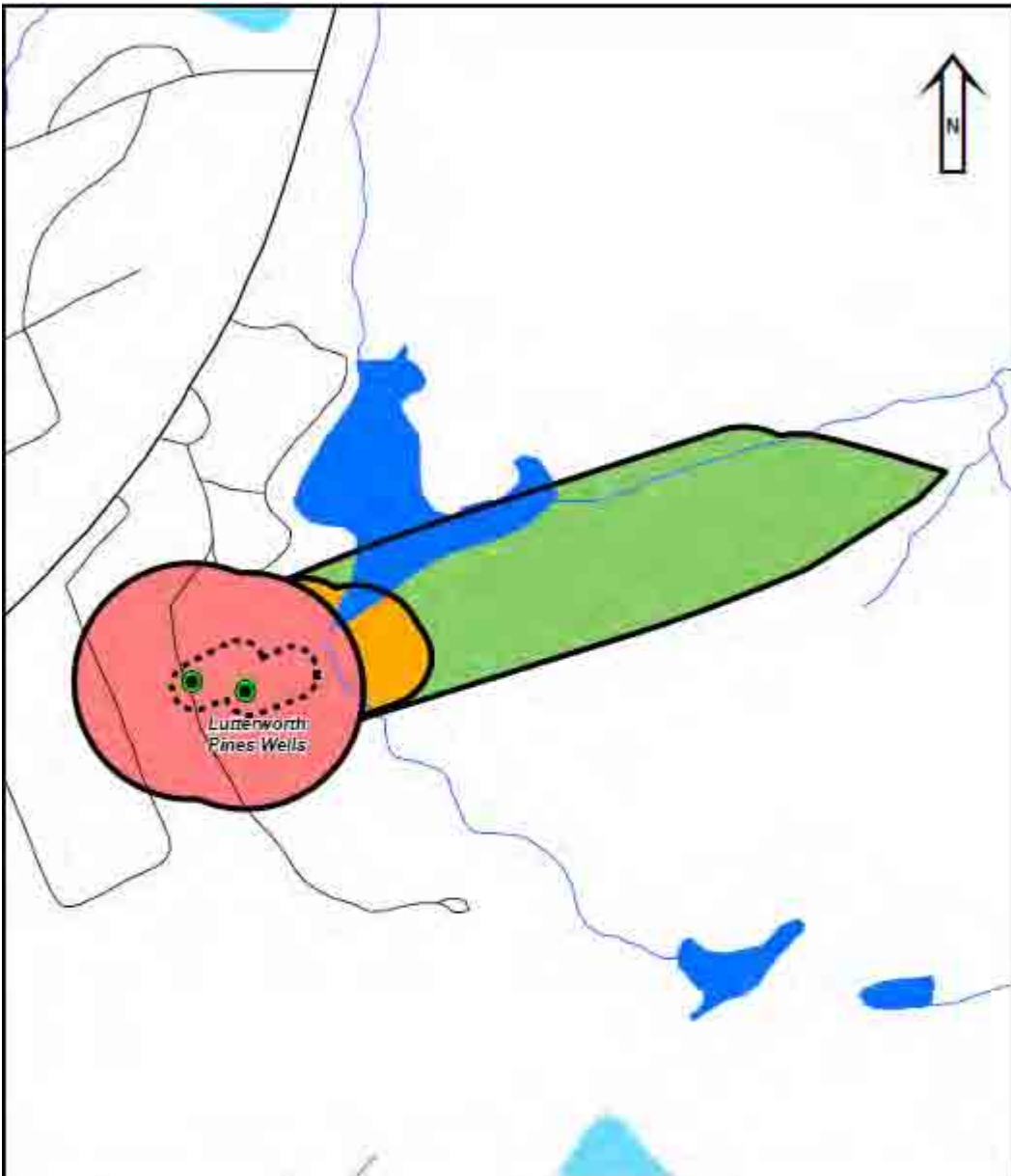


Figure 17
WHPA Delineation



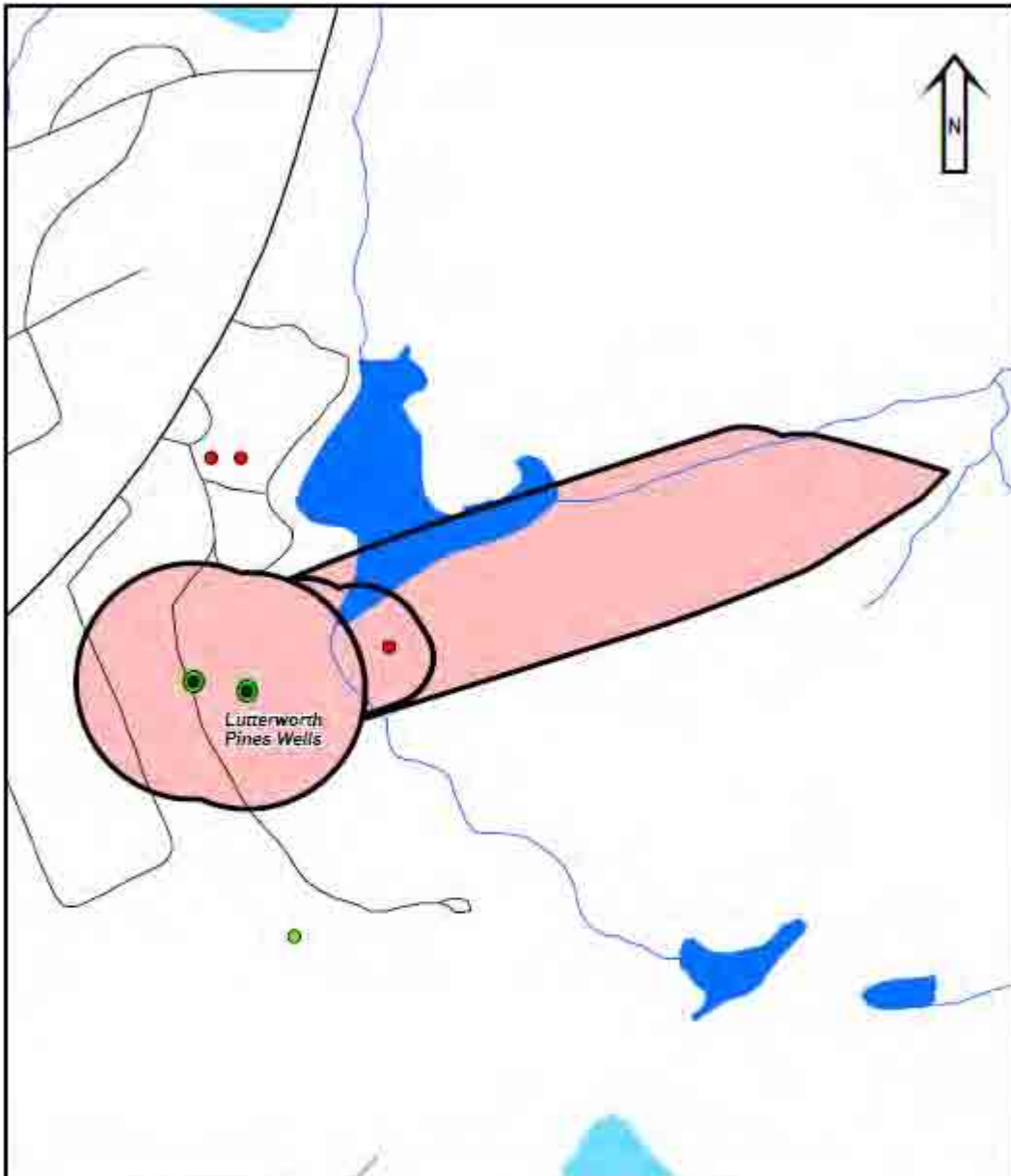


Figure 19
Vulnerability Zones

- Well
- Major Road
- Stream
- Watercourse Ferns
- Watercourse Deposit
- WWH Vulnerability Zone: High
- Well Vulnerability: High
- Well Vulnerability: Moderate
- Well Vulnerability: Low



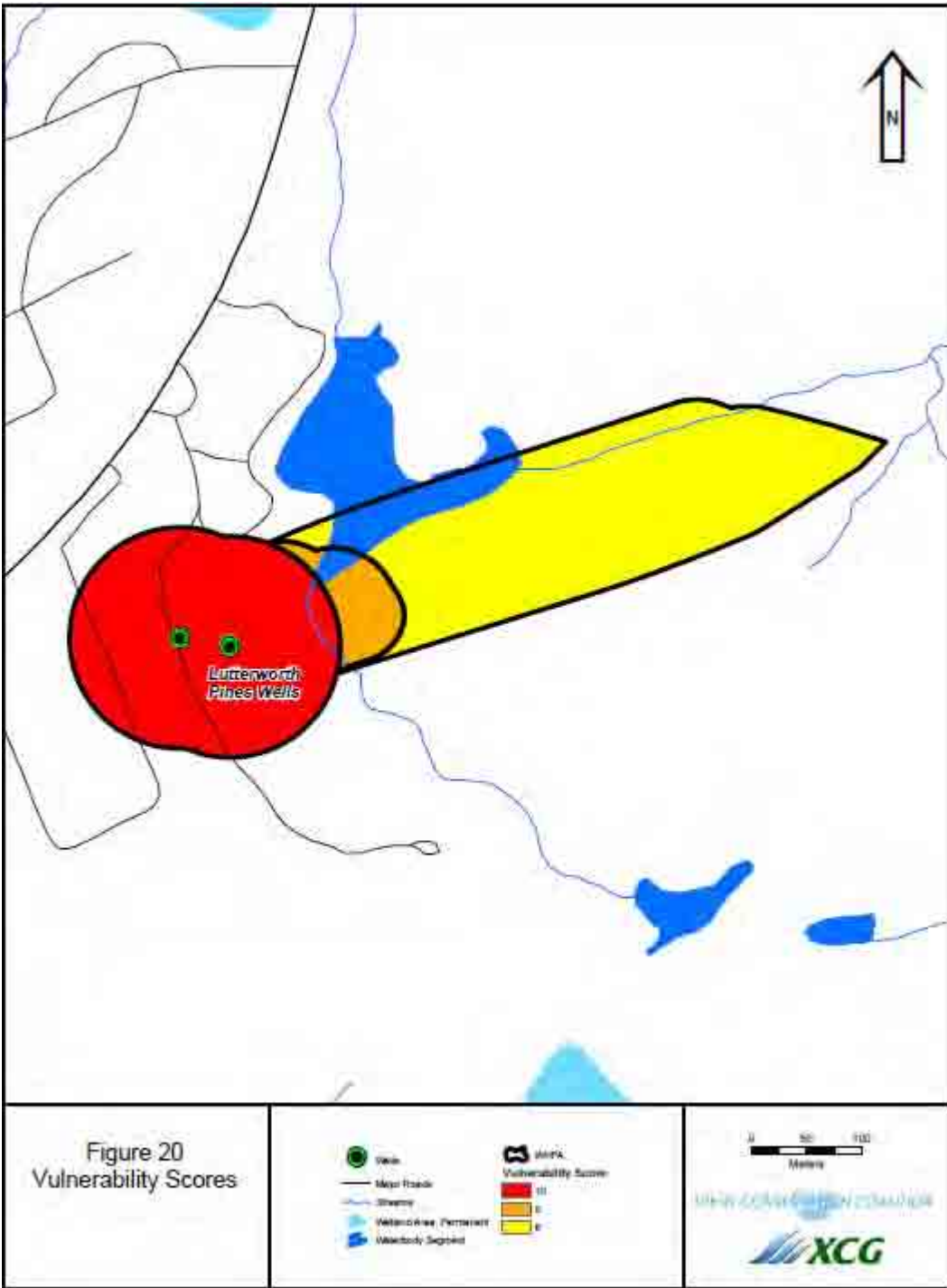


Table 1: Summary of Delineation Uncertainty

Portion of Assessment	Uncertainty Rank (High or Low)	Major Reasons
WHPA Delineation (Zone A)	Low	Well location was confirmed with GPS, 100 metre radius delineation was drawn.
WHPA Delineation (Zone B to D)	High	Limited field data for calibration Literature values for K and leakance Unknown impacts of adjacent surface waters Limitations of 3D models

Table 2: Summary of Vulnerability Uncertainty

Portion of Assessment	Uncertainty Rank (High or Low)	Major Reasons
WHPA (Zone A)	Low	Prescribed vulnerability
WHPA (Zone B to D)	High	Data is through interpolations of MOE WWR

Issues Evaluation

A five step process was used to identify and evaluate drinking water issues as outlined below:

Step 1: Assemble water quality data

Step 2: Review all water quality data as per Technical Rule 114

Step 3: Evaluate drinking water issues using qualitative approach

Step 4: Identify issue contributing area within the vulnerable area, where contributing threats are identified

Step 5: List drinking water threats as per Technical Rule 115

For the Lutterworth Pines system, the following data sources were reviewed to determine if any water quality data was available to complete the issue evaluation:

1. Municipal Groundwater Study Reports
2. Watershed Characterization Report
3. Certificate of Approval
4. Permits to Take Water
5. Municipal Water Supply Water Quality Data

XCG also reviewed various background reports (e.g. Wellfield Evaluation Report) for issue determination. . In addition to the results of compliance testing as required by MOE (annual reports and MOE drinking water system audits); the Municipality of Minden Hills also provided additional data.

A number of drinking water issues were identified through the issues evaluation exercise (Table 3). All of these issues were found to be naturally occurring. The information in Table 3 is taken from draft XCG

technical memo #2 - *Issues Evaluation for Lutterworth Pines Municipal Groundwater Drinking Water System*, dated January 2011.

Table 3: Identified Drinking Water Issues, Lutterworth Pines Municipal Drinking Water Supply

Issue	Type of Parameter	Anthropogenic/ Naturally Occurring	Issue Contributing Area Defined	Linked Potential Threats (Activities/ Conditions)
Uranium	Health	Naturally Occurring	NA	NA
Hardness	Operational	Naturally Occurring	NA	NA
Manganese	Aesthetic	Naturally Occurring	NA	NA
Sulphate	Aesthetic	Naturally Occurring	NA	NA

NA – Not Applicable

Threats Assessment

Summary of Methods:

A multiple step process was used to identify potential significant threats as defined in the Technical Rules.

- Step 1: Review vulnerable area delineation and vulnerability scoring.
- Step 2: Review appropriate information databases.
- Step 3: Conduct field reconnaissance survey.
- Step 4: Overlay parcel fabric.
- Step 5: Evaluate potentially significant threats based on land use, vulnerability score and known circumstances.
- Step 6: Enumerate potential significant threats and number of parcels affected.
- Step 7: Send letters out to land owners of parcels identified as potentially significant threats.
- Step 8: Follow up with interview and/or site visit to collect information regarding specific circumstances.
- Step 9: Enumerate identified significant threats.

To identify conditions as potential significant threats as defined in the Technical Rules, a three step process is used.

- Step 1: Review available background information.
- Step 2: Calculate risk score.
- Step 3: Enumerate potential significant threats.

Summary of Results:

A total of fourteen (14) Prescribed Drinking Water Threats (PDWT) have been identified for the Lutterworth Pines Municipal Drinking Water Supply. One parcel of land has two PDWTs: storage of fuel and septic system. The remainder of the twelve parcels each has a septic system. Results from the enumeration of significant threats exercise are outlined in Table 4 which has been extracted from draft XCG technical memo #3, dated January 2011 - *Significant Threats Enumeration for Lutterworth Pines Municipal Groundwater Drinking Water System*.

Table 4: Enumerated Significant Drinking Water Threats

Prescribed Drinking Water Threat (PDWT)	Score to Trigger a Significant Threat Vulnerability Score = 10	
	Affected Parcels	No. of PDWT
Establishment, operation or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage	13	13
Handling and storage of fuel	1	1
Total	13	14

Staff Recommendation:

That the results of the vulnerability, issues and threats assessment completed by XCG Consultants Ltd. for the new Lutterworth Pines municipal groundwater sourced drinking water system outlined in the following technical memos:

- Technical Memorandum #1 (Draft), Vulnerability Assessment of the Lutterworth Pines Municipal Well Supply, January 2010
- Technical Memorandum #2 (Draft), Issue Evaluation for Lutterworth Pines Groundwater Sourced Drinking Water System, January 2011
- Technical Memorandum #3 (Draft), Significant Threats Enumeration for Lutterworth Pines Municipal Groundwater Sourced Drinking Water System, January 2011

be accepted by the Source Protection Committee for inclusion in the Trent Updated Assessment Report (for the Kawartha-Haliburton Source Protection Area).

STAFF REPORT

File No. SPC Report-04/11

Date: February 14, 2011

To: Source Protection Committee

From: Jennifer Stephens, Project Manager

Prepared by: Shan Mugalingam, Water Resources Engineer

RE: Tier 2 Water Quantity Stress Assessment Update for CROWE-4 Sub-watershed Associated with the Havelock Municipal Wells

XCG Consultants Ltd. (XCG) conducted a Tier 2 Water Budget Analysis of the CROWE-4 sub-watershed, also referred to as the Havelock sub-watershed on behalf of the Trent Conservation Coalition Source Protection Committee. This work was summarized in the XCG report "*Final Report - Tier 2 Water Budget - Part 2 Havelock Sub-watershed*", and submitted to Trent Conservation Coalition (TCC) on April 22, 2010.

As this work was being completed, there were questions about whether the former 3-M plant located along Highway 7, east of Havelock was actively withdrawing water. A review of the Ministry of the Environment (MOE) Permit to Take Water (PTTW) database indicated that there were no recent water takings at the former 3-M plant as it had closed. Therefore, no permitted takings were included in the analysis completed for inclusion in the *Proposed* Trent Assessment Report.

Recently, staff became aware that two concurrent Permits to Take Water (PTTWs) were issued for this site in December 2007. Although the appropriate permits had been issued, no water was being taken. Relevant information on these PTTWs is shown below (Table 1).

Table 1: Summary of Additional Permitted Groundwater Takings

Permit Holder	Permit Number	Maximum Permitted Taking (L/day)	Water Use
Drain Brothers Excavating Ltd.	8007-78FKCA	926,784	Pits & Quarries – De-watering
Kawartha Ethanol Inc.	3460-78FLQJ	3,000,960	Industrial - Manufacturing

Beginning in 2010, Kawartha Ethanol began taking water. XCG was contracted to re-evaluate the Tier 2 Water Budget to account for these additional takings. XCG Consultants Ltd. summarized the results of the updated analysis in an Addendum Memo (Tier 2 Water Quantity Stress Assessment Update for CROWE-4 Sub-watershed) issued Dec 20, 2010 and revised on Jan 31, 2011. The technical addendum did not involve any changes to the existing groundwater model set-up or model calibration.

A summary of the water quantity stress assessment results from April 2010 and January 2011 are compared in Table 2. The results of the drought scenario analysis are outlined in Table 3.

Table 2: Summary of Water Quantity Stress Assessment

Category	Original Value (April 2010)	Updated Value (Jan 2011)	Threshold for Moderate Stress
Annual Average Stress (Existing)	1.6%	3.18%	10%
Maximum Monthly Stress (Existing)	1.63% (August)	3.24% (August)	25%
Annual Average Stress (Future)	1.76%	8.00%	10%
Maximum Monthly Stress (Future)	1.8% (August)	8.21% (August)	25%

Table 3: Drought Scenario Analysis

Measurement of Interest	Well #1		Well #3		Well #4	
	Depth (mbgs)	Elevation (masl)	Depth (mbgs)	Elevation (masl)	Depth (mbgs)	Elevation (masl)
Ground Surface	0	213.74	0	212.50	0	213.52
Top of Screen (ToS) or Low Level Lockout (LLLO)	10.04 (LLLO)	203.70 (LLLO)	7.32 (ToS)	205.18 (ToS)	6.82 (LLLO)	206.70 (LLLO)
Static Groundwater Level (GWL)	4.56	209.18	3.90	208.6	4.34	209.18
GWL @ Scenario D (existing -2 yr drought)	7.16 (7.22)	206.58 (206.52)	6.60 (6.65)	205.90 (205.85)	6.91 (6.95)	206.61 (206.57)
GWL @ Scenario E (future – 2 yr drought)	7.19 (7.24)	206.56 (206.50)	6.62 (6.67)	205.88 (205.83)	6.93 (6.96)	206.59 (206.56)
GWL @ Scenario G (existing – 10 yr drought)	6.67 (6.38)	207.07 (207.36)	6.16 (5.77)	206.35 (206.73)	6.47 (6.15)	207.05 (207.37)
GWL @ Scenario H (future – 10 yr drought)	6.69 (6.40)	207.05 (207.34)	6.20 (5.80)	206.31 (206.70)	6.50 (6.18)	207.03 (207.34)

Note: Values that are bracketed are the original values (April 2010)

The Technical Rules (TR 35 (2) (e, f) were used to evaluate groundwater stress based on the results outlined in Table 3. Analyses indicate there was insufficient water being supplied to Well #4 in only one of the two drought scenarios.

Therefore, the updated Tier 2 analysis of the CROWE-4 (Havelock) sub-watershed indicates a LOW stress to this sub-watershed.

Staff Recommendation:

That the results of the updated tier 2 water quantity stress assessment indicating a low water quantity stress for the sub-watershed associated with the Havelock Municipal Wells, completed by XCG Consultants Ltd. for the Trent Conservation Coalition Source Protection Region as presented in the Addendum Memo (Tier 2 Water Quantity Stress Assessment Update for CROWE-4 Sub-watershed) dated Dec 20, 2010 and revised on Jan 31, 2011 be accepted by the Source Protection Committee for inclusion in the Updated Trent Assessment Report (for the Crowe Valley Source Protection Area).

STAFF REPORT

File No. SPC Report - #07/11

Date: February 14, 2011
To: Source Protection Committee
From: Marilyn Bucholtz, Communications Coordinator
RE: Communications/Consultation Work Plan for 2011

A work plan is attached that provides details of the communications and consultation activities anticipated for 2011 in support of the Source Protection Committee and the source protection planning program. As noted in the introduction, changes may be required to the work plan as new information and guidance is provided to us by MOE and new opportunities are identified as the policy development work unfolds.

Staff Recommendation:

That the Communications/Consultation Work Plan for 2011 be accepted by the Source Protection Committee.