Summary of Proposed Amendments to the Trent Source Protection Plan and Assessment Report – Grafton Drinking Water System

Pursuant to Section 34 of Ontario Regulation 287/07 of the Clean Water Act

December 15, 2025

The Township of Alnwick/Haldimand is revising the Wellhead Protection Area (WHPA) for the Grafton Drinking Water System (DWS) due to the installation of one new municipal well. These upgrades have resulted in the Proposed Amendments to the Trent Source Protection Plan (SPP) and Assessment Report (AR) (last updated and approved June 13, 2025) listed below and summarized and highlighted in yellow on the following pages. A strike-through indicates that text is to be removed.

List of Proposed Amendments

SPP

1. Summary of Amendments (second page): Updated.
2. Appendix 2: Updated Policy Applicability Map.
3. Appendix 5: Updated to include consultation activities for the Proposed Amendments.
4. Explanatory Document to be updated.

AR: Volume 1

1. Table 5.1-2: Updated well depth of well PW3.
2. Section 5.2: Update list of background reports
3. Section 5.2.2.1.2: Added paragraph describing the updated Grafton Vulnerability Method.
4. Section 5.2.2.6.1: Added paragraph describing the updated Grafton WHPA Delineation
5. Section 5.2.2.7: Added information regarding Grafton's updated Vulnerability Assessment
6. Table 5.2-23: Updated range of vulnerability scores by WHPA for the Grafton DWS.
7. Table 5.2-24: Updated uncertainty ratings for the Grafton DWS.
8. Table 5.4-3: Updated the threat totals for Grafton.

AR: Volume 2

9. Appendix F, Groundwater Systems: Water Quality Risk Assessment, Vulnerability Assessment: Updated list of background reports
10. Appendix G, Section 34 Amendment Approval Letter

AR: Volume 3

11. Map 5-31a, Map 5-31b: Updated WHPAs, Vulnerability Scores, Livestock

Proposed Amendments to the Trent Source Protection Plan

Amendment 1*:* Summary of Amendments (second page of SPP)

As Per EBR Registry Number ###-####, the information Notice posted on the Environmental Bill of Rights describes the amendments approved by the Ministry of Environment, Conservation and Parks on (DATE) including:

- A revised wellhead protection area for the Grafton Municipal Well System; and,
- Revised assessment report maps.

Amendment 2*:* Appendix 2 – Policy Applicability Map

[To be updated in Appendix after approval from the Ministry of the Environment, Conservation and Parks.]

Amendment 3: Appendix 5

Consultation on the Updated Assessment Report

Pre-consultation on the proposed amendments to the Trent Assessment Report to reflect changes to the Grafton Municipal Well System resulting from the installation of one new well was undertaken with Implementing Bodies from November 7, 2025 to December 4, 2025.

Public Consultation was undertaken from December 15, 2025 to January 23, 2026.

Consultation on the Updated Source Protection Plan

Pre-consultation on the proposed amendments to the Trent Source Protection Plan to reflect changes to the Grafton Municipal Well System resulting from the decommissioning of one well and the installation of one replacement well was undertaken with Implementing Bodies from November 7, 2025 to December 4, 2025.

Public consultation was undertaken from December 15, 2025 to January 23, 2026.

Amendment 4*:* Explanatory Document

2.7 CONSULTATION ON NEW THREATS

In 2025, the wellhead protection areas were modified for the Grafton Municipal Well System to the decommissioning of one well and the installation of one replacement well. This resulted in changes to the delineation of the wellhead protection area. A total of two significant drinking water threats within the Trent Conservation Coalition Source Protection Region were identified in the updated study and no policies were changed as a result of these amendments. Pre-consultation occurred from November 7, 2025 to December 4, 2025. Public consultation occurred from December 15, 2025 to January 23, 2026.

Proposed Amendments to the Trent Assessment Report

Amendment 1: Table 5.1-2: Updated well depth of well 3, "PW3".

Table 5.1-2: Summary of Wells and Water Treatment Systems for Existing Municipal Residential Groundwater Systems in the Trent Source Protection Areas

System Name	Well(s)								Water Treatment System	
	Location	No. Wells	Depths (m)					GUDI Status	Disinfection	Other Available Treatment Details
Lower Trent Source Protection Area										
Grafton	Grafton	2	NA	78	82.3	NA	NA	No	Sodium hypochlorite	Sodium silicate (iron sequestration)

Amendment 2: Section 5.2 – Add background report to list

- Aqua Insight Inc., Source Protection Study for the Community of Grafton, Ontario, September 2025

Amendment 3: Section 5.2.2.1.2: - Added paragraph describing the updated Grafton Vulnerability Method

5.2.2.1.2 Vulnerability Methods

Groundwater vulnerability was determined using both index methods and advective transport methods. The use of an index method over an advective transport method or vice versa is somewhat dictated by the availability of geological information and complexity of geology. For example, an index method is preferred in areas of limited information (i.e., wells) whereas areas with adequate information are better suited for an advective transport method. The index methods and advective transport methods were applied using assumptions and approaches that were consistent with the *Technical Rules* and that would result in over-protection of the groundwater source.

For the following systems, the aquifer vulnerability index method was applied by designating geological layers as either an aquifer or an aquitard and applying a K-Factor of 1 for an aquifer and 4 for an aquitard: Greenbank, Port Perry, Birch Point, Canadiana Shores, Janetville, King's Bay, Manorview, Mariposa Estates, Victoria Glen, Pleasant Point, Pinewood, Sonya, Victoria Place, Woodfield, and Woods of Manilla. This method is considered to be a conservative application of the method described in the Ministry of the Environment, Conservation and Parks Guidance Modules, and it was necessary due to the minimal data available to describe the subsurface in the areas around many of the municipal wells. The application of this method resulted in lower index values and thus produced higher vulnerability ratings.

For the Stirling, ~~Grafton~~ Colborne, Brighton, Keene Heights, Crystal Springs, and Millbrook systems, an application of the surface to well advection time (SWAT) was used to determine groundwater vulnerability. SWAT consists of two components: the vertical travel time through the unsaturated zone above the water table (UZAT) and the travel time from the water table to the well through the saturated zone (WWAT). Determining the time of travel through the unsaturated zone is highly complex and depends on a number of parameters that have high uncertainties related to their estimates (unsaturated hydraulic conductivity, soil moisture content, competence of confining units, etc.). Furthermore, surface releases of fluid contaminants (through spills or leaks) can locally saturate the soils and move downward through the unsaturated zone in hours or days rather than years. Thus, because of the uncertainties related to the estimation of the unsaturated zone above the water table (UZAT) and because of the relatively shorter travel time attributed to UZAT (as compared to WWAT), the UZAT was not factored into the calculation of the surface to well advection time (SWAT). SWAT volumes calculated by disregarding UZAT provide lower travel times and thus produce higher vulnerability ratings.

For the Blackstock drinking water system, an application of the surface to well advection time (SWAT) was used to determine groundwater vulnerability. SWAT consists of two components: the vertical travel time through the unsaturated zone above the water table (UZAT) and the travel time from the water table to the well screen through saturated aquifers and aquitards (WWAT). Though determining UZAT can be complicated, the sophisticated semi-integrated surface water flow model (PRMS) – groundwater flow model (MODFLOW) constructed for the Durham region, provided a means for rigorously estimating UZAT

related parameters such as soil moisture content and infiltration rates. Therefore, groundwater vulnerability for the Blackstock drinking water system was determined by the application of the complete SWAT method.

The updated 2025 Grafton modelling used a similar approach as Blackstock, applying the vertical travel time through the unsaturated zone above the water table (UZAT) and the travel time from the water table to the well screen through saturated aquifers and aquitards (WWAT) to calculate the complete surface to well advection time (SWAT).

The following sections summarize the results of the WHPA delineation, groundwater vulnerability assessment, and uncertainty analysis for each municipal well system.

Amendment 4: Section 5.2.2.6.1: - Added paragraph describing the updated Grafton WHPA Delineation

5.2.2.6.1. Wellhead Protection Area Delineation

The WHPAs for the updated Colborne municipal well system were delineated based on time of travel assessed through the application of a 3D groundwater model, extracted from the existing "South Slope" model. This extraction process consisted of following refinements:

1. The model domain was reduced to focus on the Colborne wells. The northern boundary was set as the eastward flowing Cold Creek. The western boundary is the southward flowing Shelter Valley Creek. The eastern boundary is Smithville Creek west of Brighton and Lake Ontario is the southern boundary to the model domain. A constant head boundary was incorporated in the northwest extent of the model domain in the Thornhill Aquifer, representing groundwater flow-through from Oak Ridges Moraine in the north.
2. The model grid was refined around municipal wells, in order to better represent steeply declining groundwater elevations in the immediate vicinity of the municipal wells.
3. The transient mode of the groundwater model was used to simulate drawdowns from 2016 pumping tests. Model adjustments to improve results included increasing and decreasing hydraulic conductivity and storativity of layer 5 (Thornhill Aquifer Complex) and layer 4 (Lower Newmarket Till).
4. The updated model was run to determine new well capture zones under the maximum permitted rate (6566.4 m^3/d), unlike the earlier model, which used 3283.2 m^3/d, with both wells operating.

The WHPAs for the Grafton, Colborne, and Brighton municipal well systems were delineated based on time of travel determined through the application of a single three-dimensional groundwater flow model (the "South Slope" model). The model that represented the geologic system contained six geological layers: five in the overburden and one in the bedrock. The data source for the model was the Ministry of the Environment, Conservation and Parks Water Well Information System database. The WHPAs delineated for Grafton, Colborne, and Brighton municipal well systems are shown on Maps 5-29a through 5-31a.

In 2025 the Township of Alnwick/Haldimand initiated updates to the Grafton Drinking Water System. As part of this process, refinements were made to the calibrated groundwater flow model before the model was applied to delineate the updated capture zones and WHPAs. Updates were made to the model layers, effective porosity values and pumping rates at the Grafton wells.

Amendment 5: Section 5.2.2.7 – Added information regarding Grafton's updated Vulnerability Assessment

5.2.2.7 Vulnerability Assessment

Groundwater vulnerability was assessed for ~~these systems~~ Brighton and Colborne using a water table to well advection time (WWAT) method. This is an application of the surface to well advection time (SWAT) method that does not include the travel time through the unsaturated zone (see Section 5.2.2)

Since unsaturated zone travel time (UZAT) was not included in the analysis of surface to well advection time (SWAT), the identification of transport pathways that could modify the groundwater vulnerability focused on identifying constructed pathways that could reduce travel times in the saturated zone. These included the following:

- Clusters of deep wells (more than 5 wells within 100 m) that were constructed prior to 1990 (when the Ontario Wells Regulation (O. Reg. 903) made under the Ontario Water Resources Act set out minimum standards for the construction and decommissioning of all types of wells)
- Gravel pits and quarries that breach the upper confining unit
- Landfills located in former pits and quarries that reach through the upper confining unit.

Updates to the Grafton Drinking Water System in 2025 involved the application of the complete SWAT calculation, including the UZAT. The unsaturated (UZAT) and saturated (WWAT) travel times were summed and the total advective travel time (SWAT) results were classified into High (less than 5 years), Moderate (5 to 25 years) and Low (greater than 25 years) vulnerability ratings, as per the Technical Rules (MECP, 2021).

The results of the groundwater vulnerability assessment for the Grafton, Colborne, and Brighton municipal well systems are shown on Maps 5-29a through 5-31a. The range of groundwater vulnerability ratings in the WHPAs delineated for these systems is given in Table 5.2-23.

Amendment 6: Table 5.2-23 – Updated Vulnerability Ratings and Scores

5.2.2.8. Vulnerability Scores

The range of vulnerability scores assigned to the WHPAs delineated for the Grafton, Colborne, and Brighton municipal well systems is given in Table 5.2-23 and shown on Maps 5-29a through 5-31a.

Table 5.2-23: Vulnerability Scores for Grafton, Colborne, and Brighton Municipal Well Systems

System	Transport Pathways By WHPA					Range of Groundwater Vulnerability Ratings by WHPA				Range of Vulnerability Scores By WHPA				
	A	B	C	D	E	A	B	C	D	A	B	C	D	E
Brighton	-	-	Q	Q	N/A	High	High	Low-High	Low-Med	10	10	6-8	2-6	-
Colborne	-	-		L / Q	N/A	High	Low-High	Low-Med	Low-Med	10	6-10	2-8	2-4	-

System	Transport Pathways By WHPA					Range of Groundwater Vulnerability Ratings by WHPA				Range of Vulnerability Scores By WHPA				
	A	B	C	D	E	A	B	C	D	A	B	C	D	E
Grafton	-	-	-	-	-	Low	Low	Low~~-Med~~	Low	10	6	~~2-4~~ 2	2	-

[1] Q = Quarry; L = Landfill

Amendment 7: Table 5.2-24: Updated Uncertainty Rating by WHPA for the Grafton DWS.

Table 5.2-24: Uncertainty Ratings for Grafton, Colborne, and Brighton Municipal Well Systems

System	Uncertainty Ratings for WHPA Delineation					Uncertainty Ratings for Assignment of Vulnerability					Final Uncertainty Rating				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Brighton	Low	High	High	High	N/A	High	High	High	High	N/A	Low	High	High	High	N/A
Colborne	Low	High	High	High	N/A	High	High	High	High	N/A	Low	High	High	High	N/A
Grafton	Low	~~High~~ Low	~~High~~ Low	~~High~~ Low	N/A	~~High~~ Low	~~High~~ Low	~~High~~ Low	~~High~~ Low	N/A	Low	~~High~~ Low	~~High~~ Low	~~High~~ Low	N/A

Amendment 8: Updated Threat Numbers

Table 5.4-3: Summary of Significant Threats for Groundwater Systems in the Trent Source Protection Areas (Listed by System)

Drinking Water Threats		Minden	Lutterworth Pines	Cardiff	Dyno Estates	Alpine Village	Buckhorn Lake Estates	Norwood	Blackstock	Greenbank	Port Perry	Havelock	Grafton	Colborne	Brighton	Crystal Springs	Keene Heights	Millbrook	Stirling	Fraserville	Birch Point	Canadiana Shores	Janetville	Kings Bay	Manorview	Mariposa Estates	Victoria Glen	Pleasant Point	Pinewood	Sonya	Victoria Place	Woodfield	Woods of Manilla	TOTAL
No.	Prescribed Drinking Water Threats																																
1	The establishment, operation or maintenance of a waste disposal site within the meaning of Part V of the Environmental Protection Act	1						1				1		3					3														9
2	The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage	0	15	2	7	49	16	19	5	17	3	14	~~1~~	10	6	1	18	2	96	2	59	20	14	2	35	18		15	10	14	28	10	5	510
3	The application of agricultural source material to land					0		0	0	2				4	0	1			10	0			0	2			2		0		1			20
4	The storage of agricultural source material					0	0	0	0	0						0	0	0	3				0											3
5	The management of agricultural source material																																	0
6	The application of non-agricultural source material or biosolids to land								0										1															1
7	The handling and storage of non-agricultural source material or biosolids																		0															0

Drinking Water Threats		Minden	Lutterworth Pines	Cardiff	Dyno Estates	Alpine Village	Buckhorn Lake Estates	Norwood	Blackstock	Greenbank	Port Perry	Havelock	Grafton	Colborne	Brighton	Crystal Springs	Keene Heights	Millbrook	Stirling	Fraserville	Birch Point	Canadiana Shores	Janetville	Kings Bay	Manorview	Mariposa Estates	Victoria Glen	Pleasant Point	Pinewood	Sonya	Victoria Place	Woodfield	Woods of Manilla	TOTAL
8	The application of commercial fertilizer to land								0	3													0	1										3
9	The handling and storage of commercial fertilizer																																	0
10	The application of pesticide to land					0			0	2					0	1	2		0	1			0	1		8	2		0		1	0		18
11	The handling and storage of pesticide							0	0																									0
12	The application of road salt																																	0
13	The handling and storage of road salt	29																																29
14	The storage of snow	4	1					10				14																						29
15	The handling and storage of fuel	10	5	1	7	1	2	5	0	0	1	5		6		1	0	2	9		9	9	1		2	1		8	4	1	12	1		103
16	The handling and storage of a dense non-aqueous phase liquid	3						5	0			1	2	8				5	6															30
17	The handling and storage of an organic solvent	1						1						1					1															4
18	The management of runoff that contains chemicals used in the de-icing of aircraft																																	0
21	The use of land as livestock grazing or pasturing land, an outdoor confinement					1		0	0	1				1		0			16	0			0				1				1			21

Drinking Water Threats		Minden	Lutterworth Pines	Cardiff	Dyno Estates	Alpine Village	Buckhorn Lake Estates	Norwood	Blackstock	Greenbank	Port Perry	Havelock	Grafton	Colborne	Brighton	Crystal Springs	Keene Heights	Millbrook	Stirling	Fraserville	Birch Point	Canadiana Shores	Janetville	Kings Bay	Manorview	Mariposa Estates	Victoria Glen	Pleasant Point	Pinewood	Sonya	Victoria Place	Woodfield	Woods of Manilla	TOTAL
	area, or a farm- animal yard																																	
22	The establishment and operation of a liquid hydrocarbon pipeline.																																	
Total No. Significant Prescribed Drinking Water Threats		48	21	3	14	51	18	41	5	25	4	35	~~1~~ 2	33	6	4	20	9	145	3	68	29	15	6	37	27	5	23	14	15	43	11	5	780
Total No. Parcels Affected by Significant Prescribed Drinking Water Threats		34	18	2	7	51	18	35	5	21	3	32	~~1~~ 2	21	6	3	20	9	121	3	59	24	14	4	35	25	2	15	10	14	29	10	3	652
Local Drinking Water Threats																																		
None																																		0
TOTAL (All Significant Drinking Water Threats)																																		
Total No. Significant Drinking Water Threats		48	21	3	14	51	18	41	23	25	4	35	~~1~~ 2	33	6	4	20	9	145	3	68	29	15	6	37	27	5	23	14	15	43	11	5	780
Total No. Parcels Affected by Significant Drinking Water Threats		34	18	2	7	51	18	35	8	21	3	32	~~1~~ 2	21	6	3	20	9	121	3	59	24	14	4	35	25	2	15	10	14	29	10	3	652

Note: the total number of affected parcels may be less than the total number of drinking water threats because more than one threat may occur on some parcels

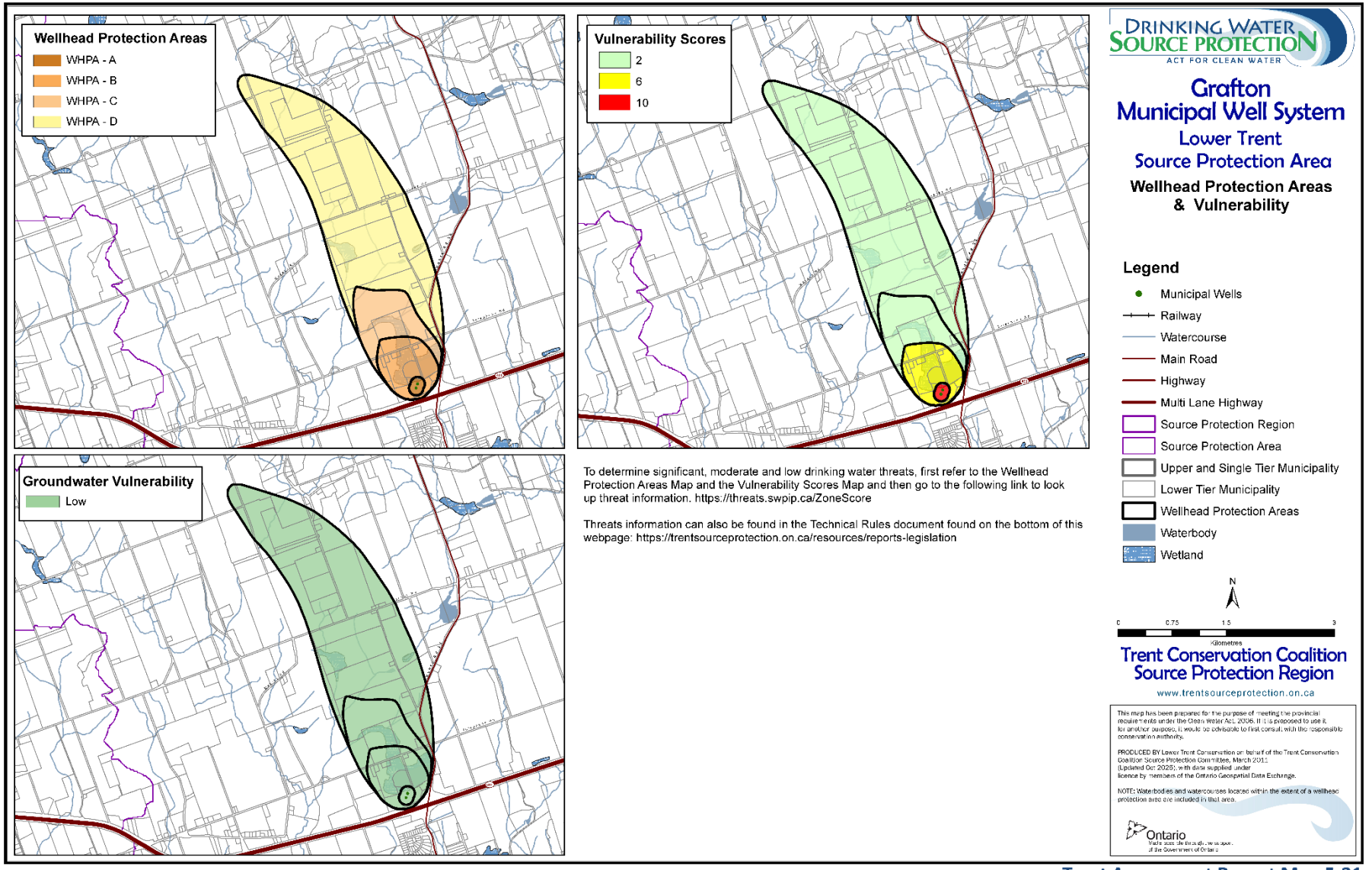
Amendment 9: Appendix F, Groundwater Systems: Water Quality Risk Assessment, Vulnerability Assessment: Updated list of background reports

Aqua Insight Inc., Source Protection Study for the Community of Grafton, Ontario, September 2025

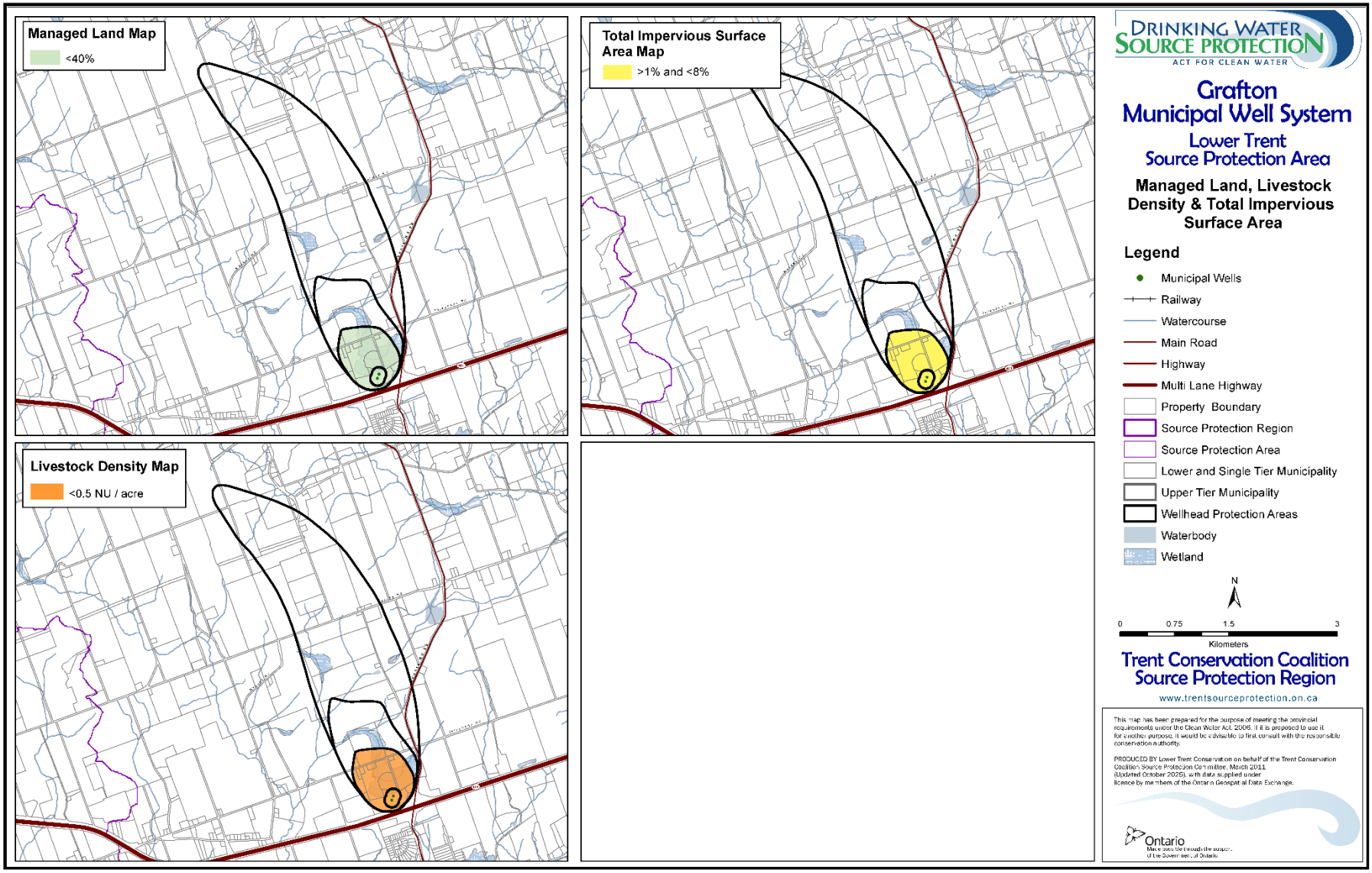
Amendment 10: Appendix G, Section 34 Approval Letter

[To be included in Appendix following approval of S.34 amendment submission to MECP.]

Amendment 11: Map 5-31a, Map 5-31b – Updated to reflect new WHPA



Trent Assessment Report Map 5-31a



Trent Assessment Report Map 5-31b