Summary of Proposed Amendments to the Trent Source Protection Plan and Assessment Report – King's Bay Drinking Water System

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

DATE TBA

The City of Kawartha Lakes is revising the Wellhead Protection Area (WHPA) for the King's Bay Drinking Water System (DWS) due to the installation of a new well. These upgrades have resulted in the Proposed Amendments to the Trent Source Protection Plan (SPP) and Assessment Report (AR) (last updated and approved DATE) 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 (to be provided).
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.
2. Table 5.1-3: Updated average annual pumping rate.
3. Section 5.2.2.1.2:
4. Section 5.2.2.2.?:
5. Table 5.2-9: Updated range of vulnerability scores
6. Table 5.2-10: Updated uncertainty ratings
7. Table 5.4-3: Updated the threat totals

AR: Volume 2

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

AR: Volume 3

10. Maps TBD

Other sections to be added as needed.

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
			1	2	3	4	5			
Kawartha-Haliburton Source Protection Area										
Canadiana Shores	North side of Lake Scugog	3	13.4	23.2	20.1	NA	NA	Yes	Sodium hypochlorite	Dual media (anthracite/silica sand) gravity filters, 1micron absolute filtration,
Janetville	Janetville	3	36.5	50	51	NA	NA	No	Sodium hypochlorite	Iron sequestration (sodium silicate)
King's Bay	West side of Lake Scugog	4~~3~~	17.4	17.4	17.7	18.3~~NA~~	NA	No	Sodium hypochlorite	
Manorview	Bethany	2	24.4	25	NA	NA	NA	Yes	UV irradiation	Cartridge filtration
Mariposa Estates	West side of Lake Scugog	2	15.5	25.2	NA	NA	NA	No	Sodium hypochlorite	Nitrate removal softening system

System Name	Well(s)								Water Treatment System	
	Location	No. Wells	Depths (m)					GUDI Status	Disinfection	Other Available Treatment Details
			1	2	3	4	5			
Omemee	Omemee	2	9.5	9.1	NA	NA	NA	No	Sodium hypochlorite	Iron sequestration
Pleasant Point	North side of Lake Scugog	2	15.2	17.1	NA	NA	NA	Yes	UV irradiation	1 micron cartridge filtration

Table 5.1-3: Pumping Rates for Existing Municipal Residential Groundwater Systems in the Trent Source Protection Areas

System Name	Monthly Average Pumping Rates (m^3/day)[1]												Average Annual Pumping Rate (m^3/day)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Kawartha-Haliburton Source Protection Area													
Canadiana Shores	58	66	63	64	77	68	72	64	56	52	52	58	62
Janetville	37	43	38	39	42	46	44	43	40	38	36	37	40
King's Bay	24	20	21	20	33	40	37	38	35	25	20	27	28
Manorview	19	17	17	19	23	27	19	20	21	18	15	15	19

System Name	Monthly Average Pumping Rates (m^3/day)[1]												Average Annual Pumping Rate (m^3/day)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Mariposa Estates	28	26	23	26	31	35	35	32	38	31	24	26	30
Omemee	38	40	32	34	36	38	32	43	35	33	36	39	36
Pleasant Point	54	54	54	62	76	82	73	70	62	59	65	62	64
Sonya	26	25	26	28	33	40	39	39	29	28	27	27	31
Woods of Manilla	47	46	46	47	60	75	66	59	51	45	44	46	53
Woodfield	13	14	13	14	16	18	17	16	14	11	11	14	14
Victoria Place	85	80	78	92	95	93	95	89	90	85	81	85	87
Blackstock	104	105	103	106	122	138	115	114	108	108	103	102	110
Greenbank	134	136	126	125	143	156	144	138	131	127	124	127	134

5.2.2 Results for Existing Municipal Systems

5.2.2.1.1 Time of Travel Methods

The groundwater vulnerability studies for the existing municipal groundwater systems used a three-dimensional groundwater flow model to calculate time of travel. The models used were based on the MODFLOW model platform, which is one of the industry standards for constructing numerical groundwater flow models.

MODFLOW uses a finite-difference method developed by the United States Geological Survey to simulate groundwater flow patterns. The numerical models take into consideration rainfall (recharge), interactions with surface water features, porosity of the geological unit, thickness of the geological unit, and ability of the geological unit to conduct water (hydraulic conductivity).

Considering all of these factors requires complex and repetitive analysis best undertaken by a computer. The models prepared in the Trent source protection areas try to simplify and reduce the Earth's layers and surface features in a digital three-dimensional space. The layers in the model are representative of the unconsolidated materials (sands, gravels, clay, etc.) and consolidated bedrock, such as granites and gneisses of the Precambrian Shield area and/or the limestones and shales of the Paleozoic era. Digital data availability in Ontario has improved considerably in the past 10 years with easy access to precipitation data, topographic data, geological data, and water well information. All these data are manipulated by geoscientists and engineers to best represent known and inferred conditions.

A total of 19 separate models were used to establish groundwater vulnerability for the 32 municipal well systems in the Trent source protection areas. More than one community was included in a model if the communities were close to each other and had similar geologic conditions.

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

5.2.2.2. City of Kawartha Lakes Municipal Residential Well Systems

The City of Kawartha Lakes operates the following 13 municipal residential well systems in the Trent source protection areas:

- Birch Point
- Canadiana Shores
- Janetville
- King's Bay
- Manorview
- Mariposa Estates
- Pinewood
- Pleasant Point
- Sonya

- Victoria Glen
- Victoria Place
- Woodfield
- Woods of Manilla

Water is obtained for these systems from a total of 6 bedrock wells and 26 overburden wells. In this area, 7 of the 32 wells are deemed to be GUDI. These systems are summarized in Table 5.2-5 along with the groundwater flow models used to delineate each WHPA.

5.2.2.2.1 Wellhead Protection Area Delineation

A consistent WHPA delineation methodology was used for the groundwater systems in the City of Kawartha Lakes. Each WHPA was delineated using a three-dimensional groundwater flow model based on the MODFLOW 2000 simulation code. Six regional groundwater models were developed to delineate WHPAs for these municipal systems; these models are summarized in Table 5.2-5.

Where a sub-regional model was developed for more than one municipal well system, model refinements made to improve the calibration at each municipal well system were incorporated into the sub-regional model. The data source for the sub-regional models was either Version 2 (8 layer) or Version 2.1 (12 layer) of the CAMC- YPDT hydrostratigraphic model. No modifications to the models were made.

The WHPAs delineated for the municipal systems in the City of Kawartha Lakes are shown on Maps 5-1a through 5-13a (for WHPA A-D). For systems with GUDI wells, the WHPA E is shown on the following maps: 5-2d (Canadiana Shores), 5-5d (Manorview), and 5-8d (Pleasant Point). Note that although well #3 in Sonya is considered to be GUDI, there is no surface water feature nearby to short-circuit contaminants to the relevant well. Therefore, in accordance with Technical Rule 49(3), this condition would preclude the use of WHPA E for the Sonya well system.

Table 5.2-5: Summary of Regional Groundwater Models for City of Kawartha Lakes Systems

Regional Model	Municipal Well System(s)	Data Source
Woodville / Woods of Manilla	Woods of Manilla	CAMC-YPDT Version 2 (8 layer)

Regional Model	Municipal Well System(s)	Data Source
Southwest	Sonya Mariposa Estates King's Bay Pleasant Point Canadiana Shores	CAMC-YPDT Version 2.1 (12 layer)
South	Janetville Pinewood Woodfield Manorview	CAMC-YPDT Version 2 (8 layer)
East	Victoria Place Birch Point	CAMC-YPDT Version 2 (8 layer)
Victoria Glen	Victoria Glen	CAMC-YPDT Version 2 (8 layer)

Note: – Other sections included for reference:

5.2.2.2.2 2019 Pinewood Wellhead Protection Studies Updates

City of Kawartha Lakes amended Pinewood Drinking Water System by removing existing well #2 and Well #3 from the system and adding a new production well #5 to the drinking water system. It is to be noted that bot well #2 and well #3 extracts water from the upper aquifer, also known as Oak Ridges Moraine Aquifer Complex (ORAC), whereas the new production well #5 and existing well #4 are screened within the deep aquifer known as the Thorncliffe Aquifer Complex (TAC). Updated wellhead protection studies were completed in April 2019 for Pinewood Well System.

The consultant hired by the city postulated that original modelling scenario, where well #4 pumping at the maximum permitted (i.e. 587,520 L/day), essentially illustrates concentric rings emulating out of the pumping well (i.e. Well #4), representing the theoretical Theis' (1935) model solution for homogeneous, infinite- acting radial flow. They further postulated that a second deep well introduced in the model at the location of Well #5, pumped at 587,520 L/day, implicitly would yield the same set of concentric rings emulating out from Well #5; and go on to state that by super positioning the WHPAs generated for Well #4 on to the position of Well #5, it is possible to obtain the maximum extent groundwater capture, regardless of whether pumping occurs from Well #4 or Well #5.

The composite WHPA incorporates the greatest combined extent for each time of travel zone by overlaying the capture zones for Well #4 and Well #5.

5.2.2.2.3 2019 Canadiana Shores Wellhead Protection Studies Updates

City of Kawartha Lakes amended Canadiana Shores Drinking Water System by removing existing supply well 1 from the system and replacing it with the replacement supply well 1 (Northing: 4896713 m; Easting: 73229 m). This replacement well 1 is located 8 m to the west of the existing supply well 1, thus shifting the WHPA-A for the new well 8 m westwards and thereby overlapping more with the WHPA-A of the other two supply wells.

Consultant hired by the city reviewed the previously conducted model study produced by GENIVAR Consultants LP in March 2010 and found that the replacement well 1 is applied to the same model grid as the existing supply well 1. It was also determined that the replacement well 1 is screened at the same geological unit as the existing supply well 1. Given the similarities in the well performance, water quality, and the fact that the pumping rates will remain the same in addition to the above assessment, the consultant concluded further modelling is not warranted to delineate WHPA B through E and vulnerability scoring.

5.2.2.2.4 2024 King's Bay Wellhead Protection Studies Updates

King's Bay Golf Club Limited c/o Geranium proposed to further develop King's Bay Golf Club site located near Seagrave, in the City of Kawartha Lakes. Ontario. The proposed development is 51.07 ha, of which 5.83 ha will be devoted to the development of the proposed 46 lots for single detached homes. This is in addition to the existing 111 homes in the area of development.

There is currently enough water to supply the existing homes and additional housing. However, as per the municipal requirements, an additional potable water source (a new municipal well) was drilled to provide firm capacity to the site. The proposed residential redevelopment will rely on groundwater as water supply source, consistent with the 111 existing homes in the area of development.

WSP Canada Inc. (WSP) was retained by King's Bay Golf Club Limited to carry out a water supply investigation for the proposed redevelopment. As per the source water protection requirements of the Clean Water Act (2006), a study was initiated by WSP to meet the source water protection requirements, and include delineation of wellhead protection areas, groundwater vulnerability analysis, and threat assessment by including the new supply well (well #4) as a municipal water supply source. This work was undertaken as per 2021 Technical Rules under the CWA.

5.2.2.2.45 Groundwater Vulnerability Assessment

An aquifer vulnerability index method was used to determine groundwater vulnerability for each of the 13 municipal systems in the City of Kawartha Lakes. Each of the 8 or 12 model layers was categorized as either an aquifer or an aquitard according to the designations developed for the Conservation Authorities Moraine Coalition in 2006. The aquifer vulnerability index was calculated as a sum of the thickness of each layer multiplied by a K-Factor of either 1 for an aquifer or 4 for an aquitard.

The presence of transport pathways identified in the WHPAs resulted in modifications to the vulnerability assignments of most of the municipal systems. The majority of the transport pathways identified in the City of Kawartha Lakes systems were private water wells. Transport pathways

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The results of the groundwater vulnerability assessments for municipal well systems in the City of Kawartha Lakes are shown on Maps 5-1a through 5-13a. The range of groundwater vulnerability ratings in the WHPAs delineated for these systems is given in Table 5.2-7.

5.2.2.2.6~~5~~ 2019 Pinewood Wellhead Protection Studies Updates

As per the original study (Genivar, March 2010), groundwater (vertical) vulnerability was assessed by calculating Aquifer Vulnerability Index (AVI) based on the CAMC/YPDT regional hydrostratigraphic interpretations.

However, since well #2 and well #3 (upper aquifer wells) were removed from the system, only the AVI values pertinent to the deep aquifer (supporting well #4 and well 35) were considered in the vertical vulnerability assessment over the WHPA footprint.

5.2.2.2.7~~6~~ 2019 Canadiana Shores Wellhead Protection Studies Updates

The replacement well is screened within the same geological unit as the replaced well. Therefore, the aquifer vulnerability mapping remains unchanged due to the replacement well and as such no new delineations are warranted.

5.2.2.2.8 2024 King's Bay Wellhead Protection Studies Updates

As per the consultants (WSP) information, an additional well was needed to satisfy the firm capacity requirements of the new development. In this case, the existing wells have the capacity to meet demands, but redundant capacity is needed. During the consultants' 2021 hydrogeological investigation, it was determined that well TW21-3 (well #4), completed in the King's Bay Aquifer, could be used as a municipal water supply source.

In order to provide a conservative approach and consistency with existing WHPA development, the pumping rates (in L/day) used to determine WHPA are based on total permitted takings of the existing wells. In this case, 4 scenarios were run with one well off during each scenario as summarized in the following table:

Scenario	Well #1	Well #2	Well #3	TW21-3 (Well #4)	Notes
1	123840	110880	176752	0	Existing wells operating
2	123840	110880	0	176752	TW21-3 replaces Well #3
3	123840	0	176752	110880	TW21-3 replaces Well

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					#2
4	0	110880	176752	123840	TW21-3 replaces Well #1

For this study, the regional scale 3D southwest sub-regional model (Genivar, 2010) was used to develop WHPAs. The model domain encompasses an area of 136.6 km^2. As part of this study, the southwest sub-regional model was refined in the King's Bay area in accordance with field activities (including test well drilling and pumping test). The model was further refined during the model calibration, such that numerical model simulations reasonably reflect the observed field conditions. In general, there were no changes made to the aquifer geometry, stratigraphy and extent, though the hydraulic conductivity of a localized area of the aquifer around the King's Bay wellfield was increased to $5x10^{-4}$ m/s based on the calibration to the pumping test. The value assigned in the original southwest sub-regional model was $2x10^{-4}$ m/s.

A particle tracking method was used to delineate time of travel capture zones for the wells. To develop the time of travel capture zones, groundwater particles were released at the pumping wells in the model and backward tracked towards their source of recharge. At each well location, particles were released in all hydrostratigraphic units "open" to the wellbore. The time-related pathlines that are subsequently generated by the model from this analysis are then overlain and a single time of travel capture drawn around the "family" of pathlines generated at each well. This was completed for all four scenarios to develop a single time of travel capture zone. The resulting capture zone from this process represents the two-dimensional projection of the particle outlines to the ground surface. In order to account for some of the uncertainty in the capture zones, a factor of safety was applied, whereby, the capture zones were increased by 20% (using the pumping wells as the reference point, the width and length of the capture zones was increased by 20%). ~~To account for some of the uncertainty in the capture zones, a factor of safety was applied. The width and length of the capture zone is increased by 20% to account for some of the uncertainty in the hydraulic characteristics of the aquifer.~~

The final delineated WHPA-D was extended past the simulated particle tracks, recognizing that they were intersecting the numerical model boundary. The simulated particle tracks reach the river on the west side of the wells, and the lake on the east side of the wells, and do not travel past these features as the model grid past this point is inactive. The final WHPA-D shape adopted was delineated using professional judgement, giving consideration to:

1. The impact of proximity of model boundaries on the flow paths and travel times;
2. Uncertainty in the extent of the aquifer past the active model domain; and
3. Maintaining the simulated spacing between the 5 and 25-year capture zones when projecting past the active model domain (i.e. river to the west, lake to the east)

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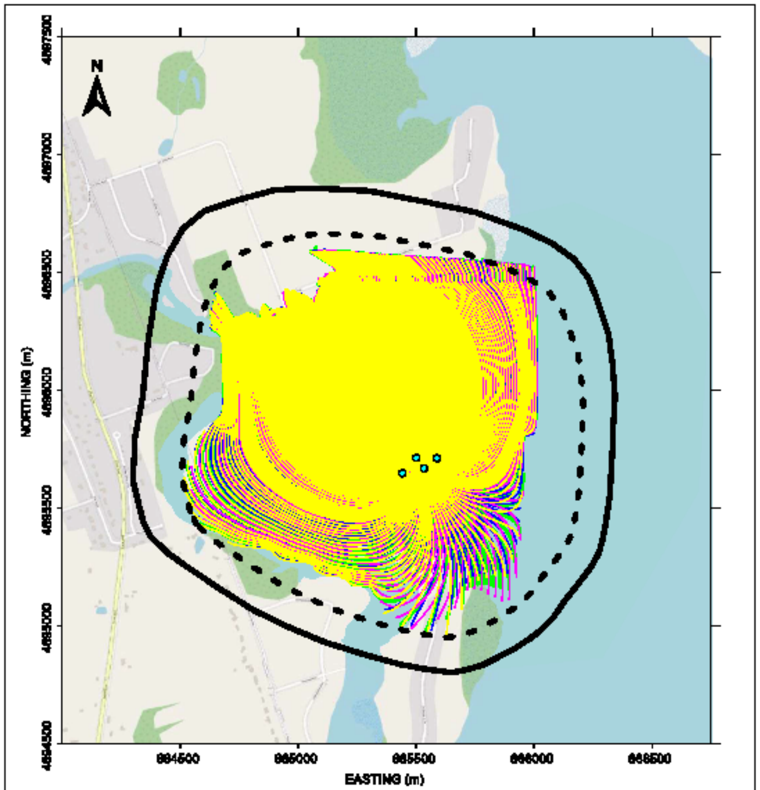
A figure illustrating the 25-year time-of-travel capture zone is shown below. The figure shows the time of travel particle tracks for all four scenarios along with the outline of the capture zone and the outline of the capture zone with the factor of safety applied.



LEGEND

- Scenario 1 Pathlines
- Scenario 2 Pathlines
- Scenario 3 Pathlines
- Scenario 4 Pathlines
- WHPA
- WHPA (20% Increase)
- Well

NOTE

1. Note that the final delineated WHPA-D was extended past the simulated particle tracks, recognizing that they were intersecting the numerical model boundary. The shape shown was delineated using professional judgement, giving consideration to;
   - The impact of proximity of model boundaries on the flow paths;
   - Uncertainty in the extent of the aquifer past the active domain
   - Maintaining the simulated spacing between the 5 and 25-year capture zone when projecting past the active model domain

CLIENT

KINGS BAY GOLF CLUB LTD. C/O GERANIUM

PROJECT

KINGS BAY GOLF CLUB REDEVELOPMENT
SOURCE WATER PROTECTION MODELLING

CONSULTANT

wsp

YYYY-MM-DD	2024-08-21
PREPARED	HW
DESIGN	HW
REVIEW	GP
APPROVED	GP

TITLE

WHPA-D with 25-Year Time of Travel Pathlines

PROJECT No.	Rev.	FIGURE
19116164(4400)	A	3

Field Code Changed

There is inherently uncertainty in the calibrated groundwater model due to variability in aquifer properties, continuity in aquitards, limitations in available subsurface information etc. To account for some of these uncertainty, various pumping scenarios were simulated at permitted pumping rates which are higher than average pumping rates typically used. This was the first step in a conservative approach to water quality protection. Secondly, a factor of safety was applied that effectively increases the spatial coverage of each time of travel related capture zone to account for some of the uncertainty in the hydraulic characteristics of the aquifer system supplying water to the well. This “uncertainty envelope” is considered to provide a practical and acceptable approach to account for uncertainty in the scientific methods being used to generate the capture zone and reflects the concept that available subsurface data is typically concentrated around the pumping well and within the aquifer of interest.

As indicated the uncertainty rating for the King’s Bay vulnerability assessment was previously high and is still considered high following the recent work at the site. While the above methods provide a conservative approach to protecting the water supply, the potential that variability in the subsurface conditions may result in an underestimate of the capture zones is still present.

In general, the conservative approach allows for a method to compensate for the uncertainty that is present. The uncertainty within WHPA-A would be considered low and increasing to high moving toward WHPA-D (i.e., the uncertainty increases with the distance away from the pumping wells, where less subsurface data is available).

The vertical vulnerability assessment was done using the Aquifer Vulnerability Index (AVI) method as per the original assessment. Since there were no changes in the stratigraphy of the conceptual model, the intrinsic vulnerability remained the same.

The WHPAs were overlain with the intrinsic vulnerability to produce vulnerability scoring maps, as per Table 4 in the Technical Rules (MECP, 2021)

Table 5.2-6: Summary of City of Kawartha Lakes Municipal Well Systems

System	Well	Aquifer Type	Geology	GUDI Status	Groundwater Flow Model
Birch Point	Well #3	confined to semi-confined	overburden	non-GUDI	East Sub-Regional
	Well #4	confined to semi-confined	overburden	non-GUDI	
Canadiana Shores	Replacement Well #1	unconfined to semi-confined	overburden	GUDI	Southwest Sub-Regional

System	Well	Aquifer Type	Geology	GUDI Status	Groundwater Flow Model
	Well #2	unconfined to semi-confined	overburden	GUDI	
	Well #3	unconfined to semi-confined	overburden	GUDI	
Janetville	Well #3	confined	overburden	non-GUDI	South Sub-Regional
	Well #4	confined	overburden	non-GUDI	
	Well #5	confined	overburden	non-GUDI	
King's Bay	Well #1	confined to semi-confined	overburden	non-GUDI	Southwest Sub-Regional
	Well #2	confined to semi-confined	overburden	non-GUDI	
	Well #3	confined to semi-confined	overburden	non-GUDI	
	Well #4	confined to semi-confined	overburden	non-GUDI	
Manorview	Well #1	semi-confined	overburden	GUDI	South Sub-Regional
	Well #2	semi-confined	overburden	GUDI	
Mariposa Estates	Well #2	confined to semi-confined	overburden	non-GUDI	Southwest Sub-Regional
	TW1-03	confined to semi-confined	overburden	non-GUDI	

Table 5.2-7: Vulnerability Scores for City of Kawartha Lakes Municipal Residential Well Systems

System	Well(s)	Method 1	Transport Pathways by WHPA2					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
Birch Point	All	AVI	-	-	-	-	N/A	High	High	High	High	10	10	8	6	N/A
Canadiana Shores	All	AVI	-	-	-	W	-	Med-high	Low-high	Low-high	Low-high	10	6-10	4-8	2-6	5.6
Janetville	All	AVI	-	-	-	-	N/A	Low	Low	Low	Low	10	6	4	2	N/A
King's Bay	All	AVI	-	-	-	-	N/A	Med-high	Med-high	Med-high	LowMed-high	10	8-10	6-8	24-6	N/A
Manorview	All	AVI	-	-	-	-	-	Med-high	Med-high	Med-high	Low-high	10	10	4-8	2-6	5.6
Mariposa Estates	Well #2	AVI	-	-	-	-	N/A	Med-high	Med-high	Med-high	Low-med	10	8-10	6-8	2-4	N/A
	TW1-03					W/Q	N/A	Med-high	Med-high	Med-high	Med-high	10	10	6-8	4-6	N/A
Victoria Glen	All	AVI	-	W	W	W	N/A	High	Med-high	Med-high	Med-high	10	8-10	6-8	4-6	N/A
Pleasant Point	Well #1	AVI	-	-	-	W	SUC	Med	Low-med	Low-med	Low-med	10	6-8	4-6	2-4	5.6

System	Well(s)	Method 1	Transport Pathways by WHPA2					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
	Well #2	AVI	-	-	-	W	D	Med	Low-med	Low-med	Low-med	10	6-8	4-6	2-4	5.6

Table 5.2-8: Uncertainty Ratings for City of Kawartha Lakes Municipal Residential Well Systems

Groundwater System	Method[1]	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**
Birch Point	AVI	Low	High	High	High	N/A	Low	High	High	High	N/A	Low	High	High	High	N/A
Canadiana Shores	AVI	Low	High	High	High	High	Low	High	High	High	High	Low	High	High	High	High
Janetville	AVI	Low	High	High	High	N/A	Low	High	High	High	N/A	Low	High	High	High	N/A
King's Bay	AVI	Low	High	High	High	N/A	Low	High	High	High	N/A	Low	High	High	High	N/A

5.3.2.4 King’s Bay

The drinking water issues evaluation for the King’s Bay municipal well system is summarized in Table 5.3-7, which lists the water quality parameters that exceeded the primary or secondary benchmarks and indicates whether or not they were considered issues and the rationale for the conclusion. No drinking water issues were identified. No upward trends were noted for the parameters present.

Table 5.3-7: King's Bay Water Quality Standards Exceedances

Parameter	Water Type[1]	Years on Record	Benchmark Exceedances			Standard		Extrapolation		Drinking Water Issue	Rationale
			Exceeds ODWQS	Above detection limit	Above local background level	Value	Type[2]	Trend	Exceed within 50 years		
Schedule 1											
Coliforms	Raw	2003/ 2004	Yes			0 cfu/100 mL	MAC	_	No	No	Rare exceedances in low numbers. Adequate treatment
Coliforms	Treated	2003/ 2004	Yes			0 cfu/100 mL	MAC	_	No	No	Adequate treatment
Schedule 2 & Table 4											
NDMA	Raw	2003/ 2004		Yes		0.009 ug/L	MAC	_	No	No	Rare exceedances in trace concentrations
Turbidity	Treated	2003/ 2004	Yes			5 NTU	OG	_	No	No	Rare exceedances in low numbers
Hardness	Raw		Yes			80 mg/L	OG				Naturally Occuring; frequent exceedance

[1]Indicates if the data on record is for raw (untreated) or treated water; [2]Standard types: MAC=Maximum Acceptable Concentration; AO=Aesthetic Objective; OG=Operational Guideline

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	511
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

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
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
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		8				5	6															28

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
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 area, or a farm- animal yard					1		0	0	1				1		0			16	0			0				1				1			21
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	33	6	4	20	9	145	3	68	29	15	6~~1~~	37	27	5	23	14	15	43	11	5	784~~79~~
Total No. Parcels Affected by Significant Prescribed Drinking Water Threats		34	18	2	7	51	18	35	5	21	3	32	1	21	6	3	20	9	121	3	59	24	14	4~~1~~	35	25	2	15	10	14	29	10	3	654~~1~~
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	33	6	4	20	9	145	3	68	29	15	~~1~~6	37	27	5	23	14	15	43	11	5	784~~79~~
Total No. Parcels Affected by Significant Drinking Water Threats		34	18	2	7	51	18	35	8	21	3	32	1	21	6	3	20	9	121	3	59	24	14	4~~1~~	35	25	2	15	10	14	29	10	3	654~~41~~

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

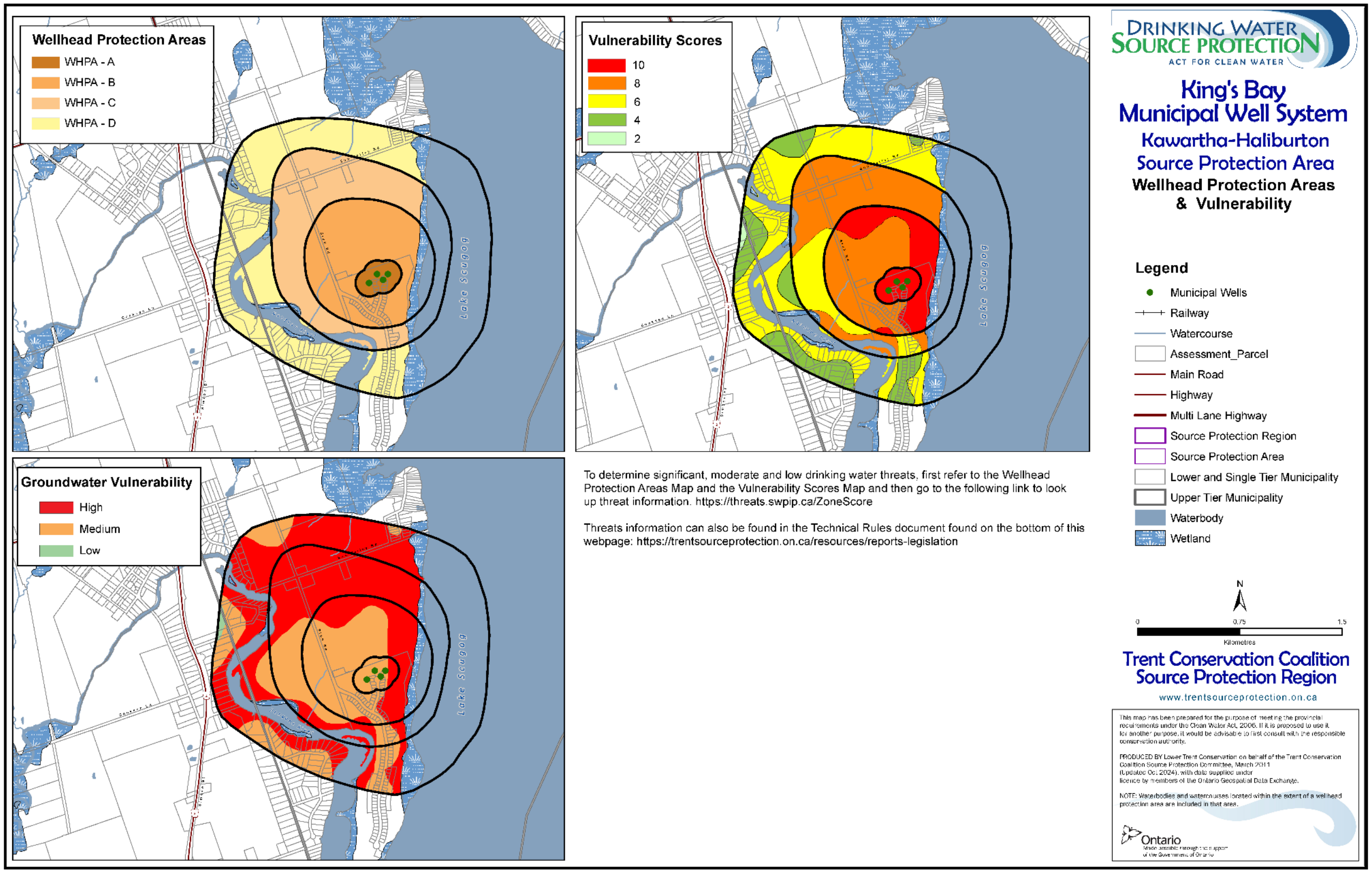
References:

WSP Canada Inc., 2024, Source Protection Vulnerability, Issues and Threats Assessment, King's Bay Golf Course Redevelopment, Seagrave, City of Kawartha Lakes, Ontario, Project Number 19116164 (4400), January 2024

Golder, A Member of WSP, 2022, Water Supply Investigation, King's Bay Golf Course Redevelopment, Seagrave, City of Kawartha Lakes, Ontario, Project Number 19116164, February 2022.

Golder, A Member of WSP, 2021, Geotechnical and Hydrogeological Investigations, King's Bay Golf Course Redevelopment, King's Bay, Township of Mariposa, Ontario, Project Number 19116164 (3000), December 2021.

Assessment Report: Volume 3 (Updated Map 5-4a, Map 5-4c has been removed)



Trent Assessment Report Map 5-4a