TABLE OF CONTENTS

LIST OF MAPS

LIST OF TABLES

13.0 COUNTY OF BRANT

13.1 County of Brant Water Quality Risk Assessment

Four municipal drinking water systems are located within the County of Brant within the Grand River Source Protection Area: Airport, Mount Pleasant, St. George, and Paris. Each system is solely sourced by groundwater. **Table 13-1** and **Table 13-2** provide information for each of these systems.

The 2017 municipal serviced areas are presented on **Map 13-1** for the Airport, Mount Pleasant, St. George and Paris drinking water systems.

Table 13-1: Drinking Water System Information for the County of Brant Municipal Residential Drinking Water Systems in the Grand River Region

DWS Number	MDWL/DWWP Name	Operating Authority	GW or SW	System Classification[1]	Number of Users served[2]
220002743	Airport Drinking Water System	County of Brant	GW	Large Municipal Residential System	764
210000069	Mount Pleasant Drinking Water System	County of Brant	GW	Large Municipal Residential System	1,801
220002734	St. George Drinking Water System	County of Brant	GW	Large Municipal Residential System	3,572
220002752	Paris Drinking Water System	County of Brant	GW	Large Municipal Residential System	12,651

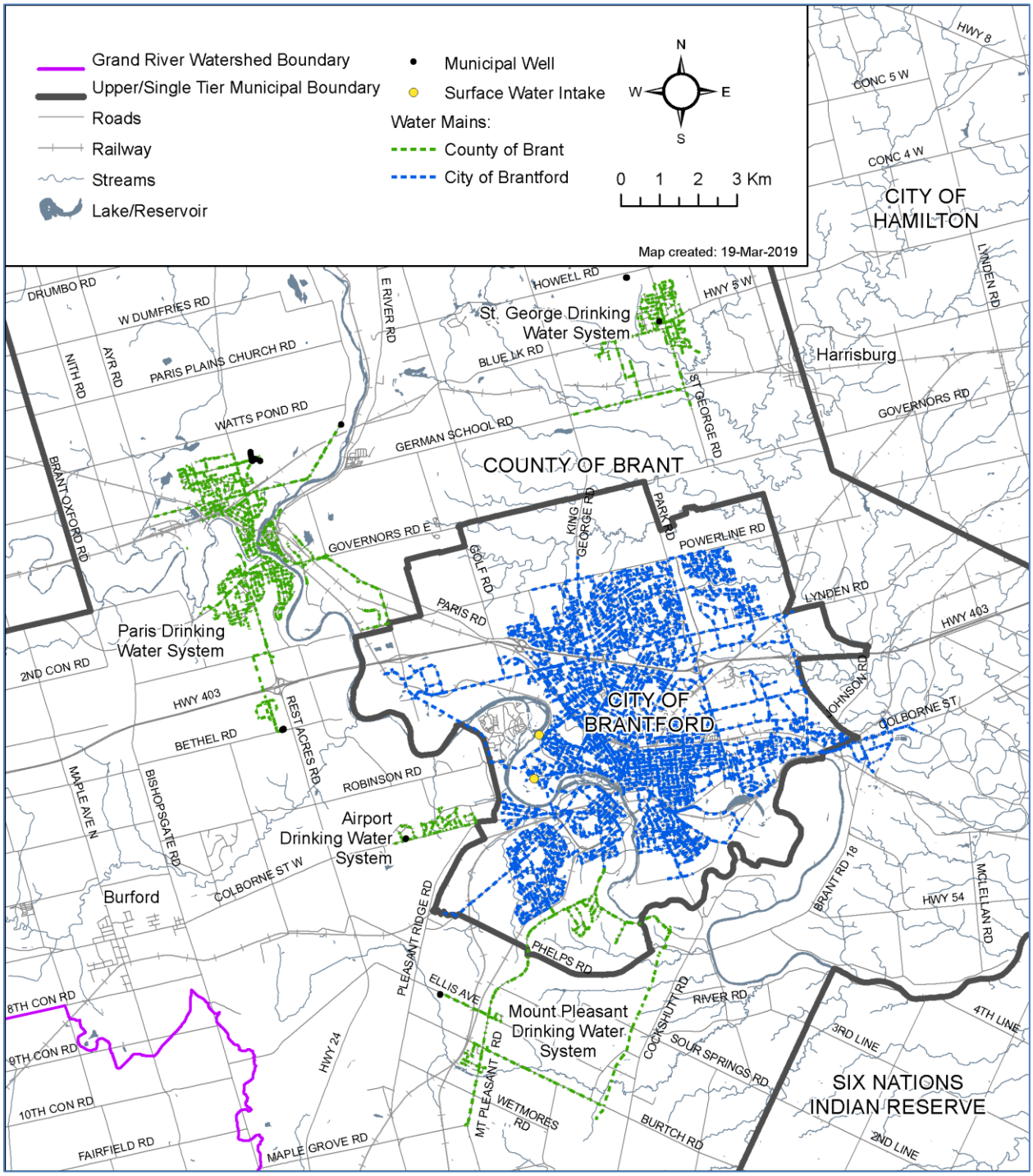
1 as defined by O. Reg. 170/03 (Drinking Water Systems) made under the Safe Drinking Water Act, 2002.
2 County of Brant, 2017

Table 13-2: Annual and Monthly Average Pumping Rates for the County of Brant Municipal Residential Drinking Water Systems in the Grand River Region

Well	Annual Avg. Taking (m^3/d)	Monthly Average Taking[1] (m^3/d)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Airport													
Well 1	240	174	172	171	186	233	334	369	343	323	234	170	166
Mount Pleasant													
Well 1	391	308	292	259	267	364	574	550	454	580	389	340	320
Well 2	382	269	267	276	311	369	512	519	605	539	366	260	295
St. George													
Well 1	388	317	296	285	403	398	528	427	351	476	333	439	398
Well 2	367	295	322	340	318	414	449	426	440	388	428	284	305
Well 3	108	105	97	86	94	130	109	96	80	130	104	76	82
Telfer Wellfield (Paris)													
P31 (Overburden)	239	265	276	230	162	222	316	271	235	271	163	183	239
P32 (Bedrock)	209	236	287	228	166	214	306	257	232	253	97	31	205
Gilbert Wellfield- Overburden (Paris)													
P210	158	86	244	232	178	201	186	136	144	221	85	97	86
P211	174	189	62	68	243	152	191	207	171	172	245	201	189
P212	48	11	73	6	93	110	59	106	3	0	0	0	11
P213	167	169	231	188	121	119	137	142	184	188	179	181	169
P214	375	360	196	640	377	606	577	545	202	212	10	413	360
P215	628	524	836	308	760	506	633	556	837	846	659	546	524
Gilbert Wellfield- Bedrock (Paris)													
P28	1548	1165	1704	1591	1720	1934	1606	1059	1614	1616	1557	1559	1454
P29	566	875	376	516	577	379	833	1219	460	493	364	375	321
Bethel Road Wellfield (Paris)													
P51	70	72	70	63	70	69	77	62	78	68	65	76	67
P52	61	49	43	41	49	60	48	34	45	48	47	201	62
P53	74	72	74	63	77	91	74	61	73	79	70	81	73
P54	74	80	76	74	79	57	83	64	85	77	79	66	73

1 Source: Supervisory Control and Data Acquisition (SCADA), 2017

Map 13-1: Brant County and City of Brantford Water Supply Serviced Areas



13.1.1 Airport Well Supply

The Airport wellfield is operated by the County of Brant, and services the surrounding area (referred to as the "Airport/Oak Hill" service area). The wellfield is located 6 km west of the Brantford town centre, at the intersection of Colborne Street West (County Road 53) and Airport Road.

The serviced area for the Airport well supply is shown on **Table 13-1**. The wellfield currently consists of one operational pumping well (W1) that services approximately 272 residences and 25 commercial water users as of end of 2017 according to the County of Brant Airport Drinking Water System Annual Report. A second pumping well (W2) was constructed in 2014 to meet projected future demands in addition to providing redundancy during maintenance and fire flow conditions. Well W2 is in the process of being connected to the existing water distribution system, and is anticipated to be brought online in 2019.

Well W1, constructed in 1967, is screened between 29.8 and 34.6 m bgs in an unconfined overburden aquifer. Well W2 is screened in the same unconfined aquifer between 30.1 and 34.2 m bgs. Neither of the wells are classified as groundwater under the direct influence of surface water (GUDI) as per the criteria outlined in MOECC (2001).

The serviced area associated with the Airport Well is shown in **Map 13-1**. Well W1 services approximately 272 residences and 25 commercial water users as of the end of 2017 according to the County of Brant Airport Drinking Water System Annual Report. A recent Municipal Class Environmental Assessment indicated that the existing average and maximum day demands on the system are 3.0 and 8.3 L/s, respectively (GM BluePlan, 2015).). The hydrostratigraphic interpretation at the Airport well site and surrounding area indicates that the aquifer supplying the municipal wells is unconfined (Earthfx, 2017). The aquifer consists mainly of sand, gravel and silt with these sediments extending to ground surface. At the municipal well site, the aquifer is approximately 25 m in thickness and includes a significant component of fine to coarse sand and gravel. Currently, Well W1 is permitted to operate at a maximum rate of 27.3 L/s. The average daily reported pumping rate from 2009 to 2014 has been considerably lower at 2.42 L/s. Well W2 is permitted to operate at a maximum of 30.8 L/s. The maximum permitted rate for the Airport municipal supply system is therefore 58.1 L/s.

13.1.2 Mount Pleasant Well Supply

The municipal groundwater supply system for Mount Pleasant is located at 328 Ellis Avenue,. There are two production wells at the site, referred to as Well 1 and Well 2. Both wells are within a single pump house located approximately 1.3 km northwest of the village.

Well 1 was constructed in 1981 and screened from 29.6 to 36.0 m bgs in an unconfined sand plain / outwash aquifer defined as a part of the Whitemans Tier 3 hydrostratigraphic model (EarthFX, 2017). Well 2 was constructed in 1995 and screened in the same aquifer as Well 1 from 29.6 to 35.7 m bgs. Neither of the wells are classified as GUDI as per the criteria outlined in MOECC (2001). Currently, the wells are permitted to operate at a daily average and daily maximum rate of 26.5.L/s. Total production from the wellfield has been consistently between 7 to 10 L/s when averaged on a daily basis.

The serviced area for the village of Mount Pleasant is shown in **Map 13-1.** The Mount Pleasant water supply system services approximately 627 residences and 25 commercial water users according to the 2017 County of Brant Mount Pleasant Drinking Water System Annual Report. The Mount Pleasant drinking water system source aquifer is primarily composed of the extensive unconfined glaciolacustrine deposits of the Norfolk Sand Plain. There is some local confinement

in the vicinity of the wellfield, the Wentworth Till Aquitard. Across the majority of this area, the sand plain aquifer is in direct contact with the underlying sands and gravels of the Grand River Valley outwash aquifer, effectively forming a single unconfined sand and gravel aquifer unit with a thickness up to 65 m (Earthfx, 2018).

13.1.3 St. George Well Supply

The St. George municipal supply system is located near the centre of the village as presented on **Map 13-1**, and consists of three overburden production wells: Well 1, Well 2 and Well 3. The three wells are currently operated out of a single pump house located at 20 Church Avenue in St. George. According to the County of Brant 2017 Annual Drinking Water Report, the wells service approximately 1,268 residences, 115 commercial accounts, and one bulk truck-fill station.

The overburden sediment thickness in the St. George area is estimated to vary from approximately 20 to 70 m, with the three overburden wells screened within these sediments from 15 to 23 m bgs.

The rated capacity of the existing municipal wells is limited to 9,961.9 m³/d or an annual daily average of 6,030.7 m^3/d as set out by the current Permit to Take Water.

The community of St. George requires an additional water supply for redundancy and to support future growth. A Class Environmental Assessment for St. George Water Servicing identified the preferred alternative to be the construction of new bedrock test wells at a previous monitoring site located to the northwest of the community centre. The new wells are cased through 57 m of overburden and completed as open holes in the bedrock to 67 m bgs. A 65 hour pumping test indicated that the two wells were capable of producing 45 L/s, or 22.5 L/s per well. None of the municipal wells are considered GUDI.

At surface, an aquitard unit overlies a confined or semi-confined sand and gravel aquifer. The aquitard thickness in the vicinity of the municipal well site ranges from approximately 5 to 15 m. The underlying aquifer includes a sequence of sand, gravel and silt sediments up to approximately 40 m in thickness. A glacial till aquitard underlies the sand and gravel aquifer and overlies the bedrock subcrop. The bedrock surface in the St. George area has been mapped as dolostone belonging to the Guelph Formation.

13.1.4 Paris Well Supply

Gilbert and Telfer Wellfields

The two northern wellfields in the Paris service area include the Gilbert and Telfer wellfields, as presented on **Map 13-1.**

The Gilbert wellfield contains eight active production wells and is located in a low-lying area to the east of Grand River Street North and south of Watt's Pond Road. Wells P28 and P29 were constructed in 1990 and 1991, respectively, and are completed in the upper bedrock aquifer. Wells P210, P211, P212, P213, P214 and P215, also located at the Gilbert Wellfield, were constructed in 2001 and are completed in the upper overburden aquifer (sand/gravel). Wells P214 and P215 were brought on-line in 2001 and wells P210, P211, P212 and P213 were connected to the municipal supply system in 2008. The overburden wells at the Gilbert Wellfield are classified as GUDI with effective filtration because of the unconfined nature of the aquifer. The wells are considered GUDI only during a regional storm event.

The Telfer Wellfield is located adjacent to West River Road (approximately 300 m west of the Grand River) and includes two active production wells (P31, P32). Well P31 (constructed in 1965) is completed in the deep overburden sediments and P32 (constructed in 1974) is completed in the upper bedrock aquifer. An additional well referred to as P36 was constructed in 1996, but is currently not connected to the municipal system. The well is completed in the deep overburden sediments.

The County indicates that there were 4082 residential connections and 309 commercial connections in 2017.

The thickness of the overburden varies up to approximately 60 m and locally along parts of the Grand River the overburden is absent. The surficial overburden deposits are mostly sand and gravel. The overburden deposits occurring beneath the upper aquifer and extending to the bedrock surface have been identified as the intermediate unit. This unit can be separated into an intermediate overburden aquitard and a discontinuous intermediate overburden aquifer. The intermediate aquitard is present across the area and is composed mainly of till, which includes clay and stones, and sandy silt. The intermediate aquitard is absent locally within the Telfer well field. Within this area the upper aquifer extends to the bedrock surface. The aquitard is up to 60 m in thickness at other locations.

A buried bedrock valley is believed to exist north of the wells and runs in an east-west direction. The upper bedrock is referred to as the lower aquifer. The lithology of this unit (Salina Formation) includes shale, dolostone and gypsum/anhydrite.

Bethel Road Wellfield

The Bethel Road wellfield contains four active production wells (P51, P52, P53 and P54) and is located along Bethel Road, west of the intersection with Rest Acres Road and south of Paris (**Map 13-2**). The four wells are completed in intermediate to deep overburden sediments. The wells are screened in an unconfined aquifer. All four production wells at the Bethel Road wellfield are considered GUDI with effective filtration.

The source aquifer for the Bethel Road wellfield has an upper and lower unit which are partially separated by a till confining unit. The upper aquifer is composed of glaciolacustrine Norfolk Sands. The lower aquifer is composed of sand and gravel referred to as Waterloo Moraine equivalent sediments (EarthFX, 2017). To the north of the wellfield, the lower aquifer is confined by the Port Stanley Till; however, in the vicinity of the wellfield and to the south of the wellfield, the lower aquifer is unconfined resulting in connectivity between the upper and lower aquifer units.

Below the lower aquifer, the Maryhill Till aquitard and the older Catfish Creek Till aquitard provide vertical confinement for the deeper overburden and bedrock aquifers. The Salina Group (shale, dolostone, and gypsum/anhydrite) forms the bedrock aquifer below the Bethel Road wellfield.

There are three significant surface water features in the Bethel Road area, with the Grand River being the largest. The Grand River is located to the east of the wellfield; Whitemans Creek is located in the southern part of the area and flows in an easterly to north easterly direction eventually discharging into the Grand River. The Nith River is located north of the site and flows in an easterly direction discharging into the Grand River.

13.1.5 Vulnerability Assessment

WHPA Delineation for the Airport, Mount Pleasant and Bethel Road Drinking Water Systems

WHPAs for the Airport, Mt. Pleasant and Bethel municipal wellfields were delineated in 2018 using the Whitemans Creek Tier 3 numerical groundwater flow model (Earthfx, 2017). The Whitemans Creek Tier 3 groundwater flow model was developed using the U.S. Geological Survey (USGS) MODFLOW code (Harbaugh, 2005). The MODFLOW-NWT (Niswonger *et al.*, 2011) version of the code was employed in the Whitemans Tier 3 study because it is well suited for representing thin aquifers and sharp changes in model layer stratigraphy such as those occurring along the incised valleys of Whitemans Creek and the Grand River. The Whitemans Tier 3 conceptual geologic model is comprised of 17 layers, which were used to generate a 12- layer groundwater flow model for the Whitemans Creek area. Refer to the Whitemans Creek Tier 3 Summary Chapter of this report for additional information on the Whitemans Creek Tier 3 groundwater flow model.

Groundwater recharge rates for the WHPA delineation were calculated using the PRMS hydrologic sub-model developed for the Whitemans Creek Tier 3 study (Earthfx, 2017a). The groundwater recharge rates reflect the effects of spatial variation in climate, topography, land cover, and soil properties.

To favour conservative WHPA delineations, pumping rates that reflected the largest expected takings from the municipal supply wells were used. This approach was applied to ensure that areas that fall within the WHPAs during periods of higher than average demands are also included in the final WHPA delineations.

Airport well W1 and well W2 are in close proximity to each other and therefore a single WHPA was delineated for both wells using a combined pumping rate of 46.4 L/s. This rate is representative of 80% of the combined maximum permitted rates for the 2 wells. WHPAs based on the specified time-of-travel zones (2, 5, and 25 years) were delineated using backwards particle tracking. The 25-year capture zone (WHPA-D) extends approximately 5 km to the southwest following the general directions of regional groundwater flow (**Map 13-2**).

Similarly, Mount Pleasant Well 1 and Well 2 are in close proximity to each other and therefore a single WHPA was delineated. Mount Pleasant WHPAs were simulated using a cumulative municipal pumping rate equivalent to 80% of the maximum permitted rate for the wellfield. A continuous rate of 10.6 L/s was applied to Well 1 and Well 2 for a combined rate of 21.2 L/s. The 25-year capture zone (WHPA-D) extends approximately 2.5 km west following the general direction of regional groundwater flow (**Map 13-2**).

For the Bethel Road wellfield WHPA, the Whitemans Creek Tier 3 model was updated to incorporate the Brant Business Park storm water management pond and infiltration gallery, located 300 m north of the wellfield. Manual water level data in the pond and infiltration gallery were used to understand the influence these features have on local groundwater flow patterns. The modelled recharge rates within the area included the contribution from the Brant Business Park infiltration gallery.

WHPAs for Bethel municipal wells P51, P52, P53, and P54 were delineated based on four different model configurations designed to investigate capture zone sensitivity. The scenarios are as follows:

1. Wellfield pumping rate set to the Whitemans Tier 3 allocated pumping rate (15.9 L/s); infiltration gallery not simulated;

2. Wellfield pumping rate set to the average instantaneous pumping rate between 2016 and 2018 (18.26 L/s); infiltration gallery not simulated;
3. Wellfield pumping rate set to the average instantaneous pumping rate between 2016 and 2018 (18.26 L/s); infiltration gallery simulated;
4. Wellfield pumping rate set to maximum available drawdown identified in Whitemans Tier 3 study (19.48 L/s); infiltration gallery simulated

The WHPAs were delineated based on the largest composite of the four sensitivity scenarios. The 25-year capture zone (WHPA-D), which extends approximately 1.5 km to the west upgradient of the general direction of regional groundwater flow, is approximately 1 km wide across the centre (**Map 13-2**).

A WHPA-E was not delineated for the Bethel municipal wells at this time as further information is required to do so. Work is currently ongoing to acquire the information to delineate a WHPA-E and will be completed as a Section 34 work plan in the near future.

WHPA Delineation for the St. George Drinking Water System

A numerical groundwater flow model and a hydrologic model for the Fairchild Creek subwatershed were developed to delineate WHPAs for the St. George Drinking Water System (EarthFX, 2018).

Groundwater recharge rates for the study area were estimated using the USGS PRMS hydrologic modelling code. The model was calibrated to match observed streamflow at Water Survey of Canada gauges on Fairchild and Spencer creeks. In addition, updated conceptual geologic and hydrostratigraphic models were developed as part of this study, which incorporated geologic datasets from the Ontario Geological Survey and previous work by EarthFX (2010).

Five pumping configurations were evaluated to investigate a range of operational conditions for the St. George wells by varying pumping rates and porosity. A composite WHPA was generated based on these scenarios. Separate WHPAs were delineated for the existing St. George supply wells (Wells 1, 2, 3) which are screened in the overburden, and the new supply wells (TW1/16 and TW2/16), which extend to the bedrock aquifer. Both WHPAs extend to the northwest, where they are limited by a groundwater divide across Galt Moraine. The St. George well supply WHPA is presented on **Map 13-3.**

WHPA Delineation for the Paris Drinking Water System (Gilbert and Telfer Wellfields)

WHPAs for the Gilbert and Telfer wellfields were generated using a calibrated numerical groundwater flow model developed for the Paris area (WNMC, 2011).The municipal overburden wells of north Paris are completed within the upper and intermediate aquifers and the municipal bedrock wells are completed within the Salina Formation.

With the model calibrated to existing conditions, the pumping rates were adjusted and the model was re-run to examine the extent of the hypothetical capture zone that would result under pumping the municipal wells at the forecast pumping rates. A backward particle tracking method was used to delineate the WHPAs for the Paris Drinking Water System.

The WHPAs for the north Paris wellfields were also delineated using a backward particle tracking method. The results indicated that the capture zones extend to the northwest up to 8 km. The north Paris overburden WHPAs have been combined with the north Paris bedrock WHPAs in **Map 13-3**.

Uncertainty in the Delineation of Wellhead Protection Areas

An uncertainty analysis related to the various components of each of the WHPA delineation studies was completed as there is a level of uncertainty associated with all subsurface analyses. A review of what is assessed during an uncertainty analysis (i.e. Technical Rules 13 and 14) is described in Chapter 3 of this Assessment Report.

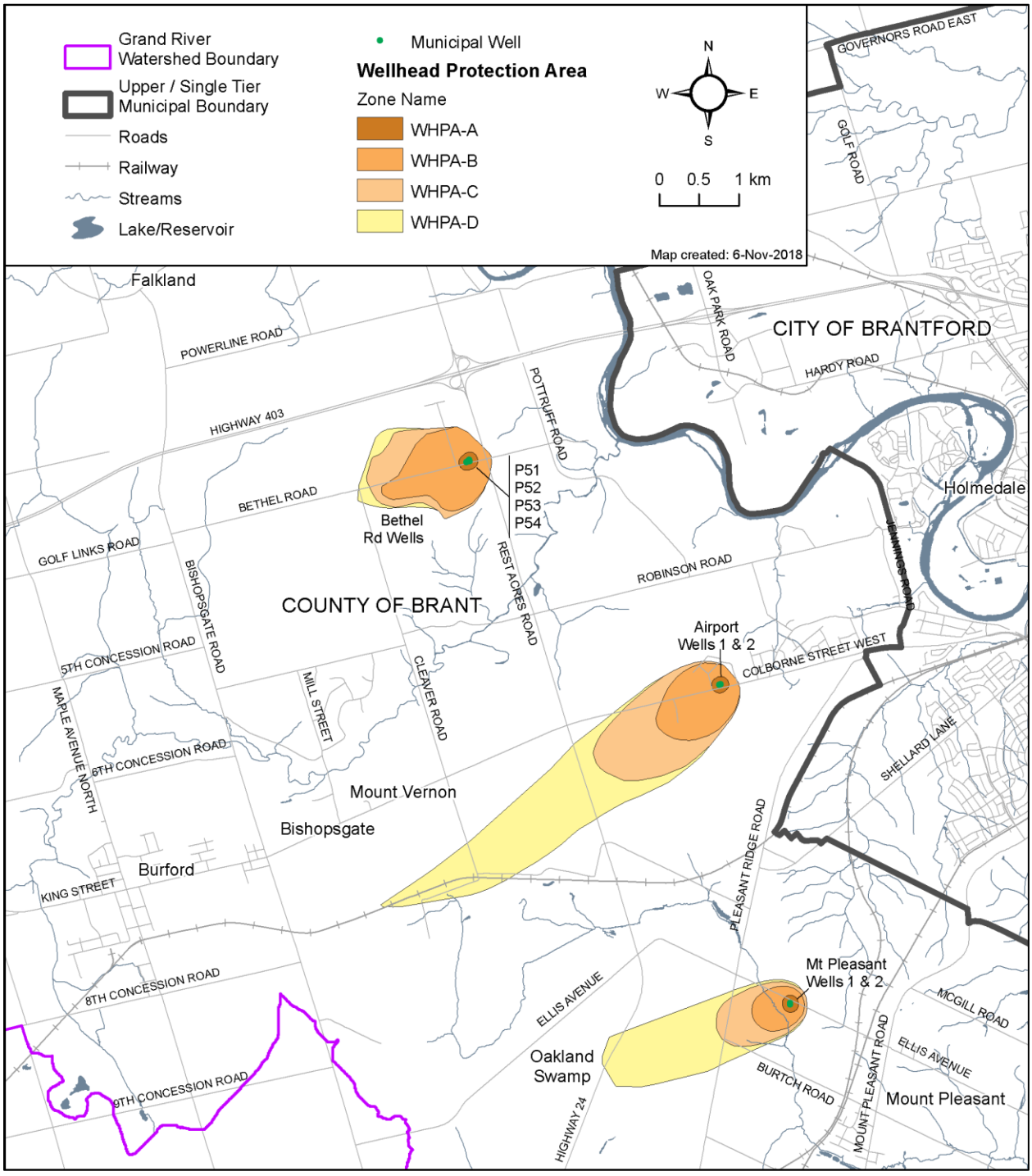
The overall uncertainty for the Airport WHPA delineation is low. Much of the low uncertainty in the groundwater flow patterns result from the relatively uniform composition of the municipal source aquifer.

A conservative approach to uncertainty analysis was used for the delineation of the Gilbert and Telfer wellfields which accounts for the intrinsic variations that naturally exist in hydrogeologic environments (i.e. hydraulic conductivity and recharge).

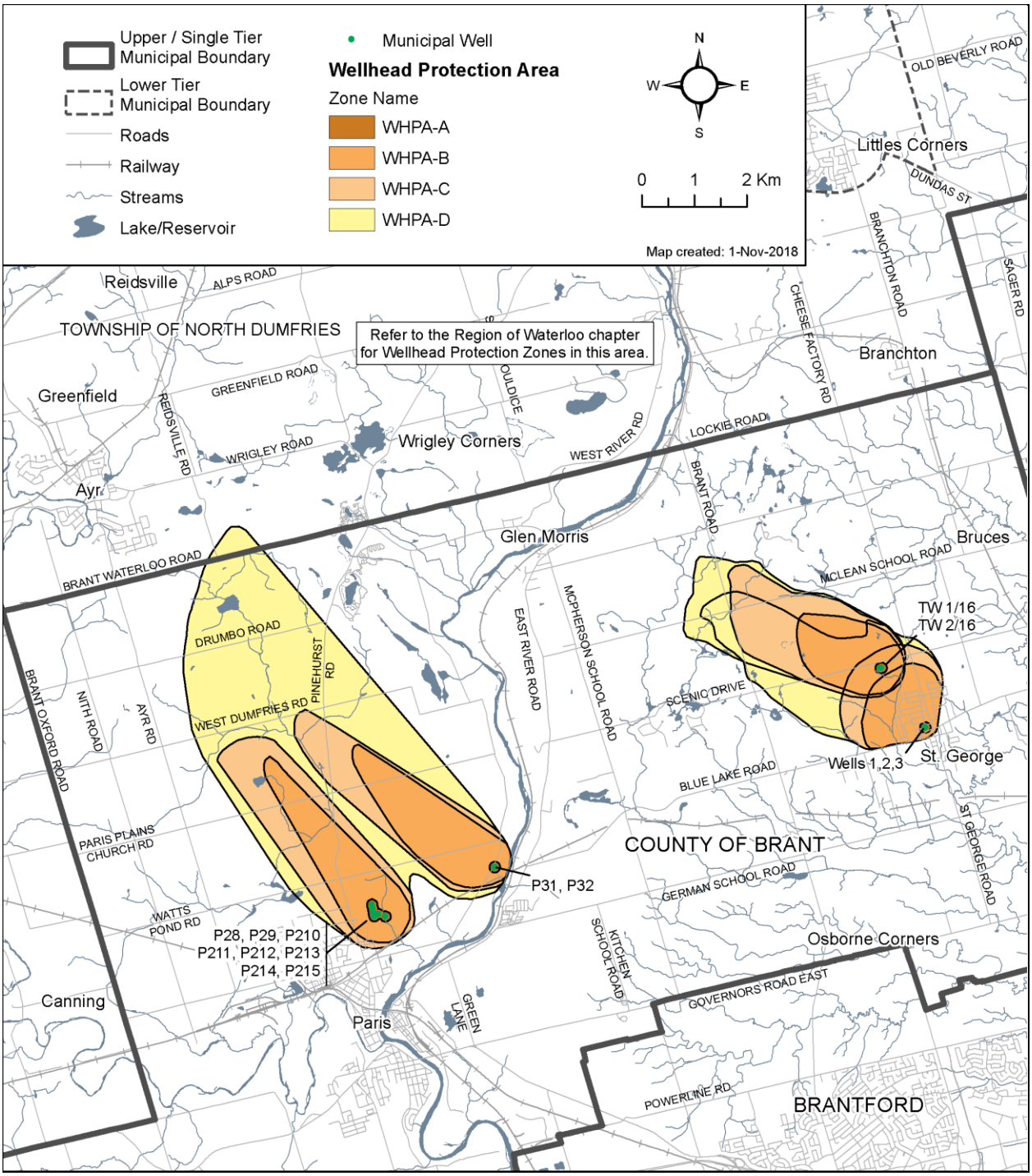
The overall uncertainty for the Bethel and Mount Pleasant WHPA delineations is high. Although low uncertainty is associated with the quality of the Whitemans Creek Tier 3 model, there is a high level of uncertainty associated with vulnerability scoring due to the complex geology near the wellfield and predicting contaminant transport behavior in groundwater.

The overall uncertainty for the St. George WHPA delineation is high. While a good overall calibration was achieved, the Fairchild Creek model over predicts drawdown and under predicts water levels in the St. George area.

Map 13-2: Airport, Mount Pleasant and Bethel Road Water Supply Wellhead Protection Areas



Map 13-3: Paris and St. George Water Supply Wellhead Protection Areas



Initial Vulnerability Scoring in Wellhead Protection Areas

Within the County of Brant, SWAT aquifer vulnerability mapping was used as the basis for the vulnerability scoring with some adjustments made to this mapping to account for local conditions in the area. Details on SWAT methodology is discussed in Chapter 3 of this Assessment Report. Initial vulnerability scoring is shown on **Map 13-4, Map 13-7 and Map 13-9**.

Adjusted Vulnerability Scoring to Account for Transport Pathways in the County of Brant

Following a review of the initial vulnerability scoring maps, an assessment of transport pathways was completed to determine whether adjustments to the vulnerability assessment were warranted. Modification of the vulnerability score was completed by increasing the vulnerability of the underlying aquifer vulnerability map from either a low to moderate value or moderate to high value.

Vulnerability scores were not adjusted for wells within the MECP WWIS identified as transport pathways because of the potential inaccuracy in their location or condition. It is recommended that the vulnerability not be increased for the presence of non-municipal wells until a well inventory is completed to verify their location and status.

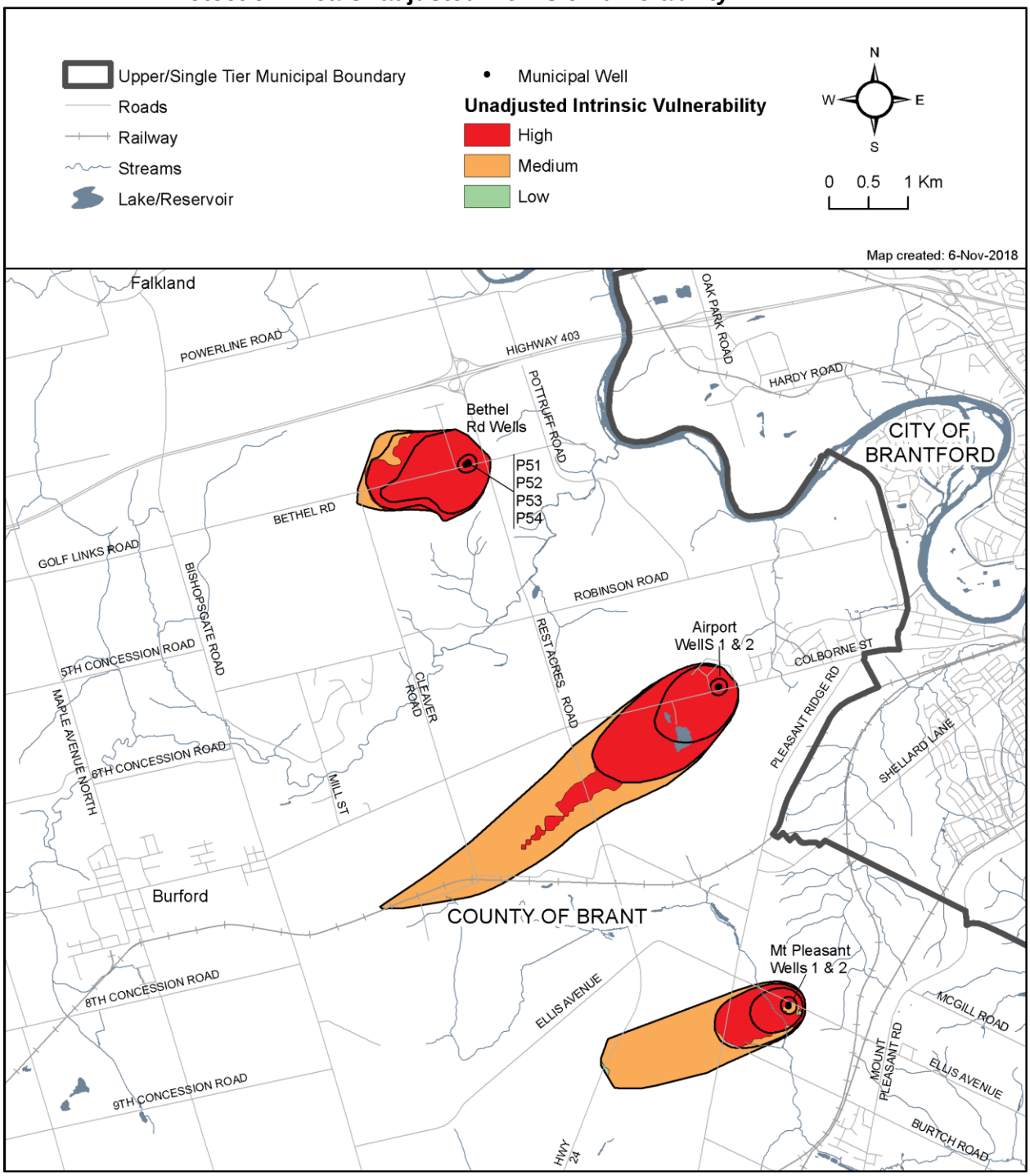
Existing and historical aggregate operations in the Airport area were reviewed; no changes were made to the vulnerability assessment as all areas are high vulnerability. For the Airport well, WHPA-A and WHPA-B (a blend of commercial-industrial and rural area) both show a vulnerability of 10. Moving outside the 2-year zone, WHPA-C has a score of 8 and WHPA-D (mostly rural area) shows a vulnerability of 4 with some vulnerability 6 (**Map 13-6**).

There is one active aggregate operation that lies partially within the delineated WHPAs for the Mount Pleasant wellfield. Vulnerability scores were adjusted within the aggregate operation limits (primarily within WHPA-D) to reflect the increased risks posed by the potential reduced surface to well travel times (**Map 13-5**). For Mount Pleasant, WHPA-A and WHPA-B have a vulnerability score of 10. WHPA-C scores mostly 8 with some 6 around the southern edge. Most of WHPA-D has a vulnerability of 4 with the increased vulnerability score of 6 where the aggregate operation is present (**Map 13-6**).

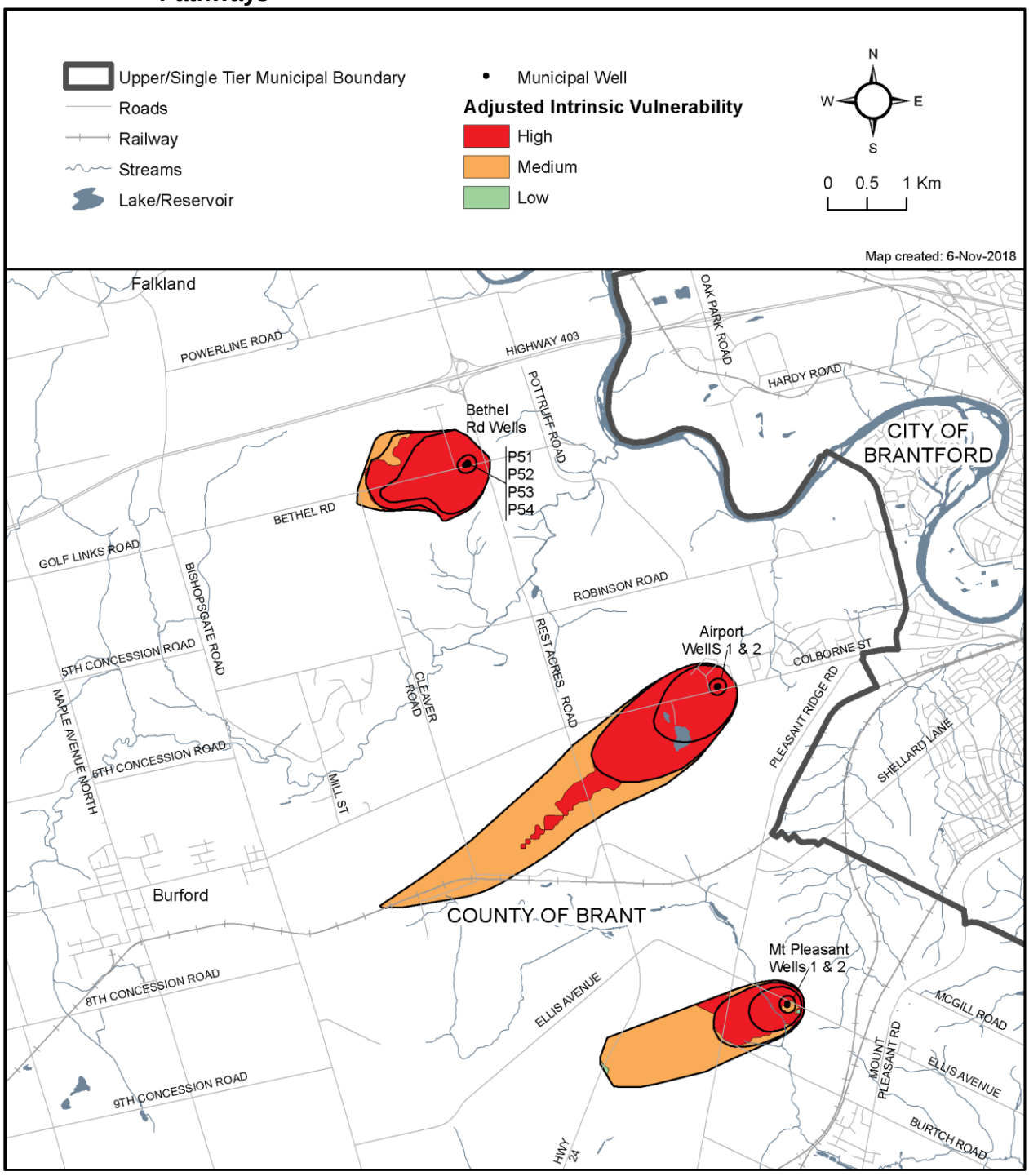
Within the Bethel Road WHPAs, one active aggregate pit operation located to the south of the wellfield, and the Brant Business Park storm water management pond to the north, lie within the vulnerable area. No adjustments to the vulnerability levels were required as the pit and pond are already located in an area of high vulnerability. The vulnerability scoring for the Bethel Road wellfields shows WHPA-B with a vulnerability score of 10. WHPA-C has a vulnerability score of 8/6 and WHPA-D a vulnerability score of 4, with vulnerability score 6 to the south of the WHPA (**Map 13-6**). The aggregate operations in the northern part of Paris were included in the transport pathways analysis, which resulted in no changes to the vulnerability assessment of the upper aquifer as it is already classified as having a high vulnerability. Vulnerability mapping for the northern Paris wells are in **Map 13-8**.

There are no preferential pathways were identified within the St. George WHPAs that could increase the vulnerability scores. Both WHPA-As have a vulnerability score of 10 for the bedrock and overburden wells, as well as WHPA-B for the overburden wells. Due to the overlapping nature of the WHPAs there are multiple vulnerability scores in each WHPA zone. The St. George vulnerability scoring is presented on **Map 13-10**.

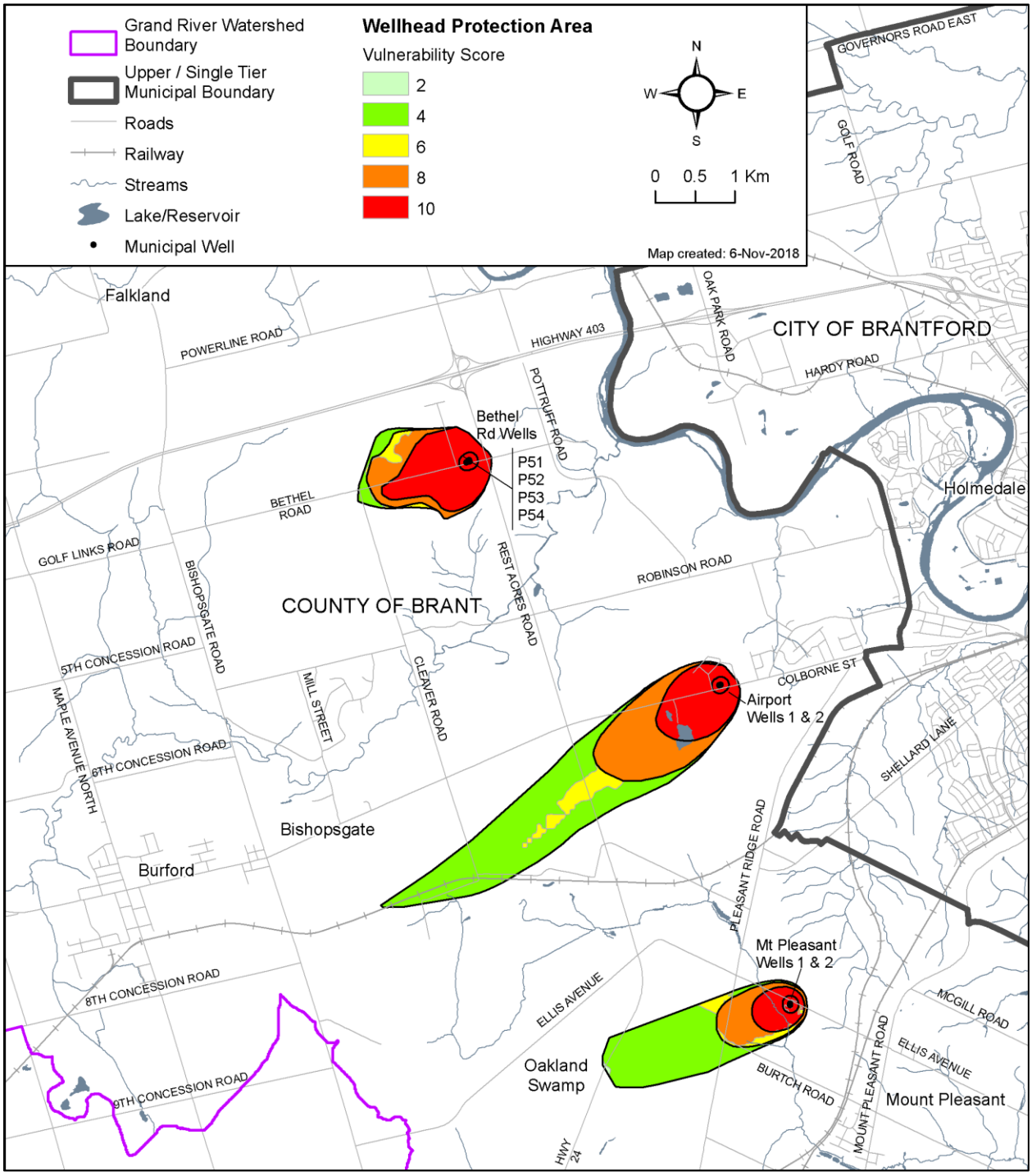
Map 13-4: Airport, Mount Pleasant and Bethel Road Water Supply Wellhead Protection Area Unadjusted Intrinsic Vulnerability



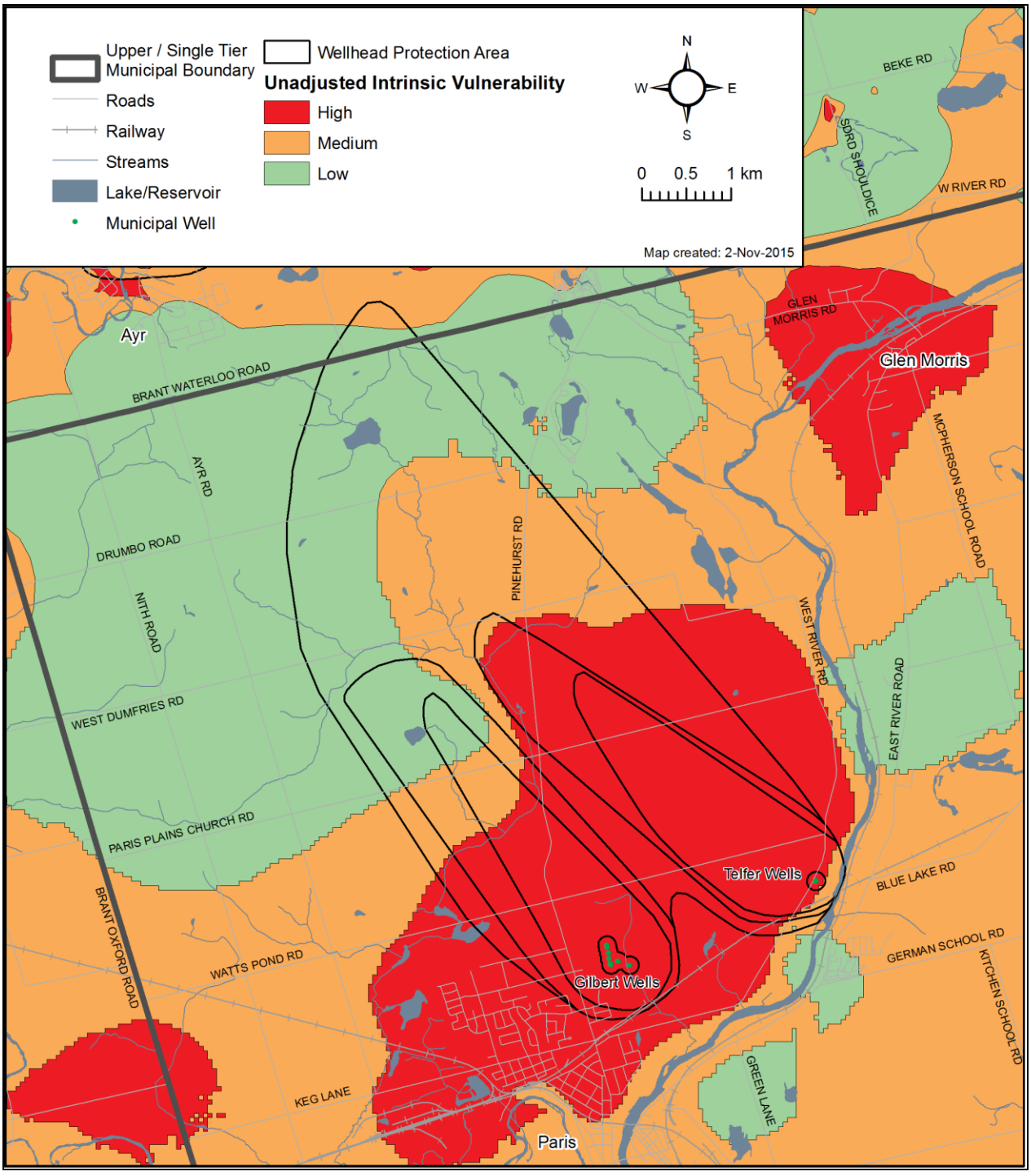
Map 13-5: Airport, Mount Pleasant and Bethel Road Water Supply Wellhead Protection Area Unadjusted Intrinsic Vulnerability – Including Transport Pathways



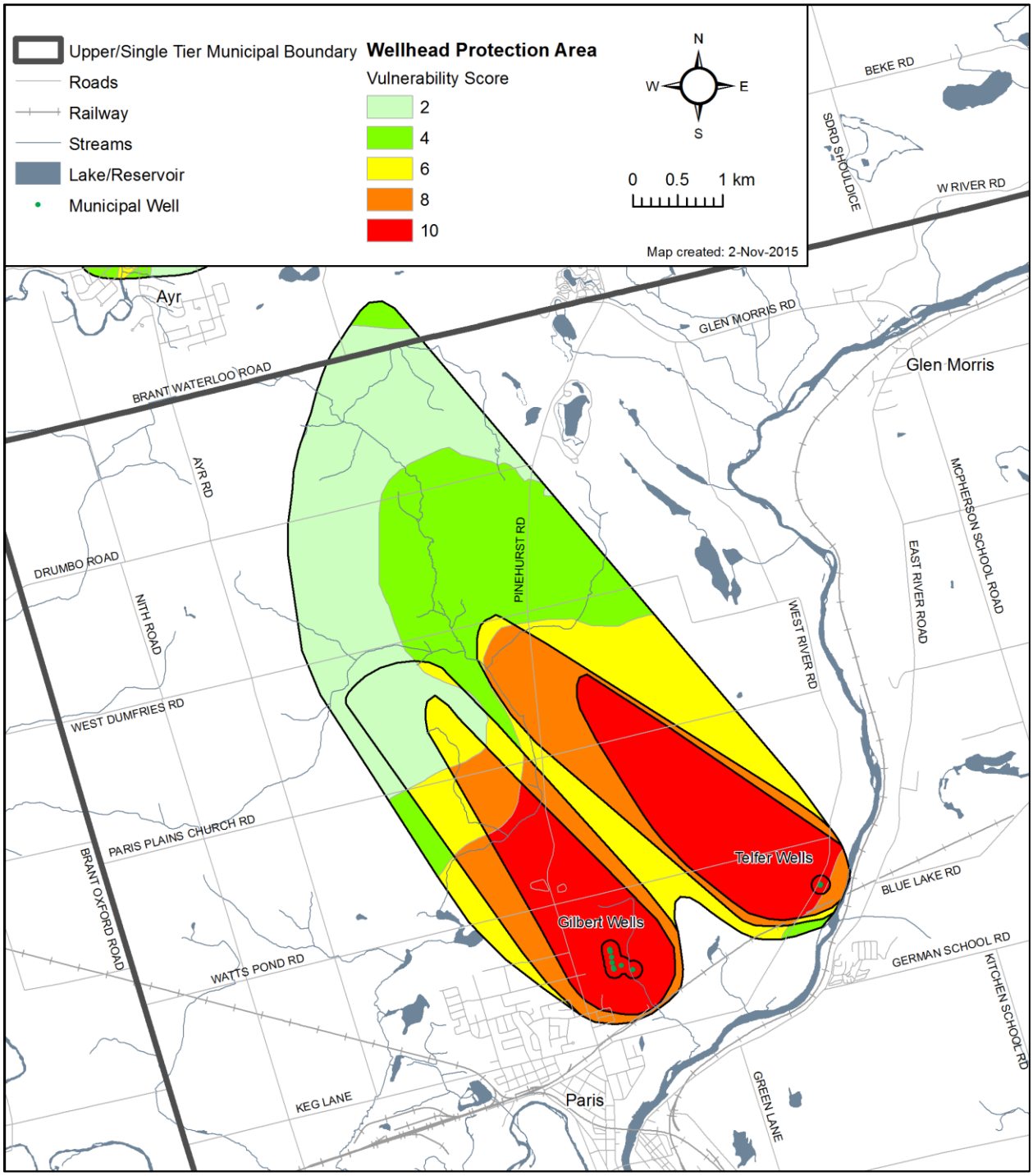
Map 13-6: Airport, Mount Pleasant and Bethel Road Water Supply Wellhead Protection Area Vulnerability



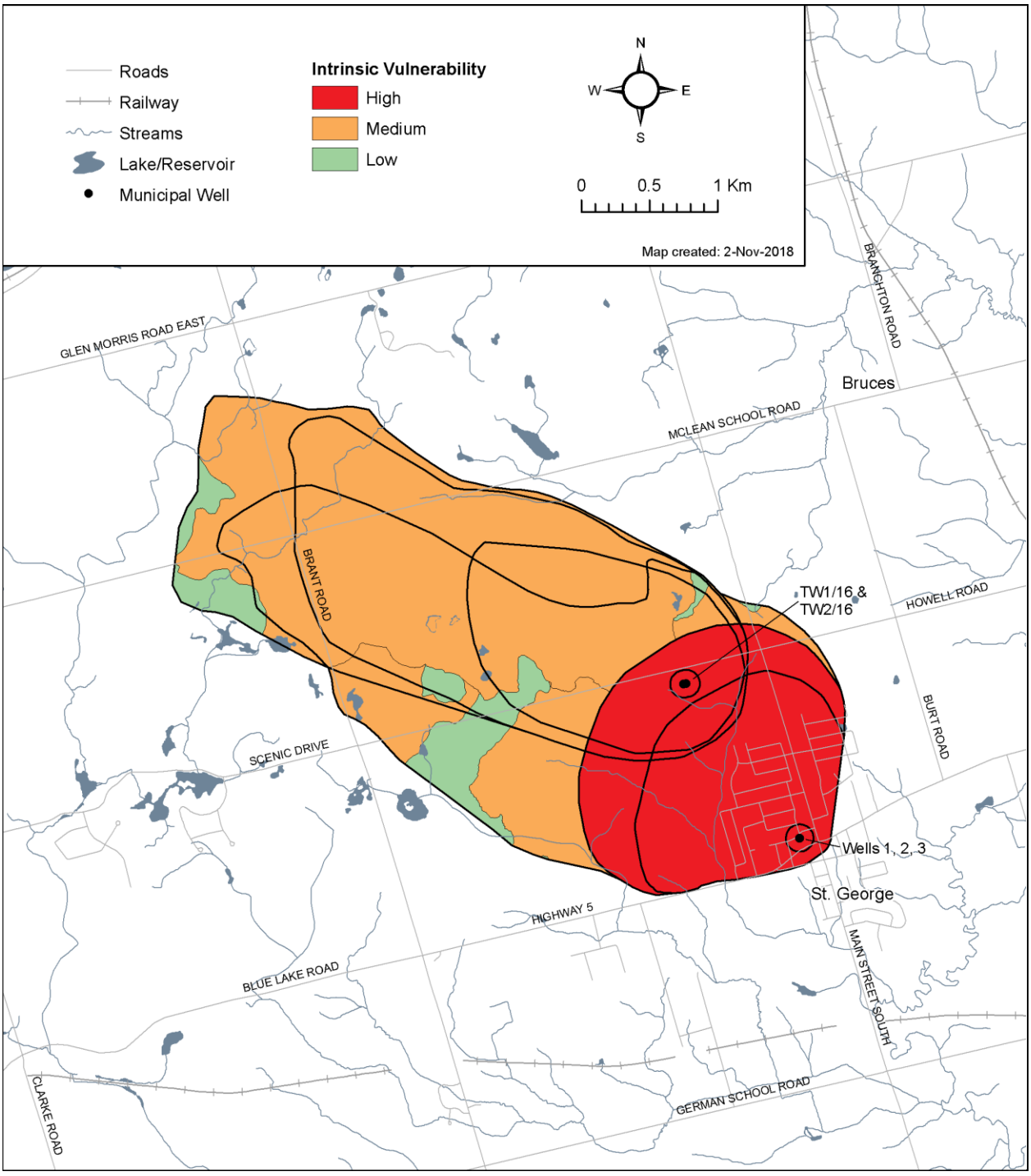
Map 13-7 Paris Water Supply Wellhead Protection Area Unadjusted Intrinsic Vulnerability



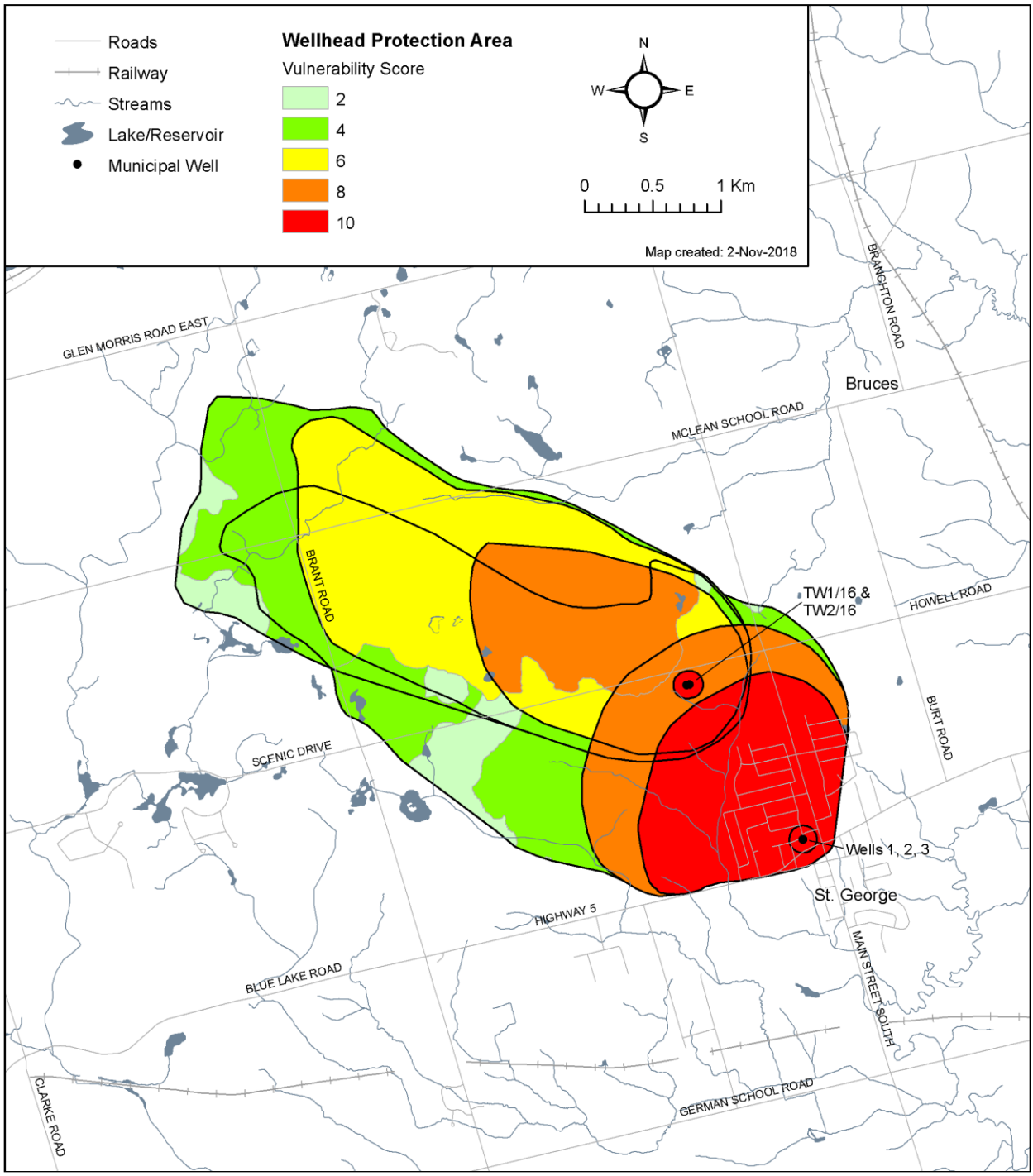
Map 13-8: Paris Water Supply Wellhead Protection Area Vulnerability



Map 13-9 St. George Wellhead Protection Area Unadjusted Intrinsic Vulnerability



Map 13-10: St. George Wellhead Protection Area Vulnerability



Managed Lands within the County of Brant Wellhead Protection Areas

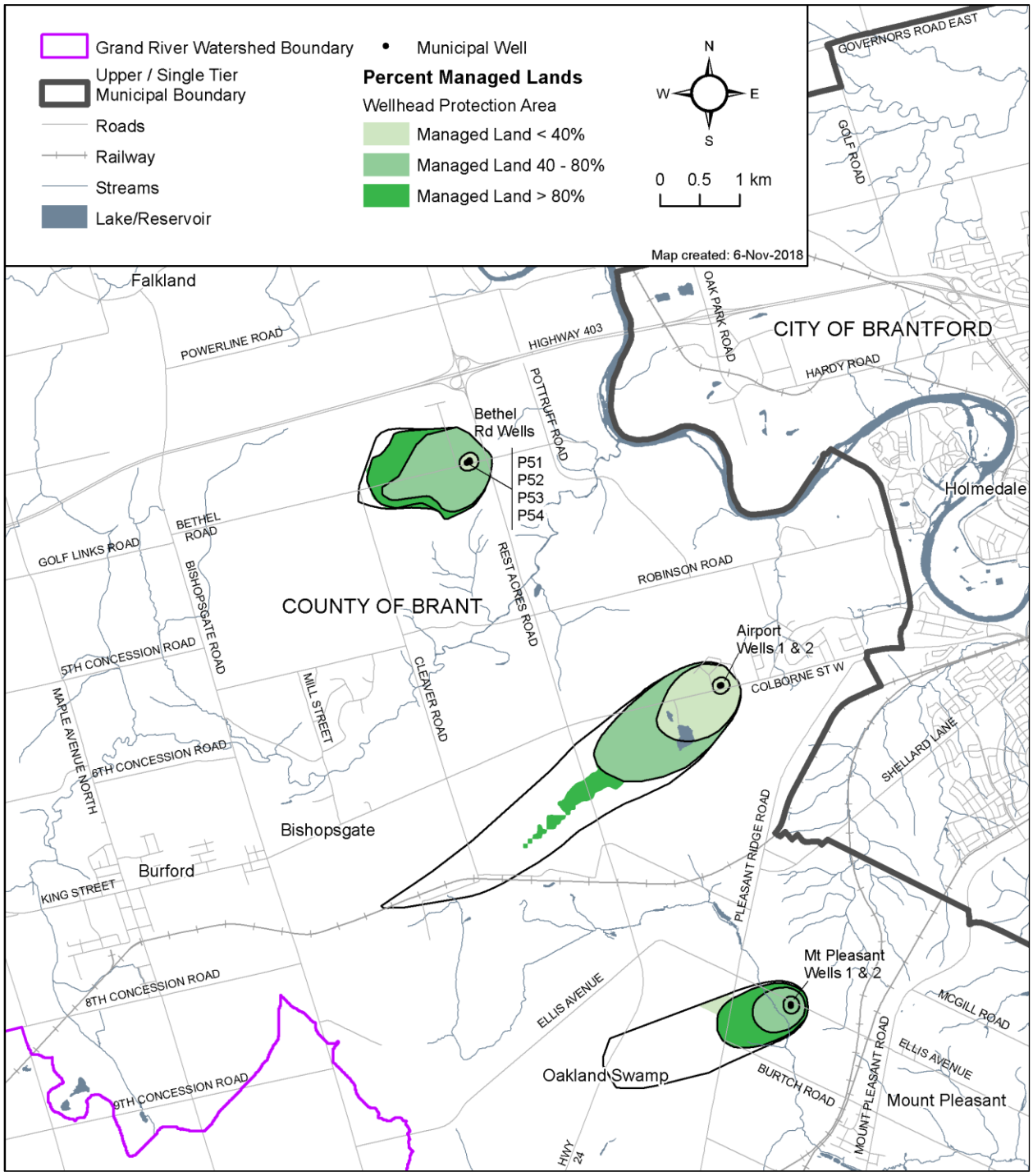
Managed Lands are lands to which nutrients are applied, and are categorized into two groups: agricultural managed land and non-agricultural managed land. Agricultural managed land includes areas of cropland, fallow, and improved pasture that may receive nutrients. Non-agricultural managed land includes golf courses, sports fields, lawns and other built-up grassed areas that may receive nutrients (primarily commercial fertilizer). A detailed methodology of the managed lands evaluation is provided in Chapter 3.

Managed lands calculations were completed for all WHPAs with a vulnerability score of 6 or greater within the County of Brant. Managed lands are enumerated in **Table 13-3**. The percent managed lands for the County of Brant WHPAs is also illustrated on **Map 13-11** and **Map 13-12.**

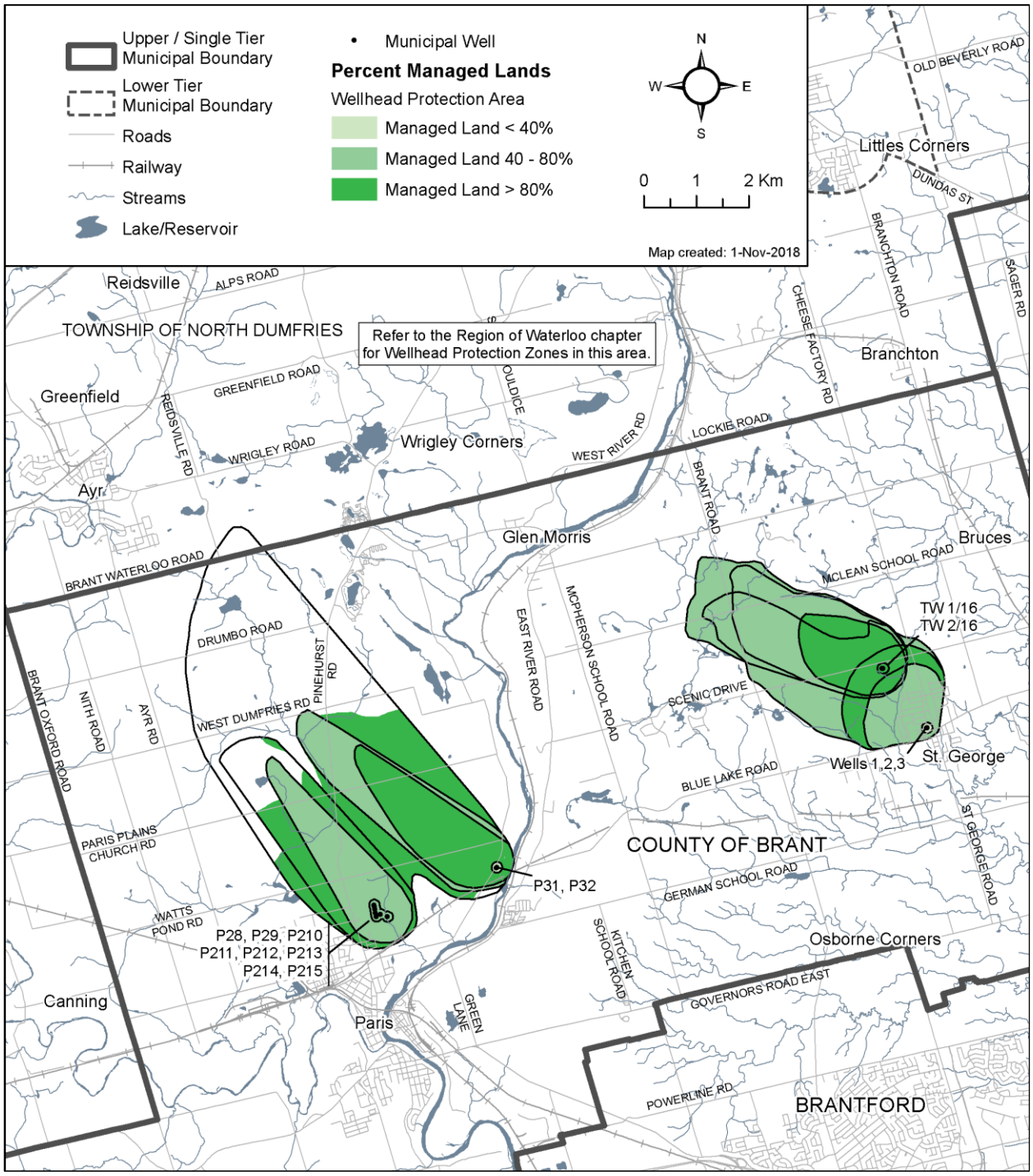
Table 13-3: Percent Managed Land in the County of Brant Wellhead Protection Areas

Location	Well	WHPA-A	WHPA-B	WHPA-C	WHPA-D
Airport	W1/W2	32%	30%	62%	94%
Mount Pleasant	W1/W2	73%	62%	87%	11%
St. George Overburden	W1/W2/W3	11%	59%	89%	71%
St. George Bedrock	TW1&2/16	100%	84%	55%	53%
Paris	Gilbert	45%	70%	84%	93%
	Telfer	33%	89%	68%	
	Bethel Road	22%	54%	80%	96%

Map 13-11: Airport, Mount Pleasant and Bethel Road Water Supply Percent Managed Lands



Map 13-12: Paris and St. George Water Supply Percent Managed Lands



Livestock Density within the County of Brant WHPAs

The calculation of livestock density is required to determine the amount of Nutrient Units (NUs) generated in each vulnerable Wellhead Protection Area scenario. This calculation is only completed when there are building structures that could house livestock on a farm parcel that intersects a vulnerable WHPA.

Livestock density calculations were completed for all WHPAs with a vulnerability score of 6 or greater within the County of Brant. Livestock density is enumerated in (**Table 13-4**). The coding of 0 indicates that there were no agricultural livestock barns to contribute nutrients and therefore the value for livestock density is 0. The livestock density for the WHPAs is also illustrated on **Map 13-13** and **Map 13-14.**

Table 13-4: Livestock Density (NU/acre) in the County of Brant Wellhead Protection Areas

Location	Well	WHPA-A	WHPA-B	WHPA-C	WHPA-D
Airport	Airport	0	0	0	0
Mount Pleasant	W1/W2	0.003	0.008	0.003	0
St. George Overburden	W1/W2/W3	0	0.00002	0.178	0.265
St. George Bedrock	TW1&2/16	0	0.137	0.117	0.06
Paris	Gilbert	0	0.244	0.6	0.079
	Telfer	0	0.113	0.698	
	Bethel Road	0	0.014	0.048	0

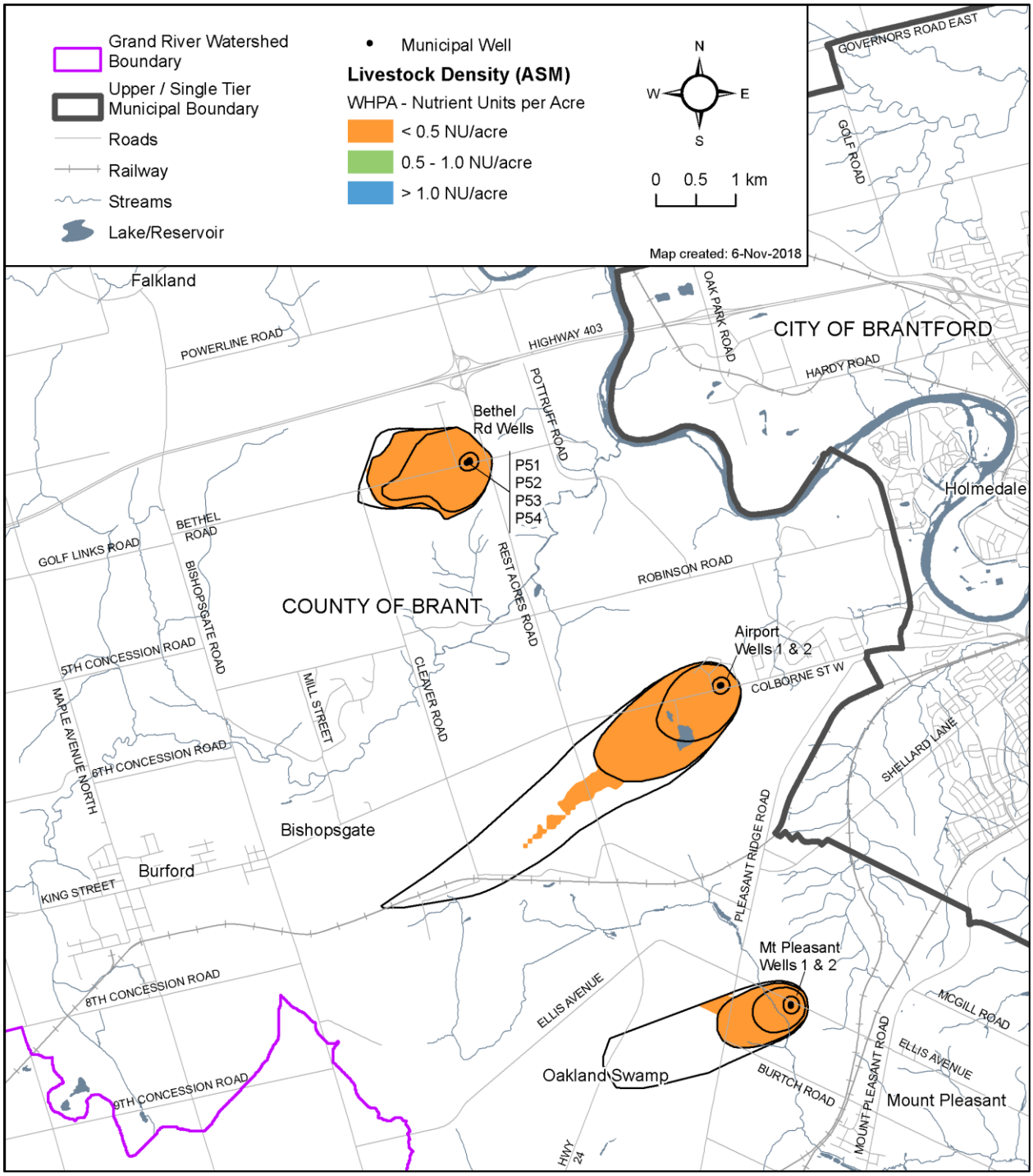
Percentage of Impervious Surface within the County of Brant WHPAs

To determine whether the application of road salt poses a threat in the County of Brant, the percent impervious surface where road salt can be applied was calculated as detailed in Chapter 3. Impervious surfaces for the Paris, Airport and Mount Pleasant wellfields were calculated by use of a moving-window average. The 1km X 1km method was used for the St. George wellfield. The application of road salt can only be a threat in areas with a vulnerability score of 6 or greater under the threats-based approach; therefore the percent impervious calculation was only completed in areas with a score of 6 or greater.

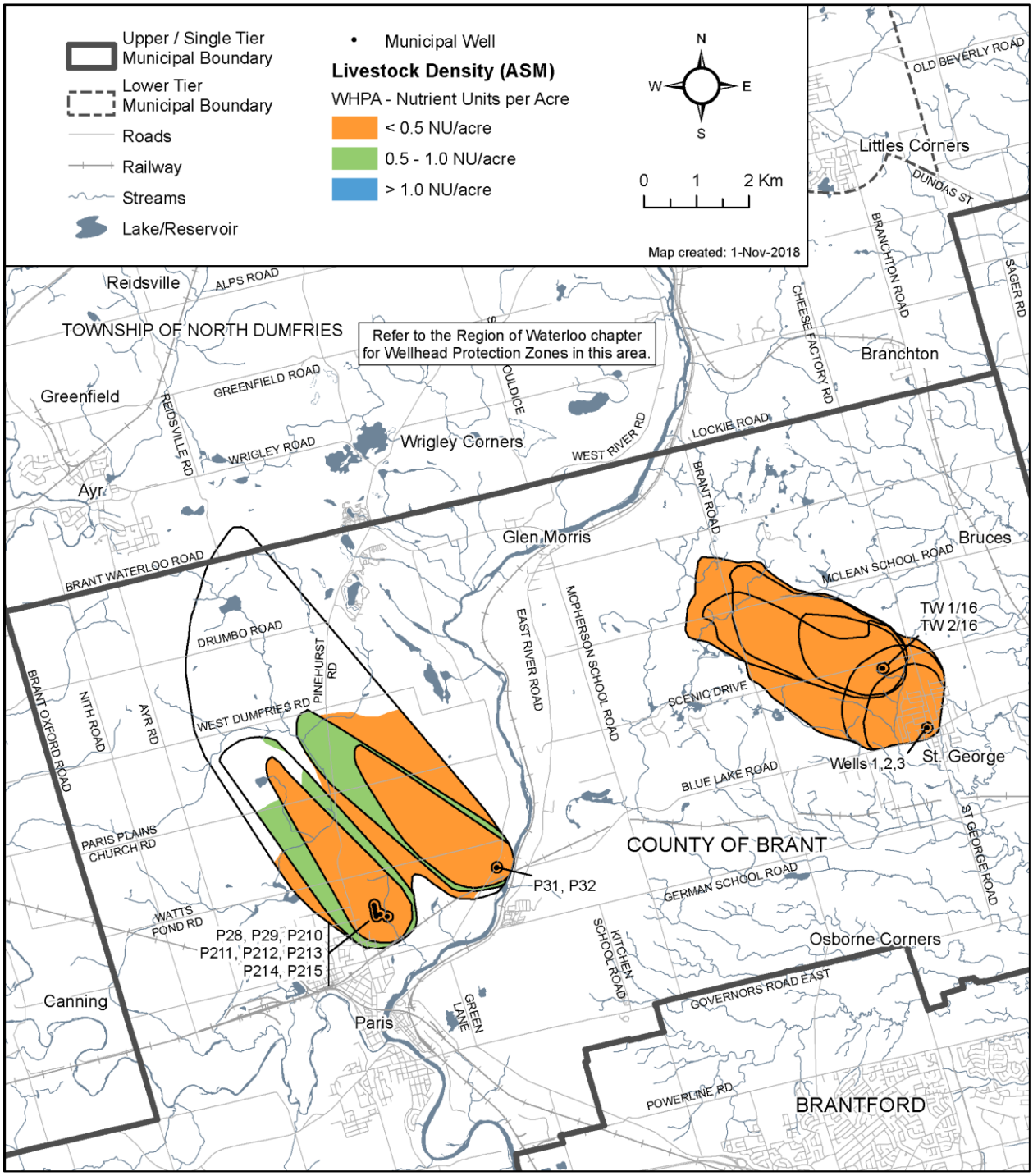
In the Airport, Mount Pleasant, and Bethel WHPAs, the results indicate low to moderate percentages of impervious surfaces. The application of road salt is not a significant threat to any of the systems/wellfields under the threats-based approach (**Map 13-15**).

In the St. George WHPAs, the majority of the results indicate low to moderate percentages of impervious surfaces. One exception is within WHPA-B of St. George Wells 1 and 2, the percentage of impervious surfaces is high (8 to 80%) surrounding urban development. In the Paris WHPAs, the results are low to moderate percentages of impervious surfaces. The Paris (Gilbert) WHPAs have a portion that can be considered moderate to high (8% to less than 80%). The application of road salt is not a significant threat in either the St. George or Paris Well Supply systems (**Map** 13-16**).**

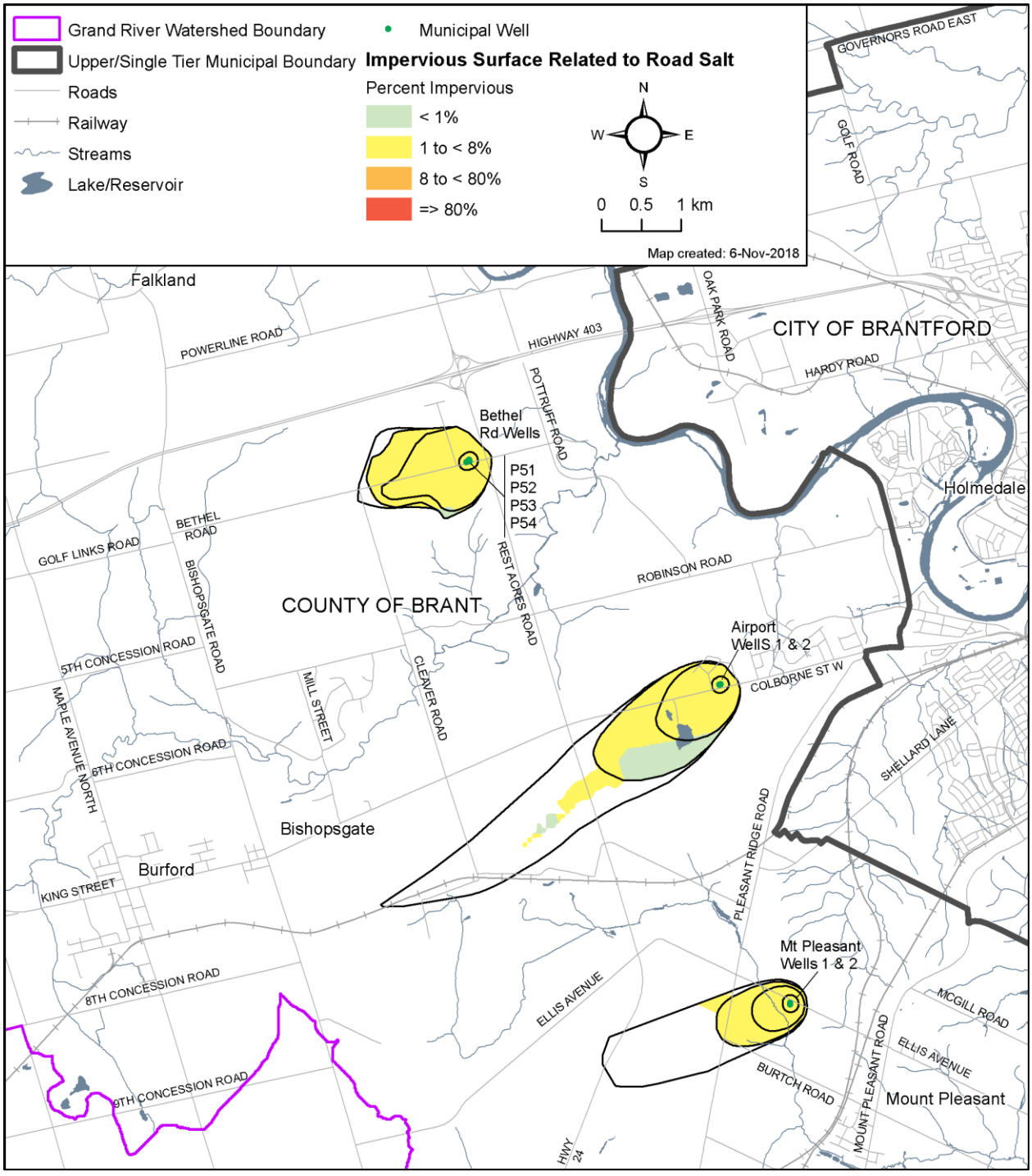
Map 13-13: Airport, Mount Pleasant and Bethel Road Water Supply Livestock Density



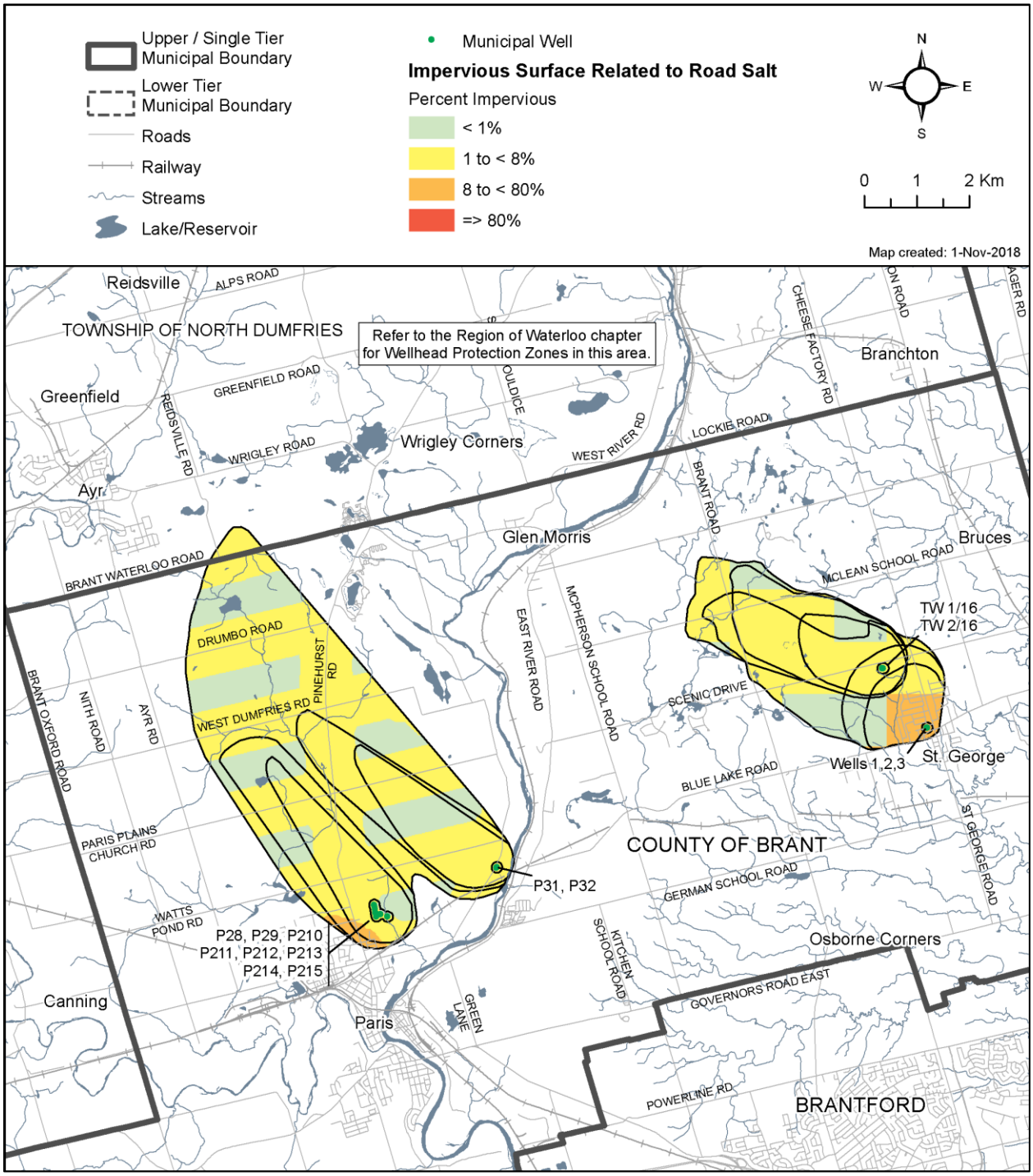
Map 13-14: Paris and St. George Water Supply Livestock Density



Map 13-15: Airport, Mount Pleasant and Bethel Road Water Supply Percent of Impervious Surfaces



Map 13-16: Paris and St. George Water Supply Percent of Impervious Surfaces



14.1.1 County of Brant Drinking Water Quality Threats Assessment

The *Ontario Clean Water Act, 2006* defines a Drinking Water Threat as "an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water, and includes an activity or condition that is prescribed by the regulation as a drinking water threat."A Prescribed Drinking Water Threats table in Chapter 3 lists all possible drinking water threats.

Identification of Significant, Moderate and Low Drinking Water Threats for the County of Brant Well Supply Systems

Table 13-5, Table 13-6, Table 13-7, Table 13-8 and Table 13-9 provide a summary of the threat levels possible in the County of Brant Well Supply System for Chemical, Dense Non-Aqueous Phase Liquid (DNAPL) and Pathogens. A checkmark indicates that the threat classification level is possible for the indicated threat type under the corresponding vulnerable area / vulnerability score; a blank cell indicates that it is not. The colours shown for each vulnerability score correspond to those shown in the maps.

Table 13-5: Identification of Drinking Water Quality Threats in the Airport Well Supply WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Threat Classification Level		
			Significant 80+	Moderate 60 to <80	Low >40 to <60
Chemicals	WHPA-A/B	10	✔	✔	✔
	WHPA-C	8	✔	✔	✔
	WHPA-D	6		✔	✔
	WHPA-D	4			
Handling / Storage of DNAPLs	WHPA-A/B/C	Any Score	✔		
	WHPA-D	6		✔	✔
	WHPA-D	4			
Pathogens	WHPA-A/B	10	✔	✔	

Table 13-6: Identification of Drinking Water Quality Threats in the Mount Pleasant WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Threat Classification Level		
			Significant 80+	Moderate 60 to <80	Low >40 to <60
Chemicals	WHPA-A/B	10	✔	✔	✔
	WHPA-B/C	8	✔	✔	✔
	WHPA-B/C/D	6		✔	✔
	WHPA-D	2 & 4			
Handling / Storage of DNAPLs	WHPA-A/B/C	Any Score	✔		
	WHPA-D	6		✔	✔
	WHPA-D	2 & 4			
Pathogens	WHPA-A/B	10	✔	✔	
	WHPA-B	8		✔	✔
	WHPA-B	6			✔

Table 13-7: Identification of Drinking Water Quality Threats in the St. George WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Threat Classification Level		
			Significant 80+	Moderate 60 to <80	Low >40 to <60
Chemicals	WHPA-A/B	10	✔	✔	✔
	WHPA-B/C	8	✔	✔	✔
	WHPA-B/C	6		✔	✔
	WHPA-C/D	2 & 4			
Handling / Storage of DNAPLs	WHPA-A/B/C	Any Score	✔		
	WHPA-D	2 & 4			
Pathogens	WHPA-A/B	10	✔	✔	
	WHPA-B	8		✔	✔
	WHPA-B	6			✔

Table 13-8: Identification of Drinking Water Quality Threats in the Paris (Gilbert and Telfer) WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Threat Classification Level		
			Significant 80+	Moderate 60 to <80	Low >40 to <60
Chemicals	WHPA-A/B	10	✔	✔	✔
	WHPA-B/C	8	✔	✔	✔
	WHPA-B/C/D	6		✔	✔
	WHPA-C/D	2 & 4			
Handling / Storage of DNAPLs	WHPA-A/B/C	Any Score	✔		
	WHPA-D	6		✔	✔
	WHPA-D	2 & 4			
Pathogens	WHPA-A/B	10	✔	✔	
	WHPA-B	8		✔	✔
	WHPA-B	6			✔

Table 13-9: Identification of Drinking Water Quality Threats in the Paris (Bethel Road) WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Threat Classification Level		
			Significant 80+	Moderate 60 to <80	Low >40 to <60
Chemicals	WHPA-A/B	10	✔	✔	✔
	WHPA-C	8	✔	✔	✔
	WHPA-C/D	6		✔	✔
	WHPA-D	4			
	WHPA-A/B/C	Any Score	✔		

Table 13-9: Identification of Drinking Water Quality Threats in the Paris (Bethel Road) WHPAs

Threat Type	Vulnerable Area	Vulnerability Score	Threat Classification Level		
			Significant 80+	Moderate 60 to <80	Low >40 to <60
Handling / Storage of DNAPLs	WHPA-D	6		✔	✔
	WHPA-D	4			
Pathogens	WHPA-A/B	10	✔	✔	

Conditions Evaluation for the County of Brant Well Supply Systems

There were no Conditions identified for the Airport, Mount Pleasant, or Paris (including Bethel Road) Well Supply Systems.

Two Conditions were determined to exist in the St. George WHPA-B. Two former fuel stations have groundwater or soil contamination. Monitoring programs are taking place at both sites and a remediation program is taking place at one of the sites. Data in the monitoring reports for these sites indicate the presence of selected parameters such as BTEX and F1-F4 and that these parameters exceed the potable groundwater standard as set out in Table 2 of the Soil, Groundwater and Sediment Standards. In addition, some of the exceedances were measured at wells located on off-site properties (Golder, 2010), which serves as evidence that the contamination has moved off site. As a result, the hazard rating for these conditions is 10 based on Technical Rule 139(1). In the St. George WHPA-B, the vulnerability score ranges from 8 to 10. As such, these Conditions are significant threats.

13.1.6 County of Brant Drinking Water Quality Issues Evaluation

The objective of the Issues evaluation is to identify drinking water Issues where the existing or trending concentration of a parameter or pathogen at an intake or monitoring location would result in the deterioration of the quality of water for use as a source of drinking water. The parameter or pathogen must be listed in Schedule 1, 2 or 3 of the Ontario Drinking Water Quality Standards (ODWQS) or Table 4 of the Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (Technical Rules XI.1 (114 – 117)).

Issues were originally identified through a review of raw production well water quality data provided by the County for the period between 2000 and 2008 and through discussions with County staff. Based on this review, a chloride Issue was identified within the Mount Pleasant Well Supply and nitrate Issues were identified for the St. George Well Supply and the Paris Well Supply (Gilbert, Telfer, and Bethel wellfields). A more recent analysis of raw production well water quality data was completed for the period between 2008 to 2017 to re-evaluate the previously identified Issues and/or identify any additional Issues. In particular, the raw water quality data available for review was compared to the ODWQS and the Technical Support Document to identify parameters approaching or exceeding the respective standard.

The microbiological data for the raw production well water from the municipal wells was also reviewed for the period from 2008 to 2017 to evaluate if there were instances when *E. coli* and/or total coliforms were detected.

Drinking Water Quality Issues Evaluation for the Airport Well Supply

No previous Issues were identified for the Airport Well Supply as per analysis conducted prior to 2008. Analysis of the raw production well water for the period between 2008 and 2017 indicated that no health-related parameters or pathogens were measured at concentrations that exceeded the ODWQS. Specifically, the raw production well water quality data demonstrated that chloride (less than 30 mg/L) and nitrate (less than 4 mg/L) concentrations were not an Issue at the Airport Well Supply despite the relatively high vulnerability within the WHPAs.

In addition, the results of the microbial testing of the raw production well water at the Airport Well Supply from 2008 to 2017 (526 samples) found that *E. coli* and total coliforms were not detected in any samples.

Therefore, no water quality Issues were identified for the Airport Well Supply.

Drinking Water Quality Issues Evaluation for the Mount Pleasant Well Supply

From 2008 to 2017, concentrations of chloride, sodium, manganese, and hardness within the raw production well water corresponding to the Mount Pleasant Well Supply were elevated at the beginning of the period of analysis. The data also indicated that there were no health related parameters or pathogens that exceeded the ODWQS.

There were instances when chloride concentrations corresponding to Well 1 surpassed the aesthetic objective of 250 mg/L from 2008 to 2010. However, the concentration of chloride within the raw production well water corresponding to both Well 1 and Well 2 was observed to have steadily decreased for the period between 2008 to 2017. For the period between 2013 and 2017, chloride concentrations were between 100 mg/L and 190 mg/L for Well 1 and 65 mg/L and 94 mg/L for Well 2 and did not exceed the aesthetic objective of 250 mg/L.

Analysis conducted prior to 2008 for the raw production well water quality data for the Mount Pleasant Well Supply identified chloride as an Issue under Technical Rule 114. The chloride data during that period indicated that a land use activity, namely outdoor salt storage, had an impact on groundwater quality in the aquifer system. The decrease in the chloride concentration for the Mount Pleasant Well Supply since 2008 can likely be attributed to the construction of a salt storage dome near the wellfield and the ceasing of outdoor salt storage since 2006.

The sodium concentration data for the raw production well water corresponding to Well 1 was slightly elevated at the beginning of the analysis period in 2008 (135 mg/L) and 2009 (158 mg/L). These values exceeded the reporting requirement as per the MOE technical support document (2003), whereby the local Medical Officer of Health is required to be notified when sodium concentrations reach above 20 mg/L in order to pass this information on to local physicians. No exceedances above the aesthetic objective of 200 mg/L were noted. In addition, the concentration of sodium steadily declined for both Well 1 and Well 2 for the period between 2008 and 2017, to 84 mg/L and 42 mg/L, respectively, in 2017. This declining trend can likely also be attributed to the change in land use activities, namely the construction of the salt storage dome near the wellfield.

Manganese concentrations within the raw production well water were solely reported for 2009 and exceeded the aesthetic objective of 0.05 mg/L for Well 1. In particular, the concentration of manganese in the raw production well water was 0.08 mg/L for Well 1 and 0.03 mg/L for Well 2 in 2009. Since manganese was not reported for the period since 2009, no trend could be discerned for this parameter. It should be noted that elevated manganese concentrations in the raw production well water may be due to naturally occurring minerals, and may also be enhanced

by microbiological activity and chemical processes occurring in the well and in the aquifer close to the well.

Hardness was solely reported for Well 2 in 2009 and exceeded the operational guideline of 80 to 100 mg/L. In particular, the hardness was reported as 340 mg/L for Well 2 in 2009; however, no trend could be extrapolated for the period between 2009 and 2017 due to a lack of further reported hardness concentrations.

Nitrate concentrations for the Mount Pleasant Well Supply were relatively low (<0.1 to 4.3 mg/L) based on concentrations measured for the period between 2008 and 2017. No nitrate concentrations for Well 1 or Well 2 exceeded the aesthetic objective of 10 mg/L for the period between 2008 and 2017.

Microbial test results corresponding to Well 1 (519 samples) and Well 2 (507 samples) for the period between 2008 and 2017 indicated that *E. coli* was not detected in any drinking water samples for the Mount Pleasant Well Supply. Total coliforms were detected at low concentrations of up to 2 CFU/100 mL and 6 CHU/100 mL in 2008 and 2014, respectively.

Ultimately, no water quality Issues were identified for the Mount Pleasant Well Supply based on the analysis conducted for the period between 2008 and 2017. Given that the concentration of chloride declined since 2008 and was no longer above the ODWQS of 250 mg/L, chloride is no longer identified as an Issue under Technical Rule 114 for the Mount Pleasant Well Supply System.

Drinking Water Quality Issues Evaluation for the St. George Well Supply

The raw production well water data analyzed for the St. George Well Supply for the period between 2008 and 2017 indicated that no parameters, namely chloride and nitrate, exceeded the ODWQS.

Nitrate concentrations were slightly elevated, yet displayed a slightly decreasing trend for the period between 2008 and 2017. In particular, nitrate concentrations corresponding to Well 1, Well 2, and Well 3 were 5.6 mg/L, 5.8 mg/L, and 5.8 mg/L, respectively in 2008, and were 3.9 mg/L, 4.3 mg/L, and 4.3 mg/L, respectively in 2017. There were however no instances when the nitrate concentration exceeded the aesthetic objective of 10 mg/L for the period between 2008 and 2017.

Nitrate was previously identified as an Issue for the St. George Well Supply under Technical Rule 114, due the slightly elevated nitrate concentrations and increasing trend observed from 2000 to 2008. Given that these concentrations have only slightly decreased since 2008, and that the change in land use activities surrounding the wellfield that may have resulted in this decrease remains unclear, nitrate remains identified as an Issue under Technical Rule 114 for the St. George Water Supply.

Microbial test results for Well 1 (514 samples), Well 2 (523 samples) and Well 3 (515 samples) were reviewed for the St. George Well Supply and indicated that there were some detections of E. coli or total coliforms at low concentrations in the raw production well water during the period between 2008 and 2017. *E. coli* was detected up to 1 CFU/100 mL for Well 2 in 2014. In addition, total coliforms were detected up to 3 CFU/100 mL for Well 2 in 2010, Well 3 in 2011, and Well 2 in 2014.

As a result of the slightly elevated nitrate concentrations in the raw production well water observed for the period between 2008 and 2017, and the lack of reasoning to support the slightly

decreasing trend nitrate remains identified as an Issue for the St. George Water Supply under Technical Rule 114. Since this trend has been observed to be decreasing since 2008, nitrate concentrations will continue to be monitored for the St. George Well Supply to determine if an Issue remains present over time.

Drinking Water Quality Issues Evaluation for the Paris Well Supply

Based on the analysis of the raw production well water for the Gilbert, Telfer, and Bethel wellfields for the period between 2008 and 2017, it was found that each wellfield displayed elevated levels of certain parameters. In particular, the raw production well water data for the Gilbert and Telfer wellfields displayed elevated levels of sulphate and nitrate, whereas the raw production well water data corresponding to the Bethel wellfield displayed elevated levels of chloride and nitrate.

No exceedances above the chloride aesthetic objective of 250 mg/L were observed for the period between 2008 and 2017 for the Gilbert and Telfer wellfields. These concentrations ranged from 17 mg/L to 46 mg/L and 19 mg/L to 26 mg/L throughout this period for the Gilbert and Telfer wellfields, respectively.

In 2017, the chloride concentrations corresponding to the wells P51 (111 mg/L), P52 (81 mg/L), P53 (128 mg/L), and P54 (128 mg/L) within the Bethel wellfield were elevated, but below the aesthetic objective of 250 mg/L. The concentration of chloride corresponding to the wells within the Bethel wellfield was also observed to have slightly increased for the period since the wells have been in operation between 2013 and 2017. These chloride concentrations ranged from 43 mg/L in 2013 to 128 mg/L in 2017 and will continue to be monitored to determine if chloride should be included as a drinking water Issue for the Bethel wellfield under Technical Rule 114.

The concentration of sodium in the raw production well water supply was solely reported in 2008 and 2009 for the Gilbert wellfield and in 2008 for the Telfer wellfield. No exceedances above the sodium concentration aesthetic objective of 200 mg/L were noted for these sampling periods. The sodium concentrations corresponding to the wells P214 and P215 within the Gilbert wellfield did exceed 20 mg/L, which is the threshold whereby the local Medical Officer of Health should be notified. These sodium concentrations were reported in 2009 as 24 mg/L and 33 mg/L for the wells P214 and P215, respectively.

Given that chloride and sodium concentrations are typically strong indicators of contamination from road salt application, the chloride and sodium concentrations measured at the Gilbert, Telfer, and Bethel wellfields may indicate that surface contaminants (most likely road salt) have had an effect on water quality in the upper aquifer.

From 2008 to 2017, there were also instances where the concentration of sulphate was approaching and/or exceeded the aesthetic objective of 500 mg/L. In particular, the wells P28 and P29 within the Gilbert wellfield ranged from 360 mg/L to 436 mg/L and 530 mg/L to 823 mg/L, respectively. The raw production well water data pertaining to each of these wells also displayed slightly decreasing trends from 2008 to 2017. The elevated sulphate concentrations were interpreted to result from the dissolution of minerals (gypsum) within the bedrock aquifer.

The concentration of sulphate reported in 2008 was also slightly elevated for the well P32 (365 mg/L) corresponding to the Telfer wellfield. No exceedances above the aesthetic objective for sulphate were noted for the period between 2008 and 2017. In addition, no elevated sulphate concentrations occurred within the Bethel wellfield throughout this period.

The raw production well water for the overburden wells at the Gilbert wellfield (P210 - P215) did have exceedances in the nitrate concentration above the aesthetic objective of 10 mg/L in 2009 and 2017 and ranged from <0.1 mg/L to 12.6 mg/L between 2008 and 2017. This trend was observed to have slightly decreased since 2008, with a slight increase noted in 2017.

For the Telfer wellfield, nitrate exceeded the aesthetic objective for the well P31 for the period between 2009 and 2012. Nitrate concentrations also ranged from 6.1 mg/L to 12 mg/L for the well P31 and 4.4 mg/L to 8.1 mg/L for the well P32 for the period between 2008 and 2017 for the Telfer wellfield. The nitrate concentrations corresponding to the Telfer wellfield also displayed a decreasing trend since 2008; however nitrate concentrations were still fairly elevated.

The nitrate concentrations for the well P52 corresponding to the Bethel wellfield was also elevated in 2013 (8.9 mg/L) and 2014 (6.1 mg/L). This trend steadily decreased for the period between 2008 and 2017, resulting nitrate concentrations of 1.0 mg/L, 0.39 mg/L, 1.4 mg/L, and 0.76 mg/L for the wells P51, P52, P53, and P54, respectively.

Nitrate Issues were previously identified for the Gilbert, Telfer, and Bethel wellfields based on previous analysis of raw production well water quality data. Given that the nitrate concentrations corresponding to the Gilbert and Telfer wellfields still displayed instances when exceedances occurred, nitrate remains identified as an Issue for the Gilbert wellfield (Overburden wells) and Telfer wellfield under Technical Rule 114. Since it was observed that the nitrate concentrations have decreased since 2008 for the Bethel wellfield and displayed no exceedances for the period between 2008 and 2017, nitrate is no longer identified as an Issue for the Bethel wellfield.

A review of the microbiological data corresponding to the Gilbert wellfield consisted of the analysis of samples collected for the wells P28 (511 samples), P29 (522 samples), P210 (499 samples), P211 (502 samples), P212 (492 samples), P213 (493 samples), P214 (499 samples), and P215 (487 samples). *E. coli* was detected at low concentrations in 2010 and 2016 for P29 (1 CFU/100 mL) and P213 (0 - 2 CFU/100 mL). In addition, total coliforms were detected occasionally at low concentrations for the wells within the Gilbert wellfield that were typically in the range of 0 - 7 CFU/100 mL. Two instances occurred whereby total coliforms were also detected at higher concentrations of 0 - 40 CFU/100 mL and 0-116 CFU/100 mL for the well P211 in 2009 and 2013, respectively. No *E. coli* was detected throughout the period between 2008 and 2017 for the wells within the Telfer wellfield; however total coliforms were detected at a concentration of up to 1 CFU/100 mL for the well P31 in 2013.

Microbial testing was conducted for the wells P51 (128 samples), P52 (237 samples), P53 (128 samples), and P54 (128 samples) within the Bethel wellfield for the period between 2013 and 2017. *E. coli* was detected at a concentration of up to 2 CFU/100 mL for the well P52 in 2014. In addition, total coliforms were detected throughout this period at concentrations that ranged between 0 - 3 CFU/100 mL to 0 - 45 CFU/100 mL for the wells P52 and P53.

Summary of Drinking Water Quality Issues Evaluation for the Paris Well Supply

Based on the water quality analysis performed for the period between 2008 and 2017, nitrate was identified as an Issue under Technical Rule 114 for the Gilbert wellfield (Overburden only) and Telfer wellfield. Upon review of the water quality data pertaining to the Bethel Road wells for the period between 2013 and 2017, nitrate concentrations were no longer above the ODWQS of 10 mg/L and displayed a decreasing trend. Therefore nitrate is no longer identified as an Issue for Bethel Road wellfield; however, nitrate remains an identified Issue for the Gilbert wellfield (Overburden only) and the Telfer wellfield. The chloride concentrations within the Bethel wellfield

raw production water supply will also continue to be monitored to determine if a chloride Issue should be identified in the future.

Issues Contributing Areas for County of Brant Well Supplies

For the nitrate Issues at the St. George Well Supply, the monitoring data suggest the possibility of contamination from agriculture and/or septic systems. The decreasing nitrate concentrations observed for the period between 2008 and 2017 will continue to be monitored and further justification to support this declining trend will be sought. This will include discussions with agricultural landowners within the St. George wellfield to determine if the implementation of Agricultural Best Management Practices may have resulted in a reduction in nitrate concentrations.

Consequently, the entire WHPA for the St. George wellfield where an Issue has been identified is included in the Issue Contributing Area (ICA) (**Map 13-17Error! Reference source not found.**).

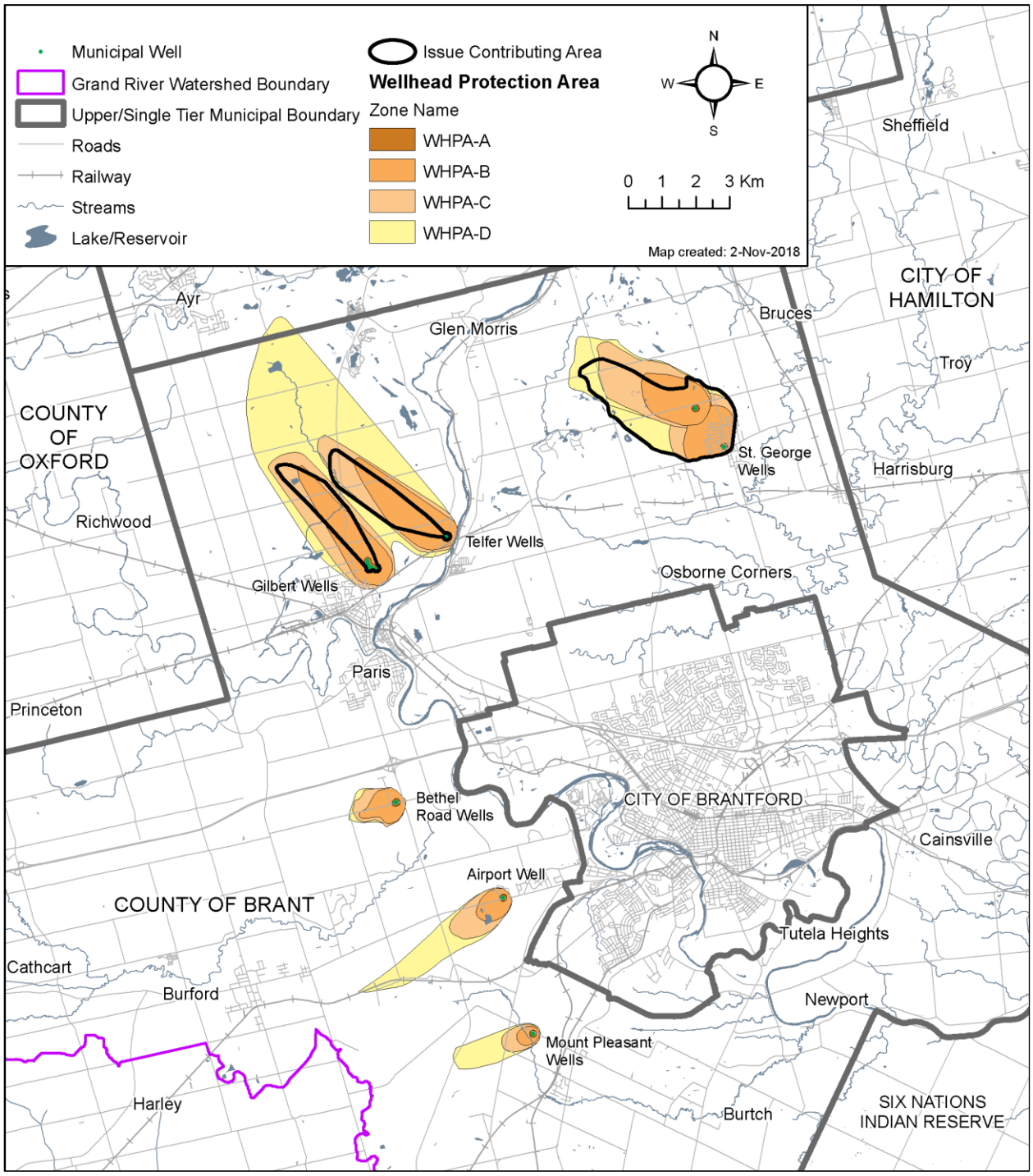
For the Gilbert wellfield (Overburden) and Telfer wellfield, agricultural activity within the WHPA is interpreted to be the main cause of the elevated nitrate concentrations. Septic systems may also contribute to the elevated levels of nitrate. As part of the threats assessment, any threat that may contribute to the nitrate Issue is considered a significant threat regardless of the vulnerability.

The ICAs for the Gilbert and Telfer wellfields were delineated using the same model as the WHPAs but instead applied average pumping rates from the years 2008 to 2010 (WNMC, 2011). These zones are thought to represent where the source water for the wells has come from in the past rather than the area that should be protected in the future. The delineated 25 year time of travel zone based on average current pumping rates is considered the ICA for the associated wellfields. The ICAs for the Gilbert and Telfer wellfields are provided in **Table 13-10Error! Reference source not found..**

Table 13-10: Issues and Issue Contributing Areas County of Brant Well Supplies

Well	Issue Contributing Area	Chemical of Concern
St. George: Wells 1, 2 and 3	WHPA-A to D	Nitrate
Gilbert Well Field – Overburden (Paris): Wells P210 – P215	25 year TOT based on average current pumping rates	Nitrate
Telfer Well Field –(Paris): Wells P31 and P32	25 year TOT based on average current pumping rates	Nitrate

Map 13-17: Issue Contributing Areas for the County of Brant Water Supply



Enumeration of Significant Drinking Water Quality Threats

The Technical Rules require an estimation of the number of locations at which an activity is a significant drinking water threat and the number of locations at which a Condition resulting from past activity is a significant drinking water threat.

St. George, Airport, Mount Pleasant and Bethel Road WHPAs

Following the identification of the above listed threats, the threat assessment involved ranking a threat as significant, moderate or low based on the vulnerability score and the circumstance information in the Tables of Drinking Water Threats (MECP, 2018).

An update to the significant threats assessment was completed in 2018 based on updated aerial photography corresponding to the revised WHPAs.

Table 13-11, Table 13-12, Table 13-13, Table 13-14 and Table 13-15, summarize the significant threats for the Airport, Mount Pleasant, St. George and Bethel Road Well Supply.

Table 13-11: Airport Well Supply Significant Drinking Water Quality Threats (current to December 2018)

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area
1	Waste Disposal Site- Storage of Hazardous Waste at Disposal Sites	4	WHPA-A WHPA-B
	Waste Disposal Site- Storage of wastes described in clauses (p), (q), (r), (s), (t) or (u) of the definition of hazardous waste	5	WHPA-A WHPA-B
2	Sewage System or Sewage Works- Septic System	16	WHPA-B
	Sewage System or Sewage Works- Sanitary Sewers and related pipes	1	WHPA-A WHPA-B
	Sewage System or Sewage Works- Septic System Holding Tank	4	WHPA-B
3	Application of Agricultural Source Material to Land	3	WHPA-B
4	Handling and Storage of Agricultural Source Material	3	WHPA-B
10	Application of Pesticides to Land	3	WHPA-B
11	Handling and Storage of Pesticides	1	WHPA-B
15	Handling and Storage of Fuel	16	WHPA-A WHPA-B
16	Handling and Storage of DNAPLs	18	WHPA-A WHPA-B WHPA-C
17	Handling and Storage of Organic Solvents	5	WHPA-A WHPA-B
Total Number of Activities		**79**	
Total Number of Properties		**21**	

Table 13-11: Airport Well Supply Significant Drinking Water Quality Threats (current to December 2018)

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area

1: Prescribed Drinking Water Threat Number refers to the prescribed drinking water threat listed in O.Reg.287/07 s.1.1.(1).

2: Where applicable, waste, sewage, and livestock threat numbers are reported by sub-threat; fuel and DNAPL by Prescribed Drinking Water Threat category.

Note: Certain types of activities on residential properties that are incidental in nature and that are significant drinking water threats are not enumerated. These threats include the application of commercial fertilizer on residential properties, the storage of organic solvents (dense non-aqueous phase liquids) on residential properties, and the storage of fuel (e.g., heating fuel tanks) on residential properties in natural gas serviced areas.

Note: County of Brant does not consider storm sewer distribution piping and other associated networks such as ditches or unlined trenches to be part of a storm water management facility.

Table 13-12: Mount Pleasant Well Supply Significant Drinking Water Quality Threats (current to December 2018)

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area
2	Sewage System or Sewage Works- Septic System	8	WHPA-A WHPA-B
	Sewage System or Sewage Works- Septic System Holding Tank	2	WHPA-A WHPA-B
3	Application of Agricultural Source Material to Land	7	WHPA-A WHPA-B
4	Handling and Storage of Agricultural Source Material	4	WHPA-A
8	Application of Commercial Fertilizer	1	WHPA-B
10	Application of Pesticides to Land	3	WHPA-A WHPA-B
12	Application of Road Salt	3	WHPA-A WHPA-B
13	Handling and Storage of Road Salt	3	WHPA-A WHPA-B
15	Handling and Storage of Fuel	5	WHPA-A
16	Handling and Storage of DNAPLs	1	WHPA-A
17	Handling and Storage of an Organic Solvent	1	WHPA-A
Total Number of Activities		**38**	
Total Number of Properties		**9**	

1: Prescribed Drinking Water Threat Number refers to the prescribed drinking water threat listed in O.Reg.287/07 s.1.1.(1).

2: Where applicable, waste, sewage, and livestock threat numbers are reported by sub-threat; fuel and DNAPL by Prescribed Drinking Water Threat category.

Note: Certain types of activities on residential properties that are incidental in nature and that are significant drinking water threats are not enumerated. These threats include the application of commercial fertilizer on residential properties, the storage of organic solvents (dense non-aqueous phase liquids) on residential properties,

Table 13-12: Mount Pleasant Well Supply Significant Drinking Water Quality Threats (current to December 2018)

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area
and the storage of fuel (e.g., heating fuel tanks) on residential properties in natural gas serviced areas.			
Note: County of Brant does not consider storm sewer distribution piping and other associated networks such as ditches or unlined trenches to be part of a storm water management facility.			

Table 13-13: St. George Overburden Well Supply Significant Drinking Water Quality Threats (current to December 2018)

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area
1	Waste Disposal Site- Storage of wastes described in clauses (p), (q), (r), (s), (t) or (u) of the definition of hazardous waste	4	WHPA-A
2	Sewage System or Sewage Works – Onsite Sewage Systems	65	WHPA-B ICA
	Sewage System Or Sewage Works – Sanitary Sewers and related wastewater collection systems	2	WHPA-A WHPA-B
3	Application Of Agricultural Source Material (ASM) To Land	29	ICA
4	Storage Of Agricultural Source Material (ASM)	21	WHPA-B ICA
8	Application Of Commercial Fertilizer To Land	39	ICA
9	Storage Of Commercial Fertilizer	17	ICA
10	Application Of Pesticide To Land	3	WHPA-B
11	Storage Of A Pesticide	3	WHPA-B
15	Storage of Fuel	9	WHPA-A WHPA-B
16	Storage Of A Dense Non Aqueous Phase Liquid (DNAPL)	3	WHPA-A
17	Storage of Organic Solvent	3	WHPA-A
21	Management Or Handling Of Agricultural Source Material – Agricultural Source Material (ASM) Generation (Grazing and pasturing)	12	WHPA-B ICA
22	The establishment and operation of a liquid hydrocarbon pipeline.	1	WHPA-B
Condition	Off-site contamination of BTEX and F1-F4 that exceed the potable groundwater standards as set out in Table 2 of the Soil, Groundwater and Sediment Standards	2	WHPA-A WHPA-B
Total Number of Activities		**209**	
Total Number of Conditions		**2**	
Total Number of Properties		**84**	

1: Prescribed Drinking Water Threat Number refers to the prescribed drinking water threat listed in O.Reg 287/07s.1.1.(1).

2: Where applicable, waste, sewage, and livestock threat numbers are reported by sub-threat; fuel and DNAPL by Prescribed Drinking Water Threat category.

Table 13-13: St. George Overburden Well Supply Significant Drinking Water Quality Threats (current to December 2018)

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area

Note: Certain types of activities on residential properties that are incidental in nature and that are significant drinking water threats are not enumerated. These threats include the application of commercial fertilizer on residential properties, the storage of organic solvents (dense non-aqueous phase liquids) on residential properties, and the storage of fuel (e.g., heating fuel tanks) on residential properties in natural gas serviced areas.

Note: County of Brant does not consider storm sewer distribution piping and other associated networks such as ditches or unlined trenches to be part of a storm water management facility.

Table 13-14: St. George Bedrock Well Supply Significant Drinking Water Quality Threats (current to December 2018)

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area
2	Sewage System or Sewage Works – Onsite Sewage Systems	1	WHPA-A
3	Application of Agricultural Source Material to Land	2	WHPA-A
10	Application of Pesticide to Land	3	WHPA-A WHPA-B
11	Storage of Pesticide	1	WHPA-B
15	Handling and Storage of Fuel	3	WHPA-A WHPA-B
Total Number of Activities		**10**	
Total Number of Properties		**3**	

1: Prescribed Drinking Water Threat Number refers to the prescribed drinking water threat listed in O.Reg 287/07s.1.1.(1).

2: Where applicable, waste, sewage, and livestock threat numbers are reported by sub-threat; fuel and DNAPL by Prescribed Drinking Water Threat category.

Note: Certain types of activities on residential properties that are incidental in nature and that are significant drinking water threats are not enumerated. These threats include the application of commercial fertilizer on residential properties, the storage of organic solvents (dense non-aqueous phase liquids) on residential properties, and the storage of fuel (e.g., heating fuel tanks) on residential properties in natural gas serviced areas.

Note: County of Brant does not consider storm sewer distribution piping and other associated networks such as ditches or unlined trenches to be part of a storm water management facility.

Table 13-15: Bethel Road Well Supply Significant Drinking Water Quality Threats (current to December 2018)

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area
1	Application of Untreated Septage to Land	2	WHPA-A
	Waste Disposal Site - Storage of wastes described in clauses (p), (q), (r), (s), (t) or (u) of the definition of hazardous waste	1	WHPA-A
2	Sewage System or Sewage Works- Sanitary Sewers and related pipes	1	WHPA-A
3	Application of Agricultural Source Material to Land	4	WHPA-B

Table 13-15: Bethel Road Well Supply Significant Drinking Water Quality Threats (current to December 2018)

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area
4	Handling and Storage of Agricultural Source Material	6	WHPA-B
10	Application of Pesticide to Land	4	WHPA-A WHPA-B
11	Handling and Storage of Pesticides	2	WHPA-B
15	Handling and Storage of Fuel	8	WHPA-A WHPA-B
16	Handling and Storage of DNAPLs	6	WHPA-A WHPA-B
17	Handling and Storage of an Organic Solvent	2	WHPA-B
21	Management or handling of Agricultural Source Material- Agricultural Source Material (ASM) Generation (Grazing and pasturing)	7	WHPA-B
21	Management or handling of Agricultural Source Material- Agricultural Source Material (ASM) Generation (Yards or Confinement)	3	WHPA-B
Total Number of Activities		**46**	
Total Number of Properties		**7**	

1: Prescribed Drinking Water Threat Number refers to the prescribed drinking water threat listed in O.Reg 287/07s.1.1.(1).

2: Where applicable, waste, sewage, and livestock threat numbers are reported by sub-threat; fuel and DNAPL by Prescribed Drinking Water Threat category.

Note: Certain types of activities on residential properties that are incidental in nature and that are significant drinking water threats are not enumerated. These threats include the application of commercial fertilizer on residential properties, the storage of organic solvents (dense non-aqueous phase liquids) on residential properties, and the storage of fuel (e.g., heating fuel tanks) on residential properties in natural gas serviced areas.

Note: County of Brant does not consider storm sewer distribution piping and other associated networks such as ditches or unlined trenches to be part of a storm water management facility.

Paris North (Telfer and Gilbert)

The threats enumeration was compiled using the data from various sources that were reviewed as part of this study. Following the preliminary research, field assessments were completed to verify and complete the threats enumeration process. As a conservative measure no effort to include the impact of management techniques that may be employed at any threat location was considered. It can therefore be concluded that the level of uncertainty associated with this enumeration is high.

A drive-by roadside inspection of the WHPAs on January 25, 2011 was completed to verify and compliment the dataset compiled during the records review portion of the assessment. The inspection consisted of a fence line/roadside documentation of the properties and their land uses included in the WHPA.

Land uses within the WHPA include residential, commercial, industrial, and agricultural. Residential homes within the Town limits are generally less than 30 years old and serviced with gas, sewer and water. A large industrial area is located within the WHPA-B of the Gilbert wellfield

that includes a variety of manufacturing and distributing operations including poultry processing and types of metal parts manufacturing.

Information collected from the County of Brant public works staff confirmed that there are no snow disposal sites within the WHPA and that there are no sewage pumping stations or sewage treatment facilities within the WHPA. Details regarding sewage flows were also provided by County staff.

An update to the significant threats assessment was completed in 2013-2014 based on updated aerial photography, slightly revised WHPAs, and limited windshield surveys.

Enumeration of Significant Drinking Water Issues for the North Paris Well Supply

All activities that may contribute to an identified Issue located within the Issue Contributing Area are significant drinking water threats and are included in the table below. **Table** 13-16 summarizes the significant threats for the Paris North Well Supply.

Table 13-16 Paris North Well Supply Significant Drinking Water Quality Threats

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area
1	Waste Disposal Site- Storage of Hazardous Waste at Disposal Sites	2	WHPA-B
	Waste Disposal Site- Storage of wastes described in clauses (p), (q), (r), (s), (t) or (u) of the definition of hazardous waste	7	WHPA-B
2	Sewage System or Sewage Works- Septic System	34	WHPA-A WHPA-B ICA
	Sewage System or Sewage Works- Sanitary Sewers and related pipes	1	WHPA-A WHPA-B ICA
	Sewage System or Sewage Works- Discharge of Untreated Stormwater from a Stormwater Retention Pond	2	ICA
	Sewage System or Sewage Works- Septic System Holding Tank	7	WHPA-A WHPA-B ICA
3	Application of Agricultural Source Material to Land	38	WHPA-A WHPA-B ICA
4	Handling and Storage of Agricultural Source Material	31	WHPA-A WHPA-B ICA
8	Application of Commercial Fertilizer	37	WHPA-A WHPA-B ICA
9	Handling and Storage of Commercial Fertilizer	13	WHPA-B ICA
10	Application of Pesticides to Land	27	WHPA-A WHPA-B
11	Handling and Storage of Pesticides	11	WHPA-B
15	Handling and Storage of Fuel	18	WHPA-A WHPA-B
16	Handling and Storage of DNAPLs	14	WHPA-A

Table 13-16 Paris North Well Supply Significant Drinking Water Quality Threats

PDWT[1] #	Threat Subcategory[2]	Number of Activities	Vulnerable Area
			WHPA-B WHPA-C
17	Handling and Storage of Organic Solvents	6	WHPA-B
21	Management or handling of Agricultural Source Material-Agricultural Source Material (ASM) Generation (Grazing and pasturing)	5	WHPA-B ICA
21	Management or handling of Agricultural Source Material-Agricultural Source Material (ASM) Generation (Yards or Confinement)	2	WHPA-B ICA
22	The establishment and operation of a liquid hydrocarbon pipeline.	2	WHPA-B
Total Number of Activities		**257**	
Total Number of Properties		**74**	

1: Prescribed Drinking Water Threat Number refers to the prescribed drinking water threat listed in O.Reg 287/07s.1.1.(1).

2: Where applicable, waste, sewage, and livestock threat numbers are reported by sub-threat; fuel and DNAPL by Prescribed Drinking Water Threat category.

Note: Certain types of activities on residential properties that are incidental in nature and that are significant drinking water threats are not enumerated. These threats include the application of commercial fertilizer on residential properties, the storage of organic solvents (dense non-aqueous phase liquids) on residential properties, and the storage of fuel (e.g., heating fuel tanks) on residential properties in natural gas serviced areas.

Note: County of Brant does not consider storm sewer distribution piping and other associated networks such as ditches or unlined trenches to be part of a storm water management facility.