# Chapter 6 – Surface Water Sources

## Purpose

Chapter 6 discusses the work in the Cataraqui Source Protection Area (CSPA) on the mapping of *intake protection zones* (IPZs) around the *surface water* intakes of municipal residential *drinking water systems*. Section 6.1 explains what an IPZ is, and some of the details of how it is defined and delineated. Section 6.2 provides specific findings for the eight intakes in the Eastern Lake Ontario / Upper St. Lawrence River IPZ study area, including IPZ delineation, vulnerability, *drinking water issues* and *threats*. Section 6.3 discusses the Picton intake, since part of its IPZ extends from the Quinte Source Protection Region into the CSPA. Section 6.4 provides details, for the inland *surface water* intake at Sydenham. All of these findings have been completed in accordance with the Technical Rules: Assessment Report (MOE, 2009j)(see **Appendix 'L-1'**) using the methods that are described in Chapter 4.

## 6.1 What is an Intake Protection Zone?

The purpose of an IPZ is to delineate an area of potential vulnerability around a *surface water* intake. Each intake may have three IPZs: IPZ 1, 2 and 3. There are variations in delineation requirements, depending on the type of intake, as defined in the Technical Rules: Assessment Report (MOE, 2009j). Each zone provides opportunity for the source protection committee or municipality to apply different levels of protective measures on *activities* planned or existing within the zone.

The delineation of IPZs is independent of specific *chemical*, biological or physical *contaminant* properties. The IPZ is the area where potential *contaminants* can be transported to the intake.

Land use *activities* or open water *activities* have associated *risks* to our sources of *drinking water*; some are more risky than others, having a potential to release large volumes of *chemicals* or *pathogens* into our *drinking water* supplies. The IPZs are prepared following a method intended to be repeatable across the province to highlight areas of greatest vulnerability to *contaminants*.

The establishment of the zones must take into account the hydrologic setting of the intake. Four different intake classifications are used; these are called Types 'A', 'B', 'C', and 'D' intakes and they affect the way IPZs are determined. The four classifications have been provincially determined and may not all be present within a given *source protection area*. The intake types for the intakes noted in this chapter are given in **Table 6-1** below.

**Table 6-1: CSPA Intake Type**

| Intake | Intake Type | Location |
|---|---|---|
| Brockville | Type 'B' | St. Lawrence River |
| Gananoque (James King) | Type 'B' | St. Lawrence River |
| Kingston Central | Type 'A' | Lake Ontario |
| Kingston West (Point Pleasant) | Type 'A' | Lake Ontario |
| Amherstview (Fairfield) | Type 'A' | Lake Ontario |
| Bath | Type 'A' | Lake Ontario |
| Napanee (A.L. Dafoe) | Type 'A' | Lake Ontario |
| Sandhurst Shores | Type 'A' | Lake Ontario |
| Picton* | Type 'D' | Bay of Quinte |
| Sydenham | Type 'D' | Sydenham Lake |

* Note: the Picton intake is located outside of the CSPA, but the associated draft IPZs extend into the area.

IPZ 1 is a set area around the intake. It is prescribed by the Technical Rules: Assessment Report (MOE, 2009j), and is not directly associated with water movement in the area of the intake. The generic IPZ 1 requirements for each intake type are detailed in **Table 6-2**. These areas may be modified to reflect local information about how water flows around the intake.

**Table 6-2: IPZ 1 Dimensions**

| Intake Type | Location | General Area Shape | Generic Area Dimension |
|---|---|---|---|
| 'A' | Great Lakes | Circle | One kilometre radius |
| 'B' | Connecting Channels | Semi-Circle/ Rectangle | One kilometre radius upstream of intake, rectangle two kilometres long and 100 metres wide downstream |
| 'C' | Rivers | Semi-Circle/ Rectangle | 200 metres radius upstream of intake, rectangle 400 metres long and ten metres wide downstream |
| 'D' | Other | Circle | One kilometre radius |

IPZ 2 is defined by the movement of water (hydrodynamics), and is sized to encompass a specific period of time for water to travel (minimum of two hours, longer may be used) from *contaminant* release to arrival at the intake. This zone is defined using a hydrodynamic *model* that takes into account data such as water velocity, water temperature, water depth, wind speed, wind direction, and water level that may move the *contaminant* plume to the intake.

The method for defining IPZ 3 varies depending on the type of intake. For the Type 'A' and 'B' intakes on Lake Ontario and the St. Lawrence River, IPZ 3 is an area of special interest. Within IPZ 3, significant *drinking water threats* may be defined if it can be shown that the release of a pollutant from one or more locations in IPZ 3 can directly travel to the intake in a reasonable time, during an extreme weather event, and harm the *raw source water* at the plant. For the purpose of the work in the CSPA, the extreme weather event has been defined as the one in 100 year storm (or more precisely, a one per cent probability wind condition).

For the Type 'D' intakes at Picton and Sydenham, IPZ 3 is defined based on the lakes and *streams* that contribute water to the intake.

Each IPZ continues on land up to the maximum limit of the Conservation Authority regulatory limit or 120 metres from the high water mark, whichever is greater. The regulatory limit is defined under the Ontario Conservation Authorities Act to define areas of potential flooding and *erosion*. There is allowance for *transport pathways* such as storm-sewers, ditches and *streams*, to extend the IPZ further on land. Pathway extension may increase the *risk* of *contaminant* release into the IPZ. Examples of IPZ delineation methods for the CSPA are shown in **Figures 6-1, 6-2, 6-3** and **6-4**.

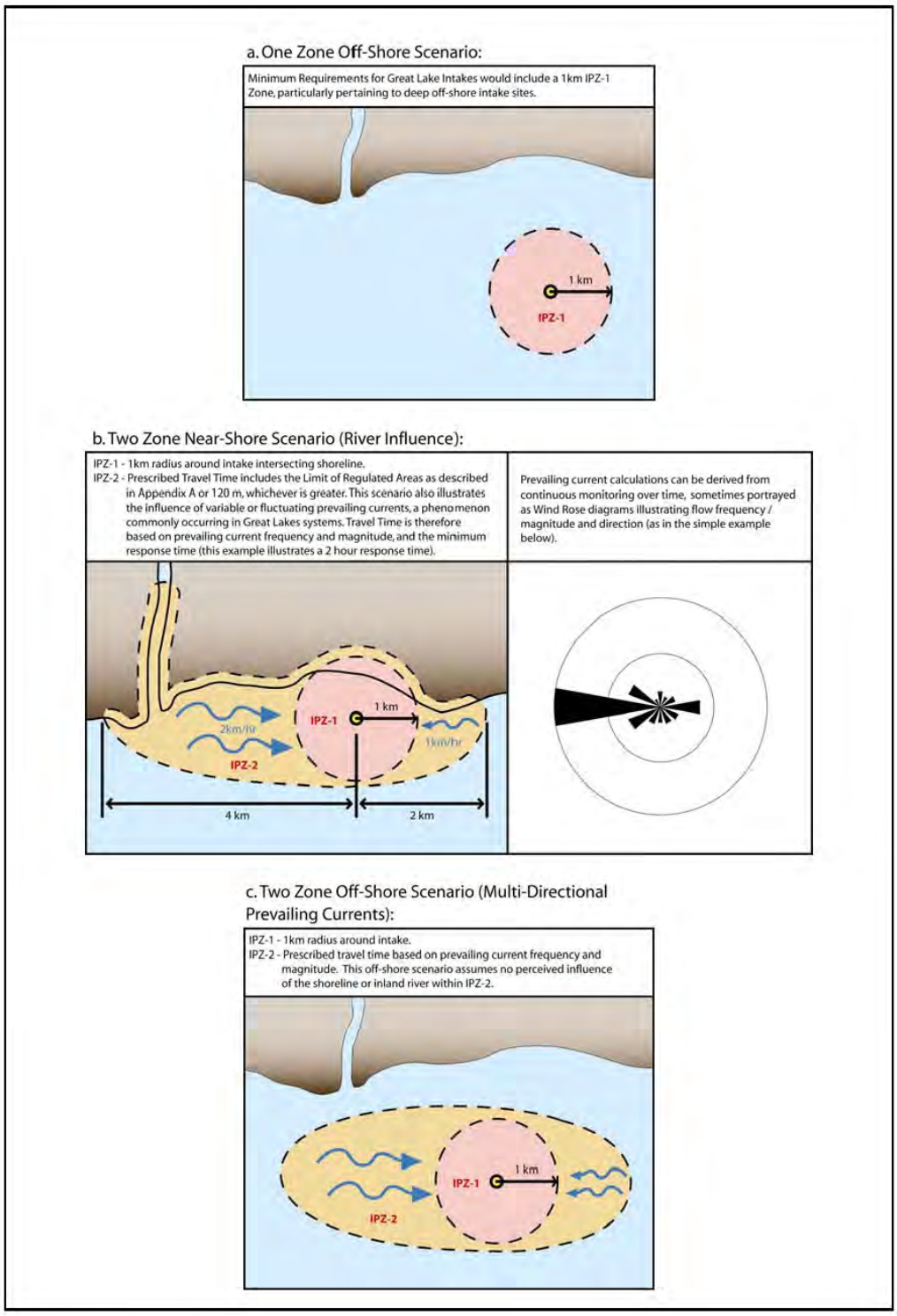


**Figure 6-1: Great Lakes (Type 'A' Intake) IPZ Delineation Example**

(MOE, 2006a)

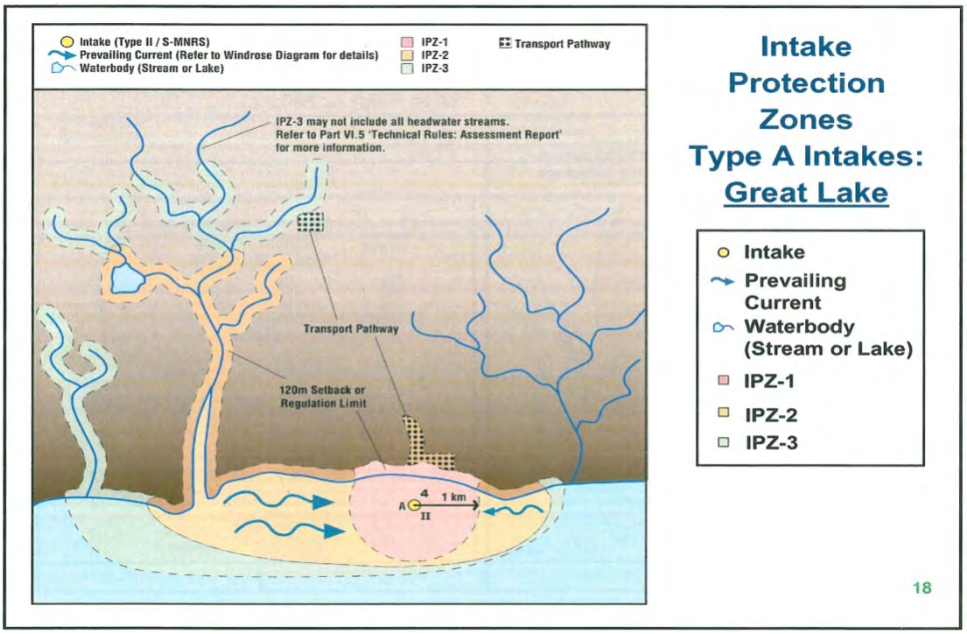


**Figure 6-2: Great Lakes (Type 'A' Intake) IPZ Transport Pathway Delineation Example**

(MOE, 2009d)

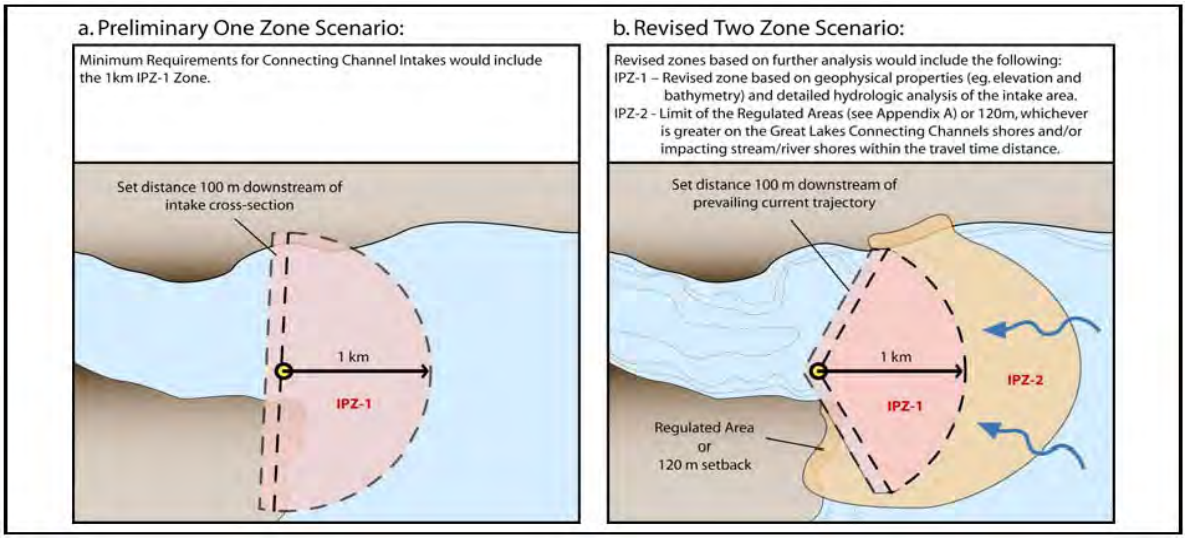


**Figure 6-3: Connecting Channel (Type 'B' Intake) IPZ Delineation Example**

(MOE, 2006a)

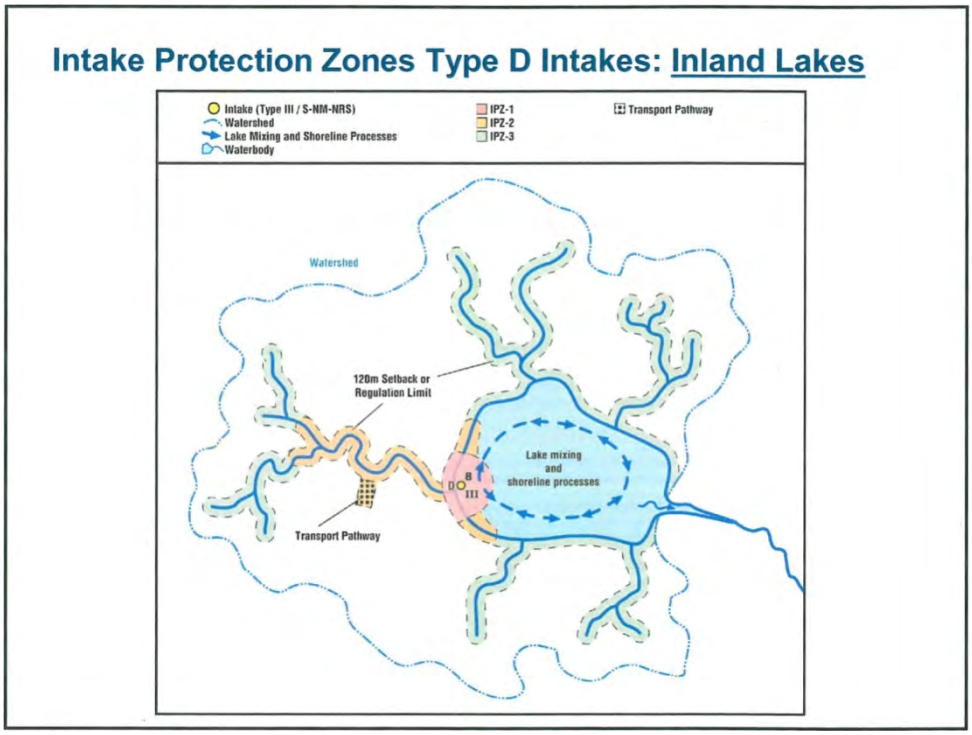


**Figure 6-4: Inland Lakes (Type 'D' Intake) IPZ Delineation Example**

(MOE, 2009d)

Once the zones have been determined following principles of science and minimum distance stipulations, the objective is to establish the vulnerability of the intake to *contamination*. Vulnerability is calculated in each zone following a scoring system that takes into account the geometry of the intake (distance from shore, depth below surface) as well as the intake type. This produces a vulnerability score that is used later to determine the *risk* of certain *activities* within each of the zones.

IPZs were delineated for nine municipal residential *drinking water* intakes in the Cataraqui area. The classification, number of residents served and locations of the municipal residential *drinking water* intakes in our area are given in **Table 6-3**. The IPZ for the Picton water treatment plant (WTP) also extends into the Cataraqui area from the Quinte Source Protection Region. For information about the Picton WTP please refer to that region's *Assessment Report*.

**Table 6-3: Drinking Water System Information**

| Drinking Water System | DWS Information |
|---|---|
| **City of Brockville Water Treatment Plant (DWS# 220001263)** | |
| Location | City of Brockville |
| Population Served | 22,350 people [(1)] |
| Area Served | 28.08 $km^2$ |
| Classification (O.Reg. 170/03) | Large municipal residential [(2)] |
| Supply Well Location | Lot 15, Concession I, Elizabethtown |
| Average Annual Volume ($m^3$) | 5,342,688 [(3)] |
| Average Monthly Volume ($m^3$) | 452,376 [(3)] |
| Monitoring Well Locations | *n/a* |
| **James W King Water Treatment Plant (DWS# 220001254)** | |
| Location | Gananoque, Town of Gananoque |
| Population Served | 5,209 people [(4)] |
| Area Served | 4.43 $km^2$ |
| Classification (O.Reg. 170/03) | Large municipal residential [(4)] |
| Supply Well Location | Lot 13, Broken Front, Leeds |
| Average Annual Volume ($m^3$) | 1,460,000 [(5)] |
| Average Monthly Volume ($m^3$) | *n/a* |
| Monitoring Well Locations | *n/a* |
| **Kingston Central Water Treatment (DWS# 220001860)** | |
| Location | Kingston, City of Kingston |
| Population Served | 80,000 people [(6)] |
| Area Served | 34.99 $km^2$ |
| Classification (O.Reg. 170/03) | Large municipal residential [(7)] |
| Supply Well Location | Lot 22, Broken Front, Kingston |
| Average Annual Volume ($m^3$) | 21,274,252 [(8)] |
| Average Monthly Volume ($m^3$) | 1,772,854 [(8)] |
| Monitoring Well Locations | *n/a* |
| **Point Pleasant Water Treatment Plant (DWS# 220001851)** | |
| Location | Kingston, City of Kingston |
| Population Served | 44,000 people [(9)] |
| Area Served | 32.42 $km^2$ |
| Classification (O.Reg. 170/03) | Large municipal residential [(10)] |
| Supply Well Location | Lot 10, Broken Front Kingston |
| Average Annual Volume ($m^3$) | 7,892,503 [(8)] |
| Average Monthly Volume ($m^3$) | 658,563 [(8)] |
| Monitoring Well Locations | *n/a* |
| **Fairfield Water Treatment Plant (DWS# 220009229)** | |
| Location | Amherstview, Loyalist Township |
| Population Served | 8,377 people [(11)] |
| Area Served | 3.85 $km^2$ |
| Classification (O.Reg. 170/03) | Large municipal residential [(11)] |
| Supply Well Location | Lot 41, Broken Front, Ernestown |
| Average Annual Volume ($m^3$) | 1,654,013 [(3)] |
| Average Monthly Volume ($m^3$) | 125,931 [(3)] |
| Monitoring Well Locations | *n/a* |

**Table 6-3: Drinking Water System Information (continued)**

| Drinking Water System | DWS Information |
|---|---|
| **Bath Water Treatment Plant (DWS# 220002217)** | |
| Location | Bath, Loyalist Township |
| Population Served | 2,441 people [12] |
| Area Served | 4.83 $km^2$ |
| Classification (O.Reg. 170/03) | Large municipal residential [12] |
| Supply Well Location | Lot 11, Broken Front, Ernestown |
| Average Annual Volume ($m^3$) | 640,400[12] |
| Average Monthly Volume ($m^3$) | *n/a* |
| Monitoring Well Locations | *n/a* |
| **A.L. Dafoe Water Treatment Plant (DWS# 220002226)** | |
| Location | Napanee, Town of Greater Napanee |
| Population Served | 8,500 people [13] in Quinte Source Protection Region |
| Area Served | 6.21 $km^2$ |
| Classification (O.Reg. 170/03) | Large municipal residential [14] |
| Supply Well Location | Lot 17, Concession I, Fredericksburgh |
| Average Annual Volume ($m^3$) | 2,478,320 [3] |
| Average Monthly Volume ($m^3$) | 214,453 [3] |
| Monitoring Well Locations | *n/a* |
| **Sandhurst Shores Water Treatment Plant (DWS# 220003877)** | |
| Location | Sandhurst Shores, Town of Greater Napanee |
| Population Served | 230 people [15] |
| Area Served | 0.38 $km^2$ |
| Classification (O.Reg. 170/03) | Small municipal residential [15] |
| Supply Well Location | Lot 9, Concession I, Fredericksburgh |
| Average Annual Volume ($m^3$) | 25,091 [3] |
| Average Monthly Volume ($m^3$) | 2116 [3] |
| Monitoring Well Locations | *n/a* |
| **Sydenham Water Treatment Plant (DWS# 260069290)** | |
| Location | Sydenham, South Frontenac Township |
| Population Served | 1187 people [16] |
| Area Served | 1.44 $km^2$ |
| Classification (O.Reg. 170/03) | Large municipal residential [16, 17] |
| Supply Well Location | Southern Parts of Lot 4 and 5, Concession V, Loughborough |
| Average Annual Volume ($m^3$) | 72,188 [8] |
| Average Monthly Volume ($m^3$) | 11,077 [8] |
| Monitoring Well Locations | *n/a* |

1. City of Brockville Drinking Water System – 2009 Annual Water Quality Report, City of Brockville
2. Brockville Water Treatment Plant – Drinking Water System Inspection Report, Ontario Ministry of the Environment, February 4, 2009.
3. Ontario Ministry of the Environment Permit to Take Water reporting database.
4. James W King Water Treatment Plant – Drinking Water System Inspection Report, Ontario Ministry of the Environment, August 19, 2009
5. Environment Canada water use data.
6. Utilities Kingston 2009 Annual Report – King Street Water Treatment Plant, Utilities Kingston, December 31, 2009
7. King Street Water Treatment Plant – Drinking Water Inspection Report, Ontario Ministry of the Environment, July 23, 2009
8. Utilities Kingston data.
9. Utilities Kingston 2009 Annual Report – Point Pleasant Water Treatment Plant, Utilities Kingston, December 31, 2009
10. Point Pleasant Water Treatment Plant – Drinking Water Inspection Report, Ontario Ministry of the Environment, June 25, 2009
11. Fairfield Water Treatment Plant – Drinking Water System Inspection Report, Ontario Ministry of the Environment, December 8, 2009
12. Bath Water Treatment Plant – Drinking Water System Inspection Report, Ontario Ministry of the Environment, July 21, 2009
13. A.L. Dafoe Water Treatment Plant – Drinking Water System Inspection Report, Ontario Ministry of the Environment, January 26, 2010
14. A.L. Dafoe Water Treatment Plant – Drinking Water System Inspection Report, Ontario Ministry of the Environment (2008)
15. Sandhurst Shores Water Treatment Plant – Drinking Water Inspection Report, Ontario Ministry of the Environment, July 3, 2008
16. Sydenham Water Treatment Plant – Drinking Water Inspection Report, Ontario Ministry of the Environment, January 29, 2009
17. Utilities Kingston 2009 Annual Report – Sydenham Water Treatment, Utilities Kingston, December 31, 2009

## 6.2 Eastern Lake Ontario/Upper St. Lawrence River Intakes

There are eight municipal residential *drinking water system* intakes along the Lake Ontario and St. Lawrence River shoreline in the CSPA (see **Map 2-10)**. They are (from east to west):

- Brockville (serving the City of Brockville and the Township of Elizabethtown-Kitley)
- James W. King (Gananoque)
- Kingston Central
- Point Pleasant (Kingston West)
- Fairfield (serving Amherstview and Odessa)
- Bath
- A. L. Dafoe (Napanee)
- Sandhurst Shores.

A study was conducted by the Centre for Water and the Environment at Queen's University (2009) to delineate an IPZ for each of the eight Cataraqui area intakes. The delineation of the IPZs was completed using a *validated* hydrodynamic *model.* For more information please refer the Delineation of Intake Protection Zones in the CRCA jurisdiction – Modelling Approach in **Appendix 'L-11a'**.

The study was overseen by a Technical Advisory Group that included representatives from each of the five municipalities that have intakes that are part of the study (the City of Brockville, the Town of Gananoque, the City of Kingston, Loyalist Township, and the Town of Greater Napanee). The *model*ling work was peer-reviewed by four experts in Canada and the United States, each of whom provided helpful suggestions.

During the field seasons of 2006 and 2007, data were gathered through a partnership between the Centre for Water and the Environment and Environment Canada at the Canadian Centre for Inland Waters. The data gathered included wind, air and water temperature, current velocity, as well as some specific current studies by *tracking drogues.*

There were to be two *models* created for this study, the first was to be a full Lake Ontario *model* in a two kilometre by two kilometre grid. This *model* would then be coupled to a finer grid *model* for the CSPA area (300 metre by 300 metre grid). The *models* were both *validated* using surface data such as temperature and water levels. Each *model validated* well with the field data on its own, and therefore the coupling of the two *models* was not needed. The CSPA area *model* alone was used for the IPZ delineation (CWE, 2009).

Once the *models* were *validated* to 2006 field data, work on the delineation of the IPZs was able to commence. It appeared that the best way to delineate an IPZ (pertaining to IPZ 2 as IPZ 1 is predetermined by the Technical Rules, as discussed below) was to use the wind speed, as wind is the predominant generator of currents in the study area.

The recorded wind in 2006 and 2007 did not reach the expected extreme conditions that were required for the study, so the recorded winds at the field stations were related to the winds

recorded at the Kingston Airport Climate station (6104146 YGK). In turn, recorded winds were then prorated to the historical wind record for the airport and increased to the ten year and 100 year *return period* condition. This process is also detailed in Delineation of Intake Protection Zones in the CRCA Jurisdiction – Modeling Approach (CWE, 2009).

The resulting wind conditions (and seasonal conditions) were then used to drive the hydrodynamic *model*, and estimate the current velocities at the eight intakes.

It had been earlier decided by the Technical Advisory Group that the minimum requirement of two hours *time of travel* would be used to delineate the IPZ 2. Knowing what the current profile in various directions can be over the season, these maximum currents can then be assumed to be maintained for two hours, which will give the distance a *contaminant* can travel (at the water surface) in that time.

With the current directions, and the *time of travel* known, a shape around each intake could be delineated as IPZ 2. These delineations are further discussed in Section 6.2.1.

Some initial IPZ 3 *modeling* work has been completed by the Queen's University Department of Civil Engineering and the Cataraqui Region Conservation Authority (CRCA); the initial findings are included below.

## 6.2.1 Delineation of the Intake Protection Zones

As discussed above, each of the IPZs for the intakes in the Cataraqui area have been delineated using data prepared by the Centre for Water and the Environment (2009) study.

### 6.2.1.1 Intake Protection Zone 1

IPZ 1 has been mapped based on the Technical Rules: Assessment Report (MOE, 2009j) (**Table 6-2**). For the six Lake Ontario intakes, IPZ 1 was delineated as a circle around the intake, with an appropriate setback on land. For the St. Lawrence River intakes, IPZ 1 was delineated as a half-circle in the upstream direction around the intake (one kilometre), with a rectangle in the downstream direction (100 metres). A combination of the regulation limit and a 120 metre high water mark setback is used for the IPZ 1 setbacks on land, in accordance with the Technical Rules.

### 6.2.1.2 Intake Protection Zone 2

IPZ 2 has been delineated using a two hour *time of travel* during a wind event that has a one in ten chance (ten per cent probability) of happening in any year, as detailed in Delineation of Intake Protection Zones in the CRCA Jurisdiction – Modeling Approach (CWE, 2009). The portion of the IPZ 2 zone that falls in the water reflects the anticipated movement of water towards the intake.

*Modeling* by Queen's University researchers shows that water can move from downstream to upstream in sustained east wind conditions. This occurs in much of the water column, in particular in the St. Lawrence River, from the surface of the water down to the bed of the *river*. This is seen in the *model*, and has been confirmed anecdotally by local residents, specifically along the shoreline in Brockville. This is the reason that IPZ 2 extends a considerable distance in the downstream direction from the intakes.

In most locations it was decided to not adjust the computer-generated zone boundaries by hand (for example, by extending them to the nearest shore) but instead to rely upon the already conservative outcome of the *model*.

Where the in-water portion of one of the zones meets the shoreline, a combination of the regulation limit and a 120 metre setback from the high water mark is used to extend it inland, in accordance with the Technical Rules.

In the opinion of the authors at Queen's University: "the *modeled* flow structure agrees well quantitatively and qualitatively with field observations" (CWE, 2009). This opinion was supported by the peer reviewers. The *model* that was used to delineate the zones was the one of best available at the time of the study. However, the study was limited by the lack of long-term field data from different seasons of the year, and by the fact that the available hydrologic *models* do not reflect the winter months in which portions of the Lake and River are covered by ice. Based on these factors, an uncertainty level of low is assigned to the IPZ delineations.

The portions of IPZ 2 that extend further inland were generated from two sources:

- Storm sewer networks that contribute water to the IPZ (within the two hour *time of travel*). CRCA staff used sanitary and storm sewer network maps provided by the municipalities and assumed full flowing pipes (worst case scenario) to add these portions. All *time of travel* calculations were done using Manning's equation. Manning's equation is used to calculate the velocity of flow in the pipe. Knowing the velocity, the distance of travel in the pipe for a give time period can be estimated. While pipe diameters and pipe *slopes* were typically not available for the storm sewer networks in the CSPA, sensitivity analyses showed that any outlets into a delineated IPZ 2 would include the entire upstream storm sewer network within the two hour *time of travel* to the intake.
- *Transport pathways* that contribute water to the IPZ were also assessed. *Transport pathways* can be ditches, pipelines, tile drains or other man-made features where water and other substances can potentially flow. When delineating the extent of IPZ 2, all *transport pathways* known on the landscape were considered for each system within Lake Ontario and the St. Lawrence River. It is important to note that only the length of the *transport pathway* that is expected to be within a two hour *time of travel* of the intake is captured in the extent of the IPZ 2 delineation.

In the case of ditches, most have been included as part of the area of the storm sewer network that drains to an IPZ 2, as they are well within the two hour *time of travel*. In one case, a ditch was added along a steep road that runs perpendicular, down a steep *slope*, to the location of an intake.

The extent of *streams* included in IPZ 2 is intended to include only the length of *stream* that is expected to be within a two hour *time of travel* of the intake. The extent of the *stream* included was decided by estimating the cross-section and *slope* of the *stream*, and assuming bankfull flow. All *time of travel* calculations were done using Manning's equation, as noted above. In most cases, simple calculations showed that the entire *stream* was within the two hour *time of travel* to the intake. In some cases, where data was available, the velocity information in the HEC-2 or

HEC-RAS *models* of the creeks were used to estimate the distance upstream from the mouth that was contained in the two hour *time of travel* to the intake.

Tile *drainage* was also used to delineate the inland portion of IPZ 2 at some locations (see below). Information was gathered from existing databases, site inspections and interviews with landowners. Where a field with tile *drainage* was found to flow directly into a waterbody (for example: a *stream*) within the zone, the entire portion of the field that *drained* to that location was added to the zone.

**Table 6-4** below indicates whether or not *transport pathways* and watercourses were used in the IPZ delineations at each intake. The extent of the surface pathways included was decided by estimating the cross-section of *streams* and ditches, and assuming bankfull flow. All *time of travel* calculations were done using Manning's equation.

**Table 6-4: Transport Pathways & Watercourses in IPZs**

| Intake | Transport Pathways | | | Watercourses | |
|---|---|---|---|---|---|
| | Ditches | Tile Drains | Storm-sewers | Streams | Rivers |
| Brockville | ✓ | | ✓ | ✓ | |
| James W. King (Gananoque) | ✓ | | ✓ | ✓ | ✓ |
| Kingston Central | ✓ | | ✓ | | |
| Point Pleasant (Kingston West) | ✓ | | ✓ | ✓ | |
| Fairfield (Amherstview) | ✓ | | ✓ | ✓ | |
| Bath | ✓ | ✓ | ✓ | ✓ | |
| A.L. Dafoe (Napanee) | ✓ | ✓ | | | |
| Sandhurst Shores | ✓ | ✓ | | ✓ | |

**Maps 6-1, 6-9, 6-16, 6-23, 6-30, 6-37, 6-44 and 6-51** show the delineated IPZ 1 and IPZ 2 for the eight Lake Ontario and St. Lawrence River intakes in the CSPA. **Map 6-2** shows the calculated IPZ 1 and IPZ 2 at Brockville, including the portions that extend into the United States of America (New York State).

#### 6.2.1.3 Intake Protection Zone 3

The CWE (2009) report includes some initial findings for IPZ 3 around the eight municipal residential *drinking water system* intakes that draw from either Lake Ontario or the St. Lawrence River within the CSPA. The area that could contribute water to the intakes during 2006 conditions (gathered field data) has been *modelled* and delineated, as described below.

**Map 6-58** shows the combined IPZ 3 for the eight CSPA intakes on the Great Lakes. It was delineated by running the hydrodynamic *model* for 29 specific sites of interest. Each *discharge* point was assigned a concentration of one (two of the 29 sites had actual concentration data from events in 2006). The *discharge* rates used for each *discharge* point were a mix of actual field data, estimated and pro-rated data. The hydrodynamic *model* was then run three times (ten *discharge* locations each) and the extent of the spread (and relative concentration isolines) of the *discharge* was mapped for each of the 29 *discharge* points. These 29 maps were then overlain to form the overall IPZ 3.

For instance, if a *contaminant* storage site was identified to be *modeled*, the location was added into the *model*. In turn, the *model* was run to see whether a release from the site could directly reach the intake during 2006 conditions. These data were used in lieu of an *extreme event* (the one in 100 year storm, or more precisely, a one per cent probability wind condition) which was deemed less critical for the *modeling* work.

In addition to the extent of the *discharge* concentration map, the concentration over the 2006 *model* year from each *discharge* point (six hour intervals) at each intake was recorded, as was the maximum value seen over the 2006 *model* year.

Using this *modeling* approach, it was found that the entire shoreline of the CSPA has the potential to contribute *contaminants* to the water at the CSPA intakes during 2006 conditions. The boundary of the combined IPZ 3 is based on the sum of the computer *model* runs for the 29 sites. Its extent is roughly coincident with areas of water in the lake and *river* that have a depth of 30 metres or less. This finding is consistent with work at the Credit-Toronto-Central Lake Ontario Source Protection Region, which identified that the water withdrawn at the intakes of Lake Ontario comes almost exclusively from areas shallower than 30 metres (Snodgrass, 2009).

Further to the delineation of IPZ 3, additional work relating specific *discharge* locations and intakes was undertaken by CRCA staff. Consideration was given to looking at various *discharge* scenarios (concentration, volume, etc.), and whether they may create a significant *threat* for the intakes. However, very little data (almost none) for the *discharge* points was available for this work, and attempting to run various scenarios through a network of 232 (29 *discharges*, eight intakes) potential relations did not appear to be a worthwhile task, given all the assumptions and uncertainties associated with that kind of work.

An attempt to back track from existing *issues* at the intakes to a *discharge* point also proved difficult, without any real information on which *discharge* locations, if any, had or could *discharge* a compound found at the intakes.

At this time, the information available to reliably identify significant *threats* to the intakes using *modeling* of the IPZ 3 zone is not available, and therefore no significant *threats* can be identified through this method. For more information regarding the IPZ 3 *modeling*, please refer to Intake Protection Zone 3 Discharge Concentration Modeling Report for Consideration of Significant Threats (Watt, 2010) in **Appendix '11b'**.

Although the initial findings for IPZ 3 are insightful, it is clear that further research is warranted such as analyses related to the identification of significant *drinking water threats* (via the event-based approach outlined in Chapter 4). Another area of interest is the presence of large industrial

facilities along the shoreline of Lake Ontario and the St. Lawrence River. There are several facilities in close proximity to the municipal intakes and therefore provide locations where further modelling regarding *drinking water threats* are needed. Recommendations for future work on this approach to identifying *threats* and *modeling* with reference to industrial facilities are discussed in Chapter 8.

It is worth noting that *contaminants* from outside the delineated IPZ 3 may affect the intakes. It has been seen that *activities* along the north shore of the main basin of Lake Ontario can travel long distances in a reasonably short period of time. In 1992, a *tritium* spill from the Pickering nuclear power plant travelled in a westerly direction and evidence of the spill was seen at water treatment plant intakes to the western extent of Lake Ontario. Had the wind been easterly, there has been suggestion that the spill could have potentially reached the Cataraqui area. The Credit-Toronto-Central Lake Ontario Source Protection Region has been conducting *modeling* to further examine the potential of *contaminant* movement in the lake. Previous *monitoring* work has shown evidence of above background levels of tritium along the north shore of Lake Ontario at water treatment plant intakes east of Pickering (though not as far east as the Cataraqui area) (L. Moore, 2010).

### 6.2.2 Vulnerability Scoring

As described in Chapter 4, vulnerability scoring is a measure of how sensitive the waters and land around an intake are to *contamination*. The vulnerability scoring for each of the eight Lake Ontario and St. Lawrence River intakes is detailed in **Appendix 'J'**.

To summarize, the vulnerability score is a multiplication of two factors, the area vulnerability factor ($Vf_a$) and the source vulnerability factor ($Vf_s$) (MOE, 2009j).

$$V = Vf_a \times Vf_s$$

The criteria for assigning $Vf_a$ and $Vf_s$ are laid out in the Technical Rules: Assessment Report (MOE, 2009j).

The area vulnerability factor ($Vf_a$) is based on:

- the percentage of the area that is composed of land
- the *land cover*, soil type, *permeability*, and the *slope* of setbacks
- the hydrological and hydrogeological conditions in the area that contributes water through *transport pathways*, and
- the proximity of the area to the intake (in the case of IPZ 3).

$Vf_a$ varies depending on intake zone. IPZ 1 receives a score of ten and, IPZ 2 can range from seven to nine. IPZ 3 is not assigned a vulnerability score for the Great Lake and *connecting channel* intakes.

Maximum scores for the area vulnerability factor were given to the Type 'A' intakes in Fairfield (Amherstview) and Bath and the Type 'B' intakes in Brockville and James W. King (Gananaoque) due to the above conditions (please refer to **Table 6-6** below and **Appendix 'J'**,

**Tables 1** to **4** for more detail relating the specific factors above for each intake). All areas are subject to *hydrogeological impacts* of fractured *bedrock* where the release of a *contaminant* on the surface can very easily penetrate into the *bedrock*, and therefore all the CSPA intakes will have a higher vulnerability.

The score vulnerability factor ($Vf_s$) applies to the location of the intake and is determined in relation to:

- the depth of the intake
- the distance of the intake from land, and
- the number of recorded *drinking water issues* related to the intake.

$Vf_s$ varies depending on the whether the intake is located on a Great Lake (such as Lake Ontario) or a *connecting channel* (such as the St. Lawrence River). For Type 'A' intakes on the Great Lakes, the vulnerability scoring can range from 0.5 to 0.7. For Type 'B' intakes on *connecting channels*, it can range from 0.7 to 0.9.

Generally, the intakes are shallow and close to shore. To account for the lack of temperature stratification (increased mixing potential), $Vf_s$ values have been maximized in most locations. The type B intakes represented by the Brockville and James W. King (Gananoque) IPZs are given the maximum score of 0.9 to account for their close proximity to the shore as well as shallow depth. The maximum score of 0.7 similarly has been assigned to the Type 'A' intakes of Fairfield (Amherstview), Bath, A.L. Dafoe (Napanee) and Sandhurst Shores, that are also very close to the shore and shallow in depth. As the Kingston intakes (Kingston Central and Point Pleasant) are deeper and further from shore, a moderate score was assigned.

The final vulnerability, 'V', ranges for IPZ 1 and IPZ 2 are shown in **Table 6-5**.

**Table 6-5: Allowable Vulnerability Score Ranges, Lake Ontario & St. Lawrence River Intakes**

| Type of Intake | IPZ 1 Range | IPZ 2 Range |
|---|---|---|
| Type 'A' (Lake Ontario) | 5 – 7 | 3.5 – 6.3 |
| Type 'B' (St. Lawrence River) | 7 – 9 | 4.9 – 8.1 |

**Maps 6-3, 6-10, 6-17, 6-24, 6-31, 6-38, 6-44 and 6-52** show the vulnerability scoring for IPZ 1 and IPZ 2 for the eight Lake Ontario and St. Lawrence River intakes in the CSPA. The vulnerability scoring is further illustrated by:

- **Maps 6-4, 6-11, 6-18, 6-25, 6-32, 6-39, 6-46 and 6-53** which show areas that can result in significant, moderate and low *drinking water threats* related to *chemicals*
- **Maps 6--5, 6-12, 6-19, 6-26, 6-33, 6-40, 6-47 and 6-54** which show areas that can result in significant, moderate and low *drinking water threats* related to *pathogens*

- **Maps 6-6, 6-13, 6-20, 6-27, 6-34, 6-41, 6-48 and 6-55** which show areas that can result in significant, moderate and low *drinking water threats* related to *DNAPLs*
- **Maps 6-7, 6-14, 6-21, 6-28, 6-35, 6-42, 6-49 and 6-56** which show areas that can result in significant, moderate and low *drinking water threats* related to *conditions*.

The IPZ delineation work was reviewed by a number of experts in this type of *modeling* work from across North America. Their review was very positive and felt the work was completed using reasonable methods. They did recommend some modifications to the report itself, for clarity.

The uncertainty associated with the vulnerability scoring for these IPZs is considered to be low, as per Technical Rules 13 and 14 and the fact the intakes are generally shallow in depth (lack of temperature stratification) and close to the shore.

**Table 6-6** shows the vulnerability scores for the intakes and provides a summary of the rationale used to assign those scores. Further information on the rationale for each score is provided in **Appendix 'J'.**

**Table 6-6: Overall Vulnerability Scores ($Vf_a$ x $Vf_s$ = V), Lake Ontario & St. Lawrence River Intakes**

| Intake | Vulnerability Score | Range | Rationale |
|---|---|---|---|
| **Brockville** | | | IPZ is roughly 50% land; urban area; moderately permeable soil over fractured bedrock; slope of land high; Type 'B' intake; moderate depth and distance from shore. |
| IPZ 1 | 10 x 0.9 = 9 | 7 – 9 | |
| IPZ 2 | 9 x 0.9 = 8.1 | 4.9 – 8.1 | |
| **James W. King (Gananoque)** | | | IPZ is mostly land; urban area; moderately permeable soil over fractured bedrock; slope of land medium; shallow Type 'B' intake with moderate distance to shore. |
| IPZ 1 | 10 x 0.9 = 9 | 7 – 9 | |
| IPZ 2 | 9 x 0.9 = 8.1 | 4.9 – 8.1 | |
| **Kingston Central** | | | IPZ is mostly water; urban area; low permeability soil over fractured bedrock; slope of land medium; deep Type 'A' intake far from shore. |
| IPZ 1 | 10 x 0.6 = 6 | 5 – 7 | |
| IPZ 2 | 8 x 0.6 = 4.8 | 3.5 – 6.3 | |
| **Point Pleasant (Kingston West)** | | | IPZ is mostly water; urban area; low permeability soil over fractured bedrock; slope of land low; deep Type 'A' intake far from shore. |
| IPZ 1 | 10 x 0.6 = 6 | 5 – 7 | |
| IPZ 2 | 7 x 0.6 = 4.2 | 3.5 – 6.3 | |
| **Fairfield (Amherstview)** | | | IPZ is mostly land; urban area; moderately permeable soil over fractured bedrock; slope of land low; shallow Type 'A' intake close to shore. |
| IPZ 1 | 10 x 0.7 = 7 | 5 – 7 | |
| IPZ 2 | 9 x 0.7 = 6.3 | 3.5 – 6.3 | |
| **Bath** | | | IPZ is mostly land; urban and agricultural area; low permeability soil over fractured bedrock; moderate slope; shallow Type 'A' intake close to shore. |
| IPZ 1 | 10 x 0.7 = 7 | 5 – 7 | |
| IPZ 2 | 9 x 0.7 = 6.3 | 3.5 – 6.3 | |
| **A.L. Dafoe (Napanee)** | | | IPZ is mostly water; agricultural area; low permeability soil over fractured bedrock; slope of land low; shallow Type 'A' intake close to shore. |
| IPZ 1 | 10 x 0.7 = 7 | 5 – 7 | |
| IPZ 2 | 8 x 0.7 = 5.6 | 3.5 – 6.3 | |
| **Sandhurst Shores** | | | IPZ is roughly 50% land; agricultural area; low permeability soil over fractured bedrock; slope of land is low; shallow Type 'A' intake moderate distance from shore. |
| IPZ 1 | 10 x 0.7 = 7 | 5 – 7 | |
| IPZ 2 | 8 x 0.7 = 5.6 | 3.5 – 6.3 | |

### 6.2.3 Water Treatment Plants

The following sections include specific information on the WTPs, as well as details on the *drinking water issues* evaluation and *threats* assessment work.

#### 6.2.3.1 Water Withdrawals for WTP

**Table 6-7** gives an idea of the volume of water withdrawn by the WTPs (the volume of treated water is slightly less). These estimated numbers are based on what has been presented in the First Engineer's Reports and Drinking Water Inspection Reports for the WTPs. Not all the reports give comparable data (period of record, years of data) so the numbers in the table are estimated based on this data.

**Table 6-7: WTP Raw Water Withdrawal Volumes**

| Municipal WTP | PTTW Allowed Volume ($m^3$/day) | Estimated Annual Volume ($m^3$) | Estimated Average Monthly Volume ($m^3$/day) | Estimated Average Daily Volume ($m^3$/day) | Estimated Maximum Daily Volume ($m^3$/day) |
|---|---|---|---|---|---|
| Brockville | 36,400 | 5,307,830 | 436,260 | 14,542 | 24,423 |
| James W. King (Gananoque) | 10,220 | 1,499,785 | 123,270 | 4,109 | 5,360 |
| Kingston Central | 118,000 | 20,756,729 | 1,706,033 | 56,868 | 73,659 |
| Point Pleasant (Kingston West) | 45,460 | 8,156,290 | 670,380 | 22,346 | 32,617 |
| Fairfield (Amherstview) | 9,000 | 1,849,911 | 152,048 | 5,068 | 6,476 |
| Bath | 6,000 | 628,074 | 51,623 | 1,721 | 3,381 |
| A.L. Dafoe (Napanee) | 10,450 | 2,204,381 | 181,182 | 6,039 | 8,184 |
| Sandhurst Shores | 600 | 24,869 | 2,044 | 68 | 297 |

The following sections give specific information for each of the WTPs. This information comes from the First Engineer's Reports, Drinking Water Inspection Reports, interviews with municipal staff, and field work.

### 6.2.4 Brockville Water Treatment Plant

The City of Brockville is the most eastern city and intake in the Cataraqui Source Protection Area and is home to approximately 23,000 people. Brockville is situated on the shores of the St. Lawrence River and is a favourite tourist destination being located in the Thousand Islands. Brockville is located on three of Ontario's busiest transportation routes including Highway 401, the Canadian National Railway and the St. Lawrence Seaway.

The Brockville WTP is operated by the City of Brockville and serves the City of Brockville and portions of the Township of Elizabethtown-Kitley. The Brockville WTP is a direct filtration facility. Treatment consists of *coagulation-flocculation* by polyaluminum chloride addition followed by filtration through sand, gravel and granular activated carbon. Filtered water is then disinfected through a combination of chlorine injection and ultraviolet radiation.

- withdrawal source: St. Lawrence River
- serviced population and municipality: 22,000 residents of the City of Brockville and 1,000 residents in Elizabethtown-Kitley Township
- date constructed: 1958 (main building), 1978 (filter building)
- intake depth: 10.5 metres
- intake pipe length (offshore): 294 metres
- intake pipe diameter: 900 millimetres.

In the 1950's dye was released in the *river* and it was found that water reaching the intake location flows past both the north and south sides of Smith Island (the largest island off of Brockville, located slightly south and west of the intake) (Richardson, 2007). The channel to the north side of the island is much shallower than that of the south side. The northern channel borders on the mainland and a highly developed residential area. The shipping channel for the St. Lawrence Seaway is on the south side of the island.

The official *intake protection zones* for Brockville end at the International Boundary between Canada and the United States of America (see **Map 6-1**). However, it is worth noting that the modeled *intake protection zones* for Brockville extend past the International Boundary into New York State waters (see **Map 6-2**). The vulnerability scoring for Brockville (see **Table 6-3**) was assessed based on the official zones within Canada.

#### Drinking Water Issue Evaluation

##### Water Quality at the Intake

The Brockville WTP participates in the Drinking Water Surveillance Program. As such, the water at the intake is characterized. High *hardness* was reported under the provincial Drinking Water Surveillance Program (data set spanning from 1990-2007). High *hardness* occurs naturally in the CSPA and may cause incrustations and increase soap consumption, but is not a *drinking water* health *risk*.

In a special project under the Drinking Water Surveillance Program, water at the Brockville WTP was examined for the presence of perfluorinated alkyl compounds (PFCs), pharmaceuticals and personal care products in the untreated and treated water. All results were below detection or no data were available, except for perfluorooctanoic acid, which was detected at a concentration below any benchmark.

The City of Brockville Engineer's Report for the Brockville Water Treatment Plant (CH2M Gore and Storrie Ltd., 2000) includes a characterization of the untreated water at the Plant, summarizing available data. No parameters exceeded the benchmark value for *drinking water issue* evaluation.

Similarly, Annual Drinking Water Compliance Reports (City of Brockville, 2006, 2007, and 2009) show that average alkalinity, *turbidity* and pH were within the acceptable range (where data exist). Temperature is seasonally elevated between June and October and temperature ranges throughout the year from 0 to 25 degrees Celsius. Both *Escherichia coli* and total

coliform bacteria occur in *raw water* at the Brockville WTP, as would be expected for a *surface water* intake; however, levels were not sufficient to be listed as a *drinking water issue*. Adverse Water Quality Incidents for total coliform in treated water were reported September 6, December 8 and December 31, 2008. For each of the noted incidents, repeated testing was carried out and results showed no *contamination*.

In the Brockville Water Treatment Plant Drinking Water Inspection Reports (MOE, 2005b, 2007c, 2008c, and 2009c), all *chemical* and microbiological parameters tested in treated and *raw water* were found to be within the desired ranges. Occasional peaks were however reported for total coliform in untreated water of up to 462 colonies per 100 millilitres reported under the provincial Drinking Water Information System (data set spanning from 2003 to 2008) and 361 colonies per 100 millilitres reported under the provincial Drinking Water Surveillance Program (with data spanning from 1990 to 2007).

#### Water Quality at Monitoring Sites

At the time this report was written, only one Provincial Water Quality Monitoring Station in Buells Creek was within the delineated IPZs for Brockville (see **Map 2-7**). The data show that levels of bacteria (*Escherichia coli*, fecal coliform, monitored between 1975 and 2002) were above the *drinking water issue* benchmark. Although any substance in Buells Creek can be expected to be strongly diluted once it empties into the St. Lawrence River, this information may provide an early indication of potential sources of current or future problems.

#### Drinking Water Issues

Based on all of the information sources discussed above, the protocol given in **Appendix 'E-1'** and the tests in rule 114 of the Technical Rules (MOE, 2009), the following substances are considered *drinking water issues* with potential human sources in the raw, untreated water for this system:

- *Escherichia coli*.

The remainder of the *drinking water* issues discussed above are considered to be natural characteristics of the *source water* for this system.

For more detailed information about natural and human source *drinking water issues*, please see **Appendix 'E-2', Table 6**. *Drinking water issues* for all WTPs are summarized in **Appendix 'E-2', Table 1**.

#### Issue Contributing Areas

There is not enough information to delineate the *issue contributing area* at this time. A detailed work plan for gathering this information is included in **Appendix 'E-3'.**

#### Threat Assessment

All three of the approaches that are outlined in Chapter 4 for the identification of *drinking water threats* are applicable to this location. Only the *threats* approach has been applied at this time. Further research will be required to confirm whether or not any significant *drinking water threats* would result from applying the event-based (IPZ 3) approach to this *intake*.

#### Vulnerability Scoring and Threat Locations

Significant *threats* can occur in an IPZ with a vulnerability score of eight or higher. The Brockville IPZ 1 has a score of nine, and IPZ 2 has a score of 8.1 (**Map 6-1**); therefore *activities* occurring in IPZ 1 and IPZ 2 have the potential to be significant *threats*. Please refer to **Table 4-2** in Chapter 4 for *activities* that could produce a significant *threat* in an IPZ.

**Maps 6-3, 6-4**, **6-5** and **6-6** show the areas that can result in significant, moderate and low drinking water *threats* relating to *chemicals, pathogens* and *DNAPLs*. Similarly, areas where *conditions* may be significant, moderate or low *threats* are shown in **Map 6-7**.

#### Historical and Existing Activities

Industrial *activities* were historically situated along the St. Lawrence River in the City of Brockville. For example, there once was an electric light works on a property in IPZ 1. Past *activities* on parcels located within and just outside IPZ 2 include mills, factories, tanneries, foundries, oil tank farms/fuel depots, laundries, coal yards, rail yards, auto services, and dry cleaners. Some past *activities* may have the potential to contaminate rock, soil and water and are termed *conditions.*

However, for this report, the Brockville IPZs were surveyed only for existing *activities* using the *threats* approach. Further research will be required to confirm whether or not any *conditions* exist.

Existing *activities* that are found within the IPZ include a water treatment facility, golf course, garage (automotive services), retail stores, hardware stores, gas station, marina, agricultural and livestock related *activities*, and private residences. These are situated over a total of approximately 170 parcels of land.

Prescribed types of *drinking water threats* that are associated with these existing *activities* could include:

- the establishment, operation or maintenance of a waste disposal site within the meaning of Part V of the Ontario Environmental Protection Act
- the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage
- the application of *agricultural source material* to land
- the storage of *agricultural source material*
- the application of commercial fertilizer to land
- the handling and storage of commercial fertilizer
- the application of *pesticide* to land
- the handling and storage of *pesticide*
- the application of road salt
- the handling and storage of road salt

- the handling and storage of fuel
- the handling and storage of a dense non-aqueous phase liquid (*DNAPLs*)
- the handling and storage of an *organic solvent*
- the use of land as livestock grazing or pasturing land, and outdoor confinement area or a farm-animal yard
- the use of a water softener
- the transportation of specified substances along corridors.

#### Transportation Corridors

Transportation corridors are shown on **Map 6-8** and include local roadways and navigation channels. Please refer to **Appendix 'I'** for a detailed list of transportation corridors within the Brockville IPZ.

The main corridors within the Brockville IPZ along which specified substances (*chemicals*) are or could be transported include:

- County Road 2 (King Street)
- County Road 42 (Lyn Road)
- St. Lawrence River.

#### Investigation of Drinking Water Threat Activities

Investigation of the *drinking water threats* through research and landowner contact confirmed three parcels of land to have significant *threats.* The significant *threats* occurring on the three land parcels relate to agricultural and recreational *activities* including the application of *agricultural source material* to land, the storage of *agricultural source material*, the application of *pesticides* and the use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard.

Moderate and low *threats* have been enumerated for the area and result in 165 moderate parcels of land with *drinking water threats*. No parcels were found to represent a low *drinking water threat*. Of the 165 moderate parcels, the dominant *drinking water threat* was the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage (septic systems or holding tanks on 158 land parcels, including island parcels). The remaining moderate *threats* were enumerated for the handling and storage of fuel, *DNAPLs* or *organic solvents*.

#### Threat Activities along Transportation Corridors

In addition to the *threats* associated with individual parcels of land, road salt application and sanitary and storm sewer networks, also contribute to the number of *threats* in the *vulnerable area*. The application of road salt contributes 55 moderate and eight low *threats* (dependant on the location of each road within the IPZ).

The transportation of specified substances along corridors contributes to 73 moderate *threats*. The transportation of fuel contributes 64 moderate *threats*; and the transportation of *pesticides*, *DNAPLs* and *organic solvents* each contribute three moderate *threats*, respectively.

The sanitary and storm sewer network also contributes one additional moderate *threat*.

**Table 6-8** below provides an enumeration summary of *drinking water threats* present for the Brockville drinking water system. The table provides the total number of assessed parcels, total *threats* present and the ranking for each *threat* circumstance: significant (S), moderate (M) or low (L). **Table 6-9**, provides an expanded list of the threat *activities* and their occurrence within the Brockville IPZ. For a more detailed outline of the *threats* and circumstances occurring within the Brockville's IPZs, please refer to **Table 5** of **Appendix 'H'.**

**Table 6-8: Brockville WTP Drinking Water Threats Summary***

| Summary of Parcels with Identified Drinking Water Threats | | | Total Number of Parcels | | | Total Number of Threats within Parcels | | |
|---|---|---|---|---|---|---|---|---|
| **Threat Classification** | **IPZ 1** | **IPZ 2** | **S** | **M** | **L** | **S** | **M** | **L** |
| **Significant (S)** | 0 | 3 | 3 | | | 9 | | |
| **Moderate (M)** | 44 | 249 | | 293 | | | 303 | |
| **Low (L)** | 0 | 8 | | | 8 | | | 8 |
| **Total Number of Parcels** | 44 | 260 | 304 | | | | | |
| **Total Number of Threats Present**** | 45 | 311 | | | | 356 | | |

*The local drinking water *threat* of the use of water softeners is not included in the above summary table. It is assumed that each private well owner is using a water softener.
**Note: A parcel can have multiple *threats*. The transportation of *chemicals* along corridors, the application of salt on roads and sewer main line *threats* are enumerated within the total *threat* count.

**Table 6-9: Threat Type and Occurrence in the Brockville IPZ**

| DWT No | Drinking Water Threat | Total | Total Ranked Significant |
|---|---|---|---|
| 2 | Septic system, holding tank or other treatment | 166 | - |
| | Stormwater management | 1 | - |
| | Wastewater collection facility (sewer mainline & connections; does not include storage tanks or bypasses) | 2 | - |
| 3 | Application of agricultural source material to land | 2 | 2 |
| 4 | Storage of agricultural source material to land | 2 | 2 |
| 8 | Application of commercial fertilizer to land | 4 | - |
| 9 | Handling and storage of commercial fertilizer | 5 | - |
| 10 | Application of pesticide to land | 4 | 3 |
| 11 | Handling and storage of pesticide | 2 | - |
| 13 | Storage of road salt | 3 | - |
| 15 | Handling and storage of fuel | 11 | - |
| 16 | Handling of a dense non-aqueous phase liquid (DNAPL) | 7 | - |
| 17 | Handling and storage of an organic solvent | 9 | - |
| 21 | Livestock pasturing or grazing and/or outdoor confinement, farm-animal yard | 2 | 2 |
| **Corridor Related Threats** | | | |
| 12 | Application of road salt on roads | 63 | - |
| local | Transportation of fuel | 64 | - |
| local | Transportation of pesticides | 3 | - |
| local | The transportation of a DNAPL | 3 | - |
| local | Transportation of an organic solvent | 3 | - |
| **Total** | | **356** | **9** |

#### Future Activities

As explained in Section 4.3, an *activity* that emerges in the future would be ranked as a *threat* to the *source water* if the underlying vulnerability score is high enough for it to be listed in the Tables of Drinking Water Threats (MOE, 2009k) as a significant, moderate, or low *threat*.

Land uses associated with *activities* that would be *threats* may or may not be permitted in the current municipal official plan and zoning by-law. An initial review of the relevant planning documents has been completed to assess which land uses are currently permitted in the *vulnerable area*; partial findings are provided below for the information of the reader.

The Brockville IPZ 1 and IPZ 2 zones are located in the City of Brockville and the Township of Elizabethtown-Kitley. The predominant permitted land use in IPZ 1 and IPZ 2 is residential (City of Brockville, 2001 and 2008a; Novatech Engineering Consultants Ltd. for Township of Elizabethtown-Kitley, 2006; Township of Elizabethtown, 1996). Commercial uses are concentrated in downtown Brockville within IPZ 2. All of the non-residential designations and

zone permit uses that are associated with prescribed *drinking water threats* will need to be reviewed. A review will help to determine if changes to the permitted uses in general, or to specific properties should be recommended as part of the *source protection plan.*

The City of Brockville is in the process of updating its official plan and the Township of Elizabethtown-Kitley is preparing a new zoning by-law. These processes will provide an opportunity to flag certain designations, zones and/or permitted land uses for further analysis prior to the completion of the *source protection plan*.

## 6.2.5 James W. King (Gananoque) Water Treatment Plant

The Town of Gananoque is located approximately 30 kilometres east of Kingston in Leeds and Grenville County. Known as the Gateway to the Thousand Islands, Gananoque has a vibrant tourist sector and is a popular fishing local for many national and international visitors. The Gananoque area is also part of the Frontenac Arch (or Axis), a geographic area that links habitats from the Carolinian forests to the south to the habitats of the Canadian Shield in the Algonquin Highlands. This area is not only unique for its landform diversity, but is also supports a high diversity of rare species (NCC, 2011).

The town of Gananoque is also rich in history and culture and is situated on three of Ontario's busiest transportation routes including Highway 401, the Canadian National Railway, the St. Lawrence Seaway as well as being close to the Thousand Island International Bridge to the United States (New York).

The WTP servicing the Town of Gananoque is named the James W. King WTP. The James W. King WTP is a direct treatment facility, combining *flocculation* with filtration. *Flocculation* is achieved using aluminum sulphate (alum). Granular activated carbon is used to help control taste and odour and chlorine is used for both Zebra Mussel control and disinfection (primary and secondary).

- withdrawal source: St. Lawrence River
- serviced population and municipality: 5,200 residents of the Town of Gananoque
- date constructed: not available
- intake depth: six metres
- intake pipe length (offshore): 396 metres
- intake pipe diameter: 600 millimetres.

#### Drinking Water Issue Evaluation

##### Water Quality at the Intake

The untreated water at the Plant was described in the James W. King Water Treatment Plant Engineer's Report (TSH, 2001b). The reported range for colour, *hardness*, and *turbidity* was found to exceed the benchmark for *drinking water issue* evaluation (1998-2000). Annual Drinking Water Compliance Reports (Town of Gananoque, 2004, 2005, 2006, 2007) also note

exceedances in the level of colour and seasonal elevations in temperatures above the Ontario Drinking Water Quality Standard.

The Drinking Water Information System (MOE) provides data spanning from 2003 to 2008. No exceedances of any guideline were noted for this source. Data from the Drinking Water Surveillance Program (MOE) reveals high levels of *hardness* (pervasive in the CSPA), colour, and *turbidity*.

Sampling carried out by the CRCA in 2007 also revealed high *hardness* levels in samples collected near the intake pipe. These samples coincided with low water events and east wind events.

Communications with WTP operators (as cited in the Watershed Characterization Report: Cataraqui Source Protection Area (CRCA, 2008) indicate that taste and odour problems occur annually from September to December at Gananoque. These problems are not known to cause harm to human health.

#### Water Quality at Monitoring Sites

Data were examined from a Provincial Water Quality Monitoring Network (PWQMN) site in the Gananoque River, just upstream of the River's confluence with the St. Lawrence River. At this location, total coliform, fecal coliform and *Escherichia coli* bacteria are noted at high levels, but no data are available beyond 1985, 1994 and 2002, respectively. Iron concentrations were also found to exceed the benchmark for *drinking water issue* evaluation. For other exceedances, please see **Appendix 'E-2', Table 7**. These substances are expected to be strongly diluted upon entry to the St. Lawrence River, but this information may provide an indication of potential sources of current or future *drinking water issues*.

#### Drinking Water Issues

Based on all of the information sources discussed above, the protocol given in **Appendix 'F-1'** and the tests in rule 114 of the Technical Rules (MOE, 2009j), there are no substances considered as *drinking water issues* with possible human sources in the raw, untreated water for this system.

For more detailed information about natural and human source *drinking water issues*, please see **Appendix 'E-2', Table 7**. *Drinking water issues* for all WTPs are summarized in **Appendix 'E-2', Table 1**.

#### Threat Assessment

Two of the approaches that are outlined in Chapter 4 for the identification of *drinking water threats* are applicable to this location: the event-based (IPZ 3) approach and the *threats* approach. Only the *threats* approach has been applied at this time. Further research will be required to confirm whether or not any significant *drinking water threats* would result from applying the event-based (IPZ 3) approach to this *intake.*

#### Vulnerability Scoring and Threat Locations

Significant *threats* can occur in an IPZ with a vulnerability score of eight or higher. The James W. King IPZ 1 has a score of nine, and IPZ 2 has a score of 8.1 (**Map 6-9**); therefore *activities* occurring in IPZ 1 and IPZ 2 have the potential to be significant *threats*.

Please refer to **Table 4-2** in Chapter 4 for *activities* that could produce a significant *threat* in an

IPZ. **Maps 6-10**, **6-11**, **6-12** and **6-13** show the areas that can result in significant, moderate and low drinking water *threats* relating to *chemicals, pathogens* and *DNAPLs*. Similarly, areas where *conditions* may be significant, moderate or low *threats* are shown on **Map 6-14**.

#### Historical and Existing Activities

Historically, industrial *activities* were situated along the St. Lawrence River and Gananoque River shorelines in the Town of Gananoque. For example, in IPZ 1 there were coal yards, fuel depots, factories, wharves and rail yards. IPZ 2 contained numerous *activities* including mills, foundries, factories, a tannery, a gas station, garages and a dry cleaner. Some past *activities* may have the potential to contaminate rock, soil and water and are termed *conditions.*

However, for this report, the James W. King IPZs were surveyed based on existing *activities* using the *threats* approach. Further research will be required to confirm whether or not any *conditions* exist.

Existing *activities* that are found within the IPZ include marinas, garages (automotive services), a funeral home, dry-cleaning services, photographic services, recreation facilities, hardware stores, a gas station, natural gas pipeline stations and private residences. These are situated over a total approximately 80 parcels of land.

Prescribed types of *drinking water threats* that are associated with these existing *activities* could include:

- the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage
- the application of *agricultural source material* to land
- the storage of *agricultural source material*
- the application of commercial fertilizer to land
- the handling and storage of commercial fertilizer
- the application of *pesticide* to land
- the handling and storage of *pesticide*
- the application of road salt
- the handling and storage of road salt
- the handling and storage of fuel
- the handling and storage of a dense non-aqueous phase liquid *(DNAPLs)*

- the handling and storage of an *organic solvent*
- the use of land as livestock grazing or pasturing land, and outdoor confinement area or a farm-animal yard
- the use of a water softener
- the transportation of specified substances along corridors.

#### Transportation Corridors

Transportation corridors are shown on **Map 6-15** and listed in **Appendix 'I'**. The transportation corridors in the Gananoque IPZ include local roadways and navigation channels. The main corridors within the Gananoque IPZ on which specified substances (*chemicals*) are or could be transported include:

- County Road 2 (King Street)
- Charles Street North, Fourth Street, Stone Street North, Victoria Avenue
- St. Lawrence River and Gananoque River navigation channels.

#### Investigation of Drinking Water Threat Activities

Investigation of the *drinking water threats* through research and landowner contact confirmed one parcel of land to have a significant *threat*. The significant *threats* occurring on this land parcel relate to agricultural *activities* including the application of *agricultural source material* to land, the storage of *agricultural source material*, the application of *pesticides* and the use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard.

Moderate and low *threats* have been enumerated for the area and result in 57 parcels with moderate *drinking water threats* (multiple *threats* per parcel) and one parcel with a low *drinking water threat*. Twenty-eight of the parcels with moderate *drinking water threats* are on islands falling within IPZ 1 and IPZ 2 and are assumed to have either septic systems or holding tanks (classified as the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage).

#### Threat Activities along Transportation Corridors

In addition to the *threats* associated with individual parcels of land, *activities* along transportation corridors and sanitary sewer networks also contribute to the number of *threats* in the *vulnerable area*. The application of road salt contributes to 41 moderate, and 11 low additional *threats* (dependant on the location of each road within the IPZ).

The transportation of specified substances along corridors contributes 68 moderate *threats*. The transportation of fuel contributes 53 moderate *threats*; and the transportation of *pesticides*, *DNAPLs* and *organic solvents* each contribute five moderate *threats*, respectively.

The sanitary sewer network also contributes one additional moderate *threat*.

**Table 6-10** below provides an enumeration summary of *drinking water threats* present for the James W. King (Gananoque) drinking water system. The table provides the total number of assessed parcels, total *threats* present and the ranking for each *threat* circumstance: significant

(S), moderate (M) or low (L). ). **Table 6-11**, provides an expanded list of the threat *activities* and their occurrence within the James W. King IPZ (Gananoque). For a more detailed outline of the *threats* and circumstances occurring within the James W. King IPZs, please refer to **Table 6** of **Appendix 'H'.**

**Table 6-10: James W. King (Gananoque) WTP Drinking Water Threats Summary***

| Summary of Parcels with Identified Drinking Water Threats | | | Total Number of Parcels | | | Total Number of Threats in Parcels | | |
|---|---|---|---|---|---|---|---|---|
| **Threat Classification** | **IPZ 1** | **IPZ 2** | **S** | **M** | **L** | **S** | **M** | **L** |
| **Significant (S)** | 0 | 1 | 1 | | | 4 | | |
| **Moderate (M)** | 58 | 108 | | 166 | | | 196 | |
| **Low (L)** | 0 | 12 | | | 12 | | | 29 |
| **Total Number of Parcels** | 58 | 121 | 179 | | | | | |
| **Total Number of Threats Present**** | 65 | 164 | | | | 229 | | |

*The local drinking water *threat* of the use of water softeners is not included in the above summary table. It is assumed that each private well owner is using a water softener.
**Note: A parcel can have multiple *threats.* The transportation of *chemicals* along corridors, the application of salt on roads and sewer main line *threats* are enumerated within the total *threat* count.

**Table 6-11: Threat Type and Occurrence in James W. King (Gananoque) IPZ**

| DWT No | Drinking Water Threat | Total | Total Ranked Significant |
|---|---|---|---|
| 2 | Septic system, holding tank or other treatment | 45 | - |
| | Wastewater collection facility (sewer mainline & connections; does not include storage tanks or bypasses) | 5 | - |
| 3 | Application of agricultural source material to land | 1 | 1 |
| 4 | Storage of agricultural source material to land | 1 | 1 |
| 8 | Application of commercial fertilizer to land | 1 | - |
| 9 | Handling and storage of commercial fertilizer | 2 | - |
| 10 | Application of pesticide to land | 1 | 1 |
| 11 | Handling and storage of pesticide | 1 | - |
| 13 | Storage of road salt | 2 | - |
| 15 | Handling and storage of fuel | 24 | - |
| 16 | Handling of dense non-aqueous phase liquid (DNAPL) | 11 | - |
| 17 | Handling and storage of an organic solvent | 14 | - |
| 21 | Livestock grazing or pasturing, outdoor confinement, | 1 | 1 |
| **Corridor Related Threats** | | | |
| 12 | Application of road salt on roads | 52 | - |
| local | Transportation of fuel | 53 | - |
| local | Transportation of pesticides | 5 | - |
| local | The transportation of a DNAPL | 5 | - |
| local | Transportation of an organic solvent | 5 | - |
| **Total** | | **229** | **4** |

#### Future Activities

As explained in Section 4.3, an *activity* that emerges in the future would be ranked as a *threat* to the *source water* if the underlying vulnerability score is high enough for it to be listed in the Tables of Drinking Water Threats (MOE, 2009k) as a significant, moderate, or low *threat*.

Land uses associated with *activities* that would be *threats* may or may not be permitted in the current municipal official plan and zoning by-law. An initial review of the relevant planning documents has been completed to assess which land uses are currently permitted in the *vulnerable area*; partial findings are provided below for the information of the reader.

The James W. King IPZ 1 and IPZ 2 zones are located in the Town of Gananoque and the Township of Leeds and the Thousand Islands. The predominant permitted land use in IPZ 1 and IPZ 2 is residential, with some pockets of commercial and industrial uses that may be associated with prescribed *drinking water threats* (J.L. Richards, 2006 and 2007; Proctor & Redfern Ltd., 1993 and 2007). All of the non-residential designations and zones will need to be reviewed to determine if changes to the permitted uses in general or to specific properties should be recommended as part of the *source protection plan.*

The Town of Gananoque is in the process of updating its official plan. This process will provide an opportunity to flag certain designations, zones and/or permitted land uses for further analysis prior to the completion of the *source protection plan*.

## 6.2.6 City of Kingston Water Treatment Plants

The City of Kingston is located at the mouth of Lake Ontario, at the gateway to the Thousand Islands in Frontenac County. Often named the 'Limestone City', Kingston is home to over 117, 000 residents and is a well known tourist location due to its vibrant history and culture. Kingston is also the location of a designated United Nations Educational, Scientific and Cultural Organization (*UNESCO*) World Heritage site of the Rideau Canal. Due to its location halfway between Toronto and Montreal, Kingston is a major transportation corridor for highway, railway and water travel.

The City of Kingston is served by two drinking WTPs, one in the central part of the city (Beverley Street) and one in the western part (Point Pleasant), both of which draw their *raw water* from Lake Ontario (see **Maps 6-17a** or **6-24a**).

### 6.2.6.1 Kingston Central Water Treatment Plant

The WTP services the downtown area of the City of Kingston (pre-amalgamation City of Kingston) and the eastern area of the City (pre-amalgamation Pittsburgh Township). This plant is also sometimes referred to as the Beverley Street WTP, as it is located at the southern end of Beverley Street. *Drinking water* is treated at Kingston Central by screening, *coagulation-flocculation* using aluminum sulphate, sedimentation, filtration and disinfection. Granular activated carbon is also used for taste and odour control.

- withdrawal source: Lake Ontario
- serviced population and municipality: 80,000 residents of the City of Kingston
- date constructed: 1952, with an expansion in 1970
- intake depth: 18 metres
- intake pipe length (offshore): 824 metres (existing installed in 1970), backup 366 metres (original installed in 1949)
- intake pipe diameter: 1200 millimetres (existing), 750 millimetres (original/backup).

#### Drinking Water Issue Evaluation

##### Water Quality at the Intake

The First Engineer's Report City of Kingston East/Central Water Purification Plant (KMK Consultants Ltd., 2001a) summarizes water quality data for the years of 1997 to 2000. These data indicate that the untreated water is high in *hardness*, exceeding 100 milligrams per litre (as calcium carbonate). *Turbidity* was found to spike up to five nephelometric *turbidity* units (NTU) from time to time and total coliform exceeded the *drinking water issue* evaluation benchmark in ten per cent of samples.

Because of their participation in the provincial Drinking Water Surveillance Program, the quality of untreated water at the Kingston Central WTP is more consistently monitored than at most other intakes in the area. Like the Drinking Water Information System and Annual Drinking Water Compliance Report (MOE, 2004c, 2005e, 2006e, 2007f, 2008f, 2009f), the Drinking Water Surveillance Program *monitoring* results from 1986 to 2008 show that *hardness* and temperature (seasonal) are high and exceed the benchmark value for *drinking water issue* evaluation. The Program also showed that total colour in untreated water was occasionally high during those years.

Total coliform, aluminum, temperature and *hardness* were also occasionally detected at excessive levels in treated water (MOE Drinking Water Surveillance Program; data spanning 1986 to 2008). Aluminum is likely a result of the treatment process (from the aluminum sulphate that is used to remove particles from the water).

#### Drinking Water Issues

Based on all of the information sources discussed above, the protocol given in **Appendix E-1** and the tests in rule 114 of the Technical Rules (MOE, 2009j), there are no substances considered *drinking water issues* with potential human sources in the raw, untreated water for this system.

For more detailed information about natural and human source *drinking water issues*, please see **Appendix 'E-2', Table 8**. *Drinking water issues* for all WTPs are summarized in **Appendix 'E-2', Table 1**.

#### Threat Assessment

Two of the approaches that are outlined in Chapter 4 for the identification of *drinking water threats* are applicable to this location: the event-based (IPZ 3) approach and the *threats* approach. Only the *threats* approach has been applied at this time. Further research will be required to confirm whether or not any significant *drinking water threats* would result from applying the event-based (IPZ 3) approach to this *intake.*

#### Vulnerability Scoring and Threat Locations

Significant *threats* can occur in an IPZ with a vulnerability score of eight or higher. The Kingston Central IPZ 1 has a score of six and IPZ 2 has a score of 4.8 (**Map 6-16**); therefore *threats* cannot be significant. Please refer to **Table 4-2** in Chapter 4 for *activities* that could produce a significant *threat* in an IPZ and the corresponding vulnerability scores.

**Maps 6-17**, **6-18**, **6-19** and **6-20** show the areas that can result in significant, moderate and low drinking water *threats* relating to *chemicals, pathogens* and *DNAPLs*. Similarly, areas where *conditions* may be significant, moderate or low *threats* are shown in **Map 6-21**.

#### Historical and Existing Activities

Similar to other waterfront towns and cities, industrial *activities* were historically situated along the Lake Ontario shoreline and the western shore of the Cataraqui River in the City of Kingston. The majority of properties along the waterfront contained stores of coal. In addition to residential use and storage of coal, *activities* in IPZ 1 included an ordnance redoubt, paint and metal factories, a brewery, boat builders and laboratories.

Sites in IPZ 2 were historically used as coal yards, breweries, foundries, boat builders, grain elevators, a tannery, a carpet and furnace cleaning company, and a gas station. The area between Lower Union Street and the LaSalle Causeway, which is part of IPZ 3, contains historical *activities* such as foundries, freight yards, locomotive factories, grain elevators and mills, wharves, ship yards, and auto servicing. The inner harbour (between the LaSalle Causeway and Belle Park) was also a busy area historically with the presence of past ship building yards, freight yards, foundries, oil tank farms and fuel depots, tanneries, and dry cleaners. Some of these past *activities* may have the potential to contaminate rock, soil and water and are termed *conditions.*

However, for this report, the Kingston Central IPZs were surveyed only for existing *activities* using the *threats* approach. Further research will be required to confirm whether or not any *conditions* exist.

Existing *activities* that are found within the IPZ include a WTP, garages (automotive services), gas stations, laundry services, funeral home, hospitals, universities, correctional services, marinas, recreation facilities, hardware stores, garden centres, and marinas. These are situated over a total of 31 parcels of land.

Prescribed types of *drinking water threats* that are associated with these existing *activities* could include:

- the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage
- the application of commercial fertilizer to land
- the handling and storage of commercial fertilizer
- the application of *pesticide* to land
- the handling and storage of *pesticide*
- the application of road salt
- the handling and storage of fuel
- the handling and storage of a dense non-aqueous phase liquid *(DNAPL)*
- the handling and storage of an *organic solvent*
- the transportation of specified substances along corridors.

#### Transportation Corridors

Transportation corridors are shown on **Map 6-22** and listed in **Appendix 'I'**. The transportation corridors in the Kingston Central IPZ include local roadways, provincial highways and navigation channels. The main corridors within the Kingston Central IPZ along which specified substances (*chemicals*) are or could be transported include:

- Brock Street, Division Street, Johnson Street, King Street, Lower University Avenue, Portsmouth Avenue, Princess Street, Sir John A. MacDonald Boulevard, Union Street, University Avenue

- Wolfe Island Ferry (provincial highway)
- Lake Ontario navigation channels.

#### Investigation of Drinking Water Threat Activities

Enumeration of *drinking water threats* resulted in no parcels of land with signifi*cant threats*. However, 18 parcels with low *drinking water threats* were identified where the majority of the *threats* relate to the handling and storage of a dense non-aqueous phase liquid (*DNAPLs*).

Of the 18 parcels with low *threats*, three of these parcels have three *threats* pertaining to the handling and storage of fuel, the handling and storage of a *DNAPL*, and the handling and storage of an *organic solvent*. Five parcels have *drinking water threats* consisting of the handling and storage of a *DNAPL*, and the handling and storage of an *organic solvent* and ten parcels have the single *threat activity* of the handling and storage of a *DNAPL*.

#### Threat Activities along Transportation Corridors

In addition to the *threats* associated with individual parcels of land, *activities* along transportation corridors and sanitary and storm sewer networks also contribute to the number of *threats* in the *vulnerable area*. The application of road salt results in 50 low *threats* (dependant on the location of each road within the IPZ).
The transportation of specified substances along corridors contributes to 33 low *threats*. The transportation of fuels contributes to seven low *threats*; the transportation of *DNAPL*s and *organic solvents* each contribute to 13 *threats*, respectively.

The sanitary and storm sewer network results in one additional moderate *threat*.

**Table 6-12** below provides an enumeration summary of *drinking water threats* present for the Kingston Central drinking water system. The table provides the total number of assessed parcels, total *threats* present and the ranking for each *threat* circumstance: significant (S), moderate (M) or low (L). **Table 6-13**, provides an expanded list of the threat *activities* and their occurrence within the Kingston Central IPZ. For a more detailed outline of the *threats* and circumstances occurring within the Kingston Central IPZs, please refer to **Table 7** of **Appendix 'H'.**

**Table 6-12: Kingston Central WTP Drinking Water Threats Summary**

| Summary of Parcels with Identified Drinking Water Threats | | | Total Number of Parcels | | | Total Number of Threats | | |
|---|---|---|---|---|---|---|---|---|
| **Threat Classification** | **IPZ 1** | **IPZ 2** | **S** | **M** | **L** | **S** | **M** | **L** |
| **Significant (S)** | 0 | 0 | 0 | | | 0 | | |
| **Moderate (M)** | 1 | 0 | | 1 | | | 1 | |
| **Low (L)** | 21 | 80 | | | 101 | | | 112 |
| **Total Number of Parcels** | 22 | 80 | 102 | | | | | |
| **Total Number of Threats Present*** | 25 | 88 | | | | 113 | | |

*Note: A parcel can have multiple *threats*. The transportation of *chemicals* along corridors, the application of salt on roads and sewer main line *threats* are enumerated within the total *threat* count.

**Table 6-13: Threat Type and Occurrence in Kingston Central IPZ***

| DWT No | Drinking Water Threat | Total |
|---|---|---|
| 2 | Combined Sewer, wastewater collection facility | 1 |
| 15 | Handling and storage of fuel | 3 |
| 16 | Handling and storage of a dense non-aqueous phase liquid (DNAPLs) | 18 |
| 17 | Handling and storage of an organic solvent | 8 |
| Corridor Related Threats | | |
| 12 | Application of road salt on roads | 50 |
| local | Transportation of fuel | 7 |
| local | The transportation of a DNAPL | 13 |
| local | Transportation of an organic solvent | 13 |
| **Total** | | **113** |

*No significant *drinking water threats* are present for the Kingston Central IPZ.

#### Future Activities

As explained in Section 4.3, an *activity* that emerges in the future would be ranked as a *threat* to the *source water* if the underlying vulnerability score is high enough for it to be listed in the Tables of Drinking Water Threats (MOE, 2009k) as a significant, moderate, or low *threat*.

Land uses associated with *activities* that would be *threats* may or may not be permitted in the current municipal official plan and zoning by-law. An initial review of the relevant planning documents has been completed to assess which land uses are currently permitted in the *vulnerable area*; partial findings are provided below for the information of the reader.

The Kingston Central IPZ 1 and IPZ 2 zones are located in the City of Kingston, with a small portion of IPZ 2 in the Township of the Frontenac Islands. The predominant permitted land uses in IPZ 1 and IPZ 2 are residential and institutional (City of Kingston, 2008a, 2008b and 2009; Clark Consulting Services for Township of Frontenac Islands, 2003a and 2003b). The institutional uses include federal penitentiaries, universities and hospitals. Commercial uses are concentrated in downtown Kingston in IPZ 2. All of the non-residential designations and zones that permit these uses are associated with prescribed *drinking water threats* will need to be reviewed. A review will help to determine if changes to the permitted uses in general, or to specific properties should be recommended as part of the *source protection plan*.

The City of Kingston is in the process of preparing a zoning by-law to implement the recently adopted official plan. This process will provide an opportunity to flag certain zones and/or permitted land uses for further analysis prior to the completion of the *source protection plan*.

### 6.2.6.2 Point Pleasant (Kingston West) Water Treatment Plant

The WTP services the western area of the City of Kingston (pre-amalgamation Kingston Township). The plant is located on Point Pleasant, just west of Cataraqui Bay. Point Pleasant is a direct filtration facility. The water treatment process includes screening, chlorination and

*coagulation-flocculation* using polyaluminum chloride (PAC1). This is followed by sand filtration, granular activated carbon and disinfection.

- withdrawal source: Lake Ontario
- serviced population and municipality: 44,000 residents of the City of Kingston
- date constructed: 1976, expansion in 1987, currently planning to expand again
- intake depth: 17 metres
- intake pipe length (offshore): 475 metres
- intake pipe diameter: 1220 millimetres.

#### Drinking Water Issues Evaluation

#### Water Quality at the Intake

The First Engineer's Report for the Kingston Water Treatment Plant Serving the West Portion of the City of Kingston (KMK Consultants Limited, 2001b) gives data from 1998-2000. When the maximum reported range for the parameters tested was compared to the *drinking water issue* benchmark value only colour and *hardness* were found to exceed the benchmark. High *hardness* is also shown in the Annual Drinking Water Compliance Reports (Utilities Kingston, 2003-2008). High levels of *hardness* are a common and natural characteristic of surface in the CSPA. The Annual Drinking Water Compliance Reports (Utilities Kingston 2004b, 2005b, 2006b, 2007b, 2008b, 2009b) and Drinking Water Information System (MOE 2004d, 2005f, 2006f, 2007g, and 2008) data also indicate occasional elevations in the total coliform concentrations.

Elevations in the level of *hardness* were found to be associated with rain events during sampling carried out by the CRCA in 2007.

In treated water, elevated aluminum concentrations were noted in the Kingston West Water Treatment Plant Drinking Water System Inspection Report (MOE). This is most likely a result of the treatment process, from the compounds used to remove particles from the water. A single occurrence of total coliform (one colony forming unit/100 millilitres) in treated water was also reported.

#### Drinking Water Issues

Based on all of the information sources discussed above, the protocol given in **Appendix 'E-1'** and the tests in rule 114 of the Technical Rules (MOE, 2009j), there are no substances considered *drinking water issues* with human sources in the raw, untreated water for this system.

For more detailed information about human and natural source *drinking water issues*, please see **Appendix 'E-2', Table 9**. *Drinking water issues* for all WTPs are summarized in **Appendix 'E-2', Table 1**.

#### Threat Assessment

Two of the approaches that are outlined in Chapter 4 for the identification of *drinking water threats* are applicable to this location: the event-based (IPZ 3) approach and the *threats* approach. Only the *threats* approach has been applied at this time. Further research will be

required to confirm whether or not any significant *drinking water threats* would result from applying the event-based (IPZ 3) approach to this *intake.*

#### Historical and Existing Activities

Kingston West was historically an agricultural area that was not developed until after World War II. For this report, the Point Pleasant (Kingston West) IPZs were surveyed only for existing *activities* using the *threats* approach. Further research will be required to confirm whether or not any *conditions* exist.

Significant *threats* can occur in an IPZ with a vulnerability score of eight or higher. The Point Pleasant IPZ 1 has a score of six and IPZ 2 has a score of 4.2 (**Map 6-23**); therefore *threats* cannot be numerically significant. Please refer to **Table 4-2** in Chapter 4 for *activities* that could produce a significant *threat* in an IPZ and the corresponding vulnerability scores.

**Maps 6-24**, **6-25**, **6-26** and **6-27** show areas that can result in significant, moderate and low *drinking water threats* relating to *chemicals*, *pathogens*, *DNAPLs*. Similarly, areas where *conditions* may be significant, moderate or low *threats* are shown in **Map 6-28**.

Existing *activities* that are found within the IPZ include a WTP, the Norman Rogers Airport, garages (automotive services), recreation facility, and industrial facilities. These are situated over a total of nine parcels of land. Norman Rogers Airport has been included in this evaluation because a small section of the parcel on which it is situated was included in IPZ 2 (see **Map 6-23**).

Prescribed types of *drinking water threats* that are associated with these existing *activities* could include:

- the establishment, operation or maintenance of a waste disposal site within the meaning of Part V of the Ontario Environmental Protection Act
- the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage
- the application of road salt
- the handling and storage of road salt
- the storage of snow
- the handling and storage of fuel
- the handling and storage of a dense non-aqueous phase liquid (*DNAPL*)
- the handling and storage of an *organic solvent*
- the management of *runoff* that contains *chemicals* used in the de-icing of aircraft
- the transportation of specified substances along corridors.

#### Transportation Corridors

Transportation corridors are shown on **Map 6-29** and listed in **Appendix 'I'**. The transportation corridors in the Point Pleasant IPZ include local roadways and Lake Ontario navigation channels.

The main corridors within the Point Pleasant IPZ along which specified substances (*chemicals*) are or could be transported include:

- Bayridge Drive, Day's Road and Front Road
- Lake Ontario navigation channels.

#### Investigation of Drinking Water Threat Activities

No parcels of land had *activities* that could be classified as significant or moderate *drinking water threats*. Two parcels were identified with low *threats* based on worst case scenario assumptions of land *activities*. Three *threats* where identified within the two parcels (the handling and storage of fuel, the handling and storage of a *DNAPL*, and the handling and storage of an *organic solvent*). As mentioned above, a small portion of IPZ 2 is situated on the eastern parcel of the Norman Rogers airport. All possible *threats* pertaining to the airport were negligible where *activities* did not score high enough to warrant even a low-ranking *threat*.

#### Threat Activities along Transportation Corridors

In addition to the *threats* associated with individual parcels of land, *activities* along transportation corridors and sanitary and storm sewer networks also contribute to the number of *threats* in the *vulnerable area*. The application of road salt results in three low *threats* (dependant on the location of each road within the IPZ).

The transportation of fuel along corridors contributes to four low *threats* and the sanitary and storm sewer network results in one additional low *threat*.

**Table 6-14** below provides an enumeration summary of *drinking water threats* present for the Point Pleasant drinking water system. The table provides the total number of assessed parcels, total *threats* present and the ranking for each *threat* circumstance: significant (S), moderate (M) or low (L). **Table 6-15**, provides an expanded list of the threat *activities* and their occurrence within the Point Pleasant IPZ. For a more detailed outline of the *threats* and circumstances occurring within the Point Pleasant IPZs, please refer to **Table 8** of **Appendix 'H'.**

**Table 6-14: Point Pleasant (Kingston West) WTP Drinking Water Threats Summary**

| Summary of Parcels with Identified Drinking Water Threats | | | Total Number of Parcels | | | Total Number of Threats | | |
|---|---|---|---|---|---|---|---|---|
| **Threat Classification** | **IPZ 1** | **IPZ 2** | **S** | **M** | **L** | **S** | **M** | **L** |
| **Significant (S)** | 0 | 0 | 0 | | | 0 | | |
| **Moderate (M)** | 0 | 0 | | 0 | | | 0 | |
| **Low (L)** | 10 | 0 | | | 10 | | | 14 |
| **Total Number of Parcels** | 10 | 0 | 10 | | | | | |
| **Total Number of Threats Present*** | 14 | 0 | | | | 14 | | |

*Note: A parcel can have multiple *threats*. The transportation of *chemicals* along corridors, the application of salt on roads and sewer main line *threats* are enumerated within the total *threat* count.

**Table 6-15: Threat Type and Occurrence in Point Pleasant (Kingston West) IPZ***

| DWT No | Drinking Water Threat | Total |
|---|---|---|
| 2 | Wastewater collection facility (sewer mainline & connections; does not include storage tanks or bypasses) | 1 |
| 15 | Handling and storage of fuel | 2 |
| 16 | Handling and storage of a dense non-aqueous phase liquid (DNAPLs) | 2 |
| 17 | Handling and storage of an organic solvent | 2 |
| **Corridor Related Threats** | | |
| 12 | Application of road salt on roads | 3 |
| local | Transportation of fuel | 4 |
| **Total** | | **14** |

*No significant *drinking water threats* are present for the Point Pleasant IPZ.

#### Future Activities

As explained in Section 4.3, an *activity* that emerges in the future would be ranked as a *threat* to the *source water* if the underlying vulnerability score is high enough for it to be listed in the Tables of Drinking Water Threats (MOE, 2009k) as a significant, moderate, or low *threat*.

Land uses associated with *activities* that would be *threats* may or may not be permitted in the current municipal official plan and zoning by-law. An initial review of the relevant planning documents has been completed to assess which land uses are currently permitted in the *vulnerable area*; partial findings are provided below for the information of the reader.

The Point Pleasant IPZs are located in the City of Kingston. The predominant permitted land use in IPZ 1 and IPZ 2 is residential with a pocket of commercial and institutional uses that may be associated with prescribed *drinking water threats* (City of Kingston, 2009; Township of Kingston, 2006). There is also a large tract of vacant industrial land that could be used for *activities* that are associated with prescribed *drinking water threats*. All of the non-residential designations and zones, and permit uses that are associated with prescribed *drinking water threats*, will need to be reviewed. This will determine if changes to the permitted uses in general, or to specific properties should be recommended as part of the *source protection plan*.

The City of Kingston is in the process of preparing a zoning by-law to implement the recently adopted official plan. This process will provide an opportunity to flag certain zones and/or permitted land uses for further analysis prior to the completion of the *source protection plan*.

### 6.2.7 Loyalist Township Water Treatment Plants

Loyalist Township is located west of Kingston and boarders the northeastern shore of Lake Ontario. Loyalist is home to small hamlets and communities including Amherstview, Bath, Odessa and the island community of Amherst Island. Rich in history, the area was first settled by the United Empire Loyalists to which the Loyalist Parkway, a stretch of Highway 33, is dedicated. The area is a mix of rural and urban areas where its picturesque scenery is enjoyed by tourists and residents alike.

Loyalist Township operates two water treatments (WTPs); one at Amherstview that services the communities of Amherstview, Odessa, Harewood and Brooklands and one at Bath that services the community of Bath.

### 6.2.7.1 Fairfield (Amherstview) Water Treatment Plant

The WTP located in Amherstview is officially named the Fairfield WTP. *Drinking water* treatment at Fairfield WTP is carried out via membrane ultra filtration, followed by granular activated carbon to control taste and odour of treated water and disinfection in a chlorine contact chamber. The treatment works were constructed in 2000 and were most recently upgraded in 2007.

- withdrawal source: Lake Ontario, North Channel
- serviced population and municipality: 8,620 residents of Loyalist Township in Amherstview, Odessa, Harewood and Brooklands
- date constructed: existing facility was constructed in 2000, but the original intake was installed in 1970
- intake depth: 3.6 metres
- intake pipe length (offshore): 120 metres
- intake pipe diameter: 600 millimetres.

#### Drinking Water Issue Evaluation

##### Water Quality at the Intake

In the Fairfield Water Treatment Plant Engineer's Report (CH2M Hill, 2001b), total coliform and *Escherichia coli* concentrations were generally low. Maximum values for temperature, colour and *hardness* exceed acceptable levels in 1999-2000 data, supporting the identification of these parameters as *drinking water issues* at the Fairfield WTP. Although no data exist, granular activated carbon is used to control taste and odour at the Fairfield WTP.

The Drinking Water Information System data reveal elevated total coliform concentrations, reaching up to 1480 colonies per 100 millilitres of untreated water. *Escherichia coli* was also found, but at lower concentrations (MOE, 2005c, 2006c, 2007c, 2008d, 2009e). An apparent increasing trend is observed for total coliform, with the majority of benchmark exceedances occurring between July and October 2008 (**Appendix 'E-2', Figure 1**).

No exceedances of the *drinking water issue* benchmark values were identified for parameters tested in the Lake near the Fairfield WTP intake during sampling carried out by the CRCA in 2007.

#### Drinking Water Issues

Based on all of the information sources discussed above, the protocol given in **Appendix 'E-1'** and the tests in rule 114 of the Technical Rules (MOE, 2009j), the following are considered *drinking water issues* with possible human sources in the raw, untreated water for this system:

- total coliform.

The remainder of the *drinking water issues* discussed above are considered to be natural characteristics of the *source water* for this system.

For more detailed information on natural and human source *drinking water issues*, please see **Appendix 'E-2', Table 10**. *Drinking water issue* for all WTPs are summarized in **Appendix 'E-2', Table 1**.

#### Issue Contributing Areas

There is not enough information to delineate the *issue contributing area* at this time. A detailed work plan for gathering this information is included in **Appendix 'E-3'.**

#### Threat Assessment

All three of the approaches that are outlined in Chapter 4 for the identification of *drinking water threats* are applicable to this location. Only the *threats* approach has been applied at this time. Further research will be required to confirm whether or not any significant *drinking water threats* would result from applying the event-based (IPZ 3) approach to this *intake.*

#### Vulnerability Scoring and Threat Locations

Significant *threats* can occur in an IPZ with a vulnerability score of eight or higher. The Fairfield IPZ 1 has a score of seven, and IPZ 2 has a score of 6.3 (**Map 6-30**); therefore *threats* cannot be significant numerically. Please refer to **Table 4-2** for *activities* that could produce a significant *threat* in an IPZ and the corresponding vulnerability scores.

**Maps 6-31**, **6-32**, **6-33** and **6-34** show areas that can result in significant, moderate and low *drinking water threats* relating to *chemicals*, *pathogens* and *DNAPLs*. Similarly, areas where *conditions* may be significant, moderate or low *threats* are shown in **Map 6-35**.

#### Historical and Existing Activities

Fairfield was historically an agricultural area that was not developed until after World War II. For this report, the Fairfield (Amherstview) IPZs were surveyed only for existing *activities* using the *threats* approach. Further research will be required to confirm whether or not any *conditions* exist.

Existing *activities* that are found within the IPZ include a gas station, dry cleaning/laundry services, agricultural and livestock related *activities*, storm water retention ponds, a recreation facility, two elementary schools, a senior's residence, a golf course and private residences. These are situated over approximately 70 parcels of land.

Prescribed types of *drinking water threats* that are associated with these existing *activities* could include:

- the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage
- the application of *agricultural source material* to land
- the storage of *agricultural source material*

- the application of commercial fertilizer to land
- the handling and storage of commercial fertilizer
- the application of *pesticide* to land
- the handling and storage of *pesticide*
- the application of road salt
- the handling and storage of fuel
- the handling and storage of a dense non-aqueous phase liquid (*DNAPL*)
- the handling and storage of an *organic solvent*
- the use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard
- the use of a water softener
- the transportation of specified substances along corridors.

#### Transportation Corridors

Transportation corridors are shown on **Map 6-36** and listed in **Appendix 'I'**. The transportation corridors in the Fairfield IPZ include local roadways, provincial highways, railways and navigation channels. The main corridors within the Fairfield IPZ along which specified substances (*chemicals*) are or could be transported include:

- Highway 33 (Bath Road)
- County Road 6, Amherst Drive, Coronation Boulevard
- the Canadian National Railway
- Lake Ontario navigation channels.

#### Investigation of Drinking Water Threat Activities

No parcels of land had *activities* that could give rise to significant *threats.* Moderate and low *threats* have been enumerated for the area and result in three moderate and 69 low *drinking water threats*, respectively.

Most *activities* identified have multiple *threats* per parcel, however, the majority of *threats* within the Fairfield IPZ relate to the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage (septic systems), the handling and storage of fuel and agricultural-related *activities*.

#### Threat Activities along Transportation Corridors

In addition to the *threats* associated with individual parcels of land, *activities* along transportation corridors and sanitary and storm sewer networks also contribute to the number of *threats* in the *vulnerable area*. The application of road salt results in 46 additional low *threats*.

The transportation of specified substances along corridors contributes to four moderate and 58 low *threats*. The transportation of fuels contributes to 47 low *threats*; the transportation of *pesticides* contribute to five low *threats* and the transportation of *DNAPL*s and *organic solvents* each contribute to two moderate and three low *threats*, respectively.

The sanitary and storm sewer network also results in one additional low *threat*.

**Table 6-16** below provides an enumeration summary of *drinking water threats* present for the Fairfield drinking water system. The table provides the total number of assessed parcels, total *threats* present and the ranking for each *threat* circumstance: significant (S), moderate (M) or low (L). **Table 6-17**, provides an expanded list of the threat *activities* and their occurrence within the Fairfield IPZ. For a more detailed outline of the *threats* and circumstances occurring within the Fairfield IPZs, please refer to **Table 9** of **Appendix 'H'.**

**Table 6-16: Fairfield (Amherstview) WTP Drinking Water Threats Summary***

| Summary of Parcels with Identified Drinking Water Threats | | | Total Number of Parcels | | | Total Number of Threats within Parcels | | |
|---|---|---|---|---|---|---|---|---|
| **Threat Classification** | **IPZ 1** | **IPZ 2** | **S** | **M** | **L** | **S** | **M** | **L** |
| **Significant (S)** | 0 | 0 | 0 | | | 0 | | |
| **Moderate (M)** | 5 | 2 | | 7 | | | 12 | |
| **Low (L)** | 37 | 136 | | | 173 | | | 211 |
| **Total Number of Parcels** | 42 | 138 | 180 | | | | | |
| **Total Number of Threats Present**** | 55 | 168 | | | | 223 | | |

*The local drinking water *threat* of the use of water softeners is not included in the above summary table. It is assumed that each private well owner is using a water softener.
**Note: A parcel can have multiple *threats*. The transportation of *chemicals* along corridors, the application of salt on roads and sewer main line *threats* are enumerated within the total *threat* count.

**Table 6-17: Threat Type and Occurrence in Fairfield IPZ***

| DWT No | Drinking Water Threat | Total |
|---|---|---|
| 2 | Septic system, holding tank or other treatment | 62 |
| | Stormwater management | 3 |
| | Wastewater collection facility (sewer mainline & connections) | 1 |
| 3 | Application of agricultural source material to land | 2 |
| 4 | Storage of agricultural source material to land | 2 |
| 8 | Application of commercial fertilizer to land | 1 |
| 9 | Handling and storage of commercial fertilizer | 1 |
| 10 | Application of pesticide to land | 1 |
| 11 | Handling and storage of a pesticide | 1 |
| 12 | Application of road salt | 11 |
| 13 | Storage of road salt | 1 |
| 15 | Handling and storage of fuel | 21 |
| 16 | Handling and storage of a DNAPLS | 1 |
| 17 | Handling and storage of an organic solvent | 5 |
| 21 | Livestock pasturing and/or outdoor confinement, farm-animal yard | 2 |
| **Corridor Related Threats** | | |
| 12 | Application of road salt on roads | 46 |
| local | Transportation of fuel | 47 |
| local | Transportation of pesticides | 5 |
| local | The transportation of a DNAPL | 5 |
| local | Transportation of an organic solvent | 5 |
| **Total** | | **223** |

Note: There are no significant drinking water threats for the Fairfield IPZ.

#### Future Activities

As explained in Section 4.3, an *activity* that emerges in the future would be ranked as a *threat* to the *source water* if the underlying vulnerability score is high enough for it to be listed in the Tables of Drinking Water Threats (MOE, 2009k) as a significant, moderate, or low *threat.*

Land uses associated with *activities* that would be *threats* may or may not be permitted in the current municipal official plan and zoning by-law. An initial review of the relevant planning documents has been completed to assess which land uses are currently permitted in the *vulnerable area*; partial findings are provided below for the information of the reader.

The Fairfield IPZ 1 and IPZ 2 zones are located in Loyalist Township, with a small portion of IPZ 1 and IPZ 2 in the City of Kingston. The predominant permitted land use in IPZ 1 and IPZ 2 is residential (City of Kingston, 2009; Cumming Cockburn Limited, 2005 and 2008; Township of Kingston, 2006). There are pockets of permitted commercial, community facility and open space uses that could be associated with prescribed *drinking water threats*. All of the

designations and zone permit uses that are associated with prescribed *drinking water threats* will need to be reviewed. A review will determine if changes to the permitted uses in general, or to specific properties should be recommended as part of the *source protection plan.*

The City of Kingston is in the process of preparing a zoning by-law to implement the recently adopted official plan. This process will provide an opportunity to flag certain zones and/or permitted land uses for further analysis prior to the completion of the *source protection plan.*

### 6.2.7.2 Bath Water Treatment Plant

The treatment process at the Bath WTP was upgraded in 1997 and now includes pre-chlorination at the intake crib, screening, *flocculation* using aluminum sulphate, rough filtration and filtration through sand, gravel and granular activated carbon and disinfection.

- withdrawal source: Lake Ontario
- serviced population and municipality: 1,800 residents of the community of Bath in Loyalist Township, as well as approximately 550 inmates at the Millhaven and Bath Institutions (Correctional Service Canada).
- date constructed: 1966, with an expansion in 1997
- intake depth: 3.4 metres
- intake pipe length (offshore): 137 metres
- intake pipe diameter: 450 millimetres.

#### Drinking Water Issue Evaluation

##### Water Quality at the Intake

The raw (untreated) water for the Bath drinking WTP was characterized in the Bath Water Treatment Plant Engineer's Report (CH2M Hill, 2001a). This report revealed high levels of *turbidity*, *hardness*, dissolved organic carbon and organic nitrogen. Volatile organics, pesticides and polychlorinated biphenyls (PCBs) were not detectable in the untreated water and inorganic and radiological substances were present at low or undetectable combinations.

Taste and odour problems at the Bath drinking WTP have been reported (CRCA, 2008). The cause of the problem is unclear, but two possible contributors are organic nitrogen in the *raw water* and compounds produced by algae. Data does not exist for concentrations of algal taste and odour compounds at Bath, but these compounds have been detected at noticeable concentrations at the A.L. Dafoe drinking WTP to the west of the Bath intake (MOE, 2001-2006). Granular activated carbon was incorporated to the filter media at Bath to help control the reported taste and odour problems.

Annual Drinking Water Compliance Reports (Loyalist Township 2007a, 2008a, 2009a) indicate that colour, temperature and pH often exceed the benchmark levels for *drinking water issue* evaluation. Both *Escherichia coli* and total coliform are often present in *raw water*, according the Drinking Water Information System data for the Bath Drinking WTP (MOE, 2004a, 2005a, 2006b, 2007b, 2008b, 2009b). *Escherichia coli* exceeds 100 colonies per 100 millilitres only

once from 2000-2007 (Annual Drinking Water Compliance Reports). Additionally, there appears to be a slight trend of increasing concentration for total coliform, but extrapolations show that the average concentration will not likely exceed the 1000 CFU/100 millilitre benchmark within the next 50 years. Bath Water Treatment Plant Drinking Water Inspection Reports (MOE, 2004a, 2005a, 2006b, 2007b, 2008b, 2009b) indicate that total coliform have been detected in treated water only once over the examined period (occurrence was in April 2007). Re-sampling results however indicated that total coliform were no longer present.

Sampling carried out in 2007 by the CRCA indicated that rain events coincided with elevated *hardness* levels at Bath. At the time of sampling, background fecal coliform levels were within the acceptable range.

#### Drinking Water Issues

Based on all of the information sources discussed above, the protocol given in **Appendix 'E-1'** and the tests in rule 114 of the Technical Rules (MOE, 2009j), the following substances are considered *drinking water issues* with possible human sources in the raw, untreated water for this system:

- organic nitrogen
- *Escherichia coli.*

The remainder of the *drinking water* issues discussed above are considered to be natural characteristics of the *source water* for this system.

For more detailed information on natural and human source *drinking water issues*, please see **Appendix 'E-2', Table 11**. *Drinking water issues* with possible human sources at all WTPs are summarized in **Appendix 'E-2', Table 1**.

#### Issue Contributing Areas

There is not enough information to delineate the *issue contributing area* at this time. A detailed work plan for gathering this information is included in **Appendix 'E-3'.**

#### Threat Assessment

All three of the approaches that are outlined in Chapter 4 for the identification of *drinking water threats* are applicable to this location. Only the *threats* approach has been applied at this time. Further research will be required to confirm whether or not any significant *drinking water threats* would result from applying the event-based (IPZ 3) approach to this *intake.*

#### Vulnerability Scoring and Threat Locations

Significant *threats* can occur in an IPZ with a vulnerability score of eight or higher. The Bath IPZ 1 has a score of seven and IPZ 2 has a score of 6.3 (**Map 6-37**); therefore *threats* cannot be numerically significant. Please refer to **Table 4-2** in Chapter 4 for *activities* that could produce a significant *threat* in an IPZ and the corresponding vulnerability scores.

**Maps 6-38**, **6-39**, **6-40** and **6-41** show the areas that can result in significant, moderate and low *drinking water threats* relating to *chemicals*, *pathogens* and *DNAPLs*. Similarly, areas where *conditions* may be significant, moderate or low *threats* are shown in **Map 6-42**.

#### Existing Activities

Similar to other waterfront towns situated along the Lake Ontario shoreline, the historical *activities* in Bath consisted of factory and agriculture related *activities*. For example, in IPZ 1 there were mills, warehouses, a tannery and a foundry, among other industrial *activities*. In more recent history, there are at least two former gas stations in IPZ 2 as well as a significant volume of fill in a former *wetland* east of Fairfield Street.

It is important to note that past *activities* may have the potential to contaminate rock, soil and water and are termed *conditions.* However, for the purposes of this report, the Bath IPZs were surveyed only for existing *activities* using the *threats* approach. Further research will be required to confirm whether or not any *conditions* exist.

Existing land *activities* that are found within the IPZ include a WTP, a large industrial facility, a federal penitentiary, marina, gas stations, private residences, agricultural and livestock related *activities*. These are situated over a total of 46 parcels of land.

Prescribed types of *drinking water threats* that are associated with these existing *activities* could include:

- the establishment, operation or maintenance of a waste disposal site within the meaning of Part V of the Ontario Environmental Protection Act
- the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage
- the application of *agricultural source material* to land
- the storage of *agricultural source material*
- the application of *non-agricultural source material* to land
- the handling and storage of *non-agricultural source material*
- the application of commercial fertilizer to land
- the handling and storage of commercial fertilizer
- the handling and storage of road salt
- the application of road salt
- the application of *pesticide* to land
- the handling and storage of *pesticide*
- the handling and storage of fuel
- the handling and storage of a dense non-aqueous phase liquid *(DNAPL)*
- the handling and storage of an *organic solvent*
- the use of a water softener
- the transportation of specified substances along corridors.

#### Transportation Corridors

Transportation corridors are shown on **Map 6-43** and listed in **Appendix 'I'**. The transportation corridors in the Bath IPZ include local roadways, provincial highways, railways and navigation channels. The main corridors within the Bath IPZ along which specified substances (*chemicals*) are or could be transported include:

- Highway 33 (Bath Road)
- County Road 7 (Church Street), County Road 22
- Canadian National Railway and associated industry spurlines
- Lake Ontario navigation channels.

#### Investigation of Drinking Water Threat Activities

Enumeration of *drinking water threats* found no parcels of land with land *activities* that could give rise to significant *threats*. Moderate and low *threats* have been enumerated for the area and result in 30 moderate and 15 low *drinking water threats*, respectively. Most *activities* identified have multiple associated *threats* per parcel, however, the majority of *threats* within the Bath IPZ relate to the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage (septic systems), the handling and storage of fuel and agricultural-related *activities*.

#### Threat Activities along Transportation Corridors

In addition to the *threats* associated with individual parcels of land, *activities* along transportation corridors and sanitary and storm sewer networks also contribute to the number of *threats* in the *vulnerable area*. The application of road salt gives rise to 29 low *threats*.

The transportation of specified substances along corridors contributes to four moderate and 37 low *threats*. The transportation of fuel contributes to 29 low *threats*; the transportation of *pesticides* contributes to four low *threats*; and the transportation of *DNAPLs* and *organic solvents* each contributes two moderate and two low *threats*, respectively.

The sanitary and storm sewer network also gives rise to one low *threat*.

**Table 6-18** below provides an enumeration summary of *drinking water threats* present for the Bath drinking water system. The table provides the total number of assessed parcels, total *threats* present and the ranking for each *threat* circumstance: significant (S), moderate (M) or low (L). **Table 6-19**, provides an expanded list of the threat *activities* and their occurrence within the Bath IPZs. For a more detailed outline of the *threats* and circumstances occurring within the Bath IPZs, please refer to **Table 10** of **Appendix 'H'.**

### Table 6-18: Bath WTP Drinking Water Threats Summary*

| Summary of Parcels with Identified Drinking Water Threats | | | Total Number of Parcels | | | Total Number of Threats within Parcels | | |
|---|---|---|---|---|---|---|---|---|
| **Threat Classification** | **IPZ 1** | **IPZ 2** | **S** | **M** | **L** | **S** | **M** | **L** |
| **Significant (S)** | 0 | 0 | 0 | | | 0 | | |
| **Moderate (M)** | 5 | 29 | | 34 | | | 64 | |
| **Low (L)** | 23 | 59 | | | 82 | | | 245 |
| **Total Number of Parcels** | 28 | 88 | 116 | | | | | |
| **Total Number of Threats Present**** | 32 | 277 | | | | 309 | | |

*The local drinking water *threat* of the use of water softeners is not included in the above summary table. It is assumed that each private well owner is using a water softener.
**Note: A parcel can have multiple *threats*. The transportation of *chemicals* along corridors, the application of salt on roads and sewer main line *threats* are enumerated within the total *threat* count.

**Table 6-19: Threat Type and Occurrence in Bath IPZ***

| DWT No | Drinking Water Threat | Total |
|---|---|---|
| 1 | Waste (industrial, commercial and/or hazardous) | 1 |
| 2 | Septic system, holding tank or other treatment | 27 |
| | Stormwater management | 6 |
| | Wastewater collection facility (sewer mainline & connections; does not include storage tanks or bypasses) | 3 |
| 3 | Application of agricultural source material to land | 29 |
| 4 | Storage of agricultural source material to land | 14 |
| 6 | Application of non-agricultural source material to land | 3 |
| 8 | Application of commercial fertilizer to land | 33 |
| 9 | Handling and storage of commercial fertilizer | 14 |
| 10 | Application of pesticide to land | 33 |
| 11 | Handling and storage of a pesticide | 1 |
| 12 | Application of road salt | 6 |
| 13 | Storage of road salt | 1 |
| 15 | Handling and storage of fuel | 34 |
| 16 | Handling and storage of a DNAPLS | 3 |
| 17 | Handling and storage of an organic solvent | 18 |
| 21 | Livestock pasturing and/or outdoor confinement, farm-animal yard | 13 |
| **Corridor Related Threats** | | |
| 12 | Application of road salt on roads | 29 |
| local | Transportation of fuel | 29 |
| local | Transportation of pesticides | 4 |
| local | The transportation of a DNAPL | 4 |
| local | Transportation of an organic solvent | 4 |
| **Total** | | **309** |

Note: There are no significant drinking water threats for the Bath IPZ.

#### Future Activities

As explained in Section 4.3, an *activity* that emerges in the future would be ranked as a *threat* to the *source water* if the underlying vulnerability score is high enough for it to be listed in the Tables of Drinking Water Threats (MOE, 2009k) as a significant, moderate, or low *threat*.

Land uses associated with *activities* that would be *threats* may or may not be permitted in the current municipal official plan and zoning by-law. An initial review of the relevant planning documents has been completed to assess which land uses are currently permitted in the *vulnerable area*; partial findings are provided below for the information of the reader.

The Bath IPZ 1 and IPZ 2 zones are located in Loyalist Township, with a small portion of IPZ 2 in the Town of Greater Napanee. The predominant permitted land uses in IPZ 1 are residential and commercial uses that could be associated with prescribed *drinking water threats* (Cumming Cockburn Ltd., 2002, 2005 and 2008; IBI Group, 2007). The IPZ 2 consists of residential and commercial uses as well as aggregate and agricultural uses that are associated with prescribed *drinking water threats*. All of the designations and zones that permit these uses are associated with prescribed *drinking water threats* will need to be reviewed. A review will help determine if changes to the permitted uses in general, or to specific properties should be recommended as part of the *source protection plan.*

The Town of Greater Napanee is in the process of reviewing and updating its official plan. Changes to the plan could *impact activities* occurring in the portion of IPZ 2 that falls within the Town of Greater Napanee. This process will provide an opportunity to flag certain designations, zones and/or permitted land uses for further analysis prior to the completion of the *source protection plan*.

## 6.2.8 Town of Greater Napanee Water Treatment Plants

There are two WTPs operating in the Town of Greater Napanee that withdraw water within the CSPA, the main intake for the community of Napanee WTP, and an intake for the Sandhurst Shores subdivision (see **Maps 6-45a** or **6-52a**).

The two intakes above are located west of Bath and south of Napanee in an area that is dominated by rural and agricultural *activities* such as orchards, vineyards, poultry and cattle farming. The region is popular among tourists who enjoy the picturesque scenery of the northeast shore of Lake Ontario along the Kingston/Picton corridor of Highway 33.

### 6.2.8.1 A.L. Dafoe (Napanee) Water Treatment Plant

The WTP is officially named the A.L. Dafoe WTP and as mentioned above, the intake provides the drinking water for residents in the Town of Napanee, approximately 17 kilometres to the north. *Drinking water* is treated at the A.L. Dafoe WTP via *flocculation* by liquid aluminum sulphate (alum) injection, mixing, settling, sand and granular activated carbon filtration and disinfection.

- withdrawal Source: Lake Ontario (backup in Napanee River, outside CSPA)
- serviced population and municipality: 10,000 residents of the Town of Napanee
- date constructed: 1890, with the most recent expansion in 1962
- intake depth: 3.4 metres
- intake pipe length (offshore): 53 metres
- intake pipe diameter: 300 millimetres.

#### Drinking Water Issue Evaluation

##### Water Quality at the Intake

The A.L. Dafoe Water Treatment Plant Engineer's Report (TSH, 2001a) assessed a variety of water quality parameters. At the time of sampling, colour and *hardness* exceeded desirable levels. *Escherichia coli* and total coliform were also found at levels that exceeded the benchmark for *drinking water issue* evaluation, but this exceedance is not supported in other data sources. Temperature has also been reported to be high, reaching up to 24 degrees Celsius between July and September in the recent Annual Drinking Water Compliance Reports for the A.L. Dafoe *drinking water system* (Greater Napanee Utilities, 2006a, 2007a, 2008a, 2009a).

One adverse water quality incident was reported for this intake during the period between 2005 and 2008: in October 2008 there was a single detection of one colony per 100 millilitres total coliform in the treated water.

The Provincial Drinking Water Surveillance Program data spanning from 1991-2001 were evaluated for *drinking water issue* identification. Occasional elevations in *hardness*, temperature, *turbidity* and colour were found throughout the data set. In treated water, colour, *hardness* and temperature remained at elevated concentrations in those years. Aluminum, chloroform and *trihalomethanes* also exceeded the Ontario Drinking Water Quality Standards in treated water over the ten year duration that this dataset covers.

Additional tests carried out under the umbrella of the provincial Drinking Water Surveillance Program identified taste and odour problems at the A.L. Dafoe WTP. The concentration of 2-methylisoborneol and geosmin were found to exceed the perceptible levels (the concentration at which the average person will detect an off flavour and/or smell in the water) seasonally, coinciding with peaks in water temperature. These problems are not known to cause harm to human health.

Water quality sampling by the CRCA in 2007 indicated that rain and west wind events coincided with elevated *hardness* at the location of the A.L. Dafoe water treatment plants' primary intake.

##### Drinking Water Issues

Based on all of the information sources discussed above, the protocol given in **Appendix 'E-1'**and the tests in rule 114 of the Technical Rules (MOE, 2009j), there are no substances considered to be *drinking water issues* with possible human sources in the raw, untreated water for this system.

Because this intake ceased to participate in the Drinking Water Surveillance Program after 2001, recent *raw water* quality data are limited. For more detailed information about natural and human source *drinking water issues*, please see **Appendix 'E-2', Table 12**. *Drinking water issues* with possible human sources for all WTPs are summarized in **Appendix 'E-2', Table 1**.

##### Threat Assessment

Two of the approaches that are outlined in Chapter 4 for the identification of *drinking water threats* are applicable to this location: the event-based (IPZ 3) approach and the *threats* approach. Only the *threats* approach has been applied at this time. Further research will be

required to confirm whether or not any significant *drinking water threats* would result from applying the event-based (IPZ 3) approach to this *intake.*

#### Vulnerability Scoring and Threat Locations

Significant *threats* can occur in an IPZ with a vulnerability score of eight or higher. The A. L. Dafoe IPZ 1 has a score of seven and IPZ 2 has a score of 5.6 (**Map 6-44**); therefore *threats* cannot be numerically significant. Please refer to **Table 4-2** in Chapter 4 for *activities* that could produce a significant *threat* in an IPZ and the corresponding vulnerability scores.

**Maps 6-45**, **6-46**, **6-47** and **6-48** show the areas that can result in significant, moderate and low *drinking water threats* relating to *chemicals*, *pathogens* and *DNAPLs*. Similarly, areas where *conditions* may be significant, moderate or low *threats* are shown in **Map 6-49**.

#### Historic and Existing Activities

The A.L. Dafoe (Napanee) IPZ area was historically dominated by agricultural related *activities*. The A. L. Dafoe IPZs were surveyed only for existing *activities* using the *threats* approach. Further research will be required to confirm whether or not any *conditions* exist.

Existing land *activities* that are found within the IPZ include a water pumping station, an industrial (power generation) facility, private residences and agricultural and livestock related *activities*. These are situated over a total of 15 parcels of land.

Prescribed types of *drinking water threats* that are associated with these existing *activities* could include:

- the establishment, operation or maintenance of a waste disposal site within the meaning of Part V of the Ontario Environmental Protection Act
- the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage
- the application of *agricultural source material* to land
- the storage of *agricultural source material*
- the application of *non-agricultural source material* to land
- the handling and storage of *non-agricultural source material*
- the application of commercial fertilizer to land
- the handling and storage of commercial fertilizer
- the application of *pesticide* to land
- the handling and storage of *pesticide*
- the handling and storage of road salt
- the application of road salt
- the handling and storage of fuel

- the handling and storage of a dense non-aqueous phase liquid (*DNAPL*)
- the handling and storage of an *organic solvent*
- the use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard
- the use of a water softener
- the transportation of specified substances along corridors.

#### Transportation Corridors

Transportation corridors are shown on **Map 6-50** and listed in **Appendix 'I'**. The transportation corridors in the A.L. Dafoe IPZ include local roadways, provincial highways, railways and navigation channels. The main corridors within the A.L. Dafoe IPZ along which specified substances (*chemicals*) are or could be transported include:

- Highway 33
- County Road 21
- a Canadian National Railway spurline
- Lake Ontario navigation channels.

#### Investigation of Drinking Water Threat Activities

No parcels of land had land *activities* capable of producing significant *threats* within the A.L. Dafoe (Napanee) IPZ. Moderate and low *threats* have been enumerated for the area and result in two moderate and ten low *drinking water threats*, respectively. Most *activities* identified have multiple associated *threats* per parcel, however, the majority of *threats* within the A.L. Dafoe (Napanee) IPZ relate to the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage (septic systems), the handling and storage of fuel and agricultural *activities*.

#### Threat Activities along Transportation Corridors

In addition to the *threats* associated with individual parcels of land, *activities* along transportation corridors also contribute to the number of *threats* in the *vulnerable area*. The application of road salt gives rise to two additional low *threats*.

The transportation of specified substances along corridors contributes to four moderate and nine low *threats*. The transportation of fuel contributes to four low *threats*; the transportation of *pesticides* contributes to three low *threats*; and the transportation of *DNAPLs* and *organic solvents* each contributes two moderate and one low *threat*, respectively.

**Table 6-20** below provides an enumeration summary of *drinking water threats* present for the A.L. Dafoe (Napanee) drinking water system. The table provides the total number of assessed parcels, total *threats* present and the ranking for each *threat* circumstance: significant (S), moderate (M) or low (L). **Table 6-21**, provides an expanded list of the threat *activities* and their occurrence within the A.L. Dafoe IPZs. For a more detailed outline of the *threats* and circumstances occurring within the A.L. Dafoe IPZs, please refer to **Table 11** of **Appendix 'H'.**

### Table 6-20: A.L. Dafoe (Napanee) WTP Drinking Water Threats Summary*

| Summary of Parcels with Identified Drinking Water Threats | | | Total Number of Parcels | | | Total Number of Threats | | |
|---|---|---|---|---|---|---|---|---|
| **Threat Classification** | **IPZ 1** | **IPZ 2** | **S** | **M** | **L** | **S** | **M** | **L** |
| **Significant (S)** | 0 | 0 | 0 | | | 0 | | |
| **Moderate (M)** | 6 | 0 | | 6 | | | 17 | |
| **Low (L)** | 14 | 7 | | | 21 | | | 49 |
| **Total Number of Parcels** | 20 | 7 | 27 | | | | | |
| **Total Number of Threats Present**** | 46 | 20 | | | | 66 | | |

*The local *drinking water threat* of the use of water softeners is not included in the above summary table. It is assumed that each private well owner is using a water softener.
**Note: A parcel can have multiple *threats*. The transportation of *chemicals* along corridors and *threats* related to the application of salt on roads are enumerated within the total *threat* count.

**Table 6-21: Threat Type and Occurrence in A.L. Dafoe IPZ***

| DWT No | Drinking Water Threat | Total |
|---|---|---|
| 1 | Waste (industrial, commercial and/or hazardous) | 1 |
| 2 | Septic system, holding tank or other treatment | 11 |
| | Wastewater collection facility (does not include storage tanks or bypasses) | 1 |
| 3 | Application of agricultural source material to land | 3 |
| 4 | Storage of agricultural source material to land | 3 |
| 6 | Application of non-agricultural source material to land | 1 |
| 8 | Application of commercial fertilizer to land | 3 |
| 9 | Handling and storage of commercial fertilizer | 2 |
| 10 | Application of pesticide to land | 3 |
| 11 | Handling and storage of a pesticide | 1 |
| 12 | Application of road salt | 1 |
| 13 | Storage of road salt | 1 |
| 15 | Handling and storage of fuel | 12 |
| 16 | Handling and storage of a DNAPLS | 1 |
| 17 | Handling and storage of an organic solvent | 4 |
| 21 | Livestock pasturing and/or outdoor confinement, farm-animal yard | 3 |
| **Corridor Related Threats** | | |
| 12 | Application of road salt on roads | 2 |
| local | Transportation of fuel | 4 |
| local | Transportation of pesticides | 3 |
| local | The transportation of a DNAPL | 3 |
| local | Transportation of an organic solvent | 3 |
| **Total** | | **66** |

Note: There are no significant drinking water threats for the A.L. Dafoe IPZ.

#### Future Activities

As explained in Section 4.3, an *activity* that emerges in the future would be ranked as a *threat* to the *source water* if the underlying vulnerability score is high enough for it to be listed in the Tables of Drinking Water Threats (MOE, 2009k) as a significant, moderate, or low *threat.*

Land uses associated with *activities* that would be *threats* may or may not be permitted in the current municipal official plan and zoning by-law. An initial review of the relevant planning documents has been completed to assess which land uses are currently permitted in the *vulnerable area*; partial findings are provided below for the information of the reader.

The A.L. Dafoe IPZ 1 and IPZ 2 zones are located in the Town of Greater Napanee and consist of industrial and agricultural permitted uses that are associated with prescribed *drinking water threats* (Cumming Cockburn Ltd., 2002; IBI Group, 2007). The relevant designations and zones that permit these uses will need to be reviewed to determine if changes to the permitted uses in general or to specific properties should be recommended as part of the *source protection plan*.

The Town of Greater Napanee is in the process of reviewing and updating its official plan. This process will provide an opportunity to flag certain designations, zones and/or permitted land uses for further analysis prior to the completion of the *source protection plan*.

#### 6.2.8.2 Sandhurst Shores Water Treatment Plant

The Sandhurst Shores WTP is a package treatment plant which incorporates *coagulation*, *flocculation*, sedimentation and filtration (with granular activated carbon) in one large partitioned steel tank. Chlorine injection is the final disinfection step as the water reaches the clearwell.

- withdrawal source: Lake Ontario (Adolphus Reach)
- serviced population and municipality: 230 residents (93 residences) in the Sandhurst Shores subdivision in the Town of Greater Napanee
- date constructed: 2003 (earliest date noted in reports)
- intake depth: 12 metres
- intake pipe length (offshore): 285 metres
- intake pipe diameter: 250 millimetres.

##### Drinking Water Issue Evaluation

###### Water Quality at the Intake

Data from the Drinking Water Information System shows that total coliform counts are generally low. Annual Drinking Water Compliance Reports for this *drinking water system* cite seasonal elevations in colour, pH and temperature (Greater Napanee Utilities, 2006b, 2007b, 2008b, and 2009b).

High levels of *hardness*, iron and colour were identified in the Sandhurst Shores Water Treatment Plant Engineer's Report (TSH, 2001c). Water quality sampling in Lake Ontario by the CRCA in 2007 found that *hardness* was reported to be higher immediately following rain events.

###### Drinking Water Issues

Based on all of the information sources discussed above, the protocol outlined in **Appendix 'E-1'** and the tests in rule 114 of the Technical Rules (MOE, 2009j), there are no substances considered *drinking water issues* with possible human sources in the raw, untreated water for this system. *Raw water* quality data are, however, limited and other possible *drinking water issues* cannot be ruled out.

For more detailed information about the natural and human source *drinking water issues*, please see **Appendix 'E-2', Table 13**. *Drinking water issues* with possible human sources for all WTPs are summarized in **Appendix 'E-2', Table 1**.

#### Threat Assessment

Two of the approaches that are outlined in Chapter 4 for the identification of *drinking water threats* are applicable to this location: the event-based (IPZ 3) approach and the *threats* approach. Only the *threats* approach has been applied at this time. Further research will be required to confirm whether or not any significant *drinking water threats* would result from applying the event-based (IPZ 3) approach to this *intake.*

#### Vulnerability Scoring and Threat Locations

Significant *threats* can occur in an IPZ with a vulnerability score of eight or higher. The Sandhurst Shores IPZ 1 has a score of seven (**Map 6-51**); therefore *threats* cannot be numerically significant. Please refer to **Table 4-2** in Chapter 4 for *activities* that could produce a significant *threat* in an IPZ and the corresponding vulnerability scores.

**Maps 6-52, 6-53, 6-54** and **6-55** show the areas that could result in significant, moderate and low *drinking water threats* related to *chemicals*, *pathogens* and *DNAPLs*. Similarly, areas where *conditions* may be significant, moderate or low *threats* are shown in **Map 6-56**.

#### Historic and Existing Activities

The Sandhurst Shores area was historically dominated by agricultural related *activities.* Originally, the Sandhurst area was developed as a planned village to service the surrounding agricultural community, but it was never fully realized.

For this report, Sandhurst Shores (Napanee) IPZs were surveyed for existing *activities* only using the *threats* approach. Further research will be required to confirm whether or not any *conditions* exist.

Existing *activities* that are found within the IPZ include a water treatment plant, private residences and agricultural and livestock related *activities*. These are situated on 160 parcels of land.

Prescribed types of *drinking water threats* that are associated with these existing *activities* could include:

- the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage
- the application of *agricultural source material* to land
- the storage of *agricultural source material*
- the application of *non-agricultural source material* to land
- the handling and storage of *non-agricultural source material*
- the application of commercial fertilizer to land
- the handling and storage of commercial fertilizer
- the application of *pesticide* to land
- the application of road salt

- the handling and storage of fuel
- the handling and storage of an *organic solvent*
- the use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard
- the use of a water softener
- the transportation of specified substances along corridors.

#### Transportation Corridors

Transportation corridors are shown on **Map 6-57** and listed in **Appendix 'I'**. The transportation corridors in the Sandhurst Shores IPZ include local roadways, provincial highways, railways and navigation channels. The main corridors within the Sandhurst Shores IPZ along which specified substances (*chemicals*) are or could be transported include:

- Highway 33
- County Road Number 1 South
- Lake Ontario navigation channels.

#### Investigation of Drinking Water Threat Activities

No parcels of land had land *activities* that could give rise to significant *threats.* Moderate and low *drinking water threats* for the Sandhurst Shores IPZ account for seven moderate and 151 low threats, respectively. Most *activities* identified have multiple associated *threats* per parcel, however, the majority of *threats* within the Sandhurst Shores IPZ relate to the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage (septic systems), the handling and storage of fuel and agricultural-related *activities*.

#### Threat Activities along Transportation Corridors

In addition to the *threats* associated with individual parcels of land, *activities* along transportation corridors also contribute to the number of *threats* in the *vulnerable area*. The application of road salt gives rise to 12 additional low *threats*.

The transportation of specified substances along corridors contributes to 16 low *threats*. The transportation of fuel contributes to 13 low *threats*; the transportation of *pesticides*, *DNAPLs* and *organic solvents* each contribute one low *threat*, respectively.

**Table 6-22** below provides an enumeration summary of the *drinking water threats* present for the Sandhurst Shores drinking water system. The table provides the total number of assessed parcels, total *threats* present and the ranking for each *threat* circumstance: significant (S), moderate (M) or low (L). **Table 6-23**, provides an expanded list of the threat *activities* and their occurrence within the Sandhurst Shores IPZ. For a more detailed outline of the *threats* and circumstances occurring within the Sandhurst, please refer to **Table 12** of **Appendix 'H'.**

### Table 6-22: Sandhurst Shores WTP Drinking Water Threats Summary*

| Summary of Parcels with Identified Drinking Water Threats | | | Total Number of Parcels | | | Total Number of Threats | | |
|---|---|---|---|---|---|---|---|---|
| **Threat Classification** | **IPZ 1** | **IPZ 2** | **S** | **M** | **L** | **S** | **M** | **L** |
| **Significant (S)** | 0 | 0 | 0 | | | 0 | | |
| **Moderate (M)** | 7 | 0 | | 7 | | | 23 | |
| **Low (L)** | 49 | 130 | | | 179 | | | 321 |
| **Total Number of Parcels** | 56 | 130 | 186 | | | | | |
| **Total Number of Threats Present**** | 103 | 241 | | | | 344 | | |

*The local *drinking water threat* of the use of water softeners is not included in the above summary table. It is assumed that each private well owner is using a water softener.
**Note: A parcel can have multiple *threats*. The transportation of *chemicals* along corridors and *threats* related to the application of salt on roads are enumerated within the total *threat* count.

### Table 6-23: Threat Type and Occurrence in Sandhurst Shores IPZ*

| DWT No | Drinking Water Threat | Total |
|---|---|---|
| 2 | Septic system, holding tank or other treatment | 141 |
| 3 | Application of agricultural source material to land | 25 |
| 4 | Storage of agricultural source material to land | 9 |
| 6 | Application of non-agricultural source material to land | 1 |
| 8 | Application of commercial fertilizer to land | 25 |
| 9 | Handling and storage of commercial fertilizer | 6 |
| 10 | Application of pesticide to land | 25 |
| 15 | Handling and storage of fuel | 70 |
| 17 | Handling and storage of an organic solvent | 5 |
| 21 | Livestock pasturing and/or outdoor confinement, farm-animal yard | 9 |
| **Corridor Related Threats** | | |
| 12 | Application of road salt on roads | 12 |
| local | Transportation of fuel | 13 |
| local | Transportation of pesticides | 1 |
| local | The transportation of a DNAPL | 1 |
| local | Transportation of an organic solvent | 1 |
| **Total** | | **344** |

Note: There are no significant drinking water threats for the Sandhurst Shores IPZ.

#### Future Activities

As explained in Section 4.3, an *activity* that emerges in the future would be ranked as a *threat* to the *source water* if the underlying vulnerability score is high enough for it to be listed in the Tables of Drinking Water Threats (MOE, 2009k) as a significant, moderate, or low *threat*.

Land uses associated with *activities* that would be *threats* may or may not be permitted in the current municipal official plan and zoning by-law. An initial review of the relevant planning documents has been completed to assess which land uses are currently permitted in the *vulnerable area*; partial findings are provided below for the information of the reader.

The Sandhurst Shores IPZ 1 and IPZ 2 zones are located in the Town of Greater Napanee. The hamlet permits a variety of residential, commercial and community facilities that could be associated with prescribed *drinking water threats* (Cumming Cockburn Ltd., 2002; IBI Group, 2007). Permitted agricultural land uses also surround the hamlet. The relevant designations and zones that permit these uses will need to be reviewed. This review will help determine if changes to the permitted uses in general, or to specific properties should be recommended as part of the *source protection plan*.

The Town of Greater Napanee is in the process of reviewing and updating its official plan. This process will provide an opportunity to flag certain designations, zones and/or permitted land uses for further analysis prior to the completion of the *source protection plan*.

### 6.2.9 Conclusions and Next Steps

*Intake protection zones* 1, 2 and 3 have been delineated for the eight intakes in the Cataraqui area that draw from either Lake Ontario or the St. Lawrence River with a “low” uncertainty. Vulnerability scoring has been assigned to each zone in accordance with the Technical Rules, also with a “low” uncertainty. *Drinking water issues* have been identified at three of the intakes and existing *drinking water threats* (*activities*) have been counted within the IPZs. Opportunities to improve these findings in the future are described in Chapter 8.

Given the lack of available data, no significant *drinking water threats* have yet been identified through *modeling* in the IPZ 3.

The next steps in technical work for these intakes include: (1) to assess whether or not there are any significant *drinking water threats* in IPZ 3 through related *modeling* work, and (2) to execute the plans for the delineation of *issue contributing areas* that are included in **Appendix ‘E’**.

## 6.3 Picton Intake

The intake for the Picton WTP is located in the Quinte Source Protection Region and the IPZ delineated for this intake extends into the CSPA.

### 6.3.1 Picton Water Treatment Plant

#### 6.3.1.1 Background

The Picton WTP intake is located west of the CSPA in the Bay of Quinte. The intake supplies a municipal residential drinking water system to residents in the communities of Picton and Bloomfield. The associated IPZ 1 and IPZ 2 are located entirely within the Quinte Source Protection Region; however, the IPZ 3 for the plant is partially located within the CSPA (see **Map 6-59**). The reader is invited to review the *Assessment Report* for the Quinte Source Protection Region for more information about this *vulnerable area*.

- withdrawal source: Picton Bay, Bay of Quinte
- serviced population and municipality: 5,905 residents in the community of Picton and 643 residents in the community of Bloomfield in Prince Edward County
- date constructed: 2005 upgrade
- intake depth: 3.3 metres (both intakes)
- intake pipe length (offshore): 91 metres (south intake), 305 metres (north intake – not used)
- intake pipe diameter: 400 millimetres (south intake), 400 millimetres (north intake – not used).

## 6.3.2 Delineation of Intake Protection Zones

The delineation of the IPZ for the Picton WTP was completed by XCG Consultants Ltd. for Quinte Conservation (XCG Consultants Ltd., 2009a). The Picton intake is classified as a Type 'D' intake in the Bay of Quinte. The *intake protection zone* 3b that enters the Cataraqui Source Protection Area was assigned a "low vulnerability". For a detailed description of the methods used for IPZ delineation, please see the Quinte Source Protection Region *Assessment Report*.

Only IPZ 3b for the Picton intake extends into the CSPA (**Map 6-59**). The IPZ was delineated by identifying all contributing watercourses west of the Glenora Ferry crossing and north to the Belleville IPZ 2. Where the in-water portion of the zone meets the shoreline, a combination of the regulation limit and a 120 metre setback from the high water mark is used to extend it inland, in accordance with the Technical Rules. The uncertainty assigned to this delineation was low.

## 6.3.3 Vulnerability Scoring

The vulnerability of the IPZ for the Picton intake is shown on **Map 6-60**. Vulnerability was assessed based on the characteristics of the intake and the characteristics of the zone. Zone characteristics considered include *runoff* generation potential, preferential pathways, distances to *threat* sources and *raw water* characteristics. The vulnerability scores for the delineated Picton IPZs are as follows: IPZ 1 has a vulnerability score of ten, IPZ 2 receives a score of nine and IPZ 3a is scored an eight, respectively. Within the Cataraqui area, the Picton IPZ 3b is assigned a vulnerability score of six with a low uncertainty.

### 6.3.3.1 Drinking Water Issue Evaluation

#### Water Quality at the Intake

The evaluation of *drinking water issues* for the Picton WTP is being completed by XCG Consultants Ltd. for Quinte Conservation. The discussion below is taken from the Technical Memorandum # 2: Quinte Source Protection Region Water Quality Issues Evaluation for Picton Drinking Water System (XCG Consultants Ltd., 2009a).

Various water quality data were reviewed for the evaluation of *drinking water issues*. None of these data relate directly to the portion of the IPZ that extends into the CSPA.

#### Drinking Water Issues

At the time this report was written, there are no substances that were considered as *drinking water issues* with possible human sources in the raw, untreated water for this system. For more information please refer to the Quinte Source Protection Region *Assessment Report*.

### 6.3.3.2 Threat Assessment

Only a portion of the Picton IPZ 3b falls within the CSPA and was surveyed for existing *activities* using the *threats* approach. Further research will be required to confirm whether or not any *conditions* exist.

The Picton IPZ 3b has a score of six therefore any *threats* found within this zone cannot be numerically significant. For detailed list of the *activities* that could produce a significant *threat*, please see **Table 4-2** in Chapter 4. **Maps 6-61**, **6-62** and **6-63** show the areas where significant, moderate and low *drinking water threats* related to *chemicals*, *pathogens* and *DNAPLs* could occur. Similarly, areas where *conditions* may be significant, moderate or low *threats* are shown in **Map 6-64**.

Data from preliminary *watershed* surveys was used to identify land *activities* within the CSPA of the Picton IPZ 3, and is not considered a comprehensive list. For a more inclusive description of the *threats* found within IPZ 1, 2 and 3, please refer to the Quinte Source Protection Region *Assessment Report*.

#### Existing Activities

Existing *activities* that are found within the Picton IPZ 3b include agricultural and livestock related *activities*, recreational areas, landfills, gas stations, garage and automotive services, and a manufacturing facility.

Prescribed types of *drinking water threats* that are associated with these existing *activities* could include:

- the establishment, operation or maintenance of a waste disposal site within the meaning of Part V of the *Environmental Protection Act*
- the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.
- the application of *agricultural source material* to land
- the storage of *agricultural source material*
- the application of *non-agricultural source material* to land
- the handling and storage of *non-agricultural source material*
- the application of commercial fertilizer to land
- the handling and storage of commercial fertilizer
- the application of *pesticide* to land
- the handling and storage of *pesticide*

- the handling and storage of road salt
- the application of road salt
- the handling and storage of fuel
- the handling and storage of a dense non-aqueous phase liquid (*DNAPL*)
- the handling and storage of an *organic solvent*
- the use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard
- the use of a water softener
- the transportation of specified substances along corridors.

#### Transportation Corridors

Transportation corridors are shown on **Map 6-65** and listed in **Appendix 'I'**. The transportation corridors in the Picton IPZ 3 include local roadways, provincial highways, railways and navigation channels. The main corridors along which specified substances (*chemicals*) are or could be transported include:

- Highway 401, Highway 33 (Bath Road), Highway 38 (Sydenham Road)
- Glenora Ferry (provincial highway)
- County Road 1 (Yarker Road), County Road Number 1, County Road 2, County Road 6, County Road 7, County Road 8, County Road 21 and County Road 22
- Canadian National Railway and associated industry spurlines
- Lake Ontario, Bay of Quinte and Hay Bay navigation channels.

#### Investigation of Drinking Water Threat Activities

No parcels of land had land *activities* that could give rise to significant *threats* and thus no further investigation was required. Eleven parcels with moderate and 24 parcels with low *drinking water threats* were identified using worst case scenario assumptions of the land *activities*. Most *activities* identified have multiple associated *threats* per parcel.

#### Threat Activities along Transportation Corridors

In addition to the *threats* associated with individual parcels of land, *activities* along transportation corridors also contribute to the number of *threats* in the *vulnerable area*. Due to the large area covered, the vast number of roads contained, and the fact that these *activities* can, at worst, produce only moderate *threats* in Picton's IPZ 3b, neither the application of road salt nor the transportation of fuel, *pesticides*, *DNAPLs* or *organic solvents* were enumerated for this IPZ.

**Table 6-24** below provides an enumeration summary of *drinking water threats* present for the Picton drinking water system for IPZ 3b. The table provides the total number of assessed parcels, total *threats* present and the ranking for each *threat* circumstance: significant (S), moderate (M) or low (L). **Table 6-25**, provides an expanded list of the threat *activities* and their

occurrence within the Picton IPZ 3b. For a more detailed outline of the *threats* and circumstances occurring within Picton's IPZ 3b, please refer to **Table 13** of **Appendix 'H'.**

**Table 6-24: Picton IPZ 3b WTP Drinking Water Threats Summary***

| Summary of Parcels with Drinking Water Threats | | Total Number of Parcels | | | Total Number of Threats | | |
|---|---|---|---|---|---|---|---|
| **Threat Classification** | **IPZ 3** | **S** | **M** | **L** | **S** | **M** | **L** |
| **Significant (S)** | 0 | 0 | | | 0 | | |
| **Moderate (M)** | 11 | | 11 | | | 21 | |
| **Low (L)** | 24 | | | 24 | | | 151 |
| **Total Number of Parcels** | 35 | 35 | | | | | |
| **Total Number of Threats Present**** | 172 | | | | 172 | | |

*The local *drinking water threat* of the use of water softeners is not included in the above summary table. It is assumed that each private well owner is using a water softener.
**Note: A parcel can have multiple *threats*. The transportation of *chemicals* along corridors, the application of salt on roads are enumerated within the total *threat* count.

**Table 6-25: Threat Type and Occurrence in Picton IPZ***

| DWT No | Drinking Water Threat | Total |
|---|---|---|
| 1 | Waste (industrial, commercial and/or hazardous) | 3 |
| 2 | Septic system, holding tank or other treatment | 16 |
| 3 | Application of agricultural source material to land | 10 |
| 4 | Storage of agricultural source material to land | 10 |
| 8 | Application of commercial fertilizer to land | 10 |
| 9 | Handling and storage of commercial fertilizer | 10 |
| 10 | Application of pesticide to land | 10 |
| 15 | Handling and storage of fuel | 30 |
| 16 | Handling and storage of a DNAPLS | 30 |
| 17 | Handling and storage of an organic solvent | 30 |
| 21 | Livestock pasturing and/or outdoor confinement, farm-animal yard | 11 |
| **Total** | | **172** |

Note: There are no significant drinking water threats for the Picton IPZ.

#### Future Activities

As explained in Section 4.3, an *activity* that emerges in the future would be ranked as a *threat* to the *source water* if the underlying vulnerability score is high enough for it to be listed in the Tables of Drinking Water Threats (MOE, 2009k) as a significant, moderate, or low *threat.*

Land uses associated with *activities* that would be *threats* may or may not be permitted in the current municipal official plan and zoning by-law. An initial review of the relevant planning

documents has been completed to assess which land uses are currently permitted in the *vulnerable area*; partial findings are provided below for the information of the reader.

The Picton IPZ 3 zone extends into the CSPA along Wilton Creek into the Town of Greater Napanee, Loyalist Township, the City of Kingston and the Township of South Frontenac.

The predominant permitted land uses in the IPZ 3 in the Town of Greater Napanee are environmental protection, residential and agricultural, with pockets of aggregate uses (Cumming Cockburn Ltd., 2002; IBI Group, 2007).

The predominant permitted land uses in the IPZ 3 in Loyalist Township are environmental protection, agricultural and residential, particularly in hamlets (Cumming Cockburn Limited, 2005 and 2008). There are also pockets of aggregate uses.

In the City of Kingston, the IPZ 3 is dominated by agricultural land uses (City of Kingston, 2009; Township of Kingston, 2006).

Within the Township of South Frontenac, the IPZ 3 is dominated by rural permitted land uses (Ainley Graham & Associates Limited for Township of South Frontenac, 2003a and 2003b).

These land use designations and zones allow a wide range of permitted uses that are associated with prescribed *drinking water threats* will need to be reviewed. A review will determine if changes to the permitted uses in general, or to specific properties should be recommended as part of the *source protection plan*.

### 6.3.4 Conclusions

*Intake protection zones* 1, 2 and 3 have been delineated for the Picton intake by the Quinte Source Protection Committee; with a low uncertainty assigned to the IPZ 3b that enters the Cataraqui area. Vulnerability scoring has been assigned to each zone in accordance with the Technical Rules, also with a low uncertainty. *Drinking water issues* have been identified and existing *drinking water threats* (*activities*) have been counted within the IPZs.

## 6.4 Inland Intakes

There is only one inland *municipal drinking water system* intake in the CSPA, the intake for Sydenham. The village of Sydenham is located approximately 20 kilometres northwest of Kingston in the Township South Frontenac. The village itself is located on the west end of Sydenham Lake that drains into Millhaven Creek. Sydenham is a unique area geologically as it lies on the boundary between the St. Lawrence Lowlands (dominated by *limestone*) and the *Canadian Shield* (dominated by *granite*).

### 6.4.1 Sydenham Water Treatment Plant

#### 6.4.1.1 Background

This relatively new facility came on-line in July 2006.

- withdrawal source: Sydenham Lake

- serviced population and municipality: 940 residents of the Village of Sydenham in South Frontenac Township, just over 50 per cent (145) of the 273 service connections were connected as of fall 2008
- date constructed: 2006
- intake depth: seven metres
- intake pipe length (offshore): 128 metres
- intake pipe diameter: 400 millimetres.

#### 6.4.1.2 Water Withdrawal for the Water Treatment Plant

The Sydenham WTP received its *Permit to Take Water* in 2004. The *Permit to Take Water* allows for a withdrawal of 1290 cubic metres per day. However, as of fall 2008, only 50 per cent of the expected service connections have been connected, meaning the plant is taking less than half of its allowable withdrawal. This is reflected in the estimated withdrawal values, which come from the First Engineer's Report and Drinking Water Inspection Reports for the WTP. **Table 6-26** below shows the estimates of water withdrawals from the Sydenham WTP (MOE, 2008i).

**Table 6-26: WTP Raw Water Withdrawal Volumes, Sydenham**

| Municipal Water Treatment Plant | Permit to Take Water Allowed Volume ($m^3$/ day) | Estimated Annual Volume ($m^3$/ day) | Estimated Average Monthly Volume ($m^3$/ day) | Estimated Average Daily Volume ($m^3$/ day) | Estimated Maximum Daily Volume ($m^3$/ day) |
|---|---|---|---|---|---|
| Sydenham | 1,290 | 83,950 | 6,900 | 230 | 609 |

### 6.4.2 Delineation of the Intake Protection Zones

The Sydenham Lake intake is classified as a Type 'D' intake, as per the Technical Rules: Assessment Report (MOE, 2009j). The Sydenham Lake IPZ delineations were completed by XCG Consultants Ltd. (see **Appendix 'L-12'**). The work included delineating IPZ 1, 2 and 3, and it used a hydrodynamic *model* built from field data. The *model* inputs included wind conditions, bathymetry, and water levels, as well as field conditions from *drogue tracking* exercises.

The full details of the Sydenham study can be found in XCG Consultants Ltd. (2009b). A "low" uncertainty rating was assigned to these findings.

The IPZ delineations for the Sydenham WTP are shown on **Map 6-66**.

- IPZ 1 is one kilometre in radius, within the *watershed* that flows to Sydenham Lake, with a 120 metre high water mark setback on land.

- IPZ 2 is delineated based on a two hour *time of travel* to the intake, but is entirely within IPZ 1 within the body of the lake. The IPZ 2 was modeled using the US Environmental Protection Agency's Environmental Fluid Dynamics Code software (XCG Consultants Ltd., 2009b). A 20 metre by 20 metre grid was used for the *modeling*. Existing bathymetric (lake depth) and lake outlet flow data were used. Field studies using *tracking drogues* (in-water sails) were completed under three different wind conditions (south, west and northeast) during the fall of 2006. This work gathered additional data about the movement of water in Sydenham Lake. The finding of the *modeling* was that within the lake, the two hour *time-of-travel* would be contained (and likely exceeded) within the one kilometre radius of IPZ 1. T*ransport pathways* (storm sewers, ditches and *streams*) are also included in the *time-of*-travel and they extend IPZ 2 over land southwards from the intake.
- IPZ 3 includes all the water bodies contributing to Sydenham Lake (see **Map 6-66**). Where the in-water portion of the zone meets the shoreline, a combination of the regulation limit and a 120 metre setback is used to extend it inland, in accordance with the Technical Rules. IPZ 3 is broken into two parts (3a and 3b) to reflect their proximity to the intake and the varying character of the landscape (IPZ 3a is on the agricultural *limestone* plain to the south; IPZ 3b is on the forested *Canadian Shield* to the north, further away from the community).

The full details of the Sydenham study can be found in XCG Consultants Ltd. (2009b). In the opinion of the consultant, "...there is low uncertainty associated with the drogue study results and *model verification* runs, allowing for a high level of confidence in the delineation" (XCG Consultants Ltd., 2009b). This opinion was supported by the peer reviewers. An uncertainty level of low is assigned to the IPZ delineations.

As with the work on the Great Lakes, the study was limited by the lack of long-term field data, and by the fact that the available hydrologic *models* do not reflect the winter months in which Sydenham Lake is covered by ice.

### 6.4.3 Vulnerability Scoring

The vulnerability of the Sydenham IPZ is shown on **Map 6-67**. The vulnerability scoring for the Sydenham IPZ is determined similar to the other IPZs where the overall vulnerability score is the result of multiplying the area vulnerability factor ($Vf_a$) with the source vulnerability factor ($Vf_s$). This score can range from 0.8 to 10 depending on the zone with higher values representing greater *risk* of *contamination*.

In reference to the Technical Rules: Assessment Report (MOE, 2009j) and work conducted by XCG Consultants Ltd., the area vulnerability factor considers:

- the percentage of the area that is composed of land
- the *land cover*, soil type, *permeability*, and the *slope* of setbacks
- the hydrological and hydrogeological conditions in the area that contributes water through *transport pathways*, and

- the proximity of the area to the intake (in the case of IPZ 3).

In turn, the score vulnerability factor applies to the location of the intake and is determined in relation to:

- the depth of the intake
- the distance of the intake from land, and
- the number of recorded *drinking water issues* related to the intake.

Each factor and the combined vulnerability scores for the Sydenham IPZs are given in **Table 6-27** below. As is permitted by Technical Rule # 90, the vulnerability scoring for IPZ 3 has been divided into (a) and (b) parts to reflect the character of the landscape (as described in Section 6.4.2 above). A low uncertainty rating was assigned to these findings.

**Table 6-27: Vulnerability scoring for Sydenham Intake Protection Zones**

| Zone | IPZ 1 | IPZ 2 | IPZ 3a | IPZ 3b |
|---|---|---|---|---|
| **($Vf_a$)** | 10 | 9 | 7 | 4 |
| **($Vf_s$)** | 0.9 | 0.9 | 0.9 | 0.9 |
| **Vulnerability Score** | 9.0 | 8.1 | 6.3 | 3.6 |

More details on the vulnerability scoring are included in Community of Sydenham Intake Protection Zone Study (XCG Consultants Ltd., 2009b) (see **Appendix 'L-12'**).

#### 6.4.3.1 Drinking Water Issue Evaluation

##### Water Quality at the Intake

*Drinking water issues* were identified by XCG Consultants Ltd. as part of the Community of Sydenham Intake Protection Zone Study (XCG Consultants Ltd., 2009b).

Annual Reports, the pre-design report and pilot study for the Sydenham WTP were examined by XCG Consultants Ltd. (Utilities Kingston, 2006, 2007, 2008 and reviewed in MOE, 2007i, 2008i). *Drinking water issues* identified from this review include colour, dissolved organic carbon, *hardness*, pH, and *turbidity*. Sampling carried out by XCG Consultants Ltd. also indicated *drinking water issues* with *hardness*, pH, and temperature.

##### Drinking Water Issues

Based on all of the information sources discussed above, the protocol outlined in **Appendix 'E-1'** and the tests in rule 114 of the Technical Rules (MOE, 2009j), the following substance is considered a *drinking water issue* with possible human sources in the raw, untreated water for this system:

- dissolved organic carbon.

The balance is considered to be natural characteristics of the *source water* for this system. For more detailed information about the natural and human source *drinking water issues*, please see **Appendix 'E-2', Table 15**. *Drinking water issues* with possible human sources for all WTPs are summarized in **Appendix 'E-2', Table 1**.

#### Issue Contributing Areas

Because dissolved organic carbon is not a listed as a *contaminant of concern* for any of the Tables of Drinking Water Threats (MOE, 2009k), no *issue contributing area* will be identified.

### 6.4.3.2 Threats Assessment

Data contained within this section is provided in part by XCG Consultants Ltd. (2009b).

Only the *threats* approach that is outlined in Chapter 4 for the identification of *drinking water threats* is applicable to this location. The event-based (IPZ 3) approach is not applicable since the *drinking water system* has been defined as a Type 'D' location (see **Table 6-1**).

#### Vulnerability Scoring and Threat Locations

Significant *threats* can occur in an IPZ with a vulnerability score of eight or higher. The Sydenham IPZ 1 has a score of nine, and IPZ 2 has a score of 8.1 (**Map 6-67**); therefore *activities* occurring in IPZ 1 and IPZ 2 have the potential to be significant *threats*. Please refer to **Table 4-2** in Chapter 4 for *activities* that could produce a significant *threat* in an IPZ.

Areas where significant, moderate, and low *drinking water threats* related to *chemicals*, *pathogens* and *DNAPLs* are shown as **Maps 6-68**, **6-69**, **6-70**. Similarly, areas where *conditions* may be significant, moderate or low *threats* are shown in **Map 6-71**.

#### Historical and Existing Activities

Historically, Sydenham was a small village home to small industry including three mills on Millhaven Creek (IPZ 1) and wagon and harness shops in the village (IPZ 2). For the purposes of this report, the Sydenham IPZs were surveyed only for existing *activities* using the *threats* approach. Further research will be required to confirm whether or not any *conditions* exist.

The enumeration of significant *threats* in these areas was completed by XCG Consultants Ltd., while the enumeration of moderate and low *threats* and identification of transportation corridors was completed by the CRCA.

Existing *activities* that are found within the IPZ include a water treatment facility, hardware and grocery stores and other commercial properties, medical offices, education facilities, a private camp, municipal parkland with a closed landfill site, agricultural and livestock related *activities* and private residences (assumed to have septic systems and heating fuel tanks). These are situated over a total of 129 parcels of land.

Prescribed types of *drinking water threats* that are associated with these existing *activities* could include:

- the establishment, operation or maintenance of a waste disposal site within the meaning of Part V of the Ontario Environmental Protection Act
- the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage
- the application of *agricultural source material* to land
- the application of commercial fertilizer to land
- the handling and storage of commercial fertilizer
- the application of *pesticide* to land
- the handling and storage of *pesticide*
- the application of road salt
- the handling and storage of road salt
- the handling and storage of fuel
- the handling and storage of a dense non-aqueous phase liquid (*DNAPL*)
- the handling and storage of an *organic solvent*
- the use of land as livestock grazing or pasturing land, and outdoor confinement area or a farm-animal yard
- the use of a water softener
- the transportation of specified substances along corridors.

#### Transportation Corridors

Transportation corridors are shown on **Map 6-72** and listed in **Appendix 'I'**. The transportation corridors in the Sydenham IPZ include local roadways, provincial highways, railways and navigation channels. The main corridors along which specified substances (*chemicals*) are or could be transported include:

- George Street, Mill Street, Portland Avenue and Wheatley Street
- County Road 5 (Rutledge Road), County Road 10 (Perth Road) and County Road 19 (Bedford Rd).

#### Investigation of Drinking Water Threat Activities

Investigation of the *drinking water threats* through research and landowner contact confirmed a total of three significant, 134 moderate, and one low *drinking water threats* in this IPZ. The majority of *threats* within the Sydenham IPZ relate to the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage (septic systems), the handling and storage of fuel and agricultural-related *activities*.

### Threat Activities along Transportation Corridors

In addition to the *threats* associated with individual parcels of land, *activities* along transportation corridors also contribute to the number of *threats* in the *vulnerable area*. The application of road salt gives rise to ten moderate and four low *threats*.

The transportation of specified substances along corridors contributes to 24 moderate *threats*. The transportation of fuel contributes to 15 moderate *threats*; the transportation of *pesticides*, *DNAPLs* and *organic solvents* each contributes three moderate, respectively.

**Table 6-28** below provides an enumeration summary of *drinking water threats* present for the Sydenham drinking water system. The table provides the total number of assessed parcels, total *threats* present and the ranking for each *threat* circumstance: significant (S), moderate (M) or low (L). **Table 6-29**, provides an expanded list of the threat *activities* and their occurrence within the Sydenham IPZ. For a more detailed outline of the *threats* and circumstances occurring within the Sydenham, please refer to **Table 14** of **Appendix 'H'.**

**Table 6-28: Sydenham WTP Drinking Water Threats Summary***

| Summary of Parcels with Identified Drinking Water Threats | | | Total Number of Parcels | | | Total Number of Threats within Parcels | | |
|---|---|---|---|---|---|---|---|---|
| **Threat Classification** | **IPZ 1** | **IPZ 2** | **S** | **M** | **L** | **S** | **M** | **L** |
| **Significant (S)** | 1 | 2 | 3 | | | 12 | | |
| **Moderate (M)** | 89 | 79 | | 168 | | | 253 | |
| **Low (L)** | 1 | 4 | | | 5 | | | 83 |
| **Total Number of Parcels** | 91 | 85 | 176 | | | | | |
| **Total Number of Threats Present**** | 175 | 173 | | | | 348 | | |

*The local *drinking water threat* of the use of water softeners is not included in the above summary table. It is assumed that each private well owner is using a water softener.
**Note: A parcel can have multiple *threats*. The transportation of *chemicals* along corridors, the application of salt on roads are enumerated within the total *threat* count.

**Table 6-29: Threat Type and Occurrence in Sydenham IPZ***

| DWT No | Drinking Water Threat | Total | Total Ranked Significant |
|---|---|---|---|
| 2 | Septic system, holding tank or other treatment | 139 | - |
| | Wastewater collection facility (does not include storage tanks or bypasses) | 1 | - |
| 3 | Application of agricultural source material to land | 3 | 3 |
| 4 | Storage of agricultural source material to land | 3 | 3 |
| 8 | Application of commercial fertilizer to land | 3 | - |
| 9 | Handling and storage of commercial fertilizer | 2 | - |
| 10 | Application of pesticide to land | 5 | 3 |
| 11 | Handling and storage of pesticide | 1 | - |
| 12 | Application of road salt | 5 | - |
| 13 | Storage of road salt | 3 | - |
| 15 | Handling and storage of fuel | 141 | - |
| 17 | Handling and storage of an organic solvent | 1 | - |
| 21 | Livestock pasturing or grazing and/or outdoor confinement, farm-animal yard | 3 | 3 |
| **Corridor Related Threats** | | | |
| 12 | Application of road salt on roads | 14 | - |
| local | Transportation of fuel | 15 | - |
| local | Transportation of pesticides | 3 | - |
| local | The transportation of a DNAPL | 3 | - |
| local | Transportation of an organic solvent | 3 | - |
| **Total** | | **348** | **12** |

#### Future Activities

As explained in Section 4.3, an *activity* that emerges in the future would be ranked as a *threat* to the *source water* if the underlying vulnerability score is high enough for it to be listed in the Tables of Drinking Water Threats (MOE, 2009k) as a significant, moderate, or low *threat*.

Land uses associated with *activities* that would be *threats* may or may not be permitted in the current municipal official plan and zoning by-law. An initial review of the relevant planning documents has been completed to assess which land uses are currently permitted in the *vulnerable area*; partial findings are provided below for the information of the reader.

The Sydenham IPZ 1, IPZ 2 and IPZ 3 zones are located in the Township of South Frontenac. Although the predominant permitted land use in the IPZ 1 and IPZ 2 zones is residential, there is wide range of other permitted uses that are associated with prescribed *drinking water threats* (Ainley Graham & Associates Ltd., 2003a and 2003b). The IPZ 3 zone consists of rural and residential land uses and environmental protection areas. The designations and zones that permit these uses will need to be reviewed to determine if changes to the permitted uses in general or to specific properties should be recommended as part of the *source protection plan*.

### 6.4.4 Conclusions

*Intake protection zones* 1, 2 and 3 have been delineated for the Sydenham intake with a low uncertainty. Vulnerability scoring has been assigned to each zone in accordance with the Technical Rules, also with a low uncertainty. *Drinking water issues* have been identified and existing *drinking water threats* (*activities*) have been counted within the IPZs.

Peer review was carried out by AECOM. It was found that the methods used were appropriate and in compliance with the Technical Rules.