

## EXECUTIVE SUMMARY

Based on the recommendations from Justice O’Connor’s inquiry into the Walkerton drinking water crisis, the Clean Water Act, 2006 was passed by the Provincial Government to protect water sources for drinking water systems. While local water treatment plants provide an abundance of clean, reliable, and safe drinking water, protecting source water is the first step in a multi-barrier approach to ensure the quality and sustainability of our municipal drinking water supply. The Act provides a framework for the development and implementation of watershed-based Source Protection Plans.

In accordance with Provincial Regulations under the Clean Water Act, the source protection planning process is being directed by a multi-stakeholder Source Protection Committee (SPC), with input from municipalities and in consultation with various stakeholders. In the Essex Region Source Protection Area (ERSPA), the development of the Assessment Report(s) and Source Protection Plan is supported by staff of the Essex Region Source Protection Authority (Essex Region Conservation Authority) assisted by various specialized consultants. Similar work is being carried out in Conservation Authorities throughout Ontario, as required by, and funded by, the Ministry of the Environment (MOE).

The Updated Assessment Report was developed in accordance with the requirements of the Clean Water Act and its regulations, as well as the MOE Director’s Technical Rules. Through information from various technical studies, this science-based Assessment Report:

- Identifies and evaluates vulnerable areas, including Intake Protection Zones, Highly Vulnerable Aquifers Significant Groundwater Recharge Areas and Wellhead Protection Areas
- Identifies the types of existing or potential future land use activities in each of the vulnerable areas, that could be ‘threats’ to source water *quality*
- Evaluates water quality ‘issues’ based on the quality of source water at each water intake for municipal drinking water systems
- Evaluates water *quantity* conditions (‘water budget’) for inland watersheds and groundwater systems, in relation to various water demands or uses

Updates and amendments were made to the ERSPA Proposed Assessment Report to form the ERSPA Updated Assessment Report. These changes reflect new information that has become available to the SPC and amendments that have been made to the Approved Assessment Report. New information includes the delineation and threats assessment of Type 3 Intake Protection Zones (IPZ-3s), and the establishment of potential significant threats criteria for Lake Erie drinking water intakes. The Events Based Area (EBA) has also been identified for all drinking water intakes in the Essex Region and a desktop GIS exercise was performed to identify existing significant threats (i.e. large fuel storage tanks) in all EBAs. In addition, technical work was conducted to identify microcystin-LR as a drinking water issue. This work is included in the Updated Assessment Report

The components of this Assessment Report are briefly summarized below.

### **Watershed Characterization**

The Essex Region watershed characterization is described in Section 2. This watershed is approximately 1,680 square kilometres in size and predominately consists of a relatively flat clay plain with the exception of some sandy areas, primarily in the southern portion of the region. The predominant land use in the region is agriculture, due to the region's excellent farmland and growing conditions. There are also several urban areas, the largest being the City of Windsor.

The Essex Region consists of three major watershed areas consisting of the areas draining to Lake St. Clair, the Detroit River, and Lake Erie. These major drainage areas may further be divided into 20 or more sub-watersheds. The region also includes Pelee Island and several other islands. The waters of Lake St. Clair and the western basin of Lake Erie are among the shallowest in the Great Lakes System. Based on the available data and information generated, the water quality of most streams and near shores in the Region is generally poor, particularly in terms of nutrients, turbidity, and *E. coli*.

Municipal drinking water supplies in the Essex Region are all drawn from the Great Lakes system (Detroit River, Lake Erie and Lake St. Clair). There are seven (7) municipal water treatment plants (WTPs) in the region and an additional plant in Wheatley which serves part of the Municipality of Leamington in the Essex Region.

Approximately 95% of the Region's population is served by municipal water treatment plants. The remaining 5% of the population depend on groundwater or other sources of drinking water. In the Essex Region, there are no municipal drinking water systems which use wells or inland streams as source waters.

### **Water Quantity Risk Assessment**

A Conceptual Water Budget and a Tier 1 Water Budget have been completed for the Essex Region. These studies, as described in Section 3 of the Assessment Report, involved an analysis of data obtained from various sources on climate, stream flow, water demand, and groundwater system stations to estimate the water budget components and stress conditions for surface water and groundwater. Water budget and water use demand estimates were used to determine the water quantity stress levels in different sub-watersheds at various times during the year. Based on the available data and information generated, 6 out of 11 subwatersheds in the Essex Region were categorized as significantly stressed in terms of surface water quantity conditions. The remaining 5 subwatersheds were characterized as having low surface water quantity stress. Water demand, or use, is generally not felt to be a significant factor in producing a stressed condition on surface water. The greatest factors in terms of surface water stresses are historical clearing and drainage, which greatly reduce water retention.

In terms of groundwater quantity stress conditions, 1 subwatershed was characterized as having significant stress, while 5 subwatersheds were categorized as having moderate stress, and the remaining 5 subwatersheds were categorized as having low stress. The low stress subwatershed characterization does not necessarily indicate groundwater resources are sufficient and sustainable. Further study is recommended in this regard, particularly in relation to potential increases of future water demand and climate change considerations.

Since the Essex Region SPA relies on the Great Lakes System to supply all of its municipal drinking water, further levels of evaluation, such as Tier 2 or Tier 3 water budget, are not required under the Drinking Water Source Protection Program.

## **Water Quality Risk Assessment**

Based on the requirements of the Ministry of the Environment, *Vulnerable Areas* in the Essex Region were identified and evaluated as part of a ‘water quality risk assessment’. In these areas, special care may need to be taken in the use and handling of chemicals and other potential contaminants. Vulnerable areas identified are Intake Protection Zones (IPZs), Event Based Areas, Highly Vulnerable Aquifers (HVAs) and Significant Groundwater Recharge Areas (SGRAs). Wellhead Protection Areas are another type of vulnerable area; however, they are not applicable in the Essex Region, as no municipal drinking water systems are supplied by groundwater. Vulnerable areas and the identification of drinking water quality threats within them are briefly described below, with details in Section 4.

*Intake Protection Zones* are areas of land and water, where run-off from streams or drainage systems, in conjunction with currents in lakes and rivers, could directly impact on the source water at the municipal drinking water intakes. The area very close to the intake is called Intake Protection Zone One (IPZ-1). This area is typically a one-kilometre radius in the water around an intake, plus an inland setback along the shore. Outside this area is the Intake Protection Zone Two (IPZ-2). This area accounts for the influence of nearby watersheds, where runoff may pick up pollutants and affect water quality in the near-shore waters at municipal intakes. The IPZ-2s, generally encompassing areas within a few kilometres of the intakes, are based on a ‘two-hour time of travel’, for the flow of water along the shores and in the tributary watersheds. IPZ-1s and IPZ-2s for all intakes in the ERSPA are delineated.

A third type of an Intake Protection Zone (IPZ-3) extends outward from IPZ-2, and covers larger watershed areas generally within 24 hours time of travel. The IPZ-3 includes all rivers and tributaries where modeling demonstrates that contaminant spills may reach the intake during an extreme rainfall or wind storm event. In the ERSPA, IPZ-3s for the Lake St. Clair, Detroit River and Lake Erie intakes are delineated based on model simulations of tanker truck fuel spills in the headwaters of selected tributaries, and fuel storage facilities in various locations. These IPZ-3 delineations include all tributary

waterways of Lake St. Clair, the Detroit River and Lake Erie in the ERSPA, as well as some lands along the Detroit River shorelines and floodplain areas.

As per the MOE Technical Rules, Vulnerability Scores are assigned for IPZ-1 and IPZ-2 of all types of intakes in the ERSPA, and for the IPZ-3s of intakes in Lake St. Clair in the ERSPA. Vulnerability Scores range from 1 to 10, with 10 being the most vulnerable. A variety of factors come into play when calculating the vulnerability score of an area, such as: intensity of land use; the depth of the water at the intake; and water quality issues.

The IPZ-1 and IPZ-2 vulnerability scores are higher for intakes in the Detroit River (ranging from 7.2 to 9.0) largely due to the urban land use. The scores tend to be more moderate for intakes in Lake St. Clair (6.3 to 9.0), and lower for intakes in Lake Erie (4.0 to 7.0), as the intakes are in somewhat deeper water. The IPZ-3 vulnerability scores for intakes in Lake St. Clair are low to moderate (4.5 to 6.3).

**Event Based Areas (EBA)** are areas where modeling has demonstrated that a spill from a specific activity can or could cause deterioration to the raw water quality at the drinking water system. If the modeling test is met, the activity is deemed a significant drinking water threat and becomes subject to Source Protection Plan policies. The EBAs in the Essex Region encompass the combination of these three zones for modeled activities (e.g. a fuel spill with 2% benzene, and specific volume criteria for each EBA dependant on modeling results) to which associated significant drinking water threat policies apply. Some areas of very high uncertainty may be included in the IPZ-3, which are acceptable under Rule 68 (Part VI.5) (*Technical Rules: Assessment Report CWA, 2006*), but are excluded from the EBA (Rule 130 (Part VI.5) (*Technical Rules: Assessment Report CWA, 2006*)). Future studies may improve the certainty of these areas, which could be added to the EBA in an updated Assessment Report.

Identifying potential threats to source water, as required by the Ministry of the Environment (MOE), is an important aspect of source water protection. A drinking water quality threat is an existing or potential future land use activity that has the potential to affect the quality of water used as a source of drinking water. Threats to source water quality may be identified through vulnerability scoring and events based modeling

approaches, and through identifying issues and conditions. These approaches are briefly described below.

Through the vulnerability scoring approach, threats are identified as Significant, Moderate or Low in vulnerable areas, based on the MOE Tables of Drinking Water Threats. These Tables list the circumstances that determine the threat level, such as activity, contaminant type and concentration, and can be accessed using the following link:

<https://www.ontario.ca/page/tables-drinking-water-threats>

*Local threats* specific to a Source Protection Area and not included in the MOE’s drinking water threats tables may also be considered with special permission from the Director. In June 2011, the Essex Region SPC requested that the transportation of fuel (such as by tanker trucks) be considered a local threat because there are many high intensity transportation corridors (e.g. highways, roads, railways, navigation channels) in the vulnerable areas of the ERSPA. The Director approved the transportation of fuel and other chemicals of concern (i.e. organic solvents DNAPLs, pesticides/herbicides and fertilizers) as local drinking water threats in August 2011. The threats based approach is used to assess the threat level of these substances in each IPZ in the Essex Region. These threats are deemed significant in all EBAs as a result of modelling activities.

Through the events based approach, an activity is a significant drinking water threat in an IPZ-1, IPZ-2 or IPZ-3 if modeling demonstrates that a release of a contaminant from the activity would result in a deterioration of the source of drinking water quality. The Essex Region SPC has accepted the Ontario drinking water quality standard (ODWQS) as the benchmark to indicate the deterioration of raw water quality at the intake. Modeling of fuel spills at various locations demonstrated exceedances of the ODWQS at all drinking water intakes in the Essex Region. These results were used to identify existing significant threats and establish potential significant threats criteria (for the handling and storage of fuel), as described below.

The Ministry of the Environment requires that existing significant threats be identified in the Assessment Report. In the ERSPA, existing significant threats were identified

through both the vulnerability scoring and events based approach. The significant threats identified typically involve activities such as industry/business fuel storage and municipal wastewater discharge.

In addition to identifying existing significant threats in the ERSPA, potential significant threats criteria were established through the events based fuel spills modeling. Through this approach, it was determined that if additional above ground fuel tanks were identified as present through a comprehensive inventory or if they were to exist in the future, they would be identified as potential significant threats based on certain criteria. The potential significant threats criteria include: where the activity occurs (IPZ-1, IPZ-2 or IPZ-3), type and concentration of contaminant, and volume of the spill. The criteria are listed in Section 4.2, under the description on events based threats for each Water Treatment Plant.

***Highly Vulnerable Aquifers (HVAs)*** are vulnerable areas generally located in the sandy soil areas in the southern part of the Essex Region, including most of Pelee Island, and are identified and evaluated in the Assessment Report. Based on the maximum vulnerability score of 6 that HVAs can be assigned, activities in HVAs can only be assessed to be moderate or low drinking water threats through the ‘vulnerability scoring approach’ at this time.

***Significant Groundwater Recharge Areas (SGRAs)*** are vulnerable areas within which it is desirable to regulate or monitor drinking water threats that may affect the recharge of an aquifer. Most of the SGRAs in the ERSPA are located in the sandy soil areas of the southern part of the Essex Region, in the Harrow area, parts of Leamington and Kingsville, and limited parts of the Turkey Creek and Pelee Island subwatersheds. Areas within SGRAs have vulnerability scores of 6, 4 or 2, and therefore can have only moderate, low or no drinking water threats through the ‘vulnerability scoring approach’ at this time.

***Issues*** are identified in the Assessment Report based on a comprehensive evaluation of the quality of source water at each water intake. As issues are likely to continue if nothing is done to address the activities that cause them, the Clean Water Act requires

that they be addressed in the Source Protection Plan, if the issues are determined to be partially or wholly from anthropogenic sources within a given Source Protection Area. The identified source water quality issues for most of the intakes in the ERSPA include organic nitrogen, turbidity, and aluminum. Further investigation is needed as to the extent to which the identified issues result from anthropogenic sources. This may lead to identifying the activities and areas that contribute to issues known to be partially or wholly due to anthropogenic causes. New technical work completed for the Updated Assessment Report resulted in the identification of microcystin-LR as a drinking water issue for Harrow-Colchester, Union, Pelee Island West Shore and Wheatley drinking water intakes. Further research and monitoring is required to determine the extent of this issue and the activities which contribute to it. Conditions are areas or sites where there is an existing contamination as a result of past activities. Various environmental reports, studies, and other literature were reviewed to identify if any such conditions exist in the IPZ-1 and IPZ-2 of the ERSPA. Some conditions have been identified in the IPZ-2s of the Stoney Point, Amherstburg, Harrow Colchester South, and Pelee Island West Shore Water Treatment Plants (WTPs). Further, some conditions have been identified in both IPZ-1s and IPZ-2s of the Lakeshore (Belle River), A. H. Weeks (Windsor), and Wheatley WTP. Based on assigned hazard scores, the conditions resulted in low or no drinking water threats. It should be noted that there was a lack of data to assess conditions for the Union WTP.

### **Great Lakes Considerations**

The Essex Region Watershed flows into the Great Lakes system and the run-off waters from the Region's watersheds are known to affect the near-shore water quality in the Great Lakes system. As required by the Clean Water Act, information associated with the following were considered in the preparation of the Assessment Report, as outlined in Section 5:

- Great Lakes Water Quality Agreement (GLWQA)
- Detroit River Canadian Clean-up (DRCC), Lake Erie Lake-wide Management Plan (LaMP), and Wheatley Harbour Area of Concern (AOC)
- Canada Ontario Agreement (COA)
- Great Lakes Charter (GLC)

## **State of Climate Change Research in the Great Lakes Basin**

A general overview of climate change considerations is included in Section 6, along with some preliminary comments regarding implications for the Assessment Report. Global temperatures have been rising steadily across the planet in recent decades. The international and national scientific communities expect this trend to continue and predict more extreme weather events in the future. Subject to further study, *climate changes* such as more intense storms may affect water quality, and possibly exacerbate source water quality ‘issues’ for the various water treatment plants in the Region. If there are more frequent periods of lowered water levels in the Great Lakes in the future, this may increase the vulnerability of some water intakes and may alter the ‘scoring’ of potential ‘threats’ to source water quality. Increased drought conditions and evapotranspiration rates may result in increased water quantity stress levels of surface streams and/or groundwater systems, although likely not affecting municipal water supplies.

## **Future Work for the Next Assessment Report(s)**

The findings of this Assessment Report are based on the best available information, the extent to which studies could be completed within the required timelines, and further updates and amendments based on new or revised information. More details on data gaps and future steps are provided in Section 4.3. Further studies and new information that informs the findings of this Assessment Report will become available in the future. Some examples of the work for a future Assessment Report include:

- Additional significant threat evaluation through event based modeling simulation of spills of other substances, building on the work to date for the significant threat associated with fuel;
- Further evaluation of the recent identification of microcystin-LR as a drinking water ‘issue’ at Lake Erie drinking water intakes in the ERSPA. Further monitoring of microcystin-LR and phosphorus sources are required. In addition, microcystin-LR should be evaluated as a drinking water issue at Lake St.Clair and Detroit River drinking water intakes;

- Evaluation of the extent to which the other drinking water issues, identified in the AR, are due to anthropogenic sources, and the areas and activities that may be contributing to such issues. Contributing anthropogenic activities would be considered to be significant threats in the IPZs;
- Consideration may also be given to the inclusion of additional drinking water systems, other than the municipal systems addressed to date. On Pelee Island, for example, there are a substantial number of non-municipal systems which supply drinking water to public facilities such as hotels, restaurants, and a school;
- Consultation with the Michigan Department of Environmental Quality (MDEQ) and others on cross jurisdictional matters.

### **Consultation**

The Essex Region Source Protection Committee recognizes the importance of early public consultation beyond the required formal consultation, under the Clean Water Act general regulation 287/07. Public meetings were held in 2009 and 2010, providing several opportunities to consult with various sectors regarding the Proposed Assessment Report completed in March 2010. Additional public meetings were held in March 2011 regarding the draft updated components of the Proposed Assessment Report. The consultation provided municipalities, affected landowners, stakeholders, and the public with information on technical studies as part of this Assessment Report. A public meeting was also held in December 2014 regarding the Updated Assessment Report. As per the requirements, the Draft Proposed and Proposed Assessment Report, as well as the draft updated/amended components of the Report were posted on the internet and distributed to municipalities and others. This allows for the SPC to receive comments on the Report, and consider relevant comments in the Report.

Details on consultation on the Proposed Assessment Report, and updated components, are provided in Section 1.8, and Appendix XII provides a chronological summary of the consultation on the Assessment Report including copies of the notices, advertisements, and letters sent to municipalities and other stakeholders.

## Source Protection Planning Process

The Assessment Report was used as a basis for the development of locally-developed Source Protection Plans that set out policies to reduce the risks to protect sources of drinking water. The Plan was initially submitted in 2012 and the Updated Plan accompanies this version of the Assessment Report. The Plan sets out:

- How the risks posed by drinking water threats will be reduced or eliminated
- Policies regarding actions to address and monitor threats and issues
- Who is responsible for taking action and timelines
- How progress will be measured and reported.

The development of the Source Protection Plan was directed by the Source Protection Committee, through support provided by the Source Protection Authority, in accordance with the Clean water Act and associated Regulations. The process involved continued collaboration with municipalities, and extensive consultation with property and business owners, industry, agriculture, community groups, and others. The Source Protection Plan involves a range of voluntary or regulatory programs and tools including: outreach and education; incentive programs; land use planning related policies; or new or amended 'provincial instruments'. In the case of some significant threats, special measures may be specified such as 'risk management plans' or 'land use restrictions'. In extreme cases, prohibition of certain land uses may be considered as a last resort. Actions to substantially reduce the risk posed by existing or potential future activities determined to be 'significant threats' will be mandatory, as required by the Clean Water Act.

In the ERSPA, the SPC has been actively involved in meetings where source protection policy types and examples were discussed. Various policies were considered for significant threats identified through the Assessment Report. The SPC recognises the importance of working with municipalities and other stakeholders to form local solutions to mitigate the risk caused by significant threats. Special studies have shown that large above ground fuel tanks and the transportation of fuel are significant threats in the intake protection zones of all intakes in the Essex Region. The Source Protection Plan includes several policies addressing these threats.