St. Clair Region

WATERSHED
Report Card 2018

The St. Clair Region Conservation Authority has prepared this report and a series of subwatershed report cards as a summary of the state of the forests, wetlands, and water resources in the St. Clair Region.

St. Clair Conservation

Watershed Checkup

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Executive Summary

Since 2008, the St. Clair Region Conservation Authority (SCRCA) has prepared a series of 14 Subwatershed Report Cards, a summary Watershed Report Card, and a final report every five years to help watershed residents, municipalities, agencies, and SCRCA staff and directors assess environmental health in the region. These Report Cards measure and grade surface water quality, forest conditions, and wetland cover in the St. Clair Region's 14 subwatersheds, and compares them with previous Report Card findings. Groundwater quality is also measured at eight monitoring well sites. Each Subwatershed Report Card also includes a summary of the unique features, local solutions that will improve environmental conditions, and highlights of progress since 2011.

Since the first Report Cards were produced in 2008, many environmental projects have been implemented, new issues have developed, and more information has become available. Both the 2013 and 2018 Report Cards use the updated methodologies and grading system that was developed by Conservation Ontario (2011) in order to standardize the grading of indicators used by Conservation Authorities across the province. Surface water quality indicators include total phosphorus, bacteria (*E. coli*), and benthic invertebrates. Forest condition indicators include the percent forest cover, percent forest interior, and the percent of the riparian zone that is forested. Wetland cover and groundwater quality indicators were graded for the first time in the 2018 Report Cards for the St. Clair Region. The wetland indicator is the measure the percent wetland cover and the groundwater quality indicators include nitrate and chloride concentrations.

Surface water quality grades for the St. Clair Region range from C to D. Since the 2013 Report Cards, overall surface water quality grades have shifted slightly but not enough data is available to discern a significant trend. Overall, the Middle East Sydenham, Lower East Sydenham, Lower North Sydenham and Lambton Shores Tributaries score a C grade while the remaining 10 subwatersheds score a D grade.

The eight groundwater wells all scored A grades for nitrate concentrations and the grades range from A to F for chloride concentrations. Elevated chloride could be naturally occurring in the aquifers or it could be due to human impacts. Since ground watersheds do not correlate with surface watersheds, the groundwater indicators are not reported in relation to the 14 subwatersheds in the St. Clair Region. The conditions noted at each monitoring well are specific to that location. The 2018 Report Card uses

data over a 10 year period from 2006 to 2015 for groundwater, as there is a relative lack of groundwater samples collected (usually one sample per site each year).

Forest condition grades range from C to F in the St. Clair Region, with a grade of C in the Lambton Shores Tributaries and F grades for the Lake St. Clair Tributaries and Cow and Perch Creeks subwatersheds. The remaining 11 subwatersheds scored a D grade. Changes in forest cover and forest interior since the previous Report Cards are now no longer considered to be due to improved mapping accuracy as the methodology used since the 2013 Report Card has remained unchanged. Any reported gains or losses now reflect real world changes.

Wetland cover is very poor across the St. Clair Region, with three subwatersheds scoring a D grade and the remaining 11 scoring an F. It is important to note that wetland cover in First Nations lands is not included in this assessment.

As the Conservation Ontario guidelines enable province-wide comparisons, the grades are generally low for the St. Clair Region and most of southwestern Ontario where there is intensive land use. In an effort to supplement the overall understanding of the health of the St. Clair Region, additional signals of watershed health have been considered such as significant natural areas, climate data, geologic characterizations, watercourse characterizations, and Species at Risk occurrences. By including these additional attributes, the complexity and unique characteristics of each subwatershed is better represented.

The 2018 Subwatershed Report Cards also include examples of projects contributing to improved environmental health. Highlights of these positive contributions include projects undertaken by individuals, organizations, and municipalities. Since 2011, various volunteer groups have worked to restore and enhance natural areas and engage their communities, private landowners have completed 300 stewardship projects, and almost 500,000 trees and shrubs have been planted by SCRCA staff.

Acknowledgments

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Section 1: Indicators and Analysis

1.1 Introduction

The St. Clair Region Watershed Report Card presents the results of monitoring the health of the region's natural features. Grades are assigned to specific surface water quality, groundwater quality, forest condition, and wetland condition indicators using a grading system that is standardized across Ontario's Conservation Authorities. The report also includes information on features of the region. When citizens, industries, agencies and government staff understand the environmental health of their region, they can take actions to protect or enhance those features.

The first Report Card for the St. Clair Region was released in 2008, and assessed data from 2001 to 2005. It included analysis of five surface water quality and forest condition indicators for the 14 subwatersheds. It described features of the individual watersheds, actions that could be taken by individuals or agencies to improve the watershed conditions, and many stewardship activities that have been implemented by private landowners and municipalities.

The 2013 Report Card was the second released for this region, covering data from 2006 to 2010. The analysis methods and degree of accuracy evolved since the first Report Cards. For both water quality and forest condition, the guidelines were revised since 2008. Ontario's Conservation Authorities developed standardized methodologies and set the grades relative to current scientific standards. The grading system was optimized for the range of environmental conditions across the province – for a watershed to achieve an A grade for an indicator, the watershed must be healthy compared to the conditions that have been reported by other Conservation Authorities across Ontario.

The 2018 Report Card is the third Report Card to be released for the St. Clair Region. Both water quality and forest condition guidelines are the same as they were in the previous Report Card and all Geographic Information System (GIS) mapping techniques have remained the same. The groundwater quality indicator has been added to the 2018 Report Card along with the grading of wetland cover for each subwatershed.

The analysis of the main four indicators is based on water quality data collected by SCRCA staff and GIS mapping. The water quality samples are collected at sites that are judged to reflect the subject subwatershed. The forest evaluation has been completed at a landscape level from analysis of

aerial photographs.

In addition to assessing indicators of environmental health, the Report Card is an opportunity to compile information on the features of the St. Clair Region. The supplementary data on subwatershed characteristics are summarized in Section 2 and in each Subwatershed Report Card.

Recognition of local actions that improve watershed health is very important. Examples of positive contributions are included in each Subwatershed Report Card. The dozens of projects that have been completed through clean water programs and habitat stewardship are also summarized.

1.1.1 The St. Clair Region

The area covered by the St. Clair Region and this Report Card is 4,130 km^2. The largest drainage area, the Sydenham River, is subdivided into nine subwatersheds. The three large adjacent water bodies, Lake Huron, the St. Clair River, and Lake St. Clair, also have many smaller tributaries that have been grouped into five subwatersheds. The resulting 14 subwatersheds are appropriately sized for residents to identify with their local communities. They are summarized in Table 1 and illustrated in Map 1.

1.2 Indicators of Environmental Health

The indicators of subwatershed health include surface water quality, forest condition and wetland cover. Each of these indicators are graded on specific parameters over a five-year period from 2011 to 2015, these grades range from A (excellent) to F (very poor). This is the first time that groundwater quality is being assessed in the SCRCA Report Cards as there was previously an insufficient amount of data. Groundwater quality is being reported over a 10-year period from 2006 to 2015 to account for the limited number of samples (i.e., only one per year vs. eight per year for surface water) and is not reported in relation to the 14 subwatersheds.

1.2.1 Surface Water Quality

The water quality of the St. Clair Region is affected by land use, weather and soils. Surface water quality can change in response to human activities, including changes in agricultural practices, urban sewage treatment, and storm water management.

The 2018 Report Cards summarize the current water quality over a relatively short time period of five years using three parameters including concentrations of total phosphorus and bacteria, and benthic

macroinvertebrate communities. This is then compared with the five years of data from each the 2008 and 2013 Report Cards. The water quality varies from year to year and the indicators may vary independently from each other. The information presented is a general assessment of surface water quality in each subwatershed, with sampling data being collected from one monitoring station for each indicator.

1.2.2 Groundwater Quality

The Provincial Groundwater Monitoring Network (PGMN) is a partnership between the Ontario Ministry of the Environment (MOE) and Conservation Authorities. The network provides background monitoring information on groundwater levels and quality. The water analysis for the PGMN program includes basic chemistry, metals, nitrate and fluoride concentrations. As of May 2007, the SCRCA has collected samples at eight monitoring wells once a year through the program. Water level data are also collected four times a year from each of the PGMN wells.

For the purposes of the Watershed Report Cards, groundwater quality is assessed using two parameters, nitrites/nitrates and chloride concentrations. Based on the Conservation Ontario 2017 guidelines for groundwater analyses and reporting, the time period to be reported on was increased to 10 years instead of five years, to improve the statistical significance. It is important to note that the values reported for groundwater conditions at the monitoring wells are specific to those locations as the ground watershed does not correlate to the surface watershed.

There are no longer any active municipal drinking water supply systems in the St. Clair Region that are using a groundwater source.

1.2.3 Forest Condition

The forests of the St. Clair Region reflect the human impact on this landscape over the last 150 years. Surveyors' records indicate that in the early 1800s almost 70% of the Sydenham River watershed was forested. Extensive clearing for agriculture and settlements removed the majority of the woodlands. Current watershed residents are concerned that the remaining woodlands are being further reduced by mortality from invasive species, such as Emerald Ash Borer, and from warmer, drier climate conditions.

This Report Card describes the woodland layer through analysis by SCRCA staff using 2015 aerial photography. The 2008 and 2013 Report Cards considered the woodland layer analysis from the Ontario Ministry of Natural

Resources and Forestry (OMNRF) using aerial photography from 2007 and 2010, respectively.

1.2.4 Wetland Cover

Wetlands are the link between land and water and make up some of the most biologically productive ecosystems in the world. Under the OMNRF Ontario Wetland Evaluation System (OWES) definition, an area must be filled or saturated with water that is less that 2 m deep for at least part of the year and the vegetation cover must be comprised of at least 50% water-adapted plants to be considered a wetland. There are four main types of wetlands: swamps, marshes, fens, and bogs. Depending on the type of wetland, its vegetation community can be dominated by trees, grasses, shrubs, or mosses.

Wetlands offer many vital hydrological and ecological functions. They improve water quality by trapping and holding nutrients, sediments and pollutants before they reach nearby bodies of water. They reduce flooding by retaining excess water and by reducing the velocity of quick-moving floodwaters, which allows the water to enter rivers and streams at a slower, less destructive rate. Wetlands also support a diverse range of plant and animal species – they are inhabited by many of southern Ontario's species during part of or all of their life cycles. The combination of shallow water, high nutrient levels and primary productivity in wetlands are ideal for the development of organisms that form the base of the food web and feed many species including fish, amphibians, insects and other invertebrates. Many species of birds and mammals rely on wetlands for food, water, and shelter – especially during migration and breeding seasons.

Compared to pre-settlement coverage, wetland losses exceed 70% in many parts of southern Ontario (Ducks Unlimited, 2010). Environment Canada (2013) recommends that at least 10% of each major watershed and 6% of each subwatershed should be maintained or restored as wetlands.

1.3 Surface Water Quality Methods

Three select indicators are used to assess surface water quality on a watershed scale:

- Total Phosphorus;
- *Escherichia coli* (*E. coli*); and
- Benthic Macroinvertebrates

These three indicators reflect key issues related to surface water quality

across the province: nutrients, bacteria/waste, and aquatic health. These indicators can help measure the influence of factors such as urban and rural land uses, soil types, and weather on the surface water quality in the St. Clair Region.

1.3.1 Total Phosphorus

Conservation Ontario (2011) recommends total phosphorus as the key water quality indicator. Phosphorus, a nutrient commonly applied as fertilizer, adheres to soil and is readily transported to streams with eroding soil. Elevated levels of phosphorus can cause algal fouling, fish kills, taste and odour problems in drinking water, and other adverse effects.

The 75th percentile concentration of total phosphorus is calculated for all samples collected within each watershed from 2011 to 2015 inclusive. The 75th percentile is the value below which 75% of the values fall. This value reflects the water condition for the majority of the five-year time period. The 75th percentile value is converted into a score and a grade, following the Conservation Ontario guidelines (Table 2).

1.3.2 Bacteria *(E. coli)*

The second water quality indicator, *E. coli*, is a fecal bacterium found in human and animal waste. *E. coli* is broadly accepted as the key indicator of fecal contamination in rivers and the presence of potential pathogens (MOEE, 1994). Long-term ambient *E. coli* data can indicate areas with higher concentrations of fecal contamination in a watershed, and can be compared with land use activities.

The concentration of ambient *E. coli* can range from very low, less than 30 colony forming units in 100mL of water (CFU/100mL), to very high, with over 1,000 CFU/100mL. Calculating the average value would inflate the conditions that typically occur, therefore the geometric mean is used. The geometric mean is calculated as the 'nth' root of the product of 'n' numbers. Following the Conservation Ontario guidelines, the five-year geometric mean is calculated for the monitoring sites within each subwatershed.

1.3.3 Benthic Macroinvertebrates

The third surface water quality indicator, is based on the community composition of invertebrate organisms living on the bottom of the watercourse at a representative site in each subwatershed. Benthic refers to the bottom of a watercourse; macro- refers to items visible without a microscope; and invertebrates are organisms without a backbone,

such as insects, worms, and crustaceans. Benthic monitoring indices are well documented and a popular indicator of the biological health. The Family Biotic Index or FBI assigns a pollution tolerance score to each taxonomic family of benthic macroinvertebrates so the number and type of invertebrates found in each benthic sample relate to the water quality where they are collected (Hilsenhoff 1988; Mandaville 2002). The higher the score, the more polluted the watercourse. A healthy aquatic environment is dominated by pollution intolerant species. For the Watershed Report Card process, the Conservation Ontario (2011) guidelines adopt the Hilsenhoff 1988 Family Biotic Index as modified by Smith et al. 2009.

Extreme weather, stream morphology, and local site disturbance are some of the key factors beyond surface water quality that can affect the benthic macroinvertebrate assemblages from year to year. In order to account for natural year-to-year variability, it is recommended that Report Card grades are based on an average FBI value from samples taken annually over five years. Grouping data in this fashion generates an accurate estimate of surface water quality on a subwatershed basis.

1.3.4 Data Collection and Sampling

In order to accurately represent the subwatershed being graded, the Conservation Ontario guidelines recommend that the water quality conditions are reported at the outlet of each catchment area. Outlet sampling is possible for most water chemistry and bacteria stations in the Sydenham subwatersheds, but not for all benthic sampling sites due to the need to wade across the width of the river for sample collection. An exception is water chemistry and bacterial stations in the Sydenham Headwaters, which are located upstream from the town of Strathroy, therefore excluding the urban influence from the Report Card grade calculation. Another exception is the Black Creek water quality station, which is located about 20 km upstream of the outlet. In five catchments, including the Lake St. Clair Tributaries, St. Clair River Tributaries, Lambton Shores Tributaries, Plympton Shoreline Tributaries, and Cow and Perch Creeks, water chemistry is monitored in the largest watercourse. In the Cow and Perch Creeks area, Perch Creek is monitored at the second last bridge before the river flows into Lake Huron, as this location experiences less backwater dilution from the lake than the lower bridge. The location of water quality and benthic macroinvertebrate sampling sites within the St. Clair Region are shown in Map 2.

Surface water quality samples have been collected in the St. Clair Region since the 1960s under the Provincial Water Quality Monitoring Network

(PWQMN), a cooperative program between the SCRCA and the Ontario Ministry of the Environment. PWQMN sample station locations varied over the years, but since 2002 the eight existing stations have remained consistent. Starting in 2004, funding under the Canada Ontario Agreement (COA) on Great Lakes Water Quality also supported the SCRCA's water sampling program. In 2005, the COA program doubled the amount of sampling conducted in the St. Clair Region. Like the PWQMN stations, the COA sampling locations have varied. To maximize program coverage, Brown Creek and Lower North Sydenham were sampled bi-monthly rather than monthly during ice-free periods. Lambton Shores Tributaries and Plympton Shoreline Tributaries had monthly sampling financed by Lambton Shores while the COA sampling was only bi-monthly. The sites with larger sample sizes were used for this analysis (Table 3).

Bacteria analysis has occurred at eight sites in the St. Clair Region through a cooperative program with the Middlesex-London Health Unit. This data provides information for calculating grades for seven subwatersheds of the Sydenham River. Five subwatersheds did not previously have any bacterial monitoring, however, monitoring sites to represent these subwatersheds were added starting in 2010 (Table 4). These subwatersheds include Cow and Perch Creeks, St. Clair River Tributaries, Lake St. Clair Tributaries, Brown Creek, and the Lower North Sydenham.

The SCRCA has monitored aquatic benthic macroinvertebrates since 1999. Benthic communities are strongly influenced by the substrate conditions in addition to water chemistry and water flow regimes. All three variables change between, and in some cases, within subwatersheds in the St. Clair Region. There is one representative benthic sampling station for each of the 14 subwatersheds and samples are collected once each spring (Table 5). Benthics must be sampled in a wadeable watercourse (i.e., less than 1 m deep). The outlets of many subwatersheds are too deep, in these cases, the sampling stations needed to be located further upstream or in tributaries of the main watercourse. In subwatersheds with more than one watercourse (e.g., St. Clair River Tributaries) the largest watercourse (e.g., Clay Creek) is chosen for water chemistry sampling.

1.4 Surface Water Quality Results

The surface water quality values and grades are summarized in Table 6 and illustrated in Map 3. Four of the 14 subwatersheds score a C grade for their surface water quality including Middle East Sydenham, Lower East Sydenham, Lower North Sydenham, and Lambton Shores Tributaries. The

remaining 10 subwatersheds score a D grade (Table 7). At a provincial scale, there tend to be lower grades in extreme southwestern Ontario regions with intensive land use, such as the St. Clair Region.

1.4.1 Total Phosphorus

Total phosphorus concentrations exceed the provincial guidelines in all subwatersheds by between three and nine times the Provincial Water Quality Objective (PWQO) of 0.03 mg/L (Table 6). Results from the Provincial Water Quality Monitoring Network indicate similar exceedances across rural watersheds in southern Ontario, particularly the area southwest of Toronto to Goderich.

Total phosphorus is highest in St. Clair River Tributaries (0.26 mg/L), Brown Creek (0.24 mg/L), and Bear Creek Headwaters (0.20 mg/L). The lowest levels of total phosphorus are in two of the subwatersheds of the East Sydenham River, with the Sydenham Headwaters measuring 0.08 mg/L and Lower East Sydenham measuring 0.09 mg/L. The Lower North Sydenham has a relatively low value for being at the downstream end of the Sydenham River watershed but this may be due to diluting effects from the backflow of Lake St. Clair or the St. Clair River as the lower reaches of the Sydenham are at the same elevation as these larger water bodies.

Since phosphorus binds to soil particles, concentrations of phosphorus are increased in areas with erodible soils such as clay. The highest readings of phosphorus are recorded in subwatersheds in the clay plains of western Lambton County. The lower readings in the Upper Sydenham may be due to a smaller catchment area and may also reflect loam and sand soils that are less erodible than clay. It should also be noted that between 2013 and 2015 the Ministry of the Environment laboratory, which provided water chemistry analysis for the St. Clair Region, switched the analysis method for total phosphorus. This change in analysis was later found to truncate the actual range of values for total phosphorus especially at sites that had a large amount of suspended solids. As a large portion of the data used in the 2018 Watershed Report Card relating to total phosphorus is affected by this, any apparent decreases in phosphorus should be interpreted with caution.

1.4.2 Bacteria *(E. coli)*

One subwatershed scores an A grade for *E. coli* concentration and two score a B grade. Six of the subwatersheds have a C grade for *E. coli* levels and five have a grade of D (Table 6). Only the Lower North Sydenham (23 CFU/100mL), Lake St. Clair Tributaries (39 CFU/100mL), and Lower East

Sydenham (80 CFU/100mL) have values within the MOE guideline of 100 CFU/100mL for the safe recreational use of water. The lower reaches of the Sydenham River and the majority of Lake St. Clair Tributaries are at the same elevation as Lake St. Clair, consequently, backflow from the lake or the St. Clair River can dilute concentrations in these tributaries.

1.4.3 Benthic Macroinvertebrates

One subwatershed scores a B grade, which suggests that some organic pollution is probable. Seven subwatersheds have a C grade, indicating fairly substantial pollution is likely. For the remaining subwatersheds, five scored a D grade and one scored an F grade indicating substantial to very substantial organic pollution is likely. These low grades are typical of watersheds in southwestern Ontario, including the abutting Upper Thames River.

The most impacted benthic scores are recorded in the Lake St. Clair Tributaries, which scores an F grade. Land use in the area is probably one of the most significant influences on surface water quality. This subwatershed has a high percentage of organic soils, is drained and intensely cropped, and has the lowest percentage of forested riparian buffer of the 14 subwatersheds. The substrate at the benthic station has 20 to 40 cm of semi-decayed organic matter, which supports only pollution tolerant invertebrates. The subwatershed is largely tiled and drained into channelized watercourses. Some watercourses in this subwatershed are managed as pumped, municipal drains that hold standing water much of the year, allowing fine sediments to settle and release the nutrients bound to them over time.

The Middle East Sydenham reports a B grade for benthics, which is the lowest average FBI value of the 14 subwatersheds evaluated. The SCRCA's Healthy Stewardship Program has targeted this subwatershed for riparian planting, livestock exclusion fencing, and other stewardship projects for over 10 years. It is possible that stewardship efforts in the Middle East Sydenham have contributed to its improved FBI scores since the 2008 Report Cards.

1.5 Surface Water Quality Discussion

Three of the water chemistry monitoring sites (Lower East Sydenham, Lower North Sydenham, and Lake St. Clair Tributaries) appear to be influenced by lake waters. When taking these influences into account, the subwatersheds that have the best overall water quality grades for the region are the Middle East Sydenham and Lambton Shores Tributaries. These subwatersheds have the best scores for the three water quality indicators and are not influenced by lake water like the Lower East Sydenham and the Lower North Sydenham

subwatersheds. These two subwatersheds also have better than average forest cover for the St. Clair Region.

The poorest water quality conditions for benthic macroinvertebrates are found in the Lake St. Clair Tributaries, which has the second lowest amount of total forest cover as well as the lowest riparian cover. The largest watercourses in this subwatershed are municipal drains that are controlled by pump works and therefore hold standing water for much of the growing season.

The subwatersheds with the poorest water quality, based on water chemistry, are Cow and Perch Creeks, Black Creek, and Lower Bear Creek. With Sarnia located in Cow and Perch Creeks and Petrolia located upstream of Lower Bear Creek, impacts from urban areas, such as storm water and waste water, are likely contributing to the poor water quality in these subwatersheds. Cow and Perch Creeks also has among the poorest overall forest condition.

1.6 Groundwater Condition Methods

Two indicators are used to assess groundwater condition for the St. Clair Region:

- Nitrite + Nitrate (mg/L)
- Chloride (mg/L)

Surface water and groundwater move differently – one over the land surface, and the other through soil and bedrock into aquifers (underground rock formations/structures that carry water). Flowpaths are typically downward or horizontal through these aquifers, and since it is hard to see these interactions underground, the source of water for individual monitoring wells can only be inferred. Most importantly, ground watershed boundaries differ from surface watershed boundaries. Groundwater quality grades provided in this Report Card are therefore reported based on each monitoring well site, not the 14 subwatersheds, like the other indicators.

Similar to the surface water monitoring program, the Provincial Groundwater Monitoring Network (PGMN) is a partnership between the Ontario Ministry of the Environment and local Conservation Authorities. Since 2007, the SCRCA has been monitoring eight wells within the St. Clair Region watershed (Map 4). Sampling occurs once a year at all monitoring wells and samples are tested for various parameters. Conservation Ontario recommends using nitrate and chloride concentrations over a 10-year time period as indicators

of groundwater quality. The 75th percentile concentration for each indicator is calculated then converted to a point score and given a grade using the Conservation Ontario guidelines (Table 8).

1.7 Groundwater Condition Results and Discussion

Groundwater condition grades range from A to F for the eight monitoring wells in the St. Clair Region (Table 9). It is important to note that the quality of nearby private wells may differ from that of the monitoring wells.

1.7.1 Nitrites + Nitrates

Nitrites and nitrates are forms of nitrogen that can occur naturally in rocks and groundwater, however, levels can be significantly increased by human impacts such as leaky septic systems and excessive use of fertilizers and manure. High concentrations make water unsafe for drinking. The Ontario and Canadian Drinking Water Quality Standard for nitrate is 10 mg/L. The 75th percentile was calculated for nitrate as recommended in the 2017 Conservation Ontario guidelines. Nitrate concentrations at all eight monitoring wells in the St. Clair Region are lower than the drinking water guideline, and all score A grades.

1.7.2 Chloride

Chloride is a naturally occurring element that can be found in high concentrations in groundwater due to natural causes, like the type of aquifer that the groundwater originates from, or it can be an indication of human impacts such as road salt, landfills and septic systems. The Canadian Drinking Water Quality Guideline for chloride is an Aesthetic Objective of 250 mg/L. The 75th percentile was calculated for chloride as recommended in the 2017 Conservation Ontario guidelines. Concentrations of chloride at the monitoring wells range from being lower than, to exceeding the drinking water guideline – three wells score an A grade whereas two wells have a C grade and three have an F grade. In general, it is considered that these sites may have higher concentrations of chloride due to naturally occurring circumstances however, there could also be human influences.

1.8 Forest Condition Methods

Three indicators are used to assess forest condition on a subwatershed scale:

- Percent Forest Cover
- Percent Forest Interior
- Percent Forested Riparian Buffer

These indicators reflect the health of the ecosystem as they support species diversity and human health, provide terrestrial habitats for native plants and animals, and contribute to healthy water quality and aquatic habitats. They can also be measured across the province.

Using 2015 aerial photography of the St. Clair Region, SCRCA staff performed a GIS desktop review of the woodland layer to assess the three forest condition indicators.

1.8.1 Forest Cover

Percent forest cover is the percentage of the watershed area that is forested or wooded. Environment Canada (2013) recommends that a minimum of 30% of a watershed should be in forest and other natural cover to sustain native plants and animals. The terms forest, woodland, and woodlot are used interchangeably for areas that are more than 60% covered in trees and are more than 2 m in height. Woodland has been interpreted to include deciduous, coniferous, mixed, and mature plantations and does not include young plantations (less than 2 m in height), hedgerows or street trees. The minimum area that is considered a forest is 0.5 ha.

For the 2008 Report Card, woodland cover was based on the Southern Ontario Land Resource Information System (SOLRIS) woodland layer provided by OMNRF with respect to the 2000 to 2007 aerial photography. At this time, woodlands were digitized based on their precise edge boundary, and included woodland “cut-outs” where woodlands were dissected around narrow features that were less than 20 m wide. The OMNRF Natural Heritage Manual (2010) indicates woodland areas are considered continuous even if they are intersected by narrow gaps 20 m or less in width between crown edges.

For the 2013 and 2018 Report Cards, all narrow gaps, less than 20 m wide, due to watercourses, non-woody vegetation classes, and private driveways were closed and the woodland feature considered continuous in those instances. Woodland gaps due to more permanent features, such as roads or railways were retained. Using the woodland delineation standards from the OMNRF Natural Heritage Manual (2010) resulted in a more accurate assessment of the total woodland cover and woodland interior habitat for the 2013 and 2018 Report Cards compared to the 2008 Report Card.

In addition to changes to the forest delineation methods used since the 2008 Report Cards, changes have also occurred to the definition of forest area. These changes are a direct result of advancements in air photo

resolution as well as the advancement of natural heritage studies in the region. The OMNRF woodland layer used in the 2008 Report Card used only two woodland communities, treed and hedgerow, in the determination of forest area. In the 2013 and 2018 Report Cards, forest communities were classified according to heritage studies completed in Middlesex and Huron Counties, which classified forest vegetation into seven community groups. Four woodland communities are now used in the forest area calculation including deciduous, coniferous, mixed, and mature plantations. Excluded communities are wooded hedgerows that are less than 30 m in width; woody riparian buffers that are less than 30 m in width; and young plantations, where the individual trees or rows of trees are discernible at a scale of 1:2000.

These changes in methodology resulted in an apparent decrease in woodland cover between the 2008 and 2013 Report Cards. This decrease in forest cover areas is considered largely due to improved mapping accuracy rather than changes in the landscape. However, the 2013 and 2018 Report Card analyses were conducted using the same methodology, therefore, reported changes more accurately reflect changes in the landscape.

The percent forest cover calculated for each subwatershed is converted into a score and grade, following the Conservation Ontario guidelines (Table 10).

1.8.2 Forest Interior

The second forest condition indicator, forest interior, refers to the inner core area of a woodlot that is more than 100 m from the forest edge. The percent forest interior is the percentage of the watershed area that is defined as forest interior. Environment Canada (2013) recommends that more than 10% of a watershed area should be forest interior. This protected core area is required by some species to breed successfully. Area-sensitive bird species, such as the Scarlet Tanager or Pileated Woodpecker, require a relatively large forest patch within which to reproduce successfully. The outer 100 m is considered edge habitat where plants and animals are susceptible to sun and wind damage, high predation rates, the invasion of alien species, and other disturbances. Some bird species also experience increased nest parasitism when located in edge habitat.

The forest interior was calculated for the 2018 Report Card using the 2015 woodland layer. Between the 2008 and 2013 Report Cards there was an apparent increase in forest interior, this change was mainly due to changes in analytical technique rather than actual increased forest interior within the landscape. However, the methodologies were consistent between the 2013

and 2018 Report Cards so any reported changes in forest interior between the 2013 and 2018 Report Cards is based on real world changes.

The percent forest interior was converted into a score and grade, following Conservation Ontario guidelines (Table 10).

1.8.3 Riparian Buffer

The third forest condition indicator is the percentage of the forested area within a 30 m zone along both sides of all open watercourses. The Conservation Authorities target is 50% of the riparian zone in forest cover, which was derived from the Environment Canada document, "How Much Habitat is Enough? A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern" (2013), which provides science-based guidelines for habitat conservation and restoration. A key recommendation of the report is that 75% of the stream length should be naturally vegetated and that streams should have a minimum 30 m wide naturally vegetated buffer on both sides (Environment Canada, 2013). To standardize the calculations and grades, the Conservation Ontario (2011) target of 50% forest cover was decided upon as not all Conservation Authorities have non-forested vegetation types mapped, such as marsh, meadow, and shrub thicket. It was estimated that two-thirds of riparian vegetation is forest, therefore, the Conservation Ontario target of the riparian zone in 50% forest cover is roughly equivalent to the Environment Canada target of the riparian zone in 75% natural vegetation cover (Conservation Ontario, 2011).

Riparian buffers provide a breeding, feeding and migration corridor for many species. In addition, they contribute to aquatic health by filtering nutrients, moderating temperatures and evaporation, and also contributing to the food web and habitat diversity of the watercourse.

For the SCRCA's 2008 Report Cards, the riparian buffer was defined more conservatively as 15 m of woody riparian buffer on both sides of an open watercourse. Conservation Authorities agreed in 2010 to adopt the Environment Canada recommendations and use the 30 m woody riparian buffer as a guideline to set targets for this decade (Table 10; Conservation Ontario, 2011).

For the 2013 and 2018 Report Cards, the percentage of the 30 m riparian buffer area that is wooded was calculated. This could include wooded riparian areas that are narrower than 30 m.

1.9 Forest Condition Results

In the St. Clair Region, forest cover is limited and is primarily constrained to land unsuitable for agriculture or development. Lambton Shores Tributaries is the only subwatershed with an overall C grade for forest conditions. Eleven watersheds have a D grade and two have an F grade including Cow and Perch Creeks and Lake St. Clair Tributaries (Table 12).

The forest condition values and grades are summarized in Table 11 and illustrated in Map 5.

The observed changes in forest condition scores between the first Report Card and the second Report Card are considered largely due to changes in analysis rather than changes in the forest condition on the landscape. Changes between the 2013 and 2018 Report Cards are due to actual physical changes to the landscape rather than being artifacts of differences in methodology.

1.9.1 Forest Cover

Environment Canada (2013) recommends a minimum of 30% forest cover for a healthy watershed. It is important to note that this number represents the minimum percent forest cover required to support one half of the native species within a watershed (Environment Canada, 2013). Forest cover for the entire St. Clair Region is 11.3% (D grade) and there was a loss of 3.28 km^2 of forest since the 2013 Report Card. This low percent forest cover is not abnormal for a highly developed portion of southern Ontario where there is intensive land use but there is opportunity for improvement. When compared with adjacent watersheds, the forest cover is similar to the Upper Thames watershed but lower than the Ausable Bayfield watershed.

Lambton Shores Tributaries has the highest percent cover in the region with 17.4% (C grade). A significant percentage of the woodland in this subwatershed, 575 ha or 26%, is within Kettle and Stony Point First Nation land. The St. Clair River Tributaries and Lake St. Clair Tributaries watersheds also have a significant portion of their woodland cover within First Nation land.

The Upper Sydenham River is the only other subwatershed that has a C grade for forest cover, with 16.1%. Three of the largest woodland patches in this subwatershed are associated with significant wetlands. There are also extensive woodlands along the Sydenham River in Southwest Middlesex.

Three of the subwatersheds (Upper Sydenham River, Middle East Sydenham, Sydenham Headwaters) with the highest forest cover are upper subwatersheds of the East Sydenham River.

Twelve subwatersheds have a D grade for forest cover. The two lowest percent forest cover values are less than 6% and are recorded in the Lower East Sydenham (5.1%) and the Lake St. Clair Tributaries (5.4%) subwatersheds. Seventy-nine percent of the woodlands in the Lake St. Clair Tributaries are on Walpole Island First Nation and, combined, all three First Nations in the St. Clair Region contain over 36 km^2 of forest cover.

1.9.2 Forest Interior

Forest interior for the entire St. Clair Region is 1.97% (F grade), due to the high number of small and narrow woodlots (Table 13). Four subwatersheds have a D grade and ten have an F grade. More than 10% interior is recommended for a healthy watershed. When compared with abutting watersheds, this region has more interior forest than the Upper Thames watershed but less than the Ausable Bayfield watershed.

The subwatersheds with the most interior forest include Lambton Shores Tributaries (3.8%) and St. Clair River Tributaries (3.7%). These subwatersheds include large tracts of forest on First Nations land. Two other subwatersheds with high forest interior values for the St. Clair Region are the Middle East Sydenham (2.6%) and Lower Bear Creek (2.6%), where the relevant woodland patches are along the river floodplain. The lowest percent forest interior is recorded in the Lower East Sydenham subwatershed (0.4%), which also has the lowest forest cover (5.1%) and over 20% of the woodlands are less than 5 ha in size (Table 13).

Developmental pressures typically create fragmented forest habitats. In the SCRCA, a measure of habitat fragmentation can be seen in the large number of woodlands smaller than 5 ha – about 50% of woodlots in the watershed are less than 5 ha in size (Table 13). These areas of smaller woodlands result in lower species diversity due to increased edge effects when compared to the same area of larger sized woodlands.

1.9.3 Riparian Buffer

The forested riparian buffer is the 30 m area that is forested on both sides of an open watercourse. The target is 50% of the riparian zone in forest cover (Conservation Ontario, 2011). The forested riparian buffer coverage for the entire St. Clair Region is 21.7%, a D grade. Five subwatersheds have a C grade

including Sydenham Headwaters, Upper Sydenham River, Lambton Shores Tributaries, Lower Bear Creek, Brown Creek. These subwatersheds are among those with the higher forest cover values for the St. Clair Region.

The two subwatersheds that received the lowest grade, F, are Lake St. Clair Tributaries (3.3%) and Cow and Perch Creeks (12.3%). These subwatersheds have the second and third lowest forest cover values for the St. Clair Region, respectively.

1.10 Forest Condition Discussion

The majority of the St. Clair Region has poor forest conditions (Table 12). The subwatershed with the best overall forest condition is Lambton Shores Tributaries, which has an overall grade of C as it has the highest percentages of forest cover and forest interior, and the third highest riparian cover. Lambton Shores Tributaries includes part of a significant woodland, wetland, and beach dune complex (approximately 20,000 ha) that extends along Lake Huron from the Kettle and Stony Point First Nation lands through the Ipperwash and Port Franks Dunes and Wetland complex to Pinery Provincial Park (Table 32).

The Upper Sydenham River has an overall D grade, with similar percentages of forest cover and riparian cover to Lambton Shores Tributaries. However, there is much less forest interior in the Upper Sydenham River subwatershed than in the Lambton Shores Tributaries, as many of the Upper Sydenham woodlands are associated with watercourses and are long and relatively narrow. The Sydenham Headwaters has the highest percentage of forested riparian buffer.

Two subwatersheds, Lake St. Clair Tributaries and Cow and Perch Creeks, have very poor forest conditions, and an overall F grade. Each of these subwatersheds have low values for all three forest condition indicators. The Lake St. Clair Tributaries subwatershed has some of the most intensely worked agricultural land in the St. Clair Region and most of the natural cover has been removed. The Cow and Perch Creeks subwatershed has been cleared for residential, commercial and industrial development associated with Sarnia, the largest urban center in the St. Clair Region. Many of the watercourses in these subwatersheds are actively maintained as municipal drains and the land within 30 m of the open water is cleared and cropped.

1.11 Wetland Cover Methods

Environment Canada recommends that at least 10% of each major watershed and 6% of each subwatershed should be wetlands, to sustain water balance and biodiversity functions (Environment Canada, 2013).

The majority of the wetlands that are known from the St. Clair Region have been evaluated by OMNRF using the Ontario Wetland Evaluation System (OWES). Since the last Report Card, SCRCA staff has completed a detailed analysis to identify any unevaluated wetlands. This required a desktop review of aerial photos, particularly examining areas where the soil types, groundwater discharge mapping or proximity to evaluated wetlands increased the likelihood of identifying previously unmapped wetlands. Sites were then ranked by the certainty of wetland presence with approximately 343 ha identified as potential wetlands by the SCRCA (Table 15).

Percent wetland cover was then calculated and scored using the Conservation Ontario guidelines (Table 14).

1.12 Wetland Cover Results and Discussion

Wetlands cover just 1.1% of the St. Clair Region (Table 15). It is important to note that the First Nations lands have not been included in the assessment of the wetland cover indicator as First Nations lands have not been evaluated under OWES. The Sydenham Headwaters, Lambton Shores Tributaries, and Upper Sydenham River have the highest wetland coverage in the St. Clair Region, with 4.5%, 2.9%, and 2.6% respectively. Seven subwatersheds have less than 0.5% wetland cover. Wetland restoration and enhancement should be strongly encouraged in all subwatersheds.

1.13 Watershed Features and Actions for Improvement

In addition to the data used to calculate grades, information on the features of each subwatershed is included in the Section 2 tables and each Subwatershed Report Card. This information may indicate why a subwatershed experiences good or poor conditions, and why there have been changes since the last Report Cards. For example, higher amounts of precipitation and of flow have been recorded, which may increase bacteria readings but improve benthic conditions. The analysis of woodlot area sizes indicates that the largest woodlot in the St. Clair Region is in the Lake St. Clair Tributaries, and 68% of the woodlot coverage in that subwatershed is concentrated in 17 woodlots. Many other features have also been

summarized to provide benchmarks for the next Report Card.

Many residents are actively working to improve the health of the watershed, recognizing that the condition of their region influences their quality of life. Actions range from volunteering to plant trees on public lands, to implementing Woodlot Management Plans and Environmental Farm Plans on their private lands, and even donating property to be restored and conserved. Tree planting projects from 2011 to 2015 are summarized in Tables 16 and 17 and a range of stewardship projects are recognized in the individual Subwatershed Report Cards.

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Section 2: Tables and Maps

Table 1. Summary of subwatershed areas in the St. Clair Region

Subwatershed	Tributary of	Area (km^2)	Area (ha)	% of St. Clair Region
Sydenham Headwaters	East Sydenham River	224	22,391	5.4
Upper Sydenham River	East Sydenham River	229	22,917	5.5
Brown Creek	East Sydenham River	155	15,525	3.8
Middle East Sydenham	East Sydenham River	538	53,843	13.0
Lower East Sydenham	East Sydenham River	397	39,670	9.6
Bear Creek Headwaters	North Sydenham River	379	37,869	9.2
Lower Bear Creek	North Sydenham River	253	25,251	6.1
Black Creek	North Sydenham River	324	32,425	7.9
Lower North Sydenham	North Sydenham River	253	25,255	6.1
Lambton Shores Tributaries	Lake Huron	127	12,665	3.1
Plympton Shoreline Tributaries	Lake Huron	239	23,863	5.8
Cow and Perch Creeks	Lake Huron	266	26,628	6.4
St. Clair River Tributaries	St. Clair River	262	26,237	6.4
Lake St. Clair Tributaries	Lake St. Clair	484	48,409	11.7
Total		**4,130**	**412,948**	**100.0**

Table 2. Surface water quality indicators scoring and grading system

Total Phosphorus (mg/L)	Bacteria (CFU *E. coli*/ 100mL)	Benthic Score (FBI)	Point Score	Grade	Overall Surface Water Quality	
					Final Points	Final Grade
< 0.020	0 – 30	0.00 – 4.25	5	A	> 4.4	A
0.020 – 0.030	31 – 100	4.26 – 5.00	4	B	3.5 – 4.4	B
0.031 – 0.060	101 – 300	5.01 – 5.75	3	C	2.5 – 3.4	C
0.061 – 0.180	301 – 1000	5.76 – 6.50	2	D	1.5 – 2.4	D
> 0.180	> 1000	6.51 – 10.00	1	F	< 1.5	F

Total phosphorus calculated using 75th percentiles

Bacteria calculated using geometric means

FBI = Modified Family Biotic Index; based on New York State tolerance values used for Benthic Invertebrates indicator.

Source: Conservation Ontario, 2017

Table 3. Number of total phosphorus samples collected and sampling station locations

Subwatershed	Site	Total Phosphorus		
		No. of Samples 2001-2005	No. of Samples 2006-2010	No. of Samples 2011-2015
Sydenham Headwaters	East Sydenham River at Hickory Drive	31	37	35
Upper Sydenham River	East Sydenham River at Shiloh Line	30	36	36
Brown Creek	Brown Creek at Rokeby Line	16	26	19
Middle East Sydenham	East Sydenham River at Lambton Line	16	25	18
Lower East Sydenham	Main Sydenham River at McNaughton Ave	31	36	36
Bear Creek Headwaters	Bear Creek at Marthaville Road	29	36	36
Lower Bear Creek	Bear Creek at Bickford Line	31	34	36
Black Creek	Black Creek at Marthaville Road	29	35	36
Lower North Sydenham	North Sydenham River at Lambton Line	16	25	18
Lambton Shores Tributaries	Shashawanda at Rawlings Road	n/d	10	17
Plympton Shoreline Tributaries	Hickory Creek at Elmsley Road	n/d	10	17
Cow and Perch Creeks	Cow Creek at Lakeshore Road	16	33	36
St. Clair River Tributaries	Clay Creek at White Line near C&O railroad	8	36	36
Lake St. Clair	Little Bear Creek at Bear Line Road	16	37	34

n/d = no data

Table 4. Number of *E. coli* samples collected and sampling station locations

Subwatershed	Site	*E. coli*		
		No. of Samples 2001-2005	No. of Samples 2006-2010	No. of Samples 2011-2015
Sydenham Headwaters	East Sydenham River at Hickory Drive	23	38	40
Upper Sydenham River	East Sydenham River at Shiloh Line	23	37	40
Brown Creek	Brown Creek at Rokeby Line	n/d	n/d	20
Middle East Sydenham	East Sydenham River at Lambton Line	23	37	39
Lower East Sydenham	Main Sydenham River at McNaughton Ave	23	38	40
Bear Creek Headwaters	Bear Creek at Marthaville Road	23	38	40
Lower Bear Creek	Bear Creek at Bickford Line	23	38	40
Black Creek	Black Creek at Marthaville Road	23	38	39
Lower North Sydenham	North Sydenham River at Lambton Line	n/d	n/d	20
Lambton Shores Tributaries	Shashawanda at Rawlings Road	n/d	n/d	20
Plympton Shoreline Tributaries	Hickory Creek at Elmsley Road	n/d	n/d	19
Cow and Perch Creeks	Cow Creek at Lakeshore Road	n/d	n/d	39
St. Clair River Tributaries	Clay Creek at White Line near C&O railroad	n/d	n/d	39
Lake St. Clair	Little Bear Creek at Bear Line Road	n/d	n/d	41

n/d = no data

Table 5. Number of benthic invertebrate samples collected and sampling station locations

Subwatershed	Site	Benthic Invertebrates		
		No. of samples 2001-2005	No. of samples 2006-2010	No. of samples 2011-2015
Sydenham Headwaters	East Sydenham River at Coldstream Road	5	8	10
Upper Sydenham River	East Sydenham River at Sexton Road	5	5*	10
Brown Creek	Brown Creek at Rokeby Line	5	8	10
Middle East Sydenham	East Sydenham River east of Mawlam Road	3	8	10
Lower East Sydenham	East Sydenham River at Dawn Mills Road	5	7	10
Bear Creek Headwaters	Bear Creek at Kingscourt Road	4	7	10
Lower Bear Creek	Bear Creek at Telfer Road	4	7	10
Black Creek	Black Creek at Mandaumin Road	2	8	10
Lower North Sydenham	West Otter Creek Drain at Charlemont Line	4	7	9
Lambton Shores Tributaries	Shashawanda at Kinnaird Road	n/d	6	10
Plympton Shoreline Tributaries	Hickory Creek at Forest Road	5	6	8
Cow and Perch Creeks	Cow Creek at Mandaumin Road	4	6	10
St. Clair River Tributaries	Clay Creek at White Line near Hwy 40	3	6	9
Lake St. Clair	Rankin Creek at Bear Line Road	5	6	10

n/d = no data
**Riffle sample for 2010 not included*

Table 6. Surface water quality indicator results and grades for all subwatersheds

Subwatershed	Total Phosphorus (mg/L)			Bacteria (*E. coli* CFU/100mL)			Benthic Score (FBI)			Overall Grade		
	2001-2005	2006-2010	2011-2015	2001-2005	2006-2010	2011-2015	2001-2005	2006-2010	2011-2015	2001-2005	2006-2010	2011-2015
Sydenham Headwaters	0.06 C	0.06 C	0.08 D	297 C	210 C	324 D	5.91 D	5.40 C	5.71 C	C	C	D
Upper Sydenham River	0.09 D	0.08 D	0.11 D	155 C	223 C	308 D	5.90 D	6.01 D	5.31 C	D	D	D
Brown Creek	0.09 D	0.14 D	0.24 F	n/d	n/d	192 C	5.65 C	5.41 C	5.44 C	C	C	D
Middle East Sydenham	0.08 D	0.08 D	0.12 D	99 B	162 C	234 C	5.76 D	5.55 C	4.88 B	C	C	C
Lower East Sydenham	0.06 C	0.08 D	0.09 D	86 B	50 B	80 B	5.48 C	5.53 C	5.45 C	C	C	C
Bear Creek Headwaters	0.22 F	0.22 F	0.20 F	263 C	192 C	279 C	5.79 D	5.71 C	5.57 C	D	D	D
Lower Bear Creek	0.23 F	0.19 F	0.17 D	216 C	220 C	342 D	5.62 C	5.75 C	5.81 D	D	D	D
Black Creek	0.21 F	0.14 D	0.16 D	219 C	146 C	304 D	6.23 D	5.83 D	6.19 D	D	D	D
Lower North Sydenham	0.15 D	0.13 D	0.12 D	n/d	n/d	23 A	6.62 F	6.30 D	5.95 D	D	D	C
Lambton Shores Tributaries	n/d	0.10 D	0.15 D	n/d	n/d	148 C	5.78 D	5.63 C	5.28 C	D	C	C
Plympton Shoreline Tributaries	n/d	0.07 D	0.17 D	n/d	n/d	146 C	n/d	5.85 D	5.85 D	n/d	D	D
Cow and Perch Creeks	0.15 D	0.16 D	0.16 D	n/d	n/d	409 D	5.77 D	6.00 D	5.96 D	D	D	D
St. Clair River Tributaries	0.18 D	0.15 D	0.26 F	n/d	n/d	129 C	6.92 F	5.68 C	5.74 C	D	C	D
Lake St. Clair Tributaries	0.08 D	0.09 D	0.10 D	n/d	n/d	39 B	6.90 F	7.01 F	7.06 F	D	D	D
St. Clair Region Average	**0.13 D**	**0.12 D**	**0.15 D**	**191 C**	**172 C**	**211 C**	**6.03 D**	**5.83 D**	**5.73 C**	**D**	**D**	**D**

n/d = no data
Sources (2011-2015): Ontario Ministry of the Environment Provincial Water Quality Monitoring Network, Middlesex Health Unit, and SCRCA

Table 7. Subwatersheds sorted by 2011-2015 surface water quality grades (point scores in brackets)

A (> 4.4)	B (3.5 – 4.4)	C (2.5 – 3.4)	D (1.5 – 2.4)	F (< 1.5)
		Middle East Sydenham (3.0)	**St. Clair Region Average (2.4)**	
		Lower East Sydenham (3.0)	Sydenham Headwaters (2.3)	
		Lower North Sydenham (3.0)	Upper Sydenham River (2.3)	
		Lambton Shores Tributaries (2.7)	Brown Creek (2.3)	
			Bear Creek Headwaters (2.3)	
			Plympton Shoreline Tributaries (2.3)	
			St. Clair River Tributaries (2.3)	
			Lake St. Clair Tributaries (2.3)	
			Lower Bear Creek (2.0)	
			Black Creek (2.0)	
			Cow and Perch Creeks (2.0)	

Table 8. Groundwater quality indicators scoring and grading system

Nitrite + Nitrate (mg/L)	Chloride (mg/L)	Overall Groundwater Quality	
		Point Score	Grade
0.0 – 2.5	1.0 – 62.5	5	A
2.6 – 5.0	62.6 – 125.0	4	B
5.1 – 7.5	125.1 – 187.5	3	C
7.6 – 10.0	187.6 – 250.0	2	D
> 10.0	> 250.0	1	F

Source: Conservation Ontario, 2017

Table 9. Groundwater quality indicator results and grades

Well Name (WELL ID)	Closest Intersection	Nitrite + Nitrate				Chloride			
		75th Percentile (mg/L)	No. of Samples	Point Score	Grade	75th Percentile (mg/L)	No. of Samples	Point Score	Grade
Coldstream CA (W0000431-1)	Coldstream Road and Quaker Lane	0.05	7	5	A	32	10	5	A
Clark Wright CA (W0000436-1)	Glen Oak Road and Walkers Drive	0.05	7	5	A	16	10	5	A
Kerwood (W0000459-1)	Kerwood Road and Adele Street	0.05	7	5	A	178	10	3	C
A.W. Campbell CA (W0000435-1)	Peak of Mosa Road and Shiloh Line	0.05	7	5	A	4	10	5	A
Bothwell (W0000461-1)	Downie Road and Fansher Road	0.05	6	5	A	167	9	3	C
Warwick CA (W0000460-1)	Warwick Village Road and London Line	0.05	7	5	A	451	9	1	F
Tiernay (W0000109-2)	Robinson Road and Edy's Mills Line	0.15	6	5	A	300	10	1	F
Guthrie Park (W0000106-2)	St. Clair Parkway and Curran Avenue	0.07	6	5	A	456	10	1	F

Note: The boundaries of surface watersheds and ground watersheds are not the same; nearby well water quality may vary from that of the monitoring wells

Source: SCRCA; Ontario Ministry of the Environment Provincial Groundwater Monitoring Network (2006-2015)

Table 10. Forest condition indicators scoring and grading system

% Forest Cover	% Forest Interior	% Forested Riparian Buffer	Point Score	Grade	Overall Forest Condition	
					Final Points	Final Grade
> 35.0	> 11.5	> 57.5	5	A	> 4.4	A
25.1 – 35.0	8.6 – 11.5	42.6 – 57.5	4	B	3.5 – 4.4	B
15.1 – 25.0	5.6 – 8.5	27.6 – 42.5	3	C	2.5 – 3.4	C
5.0 – 15.0	2.5 – 5.5	12.5 – 27.5	2	D	1.5 – 2.4	D
< 5.0	< 2.5	< 12.5	1	F	< 1.5	F

Source: Conservation Ontario, 2017

Table 11. Forest condition indicator results and grades for all subwatersheds

Subwatershed	% Forest Cover			% Forest Interior			% Forested Riparian Buffer			Overall Grade		
	2001-2005	2006-2010	2011-2015	2001-2005	2006-2010	2011-2015	2001-2005	2006-2010	2011-2015	2001-2005	2006-2010	2011-2015
Sydenham Headwaters	13.9 D	14.3 D	14.4 D	1.3 F	1.6 F	1.6 F	n/d	37.8 C	41.6 C	D	D	D
Upper Sydenham River	15.5 C	16.0 C	16.1 C	1.5 F	2.4 F	2.4 F	n/d	30.9 C	34.4 C	D	D	D
Brown Creek	12.2 D	12.6 D	12.5 D	1.9 F	2.2 F	2.2 F	n/d	25.4 D	28.7 C	D	D	D
Middle East Sydenham	14.5 D	14.7 D	14.6 D	2.3 F	2.7 D	2.6 D	n/d	26.1 D	26.0 D	D	D	D
Lower East Sydenham	5.9 D	5.4 D	5.1 D	0.4 F	0.4 F	0.4 F	n/d	12.3 F	12.9 D	D	F	D
Bear Creek Headwaters	11.8 D	11.7 D	11.5 D	1.7 F	1.8 F	1.8 F	n/d	23.6 D	23.2 D	D	D	D
Lower Bear Creek	14.7 D	14.5 D	14.3 D	2.4 F	2.7 D	2.6 D	n/d	30.4 C	30.8 C	D	D	D
Black Creek	13.0 D	13.5 D	13.4 D	2.1 F	2.3 F	2.3 F	n/d	22.4 D	22.9 D	D	D	D
Lower North Sydenham	9.4 D	9.8 D	9.6 D	1.1 F	1.4 F	1.3 F	n/d	14.1 D	14.0 D	D	D	D
Lambton Shores Tributaries	17.8 C	17.3 C	17.4 C	4.3 D	4.1 D	3.8 D	n/d	32.4 C	32.8 C	C	C	C
Plympton Shoreline Tributaries	10.9 D	10.8 D	10.8 D	1.6 F	1.6 F	1.6 F	n/d	22.5 D	22.9 D	D	D	D
Cow and Perch Creeks	8.9 D	8.0 D	8.0 D	0.9 F	1.1 F	1.0 F	n/d	12.3 F	12.3 F	D	F	F
St. Clair River Tributaries	14.9 D	14.3 D	14.1 D	3.7 D	3.9 D	3.7 D	n/d	18.8 D	18.4 D	D	D	D
Lake St. Clair Tributaries	5.8 D	5.4 D	5.4 D	1.7 F	1.8 F	1.8 F	n/d	3.0 F	3.3 F	D	F	F
St. Clair Region Average	**12.1 D**	**12.5 D**	**12.0 D**	**1.9 F**	**2.1 F**	**2.1 F**	**n/d**	**22.3 D**	**23.1 D**	**D**	**D**	**D**
St. Clair Region Total	**11.5 D**	**11.4 D**	**11.3 D**	**1.8 F**	**2.0 F**	**2.0 F**	**n/d**	**21.2 D**	**21.7 D**	**D**	**D**	**D**

n/d = no data
Note: methodology changed for all three forest condition indicators between 2001-2005 and 2006-2010 but has remained the same since

Table 12. Subwatersheds sorted by 2011-2015 forest condition grades (point scores in brackets)

A (> 4.4)	B (3.5 – 4.4)	C (2.5 – 3.4)	D (1.5 – 2.4)	F (< 1.5)
		Lambton Shores Tributaries (2.7)	Upper Sydenham River (2.3)	Cow and Perch Creeks (1.3)
			Lower Bear Creek (2.3)	Lake St. Clair Tributaries (1.3)
			Sydenham Headwaters (2.0)	
			Brown Creek (2.0)	
			Middle East Sydenham (2.0)	
			St. Clair River Tributaries (2.0)	
			St. Clair Region Average (1.9)	
			Lower East Sydenham (1.7)	
			Bear Creek Headwaters (1.7)	
			Black Creek (1.7)	
			Lower North Sydenham (1.7)	
			Plympton Shoreline Tributaries (1.7)	
			St. Clair Region Total (1.7)	

Table 13: Number of woodlots in each subwatershed by size category

Subwatershed	Number of Woodlots				Total No.	Total Woodlot Area (ha)				Total Area (ha)	Percentage of Woodlot Area				Size of Largest Woodlot (ha)
	<5 ha	5-10 ha	10-30 ha	>30 ha		<5 ha	5-10 ha	10-30 ha	>30 ha		<5 ha	5-10 ha	10-30 ha	>30 ha	
Sydenham Headwaters	228	64	58	26	376	403	471	890	1,455	3,219	13	15	28	45	128
Upper Sydenham River	210	57	51	31	349	392	389	904	2,007	3,692	11	11	24	54	143
Brown Creek	87	22	22	18	149	165	157	409	1,217	1,948	8	8	21	62	156
Middle East Sydenham	340	135	113	72	660	677	979	1,972	4,258	7,886	9	12	25	54	138
Lower East Sydenham	211	60	50	9	330	459	432	757	393	2,041	22	21	37	19	60
Bear Creek Headwaters	163	62	69	43	337	328	457	1,119	2,465	4,369	8	10	26	56	135
Lower Bear Creek	163	38	42	37	280	320	271	743	2,283	3,617	9	7	21	63	171
Black Creek	189	64	70	40	363	399	434	1,168	2,360	4,361	9	10	27	54	155
Lower North Sydenham	137	41	51	20	249	312	311	857	934	2,414	13	13	36	39	79
Lambton Shores Tributaries	89	22	37	11	159	171	164	597	1,276	2,208	8	7	27	58	244
Plympton Shoreline Tributaries	125	44	46	25	240	259	323	767	1,220	2,569	10	13	30	47	95
Cow and Perch Creeks	167	38	49	12	266	318	275	877	656	2,126	15	13	41	31	135
St. Clair River Tributaries	167	46	49	33	295	346	319	848	2,183	3,696	9	9	23	59	261
Lake St. Clair Tributaries	156	26	19	17	218	311	189	338	1,801	2,639	12	7	13	68	353
St. Clair Region Total	**2,432**	**719**	**726**	**394**	**4,271**	**4,860**	**5,171**	**12,246**	**24,508**	**46,785**	**10**	**11**	**26**	**52**	**353***
Average	**174**	**51**	**52**	**28**	**305**	**347**	**369**	**875**	**1,751**	**3,342**	**11**	**11**	**27**	**51**	**161**

**The largest woodlot in the St. Clair Region is located in the Lake St. Clair Tributaries*

Table 14. Wetland cover grading system

% Wetland Cover	Grade
> 11.5	A
8.6 – 11.5	B
5.6 – 8.5	C
2.5 – 5.5	D
< 2.5	F

Source: Conservation Ontario, 2017

Table 15. Wetland cover grades for all subwatersheds

Subwatershed	Total Subwatershed Area (ha)	Potential SCRCA Wetlands		MNRF Wetlands		Wetland Total		Final Grade
		Area (ha)	% Area of Watershed	Area (ha)	% Area of Watershed	Area (ha)	% Area of Watershed	
Sydenham Headwaters	22,391	43	0.2	969	4.3	1,012	4.5	D
Upper Sydenham River	22,917	95	0.4	504	2.2	599	2.6	D
Brown Creek	15,525	20	0.1	48	0.3	68	0.4	F
Middle East Sydenham	53,843	96	0.2	555	1.0	651	1.2	F
Lower East Sydenham	39,670	4	0.0	0	0.0	4	0.0	F
Bear Creek Headwaters	37,869	53	0.1	97	0.3	150	0.4	F
Lower Bear Creek	25,251	12	0.0	187	0.7	199	0.8	F
Black Creek	32,425	19	0.1	68	0.2	87	0.3	F
Lower North Sydenham	25,255	0	0.0	79	0.3	79	0.3	F
Lambton Shores Tributaries	12,665	0	0.0	362	2.9	362	2.9	D
Plympton Shoreline Tributaries	23,863	0	0.0	72	0.3	72	0.3	F
Cow and Perch Creeks	26,628	1	0.0	59	0.2	60	0.2	F
St. Clair River Tributaries	26,237	0	0.0	382	1.5	382	1.5	F
Lake St. Clair Tributaries	48,409	0	0.0	732	1.5	732	1.5	F
St. Clair Region Total	**412,948**	**343**	**0.1**	**4,114**	**1.0**	**4,457**	**1.1**	**F**

Potential SCRCA Wetlands = Areas identified using three GIS-based indicators of wetland potential and desk-top examination of 2010 aerial orthophotography

MNRF Wetlands = Areas evaluated under the Ontario Wetland Evaluation System (OWES) and approved by the Ministry of Natural Resources and Forestry (June 2017); No First Nations Land has been evaluated under OWES.

Note: Wetland cover calculations do not include First Nations land

Table 16. Trees and shrubs planted by the SCRCA from 2011 to 2015

Subwatershed	No. of Projects	No. of Trees and Shrubs Planted
Sydenham Headwaters	16	37,860
Upper Sydenham River	11	14,380
Brown Creek	6	8,020
Middle East Sydenham	16	30,930
Lower East Sydenham	5	8,980
Bear Creek Headwaters	6	4,340
Lower Bear Creek	8	17,590
Black Creek	2	2,590
Lower North Sydenham	14	29,615
Lambton Shores Tributaries	0	0
Plympton Shoreline Tributaries	7	30,020
Cow and Perch Creeks	7	8,070
St. Clair River Tributaries	10	76,545
Lake St. Clair Tributaries	7	5,885
St. Clair Region Total	**115**	**274,825**

Notes: Includes trees planted on private lands and corporate lands by SCRCA staff under the Conservation Services program.

Does not include trees planted by SCRCA under the Memorial Forest program on municipal, SCRCA and other public properties.

Includes projects completed by SCRCA staff in partnership with Rural Lambton Stewardship Network.

Table 17. Memorial Forest and Conservation Area tree plantings from 1988 to 2015

Subwatershed	No. of Projects	No. of Trees Planted
Sydenham Headwaters	15	44,377
Upper Sydenham River	5	6,390
Brown Creek	0	0
Middle East Sydenham	9	11,485
Lower East Sydenham	4	88
Bear Creek Headwaters	9	18,093
Lower Bear Creek	4	10,806
Black Creek	0	0
Lower North Sydenham	11	120,709
Lambton Shores Tributaries	0	0
Plympton Shoreline Tributaries	13	3,054
Cow and Perch Creeks	5	59,952
St. Clair River Tributaries	12	310
Lake St. Clair Tributaries	0	0
St. Clair Region Total	**87**	**275,264**

Note: Memorial Forest program supports tree plantings on public lands, owned by local municipalities, counties or the SCRCA

Table 18. Subwatersheds within each municipality and First Nation

Municipality/ First Nation	Subwatershed(s) within each Municipality/First Nation	Area (km^2)	% Area
Adelaide Metcalfe	Upper Sydenham River	111	49
	Middle East Sydenham	51	23
	Brown Creek	33	15
	Sydenham Headwaters	29	13
	Bear Creek Headwaters	1	<1
Brooke-Alvinston	Middle East Sydenham	130	42
	Brown Creek	69	22
	Bear Creek Headwaters	67	21
	Black Creek	30	9
	Upper Sydenham River	17	5
Chatham-Kent	Lake St. Clair Tributaries	338	52
	Lower East Sydenham	245	38
	Lower North Sydenham	49	8
	Middle East Sydenham	10	1
	St. Clair River Tributaries	5	1
Dawn-Euphemia	Middle East Sydenham	181	40
	Lower East Sydenham	150	33
	Black Creek	73	16
	Lower North Sydenham	45	10
Enniskillen	Black Creek	162	48
	Bear Creek Headwaters	89	26
	Lower Bear Creek	81	24
	Cow and Perch Creeks	7	2
Lambton Shores (not including Kettle and Stony Point First Nation)	Lambton Shores Tributaries	110	97
	Plympton Shoreline Tributaries	3	3
Middlesex Centre	Sydenham Headwaters	115	100
Newbury	Middle East Sydenham	2	100
Oil Springs	Black Creek	8	100
Petrolia	Bear Creek Headwaters	10	77
	Lower Bear Creek	3	23
Point Edward	St. Clair River Tributaries	3	100

Table 18. Subwatersheds within each municipality and First Nation (continued)

Municipality/ First Nation	Subwatershed(s) within each Municipality/First Nation	Area (km^2)	% Area
Plympton-Wyoming	Plympton Shoreline Tributaries	181	56
	Cow and Perch Creeks	86	26
	Bear Creek Headwaters	47	14
	Lower Bear Creek	10	3
	Lambton Shores Tributaries	2	<1
Sarnia (not including Aamjiwnaang First Nation)	Cow and Perch Creeks	141	84
	St. Clair River Tributaries	27	16
Southwest Middlesex	Middle East Sydenham	165	94
	Upper Sydenham River	10	6
St. Clair	St. Clair River Tributaries	216	35
	Lower North Sydenham	159	26
	Lower Bear Creek	159	26
	Black Creek	51	8
	Cow and Perch Creeks	33	5
	Lower East Sydenham	2	<1
Strathroy-Caradoc	Upper Sydenham River	92	54
	Sydenham Headwaters	79	46
Warwick	Bear Creek Headwaters	166	59
	Plympton Shoreline Tributaries	54	19
	Brown Creek	54	19
	Lambton Shores Tributaries	6	2
Aamjiwnaang First Nation	St. Clair River Tributaries	12	94
	Cow and Perch Creeks	1	6
Kettle and Stony Point First Nation	Lambton Shores Tributaries	9	100
Walpole Island First Nation	Lake St. Clair Tributaries	147	100

Table 19. Municipalities and First Nations within each subwatershed

Subwatershed	Total Area (km^2)	Municipalities/ First Nations within each Subwatershed	Area (km^2)	% Area
Sydenham Headwaters	223.9	Middlesex Centre	115.2	51
		Strathroy-Caradoc	79.3	35
		Adelaide-Metcalfe	29.4	13
Upper Sydenham River	229.2	Adelaide-Metcalfe	110.6	48
		Strathroy-Caradoc	92.2	40
		Brooke-Alvinston	16.5	7
		Southwest Middlesex	9.9	4
Brown Creek	155.2	Brooke-Alvinston	69.0	44
		Warwick	53.6	35
		Adelaide-Metcalfe	32.6	21
Middle East Sydenham	538.4	Dawn-Euphemia	180.9	34
		Southwest Middlesex	164.9	31
		Brooke-Alvinston	129.8	24
		Adelaide-Metcalfe	51.2	10
		Chatham-Kent	9.5	2
		Newbury	2.1	<1
Lower East Sydenham	396.8	Chatham-Kent	244.5	62
		Dawn-Euphemia	149.9	38
		St. Clair	2.3	1
Bear Creek Headwaters	378.7	Warwick	165.6	44
		Enniskillen	89.1	24
		Brooke-Alvinston	67.0	18
		Plympton	46.8	12
		Petrolia	9.6	3
		Adelaide-Metcalfe	0.6	<1
Lower Bear Creek	252.5	St. Clair	158.6	63
		Enniskillen	81.0	32
		Plympton-Wyoming	10.1	4
		Petrolia	2.8	1

Table 19. Municipalities and First Nations within each subwatershed (continued)

Subwatershed	Total Area (km^2)	Municipalities/ First Nations within each Subwatershed	Area (km^2)	% Area
Black Creek	324.2	Enniskillen	162.4	50
		Dawn-Euphemia	72.7	22
		St. Clair	51.2	16
		Brooke-Alvinston	29.6	9
		Oil Springs	8.3	3
Lower North Sydenham	252.7	St. Clair	159.3	63
		Chatham-Kent	48.8	19
		Dawn-Euphemia	44.6	18
Lambton Shores Tributaries	126.7	Lambton Shores	110.0	87
		Kettle and Stony Point FN	8.9	7
		Warwick	6.3	5
		Plympton-Wyoming	1.5	<1
Plympton Shoreline Tributaries	238.6	Plympton-Wyoming	181.0	76
		Warwick	54.4	23
		Lambton Shores	3.2	1
Cow and Perch Creeks	266.3	Sarnia	140.9	53
		Plympton-Wyoming	85.5	32
		St. Clair	32.6	12
		Enniskillen	6.5	2
		Aamjiwnaang First Nation	0.8	<1
St. Clair River Tributaries	261.2	St. Clair	214.6	82
		Sarnia	26.8	10
		Aamjiwnaang First Nation	11.6	4
		Chatham-Kent	4.9	2
		Point Edward	3.3	1
Lake St. Clair Tributaries	483.2	Chatham-Kent	337.3	70
		Walpole Island First Nation	145.9	30

Table 20. Land use by subwatershed

Subwatershed	% Agricultural	% Forest *	% Urban/Industrial	% Other/ Not Mapped
Sydenham Headwaters	81	11	7	0.3
Upper Sydenham River	84	14	0.8	0.6
Brown Creek	87	13	0.4	0.1
Middle East Sydenham	85	14	0.6	0.4
Lower East Sydenham	91	6	2	0.9
Bear Creek Headwaters	85	11	3	0.2
Lower Bear Creek	85	12	3	0.8
Black Creek	84	13	2	0.4
Lower North Sydenham	88	11	1	0.5
Lambton Shores Tributaries	77	19	3	0.8
Plympton Shoreline Tributaries	86	11	2	0.8
Cow and Perch Creeks	79	6	14	1
St. Clair River Tributaries	68	9	23	0.4
Lake St. Clair Tributaries	66	1	1	32
St. Clair Region Average	**82**	**11**	**4**	**3**

Note: This table provides a broad overview of land use within the subwatersheds

**Updated forest area analysis, using 2015 aerial photography, is within "Table 11. Forest condition indicator results and grades for all subwatersheds"*

Source: GIS derived from "Agriculture Resource Inventory," Ontario Ministry of Agriculture and Food, 1983

Table 21. Soil types in each subwatershed by percent area

Subwatershed	% Bottom Land and Beach	% Loam	% Sand Loams	% Silt and Clay	% Silt and Clay Loams	% Organic	% Not Mapped	% Fine Sand	% Water
Sydenham Headwaters	11.2	14.7	20.4	40.8	8.9	0.1	3.3	0.6	
Upper Sydenham River	8.1	9.7	42.4	37.3		0.2	0.2	2.1	
Brown Creek	4.6	4.1	1.7	64.3	25.1		0.2		
Middle East Sydenham	5.2	3.4	34.5	53.5	2.9		0.5		
Lower East Sydenham	3.5	7.0	18.1	63.2	5.6		1.8	0.3	0.7
Bear Creek Headwaters	4.1	4.9	1.9	83.9	5.3				
Lower Bear Creek	3.6	0.2	1.1	94.5	0.6				
Black Creek	3.4	0.2		95.9	0.5				
Lower North Sydenham	1.7	2.7	1.0	93.0	0.5		0.8		0.4
Lambton Shores Tributaries	3.1	5.6	2.1	79.8	9.5				
Plympton Shoreline Tributaries	3.3	3.2	3.5	90.0					
Cow and Perch Creeks	0.9	1.0	3.3	90.6	2.7	0.9	0.6		
St. Clair River Tributaries	0.8	7.4	3.2	79.8	5.0		3.8		
Lake St. Clair Tributaries		5.5	35.8	30.9	7.1	16.5	3.8	0.2	0.2

Water = open waterbodies within subwatersheds

Not Mapped = mainly urban/built-up areas

Note: Figures represent the percentage of the subwatershed area in each soil type

Source: Derived using GIS and soil maps from the Ontario Ministry of Agriculture and Food, Soils Ontario Version 1.0

Table 22. Physiography of each subwatershed by percent area

Subwatershed	% Spillways	% Till Moraines	% Clay Plains	% Sand Plains	% Till Plains Undrumlinized	% Beaches and Shorecliffs	% Bevelled Till Plains	% Peat and Muck
Sydenham Headwaters	11.2	14.7	20.4	40.8	8.9	0.1	3.3	0.6
Upper Sydenham River	8.1	9.7	42.4	37.3		0.2	0.2	2.1
Brown Creek	4.6	4.1	1.7	64.3	25.1		0.2	
Middle East Sydenham	5.2	3.4	34.5	53.5	2.9		0.5	
Lower East Sydenham	3.5	7.0	18.1	63.2	5.6		1.8	0.3
Bear Creek Headwaters	4.1	4.9	1.9	83.9	5.3			
Lower Bear Creek	3.6	0.2	1.1	94.5	0.6			
Black Creek	3.4	0.2		95.9	0.5			
Lower North Sydenham	1.7	2.7	1.0	93.0	0.5		0.8	
Lambton Shores Tributaries	3.1	5.6	2.1	79.8	9.5			
Plympton Shoreline Tributaries	3.3	3.2	3.5	90.0				
Cow and Perch Creeks	0.9	1.0	3.3	90.6	2.7	0.9	0.6	
St. Clair River Tributaries	0.8	7.4	3.2	79.8	5.0		3.8	
Lake St. Clair Tributaries		5.5	35.8	30.9	7.1	16.5	3.8	0.2

Note: Figures represent the percentage of the subwatershed area in each physiographic unit

Source: GIS derived from Chapman, L.J. & D.F. Putnam, 1973

Table 23. Average annual air temperature from 2011 to 2015

Relevant Subwatershed(s)	Station Name	Average Annual Air Temperature (°C)								
		2011	2012	2013	2014	2015	Mean 2002-2005	Mean 2006-2010	Mean 2011-2015	Mean 2002-2015
Sydenham Headwaters, Upper Sydenham River, Brown Creek, Middle East Sydenham	Strathroy	8.56	9.98	7.96	6.62	8.05	8.40	8.78	8.23	8.48
Bear Creek Headwaters, Lower Bear Creek, Black Creek	Petrolia	9.08	10.41	8.48	7.35	8.29	8.94	8.93	8.72	8.86
Lower East Sydenham, Lower North Sydenham, Lake St. Clair Tributaries	Wallaceburg	10.93	12.22	10.44	9.42	10.34	9.87	10.57	10.67	10.40
Lambton Shoreline Tributaries, Plympton Shores Tributaries, Cow and Perch Creeks, St. Clair River Tributaries	Sarnia	8.95	10.37	8.35	7.14	8.61	8.41	8.96	8.68	8.70
Average		**9.38**	**10.75**	**8.81**	**7.63**	**8.82**				

Station name = relevant meteorological station for each subwatershed

Table 24. Annual precipitation from 2011 to 2015

Relevant Subwatershed(s)	Station Name	Annual Precipitation (mm)								
		2011	2012	2013	2014	2015	Mean 2002-2005	Mean 2006-2010	Mean 2011-2015	Mean 2002-2015
Sydenham Headwaters, Upper Sydenham River, Brown Creek, Middle East Sydenham	Strathroy	1,165	663	1,032	876	776	835	983	902	912
Bear Creek Headwaters, Lower Bear Creek, Black Creek	Petrolia	1,118	833	989	693	625	860	972	852	897
Lower East Sydenham, Lower North Sydenham, Lake St. Clair Tributaries	Wallaceburg	1,226	657	841	807	682	842	924	843	871
Lambton Shoreline Tributaries, Plympton Shores Tributaries, Cow and Perch Creeks, St. Clair River Tributaries	Sarnia	986	733	812	687	614	822	849	766	812
Average		**1,124**	**722**	**919**	**766**	**674**				

Station name = relevant meteorological station for each subwatershed

Table 25. Mean annual streamflow from 2011 to 2015

Relevant Subwatershed(s)	Station Name (Station ID)	Mean Annual Streamflow (m^3/s)								
		2011	2012	2013	2014	2015	Mean 2003-2005	Mean 2006-2010	Mean 2011-2015	Mean 2003-2015
Sydenham Headwaters, Upper Sydenham River	Strathroy (02GG005)	2.09	1.92	2.05	1.99	1.94	1.80	2.32	2.00	2.08
Middle East Sydenham	Alvinston (02GG002)	10.93	10.66	10.84	10.84	10.71	6.81	8.47	10.79	8.98
Middle East Sydenham	Florence (02GG003)	3.97	3.40	3.74	3.71	3.48	10.89	13.64	3.66	9.17
Lower East Sydenham	Dresden (02GG007)	11.17	10.92	8.96	19.19	11.92	14.93	17.92	12.43	15.12
Bear Creek Headwaters, Lower Bear Creek	Petrolia (02GG006)	4.34	4.07	4.25	4.27	4.17	2.42	3.20	4.22	3.41
Lower Bear Creek	Brigden (02GG009)	4.76	3.84	4.08	4.32	3.92	4.96	6.47	4.18	5.24
Black Creek	Black Creek (02GG013)	6.79	6.42	6.52	6.63	6.31	n/a	2.81	6.53	4.67
Cow and Perch Creeks	Perch Creek (02FF012)	3.04	2.79	3.17	3.14	2.89	0.61	0.95	3.01	1.66
Average		**5.89**	**5.50**	**5.45**	**6.76**	**5.67**				

Station Name= relevant stream gauge station for each subwatershed

Note: There is no streamflow data available for the following subwatersheds – Brown Creek, Lower North Sydenham, Lambton Shores Tributaries, Plympton Shoreline Tributaries, St. Clair River Tributaries, Lake St. Clair Tributaries

Table 26. Major watercourses and drains by subwatershed

Subwatershed	Major Watercourses
Sydenham Headwaters	East Sydenham River (in part), Taylor Drain, Calvin Creek, Gold Creek, Bell Drain, Trout Creek, Stokman Creek, Cable Drain
Upper Sydenham River	East Sydenham River (in part), Campbell Creek, Spring Creek, Brigham-Watts Drain, O'Neil Drain, Dortmans Creek, White Drain, Lipset Drain
Brown Creek	Brown Creek, Hardy Creek, Hair Creek, Edgar Drain No.1, Cameron Drain, Kersey Drain
Middle East Sydenham	East Sydenham River (in part), Morrogh Creek, Haggerty Creek Drain, Fansher Creek, Hugh McLaughlin Drain, McCracken Drain, Peter Mitchell Drain, Cherry Drain
Lower East Sydenham	East Sydenham River (in part), Butler Drain, Dankey Creek Drain, Crowell Creek, Little Bear Creek, Drummond Creek, Long Creek, Molly Creek
Bear Creek Headwaters	Bear Creek (in part), Gilliland Geerts Drain, Leach Drain, Higgins Drain, Durham Creek, Graham Drain, Moffatt Drain, Moore Drain
Lower Bear Creek	Bear Creek (in part), Stonehouse Drain, Stewart Drain, Nobel Wooley Drain, Johnson Drain, Burton Creek, Nichol Creek, Jarvis Drain
Black Creek	Black Creek, Fox Creek, McMurphy Drain, Simpson Drain, Groves Drain, Plum Creek, Currie Creek Drain, Booth Creek Drain
Lower North Sydenham	North Sydenham River, Heyland Drain, Gooden Creek, Indian Creek, Running Creek, Otter Creek Drain, East Otter Creek Drain, West Otter Creek Drain
Lambton Shores Tributaries	Duffus Creek, Shashawandah Creek, James Creek, Woods Creek, Walden Drain, Haney Drain
Plympton Shoreline Tributaries	Hickory Creek, Douglas Drain, Highland Creek, Aberarder Creek, Bonnie Doon Creek, Errol Creek, Kernohan O'Donnell Drain, McPherson Drain
Cow and Perch Creeks	Cow Creek, Pulse Creek Drain, Waddell Creek, Perch Creek, Wawanosh Drain, Armstrong Drain, Park Drain
St. Clair River Tributaries	Talfourd Creek, Marshy Creek, Baby Creek, Bowens Creek, Clay Creek, Marsh Creek, Grape Run Drain
Lake St. Clair Tributaries	Maxwell Creek, Little Bear Creek Drain, Rankin Creek Drain, Big Creek Drain, Purdie Creek Drain

Table 27. Flow and temperature regime of watercourses in each subwatershed

Subwatershed	Flow Regime							Temperature Regime				
	Total Length of Watercourses (km)	Permanent (km)	Intermittent (km)	Unknown (km)	% Permanent	% Intermittent	% Unknown	Total Open Watercourses (km)	Cold (km)	Warm (km)	% Cold	% Warm
Sydenham Headwaters	342	157	40	145	46	12	42	197	17	180	8	92
Upper Sydenham River	417	171	60	186	41	14	45	231	8	224	3	97
Brown Creek	329	95	48	186	29	15	56	143	0	143	0	100
Middle East Sydenham	973	357	277	340	37	28	35	633	0	633	0	100
Lower East Sydenham	594	274	236	84	46	40	14	510	0	510	0	100
Bear Creek Headwaters	685	244	193	248	36	28	36	437	0	437	0	100
Lower Bear Creek	333	173	97	63	52	29	19	270	0	270	0	100
Black Creek	580	205	233	143	35	40	25	437	0	437	0	100
Lower North Sydenham	275	125	116	34	45	42	12	241	0	241	0	100
Lambton Shoreline Tributaries	156	64	79	13	41	51	9	143	2	141	1	99
Plympton Shores Tributaries	330	151	77	103	46	23	31	227	0	227	0	100
Cow and Perch Creeks	369	158	74	137	43	20	37	232	2	230	1	99
St. Clair River Tributaries	276	83	102	91	30	37	33	185	0	185	0	100
Lake St. Clair Tributaries	521	234	198	89	45	38	17	432	0	432	0	100
St. Clair Region Total	**6,179**	**2,487**	**1,831**	**1,862**	**40**	**30**	**30**	**4,317**	**28**	**4,289**	**1**	**99**
Average	**441**	**178**	**131**	**133**	**41**	**30**	**29**	**308**	**2**	**306**	**1**	**99**

Unknown= Municipal drains that are buried or unknown classification
Open = Classified watercourses that are not buried
Cold = Cold or cool watercourse based on limited temperature sampling
Warm = Warm watercourse based on fish communities
Sources: Ministry of Natural Resources NRVIS for SCRCA; SCRCA Drain Classification database

Table 28. Length of watercourses in each subwatershed by type (natural, municipal drain or unclassified)

Subwatershed	Total Length of Watercourses (km)	Natural Watercourse (km)	Municipal Drain (km)	Unclassified (km)	% Natural Watercourse	% Municipal Drain	% Unclassified Watercourse
Sydenham Headwaters	248	74	117	57	30	47	23
Upper Sydenham River	352	75	153	124	21	43	35
Brown Creek	209	49	88	72	23	42	34
Middle East Sydenham	923	105	525	293	11	57	32
Lower East Sydenham	588	108	402	78	18	68	13
Bear Creek Headwaters	540	114	329	97	21	61	18
Lower Bear Creek	327	103	166	58	31	51	18
Black Creek	553	90	342	121	16	62	22
Lower North Sydenham	277	37	206	34	13	74	12
Lambton Shores Tributaries*	153	31	122	0	20	80	0
Plympton Shoreline Tributaries	283	56	169	58	20	60	20
Cow and Perch Creeks	353	36	195	122	10	55	35
St. Clair River Tributaries	277	36	151	90	13	55	32
Lake St. Clair Tributaries	521	0	437	84	0	84	16
St. Clair Region Total	**5,604**	**914**	**3,402**	**1,288**	**16**	**61**	**23**

Total Length of Watercourses = Total length of inland, surface watercourses; Great Lakes connecting channels and watercourses on Walpole Island First Nation lands are not included.

Natural Watercourse = Watercourse not identified as a Municipal Drain (Classified as N during OMAFRA Drain classification project 2004)

Municipal Drain = Watercourses identified as a Municipal Drain (classified as A, B, C, D, E, F during OMAFRA Drain classification project 2004)

Unclassified = Watercourses with an Unknown Drain Class (classified as U during OMAFRA Drain Classification project 2004)

**All watercourses in Lambton Shores were classified by Ausable Bayfield Conservation Authority as Open (Type A, B, C, D, E, or F) or Buried (Type T), whether they were a Natural Watercourse or a Municipal Drain; queries were based on Channel Type (Natural, Channelized or Unknown).*

Source: SCRCA Municipal Drain Classification, 2004; except for Lambton Shores, where watercourses were assessed by Ausable Bayfield Conservation Authority.

Table 29. Agricultural tile drainage by subwatershed

Subwatershed	Total Area (km^2)	Unknown Drainage (km^2)	Randomly Tiled (km^2)	Systematically Tiled (km^2)	% Unknown Drainage	% Randomly Tiled	% Systematically Tiled
Sydenham Headwaters	224	160	23	41	71	10	18
Upper Sydenham River	229	139	35	55	61	15	24
Brown Creek	155	49	32	74	32	21	48
Middle East Sydenham	540	224	99	217	41	18	40
Lower East Sydenham	398	83	77	238	21	19	60
Bear Creek Headwaters	379	114	44	221	30	12	58
Lower Bear Creek	253	78	75	100	31	30	40
Black Creek	325	98	20	207	30	6	64
Lower North Sydenham	253	57	20	176	23	8	70
Lambton Shores Tributaries	127	54	14	59	43	11	46
Plympton Shoreline Tributaries	240	74	31	135	31	13	56
Cow and Perch Creeks	267	100	36	131	37	13	49
St. Clair River Tributaries	263	132	45	86	50	17	33
Lake St. Clair Tributaries	484	180	30	274	37	6	57
St. Clair Region Total	**4,137**	**1,542**	**581**	**2,014**	**37**	**14**	**49**
Average	**296**	**110**	**42**	**144**	**38**	**14**	**47**

Unknown Drainage = Land without agricultural tiles

Source: Based on "Tile Drainage Area," Ontario Ministry of Agriculture, Food and Rural Affairs, 2015

Table 30. Dams and barriers to fish movement

Subwatershed	Total No. of Dams or Barriers	No. of Private Dams and Barriers	No. of Public Dams and Barriers	Names of Public Dams and Barriers
Sydenham Headwaters	10	7	3	Cuddy Woods Dam, Coldstream CA Dam, Strathroy CA Dam
Upper Sydenham River	6	5	1	Wright CA Dam
Brown Creek	4	4	0	
Middle East Sydenham	3	1	2	Campbell CA Dams
Lower East Sydenham	2	1	1	VanderVeeken Dam
Bear Creek Headwaters	5	3	2	Petrolia CA Dam, Warwick CA Dam
Lower Bear Creek	7	3	4	Henderson CA Weir 1, Weir 2 and Weir 3, Marthaville HMA Dam
Black Creek	0	0	0	
Lower North Sydenham	2	1	1	McKeough CA Dam
Lambton Shores Tributaries	2	2	0	
Plympton Shoreline Tributaries	4	3	1	Dodge CA Dam
Cow and Perch Creeks	0	0	0	
St. Clair River Tributaries	1	0	1	McKeough CA Drop Structure
Lake St. Clair Tributaries	5	1	4	Bay Lodge Dam, Hind Relief Dam, Rankin Creek Dam
St. Clair Region Total	**51**	**31**	**20**	

Source: SCRCA Dam and Barrier Inventory, 2007

Table 31. Sewage Treatment Plant facilities

Subwatershed	Wastewater Treatment Plants or Lagoons	Receiving Watershed within SCRCA	Plant Discharging outside SCRCA	Updates During Reporting Time Window	Receiving Watercourse
Sydenham Headwaters	Ilderton WWTP		Ilderton WWTP		Oxbow Creek, a tributary of Thames River
	Strathroy WWTP	Sydenham Headwaters			East Sydenham River
Upper Sydenham River					
Brown Creek	Kerwood Facility	Brown Creek			
Middle East Sydenham	Alvinston WWTP	Middle East Sydenham			East Sydenham River
	Newbury WWTP	Middle East Sydenham			Dolby Drain
Lower East Sydenham	Dresden WWTP	Lower East Sydenham			East Sydenham River
	Wallaceburg WWTP	Lower East Sydenham			East Sydenham River
Bear Creek Headwaters	Watford Lagoons	Bear Creek Headwaters		Upgrade – 2014	Moffatt Drain, a tributary of Bear Creek
	Petrolia WWTP	Lower Bear Creek			Bear Creek
Lower Bear Creek	Wyoming WWTP	Lower Bear Creek			Bear Creek
	Brigden Lagoons	Lower Bear Creek			One annual seasonal outfall to Bear Creek

Table 31. Sewage treatment plant facilities (continued)

Subwatershed	Wastewater Treatment Plants or Lagoons	Receiving Watershed within SCRCA	Plant Discharging outside SCRCA	Updates During Reporting Time Window	Receiving Watercourse
Black Creek	Oil City Lagoons	Black Creek			Seasonal outfall to Fox Creek Drain, a tributary of Black Creek
	Oil Springs Lagoons	Black Creek			Seasonal outfall to Black Creek
Lower North Sydenham					
Lambton Shores Tributaries					
Plympton Shoreline Tributaries	Plympton-Lakeshore WWTP		Plympton-Lakeshore WWTP		Lake Huron
	Forest Lagoons	Plympton Shores Tributaries			Hickory Creek
Cow and Perch Creeks	Brights Grove Lagoons	Cow and Perch Creeks			
St. Clair River Tributaries	Point Edward WWTP		Point Edward WWTP		St. Clair River
	Sarnia WWTP		Sarnia WWTP		St. Clair River
	Sombra Lagoons	St. Clair River Tributaries			Seasonal outfall spring and fall to Meyers Drain
	Courtright WWTP		Courtright WWTP		St. Clair River
	Port Lambton Lagoons	St. Clair River Tributaries			Marshy Creek Drain
Lake St. Clair Tributaries	Mitchell's Bay Lagoons	Lake St. Clair Tributaries			Rankin Creek Drain

WWTP = Wastewater Treatment Plant

Table 32. Significant natural areas within each subwatershed

Subwatershed	Provincially Significant Wetland	Locally Significant Wetland	Significant Natural Area/ Environmentally Significant Area*	Provincial Life Science ANSI	Regional Life Science ANSI	Provincial Earth Science ANSI
Sydenham Headwaters	Sydenham River Wetlands (SC 8)	Gold Creek Wetland	Coldstream Woodlot		Telfer Woodlot	
	Komoka/South Strathroy Creek Wetlands (SC 9)	Sinker Drain Wetland (SC 53)	Vanneck Woods		Ivan Woodlot	
	South Ilderton Heronry Wetlands and Woodlot (SC 12)	Hyde Park Wetland (SC 55)	Ivan Woods			
	Telfer Woods and Wetland	Harford Wetland (AB 9)	Caradoc North Woods			
	Duncrief Wetland	Telfer Woodlot (SC 11)				
		Lamont Drive Wetland				
Upper Sydenham River	Longwoods Woods and Wetland Complex (SC 6)	Melwood Wetland	Brooke Township Sydenham Woods		Kerwood Woods	
	Sydenham River Wetlands (SC 8)	Scotchmere Drive Wetlands				
	Kerwood Swamp	Napier Swamp (SC 16)				
	Komoka/South Strathroy Creek Wetlands (SC 9)					
Brown Creek	Walnut Heronry Woods	Hardy Creek Swamp (SC 14)	Walnut Hickory Woods		Brown Creek Woods	
	Brown Creek Woods and Wetland		Kerwood Bluff		Walnut Woods	

Table 32. Significant natural areas within each subwatershed (continued)

Subwatershed	Provincially Significant Wetland	Locally Significant Wetland	Significant Natural Area/ Environmentally Significant Area*	Provincial Life Science ANSI	Regional Life Science ANSI	Provincial Earth Science ANSI
Middle East Sydenham	Skunks Misery (LT22) (in part)	West Newbury Wetland (SC 1)	Sydenham River Corridor Carolinian Canada Site	Skunk's Misery	Oakdale Woods	
	Bobcat Swamp Wetland Complex (SC 2)	McPhail Woodland and Wetland	Shetland Heronry			
	McCready Woods and Wetland (SC 22)		Shetland Kentucky Coffee-tree Grove Carolinian Canada Site			
	Grape Fern Woods and Wetland		Knapdale Woods			
	Melbourne Marsh (SC 3)		Newbury Woods			
	Euphemia #3 (Cairo Wetland)		Cairo Woods			
			County Line Woods			
			Cottonwood Swamp			
			Fansher Creek Natural Area			
			Shield Woods			
			A. W. Campbell Conservation Area			
			Gawne Management Area			
			Sinclair Management Area			
			Euphemia Woodlot			
			Dawn-Euphemia Forest			

Table 32. Significant natural areas within each subwatershed (continued)

Subwatershed	Provincially Significant Wetland	Locally Significant Wetland	Significant Natural Area/ Environmentally Significant Area*	Provincial Life Science ANSI	Regional Life Science ANSI	Provincial Earth Science ANSI
Lower East Sydenham	Lower East Sydenham			Deyo's or Dare's Woods		Thamesville Moor
				Langbank Woods		Oakdale Woods
				Huff's Corners Woods		
				Rutherford Woods		
Bear Creek Headwaters	Warwick Conservation Area Wetlands	Bear Creek Source Woods and Wetland	Little Bear Creek Natural Area		Brown Creek Woods	
		Bridgeview (Petrolia) Conservation Area Wetland (SC 37)	Highway 402 Woods		Bear Creek South of Wyoming	
		West Warwick Woods (SC 54)	Bear Creek Woodlot #1		Walnut Woods	

Table 32. Significant natural areas within each subwatershed (continued)

Subwatershed	Provincially Significant Wetland	Locally Significant Wetland	Significant Natural Area/ Environmentally Significant Area*	Provincial Life Science ANSI	Regional Life Science ANSI	Provincial Earth Science ANSI
Lower Bear Creek	Moore Wildlife Management Area (Bear Creek Woods #4) and Wetland	Bear Creek Woods #3 and Wetland	Waubuno Woods	Bear Creek Floodplain	Clay Creek Woodland	
	Burton Drain Woods #3 and Wetland	Brigden Crown Game Reserve Wetland	Nichol Creek Woods			
	Bickford Oak Woods Wetland Complex (SC 50)	Lambton Landfill Wetlands	Bear Creek Woodlot #5			
		Henderson Conservation Area (Bear Creek Woods #2) and Wetlands (SC 34)	Burton Drain Woods #2			
Black Creek	Walnut Heronry Woods	Plum Creek Woods and Wetland	Bickford Line Woods	Plum Creek	Black Creek	
		Black Creek Woods #1 (Fox Creek Woods) and Wetland	Plum Creek	Bear Creek Floodplain	Walnut Woods	
			Black Creek Natural Area #2			

Table 32. Significant natural areas within each subwatershed (continued)

Subwatershed	Provincially Significant Wetland	Locally Significant Wetland	Significant Natural Area/ Environmentally Significant Area*	Provincial Life Science ANSI	Regional Life Science ANSI	Provincial Earth Science ANSI
Lower North Sydenham	Snye River Marshes (SC 17)		Wallaceburg Woods		Duthill Woodlot	
	Chicken Island Wetland (SC 19)		Rutherford Woods			
	Reid Conservation Area (Duthill Woods #2) and Wetlands	McKeough C.A. and Grant's Wetland	Terminus Woods			
	Bickford Oak Woods Wetland Complex (SC 50)		Combine Woods			
	Bray's Swamp (SC 27)		Wilkesport Woods			
			McKeough Conservation Area (Duthill Woods #1) and Floodway			

Table 32. Significant natural areas within each subwatershed (continued)

Subwatershed	Provincially Significant Wetland	Locally Significant Wetland	Significant Natural Area/ Environmentally Significant Area*	Provincial Life Science ANSI	Regional Life Science ANSI	Provincial Earth Science ANSI
Lambton Shores Tributaries	South Kettle Point Lakeshore Marshes (SC 49)		Cedar Point	Former Ipperwash Provincial Park	Gustin Grove Marsh/ Shashawandah Creek	Former Ipperwash Provincial Park
	Ipperwash Inner Dunal Complex (SC 48)		Ipperwash Natural Areas	Kettle Point		Kettle Point
	Cedar Point, Dolmage & Rawlings Rd Wetland Complex (SC 56)		Shashawandah Creek/Lakeshore Marsh complex	Port Franks Wetlands and Forested Dunes		
			Jericho Creek/Mud Creek Woods			
			Port Franks Natural Areas			

Table 32. Significant natural areas within each subwatershed (continued)

Subwatershed	Provincially Significant Wetland	Locally Significant Wetland	Significant Natural Area/ Environmentally Significant Area*	Provincial Life Science ANSI	Regional Life Science ANSI	Provincial Earth Science ANSI
Plympton Shoreline Tributaries	Cedar Point, Dolmage & Rawlings Rd Wetland Complex (SC 56)	Uttoxeter Swamp (SC 41)	Aberarder Creek Woods			
		Spicebush Swamp (SC 43)	Esli Dodge Conservation Area			
		Plympton/West Warwick Woods and Wetland (SC 54)	Uttoxeter Swamp			
		West Warwick Woods (SC 54)	McEwen Conservation Area			
			Highland Creek Conservation Area			
			Reeces Corners Gravel Pits			
			Camlachie Woods			
			Blue Point Woods			
			Egremont Road Woods			

Table 32. Significant natural areas within each subwatershed (continued)

Subwatershed	Provincially Significant Wetland	Locally Significant Wetland	Significant Natural Area/ Environmentally Significant Area*	Provincial Life Science ANSI	Regional Life Science ANSI	Provincial Earth Science ANSI
Cow and Perch Creeks	Wawanosh Conservation Area Wetlands (SC 46)	Perch Creek (Sarnia Landfill) Wetland (SC 40)	402 Woods			
			Dennis Rupert Prairie			
			Brights Grove Lagoons			
			Reeces Corners Gravel Pits			
			Camlachie Woods			
			Jackson Drive Woods			
			Deptford Pink Woods			
			Saredeca Woods			
			Logans Pond			
			Mandaumin Nature Reserve			
			Blackwell Prairie/ Howard Watson Nature Trail			
			Suncor Natureway			
			Perch Creek Wildlife Management Area and Wetland			

Table 32. Significant natural areas within each subwatershed (continued)

Subwatershed	Provincially Significant Wetland	Locally Significant Wetland	Significant Natural Area/ Environmentally Significant Area*	Provincial Life Science ANSI	Regional Life Science ANSI	Provincial Earth Science ANSI
St. Clair River Tributaries	Stag Island Natural Area and Wetland (SC 52)	McKeough C.A. and Grant's Wetland	Aamjiwnaang First Nation	Walpole Island	Duthill Woodlot	
	Marshy Creek Marsh (SC 35)	Upper Clay Creek Wetland Complex (SC 52)	Sassafras Woods		Clay Creek Woodland	
	Bickford Oak Woods Wetland Complex (SC 50)	Bickford Oak Woods Wetland Complex (SC 50)	Sombra Sycamore Woods			
			Upland Plover Woods			
			Spice Bush Woods			
			Fertilizer Plant Woods			
			Bickford Oak Woods (Clay Creek Woods)			
			Indian Pipe Woods			
			Payne Woods			
			Hydro Plant Woods			
			Dow Wetlands			

Table 32. Significant natural areas within each subwatershed (continued)

Subwatershed	Provincially Significant Wetland	Locally Significant Wetland	Significant Natural Area/ Environmentally Significant Area*	Provincial Life Science ANSI	Regional Life Science ANSI	Provincial Earth Science ANSI
Lake St. Clair Tributaries	Chenal Ecarte Marshes (SC 18)		Walpole Island First Nation	Walpole Island	Chenal Ecarte Prairie	
	Deyo's Woodlot		Chenal Ecarte Prairie	Lake St. Clair Marshes		
	St. Clair Marsh Complex					
	Snye River Marshes (SC 17)					

ANSI = Area of Natural and Scientific Interest
Note: Wording varies by county

Table 33. Known and potential bird Species at Risk occurrences by subwatershed

Common Name	SARO	COSEWIC	Sydenham Headwaters	Upper Sydenham River	Brown Creek	Middle East Sydenham	Lower East Sydenham	Bear Creek Headwaters	Lower Bear Creek	Black Creek	Lower North Sydenham	Lambton Shores Tributaries	Plympton Shoreline Tributaries	Cow and Perch Creeks	St. Clair River Tributaries	Lake St. Clair Tributaries	No. Subwatersheds Occur
Acadian Flycatcher	END	END	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Bank Swallow	THR	THR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Barn Swallow	THR	THR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Black Tern	SC	NAR														X	1
Bobolink	THR	THR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Cerulean Warbler	THR	END					X	X	X		X			X	X		6
Chimney Swift	THR	THR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Eastern Meadowlark	THR	THR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Eastern Whip-poor-will	THR	THR										X					1
Forster's Tern*	DD	DD										X					1
Hooded Warbler	NAR	NAR				X						X					2
King Rail	END	END	X	X												X	3
Least Bittern	THR	THR	X	X	X	X	X	X	X	X	X	X	X	X		X	13
Loggerhead Shrike	END	END											X				1
Northern Bobwhite	END	END							X					X			2
Peregrine Falcon	SC	NAR													X		1
Prothonotary Warbler	END	END		X	X	X	X	X	X	X	X		X	X	X	X	12
Red-headed Woodpecker	SC	THR				X											1
Yellow-breasted Chat	END	END	X		X	X	X	X	X	X	X	X	X	X	X		12
Total No. Species			**9**	**9**	**9**	**11**	**10**	**10**	**11**	**9**	**10**	**11**	**10**	**11**	**10**	**10**	

EXP = Extirpated; END = Endangered; DD = Data Deficient; NA = Not Assessed; NAR = Not At Risk;

SC = Special Concern; THR = Threatened

SARO = Species At Risk of Ontario, designated by the Ontario Ministry of Natural Resources (OMNRF) in accordance with the provincial Endangered Species Act (ESA)

COSEWIC = Committee on the Status of Endangered Wildlife in Canada (independent group of experts)

**Forster's Tern has an SRANK of S2B (SRANK = Provincial rank based on the Committee On the Status of Species At Risk in Ontario (COSSARO); S2B = Imperiled/Very Rare Breeding Population)*

Source: MNRF Natural Heritage Information Centre (NHIC) data; SCRCA records; 1995 to 2015 occurrences

Table 34. Known and potential mammal Species at Risk occurrences by subwatershed

Common Name	SARO	COSEWIC	Sydenham Headwaters	Upper Sydenham River	Brown Creek	Middle East Sydenham	Lower East Sydenham	Bear Creek Headwaters	Lower Bear Creek	Black Creek	Lower North Sydenham	Lambton Shores Tributaries	Plympton Shoreline Tributaries	Cow and Perch Creeks	St. Clair River Tributaries	Lake St. Clair Tributaries	No. Subwatersheds Occur
American Badger (Southwestern Ontario population)	END	END						X		X	X	X	X			X	6
Eastern Small-footed Myotis	END	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Little Brown Myotis	END	END	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Northern Myotis	END	END	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Total No. Species			**3**	**3**	**3**	**3**	**3**	**4**	**3**	**4**	**4**	**4**	**4**	**3**	**3**	**4**	

EXP = Extirpated; END = Endangered; DD = Data Deficient; NA = Not Assessed; NAR = Not At Risk;

SC = Special Concern; THR = Threatened

SARO = Species At Risk of Ontario, designated by the Ontario Ministry of Natural Resources (OMNRF) in accordance with the provincial Endangered Species Act (ESA)

COSEWIC = Committee on the Status of Endangered Wildlife in Canada (independent group of experts)

Source: MNRF Natural Heritage Information Centre (NHIC) data; SCRCA records; 1995 to 2015 occurrences

Table 35. Known and potential reptile Species at Risk occurrences by subwatershed

Common Name	SARO	COSEWIC	Sydenham Headwaters	Upper Sydenham River	Brown Creek	Middle East Sydenham	Lower East Sydenham	Bear Creek Headwaters	Lower Bear Creek	Black Creek	Lower North Sydenham	Lambton Shores Tributaries	Plympton Shoreline Tributaries	Cow and Perch Creeks	St. Clair River Tributaries	Lake St. Clair Tributaries	No. Subwatersheds Occur
Blanding's Turtle	THR	END			X		X	X	X	X	X		X		X		8
Butler's Gartersnake	END	END					X	X		X	X		X	X	X		7
Eastern Foxsnake (Carolinian population)	END	END			X		X	X	X		X		X		X	X	8
Eastern Hog-nosed Snake	THR	THR	X				X			X	X						4
Eastern Milksnake	NAR	SC										X					1
Eastern Ribbonsnake	SC	SC										X					1
Gray Ratsnake (Carolinian population)	END	END				X											1
Northern Map Turtle	SC	SC			X											X	2
Queensnake	END	END	X		X			X				X	X				5
Snapping Turtle	SC	SC	X	X		X	X					X			X	X	7
Spiny Softshell	END	END	X	X	X	X	X	X	X	X	X	X		X		X	12
Total No. Species			**4**	**2**	**5**	**3**	**7**	**6**	**4**	**5**	**5**	**6**	**4**	**3**	**5**	**5**	

EXP = Extirpated; END = Endangered; DD = Data Deficient; NA = Not Assessed; NAR = Not At Risk;

SC = Special Concern; THR = Threatened

SARO = Species At Risk of Ontario, designated by the Ontario Ministry of Natural Resources (OMNRF) in accordance with the provincial Endangered Species Act (ESA)

COSEWIC = Committee on the Status of Endangered Wildlife in Canada (independent group of experts)

Source: MNRF Natural Heritage Information Centre (NHIC) data; SCRCA records; 1995 to 2015 occurrences

Table 36. Known and potential fish Species at Risk occurrences by subwatershed

Common Name	SARO	COSEWIC	Sydenham Headwaters	Upper Sydenham River	Brown Creek	Middle East Sydenham	Lower East Sydenham	Bear Creek Headwaters	Lower Bear Creek	Black Creek	Lower North Sydenham	Lambton Shores Tributaries	Plympton Shoreline Tributaries	Cow and Perch Creeks	St. Clair River Tributaries	Lake St. Clair Tributaries	No. Subwatersheds Occur
Blackstripe Topminnow	SC	SC					X	X		X	X						4
Brindled Madtom	NAR	NAR				X	X	X								X	4
Channel Darter	THR	0							X	X	X			X	X	X	6
Eastern Sand Darter	END	THR				X	X	X		X	X						5
Ghost Shiner	NAR	NAR														X	1
Grass Pickerel	SC	SC													X	X	2
Lake Chubsucker	THR	END										X				X	2
Lake Sturgeon (Great Lakes - Upper St. Lawrence River population)	THR	THR													X	X	2
Northern Brook Lamprey	SC	SC													X		1
Northern Madtom	END	END														X	1
Pugnose Minnow	THR	THR									X					X	2
Pugnose Shiner	THR	THR										X				X	2
Silver Chub	THR	END														X	1
Silver Shiner	THR	THR	X														1
Spotted Sucker	SC	SC				X	X	X	X		X				X	X	7
Total No. Species			**1**	**1**	**0**	**4**	**4**	**7**	**5**	**6**	**6**	**3**	**1**	**3**	**6**	**11**	

EXP = Extirpated; END = Endangered; DD = Data Deficient; NA = Not Assessed; NAR = Not At Risk;

SC = Special Concern; THR = Threatened

SARO = Species At Risk of Ontario, designated by the Ontario Ministry of Natural Resources (OMNRF) in accordance with the provincial Endangered Species Act (ESA)

COSEWIC = Committee on the Status of Endangered Wildlife in Canada (independent group of experts)

Source: MNRF Natural Heritage Information Centre (NHIC) data; SCRCA records; 1995 to 2015 occurrences

Table 37. Known and potential mussel Species at Risk occurrences by subwatershed

Common Name	SARO	COSEWIC	Sydenham Headwaters	Upper Sydenham River	Brown Creek	Middle East Sydenham	Lower East Sydenham	Bear Creek Headwaters	Lower Bear Creek	Black Creek	Lower North Sydenham	Lambton Shores Tributaries	Plympton Shoreline Tributaries	Cow and Perch Creeks	St. Clair River Tributaries	Lake St. Clair Tributaries	No. Subwatersheds Occur
Eastern Pondmussel	END	SC		X	X	X		X		X						X	6
Fawnsfoot	END	END				X	X			X	X						4
Kidneyshell	END	END		X			X	X		X	X					X	6
Mapleleaf Mussel	THR	SC				X	X		X	X	X	X		X			7
Northern Riffleshell	END	END		X	X	X		X		X	X						6
Rainbow Mussel	SC	SC				X											1
Rayed Bean	END	END		X	X	X	X	X		X	X					X	8
Round Hickorynut	END	END	X	X		X	X	X		X	X					X	8
Round Pigtoe	END	END		X	X	X	X	X		X	X	X	X			X	10
Salamander Mussel	END	END		X	X	X	X	X		X	X	X	X				9
Snuffbox	END	END		X	X	X	X	X		X	X	X					8
Threehorn Wartyback	THR	THR					X										1
Wavy-rayed Lampmussel	THR	SC		X	X	X	X	X		X	X			X		X	9
Total No. Species			**1**	**9**	**7**	**11**	**10**	**9**	**1**	**11**	**10**	**4**	**2**	**2**	**0**	**6**	

EXP = Extirpated; END = Endangered; DD = Data Deficient; NA = Not Assessed; NAR = Not At Risk;

SC = Special Concern; THR = Threatened

SARO = Species At Risk of Ontario, designated by the Ontario Ministry of Natural Resources (OMNRF) in accordance with the provincial Endangered Species Act (ESA)

COSEWIC = Committee on the Status of Endangered Wildlife in Canada (independent group of experts)

Source: MNRF Natural Heritage Information Centre (NHIC) data; SCRCA records; 1995 to 2015 occurrences

Table 38. Known and potential insect Species at Risk occurrences by subwatershed

Common Name	SARO	COSEWIC	Sydenham Headwaters	Upper Sydenham River	Brown Creek	Middle East Sydenham	Lower East Sydenham	Bear Creek Headwaters	Lower Bear Creek	Black Creek	Lower North Sydenham	Lambton Shores Tributaries	Plympton Shoreline Tributaries	Cow and Perch Creeks	St. Clair River Tributaries	Lake St. Clair Tributaries	No. Subwatersheds Occur
Mottled Duskywing	END	END										X					1
Northern Barrens Tiger Beetle	END	END										X					1
Rusty-patched Bumble Bee	END	END										X		X			2
Total No. Species			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**1**	**0**	**0**	

EXP = Extirpated; END = Endangered; DD = Data Deficient; NA = Not Assessed; NAR = Not At Risk;

SC = Special Concern; THR = Threatened

SARO = Species At Risk of Ontario, designated by the Ontario Ministry of Natural Resources (OMNRF) in accordance with the provincial Endangered Species Act (ESA)

COSEWIC = Committee on the Status of Endangered Wildlife in Canada (independent group of experts)

Source: MNRF Natural Heritage Information Centre (NHIC) data; SCRCA records; 1995 to 2015 occurrences

Table 39. Known and potential plant Species at Risk occurrences by subwatershed

Common Name	SARO	COSEWIC	Sydenham Headwaters	Upper Sydenham River	Brown Creek	Middle East Sydenham	Lower East Sydenham	Bear Creek Headwaters	Lower Bear Creek	Black Creek	Lower North Sydenham	Lambton Shores Tributaries	Plympton Shoreline Tributaries	Cow and Perch Creeks	St. Clair River Tributaries	Lake St. Clair Tributaries	No. Subwatersheds Occur
American Bluehearts	END	END										X					1
American Chestnut	END	END	X	X	X			X	X	X	X	X	X	X	X	X	12
Blue Ash	THR	THR	X		X	X	X	X	X	X	X		X	X	X		11
Broad Beech Fern	SC	SC										X					1
Butternut	END	END	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Climbing Prairie Rose	SC	SC									X				X	X	3
Common Hop-tree	SC	SC							X	X	X			X	X	X	6
Crooked-stem Aster	SC	SC	X														1
Dense Blazing-star	THR	THR					X			X		X			X	X	5
Drooping Trillium	END	END	X			X											2
Dwarf Hackberry	THR	THR										X					1
Eastern False Rue-anemone	THR	THR	X									X					2
Eastern Flowering Dogwood	END	END	X	X	X	X	X	X		X	X	X	X	X		X	12
Eastern Prairie Fringed Orchid	END	END					X									X	2
False Hop Sedge	END	END	X	X				X	X	X	X			X	X		8
Gattinger's False Foxglove	END	END														X	1
Green Dragon	SC	SC	X	X	X				X			X					5
Heart-leaved Plantain	END	END										X					1
Kentucky Coffee-tree	THR	THR		X	X			X	X	X	X			X	X	X	9

Table 39. Known and potential plant Species at Risk occurrences by subwatershed (continued)

Common Name	SARO	COSEWIC	Sydenham Headwaters	Upper Sydenham River	Brown Creek	Middle East Sydenham	Lower East Sydenham	Bear Creek Headwaters	Lower Bear Creek	Black Creek	Lower North Sydenham	Lambton Shores Tributaries	Plympton Shoreline Tributaries	Cow and Perch Creeks	St. Clair River Tributaries	Lake St. Clair Tributaries	No. Subwatersheds Occur
Large Whorled Pogonia	END	END		X		X											2
Pink Milkwort	END	END														X	1
Pitcher's Thistle	THR	SC										X					1
Purple Twayblade	THR	THR				X	X			X	X					X	5
Riddell's Goldenrod	SC	SC		X		X								X		X	4
Shumard Oak	SC	SC									X	X	X				3
Skinner's False Foxglove	END	END														X	1
Small White Lady's-slipper	END	THR					X										1
Spoon-leaved Moss	END	THR							X	X	X			X	X		5
Stiff-leaved Showy Goldenrod	END	END													X		1
Swamp Rose-mallow	SC	SC									X				X	X	3
White Prairie Gentian	END	END													X	X	2
Willow-leaved Aster	THR	THR	X	X				X	X	X						X	6
Wood-poppy	END	END	X														1
Total No. Species			**12**	**10**	**8**	**8**	**9**	**9**	**11**	**12**	**14**	**13**	**7**	**11**	**14**	**17**	

EXP = Extirpated; END = Endangered; DD = Data Deficient; NA = Not Assessed; NAR = Not At Risk; SC = Special Concern; THR = Threatened

SARO = Species At Risk of Ontario, designated by the Ontario Ministry of Natural Resources (OMNRF) in accordance with the provincial Endangered Species Act (ESA)

COSEWIC = Committee on the Status of Endangered Wildlife in Canada (independent group of experts)

Source: MNRF Natural Heritage Information Centre (NHIC) data; SCRCA records; 1995 to 2015 occurrences

Table 40. Fish species occurrences by subwatershed

COMMON NAME	SYDENHAM HEADWATERS	UPPER SYDENHAM RIVER	BROWN CREEK	MIDDLE EAST SYDENHAM	LOWER EAST SYDENHAM	BEAR CREEK HEADWATERS	LOWER BEAR CREEK	BLACK CREEK	LOWER NORTH SYDENHAM	LAMBTON SHORES TRIBUTARIES	PLYMPTON SHORELINE TRIBUTARIES	COW AND PERCH CREEKS	ST. CLAIR RIVER TRIBUTARIES	LAKE ST. CLAIR TRIBUTARIES	NO. SUBWATERSHEDS OCCUR
Alewife (NN)					X				X	X		X	X		5
American Brook Lamprey	X												X		2
Banded Killifish					X				X			X		X	4
Bigmouth Buffalo				X	X		X	X	X						5
Black Bullhead	X	X	X	X	X	X	X	X	X		X	X	X	X	13
Black Crappie	X	X		X	X	X	X	X	X	X			X	X	11
Blackchin Shiner	X				X								X	X	4
Blacknose Dace		X		X		X				X				X	5
Blacknose Shiner								X						X	2
Blackside Darter	X	X	X	X	X	X	X	X	X	X	X		X	X	13
Black Redhorse					X										1
Blackstripe Topminnow	X	X		X	X	X	X	X	X				X	X	10
Bluegill	X	X		X	X	X	X	X	X			X	X	X	11
Bluntnose Minnow	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Bowfin	X				X				X				X	X	5
Brassy Minnow		X		X	X	X		X				X			6
Brindled Madtom		X		X	X	X								X	5
Brook Silverside	X			X	X		X	X		X			X	X	8
Brook Stickleback	X	X		X	X	X	X			X	X	X	X		10
Brown Trout	X												X		2
Brook Lamprey	X												X		2
Brown Bullhead	X		X	X	X	X	X	X				X	X	X	10
Burbot												X			1
Central Mudminnow	X	X		X	X	X	X	X	X	X	X	X	X	X	13

Table 40. Fish species occurrences by subwatershed (continued)

COMMON NAME	SYDENHAM HEADWATERS	UPPER SYDENHAM RIVER	BROWN CREEK	MIDDLE EAST SYDENHAM	LOWER EAST SYDENHAM	BEAR CREEK HEADWATERS	LOWER BEAR CREEK	BLACK CREEK	LOWER NORTH SYDENHAM	LAMBTON SHORES TRIBUTARIES	PLYMPTON SHORELINE TRIBUTARIES	COW AND PERCH CREEKS	ST. CLAIR RIVER TRIBUTARIES	LAKE ST. CLAIR TRIBUTARIES	NO. SUBWATERSHEDS OCCUR
Central Stoneroller	X								X	X			X	X	5
Channel Catfish	X			X	X		X	X	X				X	X	8
Channel Darter									X					X	2
Chinook Salmon	X											X	X		3
Coho Salmon														X	1
Common Carp (NN)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Common Shiner	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Creek Chub	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Eastern Sand Darter		X		X	X				X						4
Emerald Shiner	X			X	X	X	X	X	X	X	X	X	X	X	12
Fantail Darter		X		X	X	X								X	5
Fathead Minnow	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Finescale Dace			X												1
Freshwater Drum	X			X	X		X	X	X				X	X	8
Ghost Shiner	X	X		X	X		X	X	X				X	X	9
Gizzard Shad	X	X		X	X	X	X	X	X	X	X	X	X	X	13
Golden Redhorse	X	X	X	X	X	X	X	X	X				X	X	11
Goldfish (NN)	X			X	X	X		X				X	X	X	8
Golden Shiner	X						X	X		X			X	X	6
Grass Carp												X	X		2
Grass Pickerel					X									X	2
Greater Redhorse					X	X							X		3
Green Sunfish	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Greenside Darter		X	X	X	X	X	X	X						X	8

Table 40. Fish species occurrences by subwatershed (continued)

COMMON NAME	SYDENHAM HEADWATERS	UPPER SYDENHAM RIVER	BROWN CREEK	MIDDLE EAST SYDENHAM	LOWER EAST SYDENHAM	BEAR CREEK HEADWATERS	LOWER BEAR CREEK	BLACK CREEK	LOWER NORTH SYDENHAM	LAMBTON SHORES TRIBUTARIES	PLYMPTON SHORELINE TRIBUTARIES	COW AND PERCH CREEKS	ST. CLAIR RIVER TRIBUTARIES	LAKE ST. CLAIR TRIBUTARIES	NO. SUBWATERSHEDS OCCUR
Hornyhead Chub	X			X	X	X							X	X	6
Hydrid Sunfish	X												X		2
Iowa Darter													X	X	2
Johnny Darter	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Lake Chubsucker														X	1
Lake Herring	X												X		2
Lake Sturgeon															0
Lake Whitefish												X			1
Largemouth Bass	X	X		X	X	X	X	X	X	X			X	X	11
Least Darter		X	X	X	X	X				X	X	X		X	9
Logperch	X	X	X	X	X	X	X	X	X	X	X		X	X	13
Longear Sunfish		X	X	X	X	X	X	X						X	8
Longnose Gar	X			X	X	X	X	X	X	X			X	X	10
Longnose Dace											X				1
Longnose Sucker						X									1
Mimic Shiner	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Mudpuppy						X									1
Mottled Sculpin	X	X			X								X	X	5
Mooneye	X			X	X				X				X		5
Muskellunge					X						X	X			3
Northern Hog Sucker		X		X	X	X			X				X		6
Northern Madtom				X	X										2
Northern Pike	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Northern Sunfish		X	X	X	X	X		X	X					X	8

Table 40. Fish species occurrences by subwatershed (continued)

COMMON NAME	SYDENHAM HEADWATERS	UPPER SYDENHAM RIVER	BROWN CREEK	MIDDLE EAST SYDENHAM	LOWER EAST SYDENHAM	BEAR CREEK HEADWATERS	LOWER BEAR CREEK	BLACK CREEK	LOWER NORTH SYDENHAM	LAMBTON SHORES TRIBUTARIES	PLYMPTON SHORELINE TRIBUTARIES	COW AND PERCH CREEKS	ST. CLAIR RIVER TRIBUTARIES	LAKE ST. CLAIR TRIBUTARIES	NO. SUBWATERSHEDS OCCUR
Northern Redbelly Dace	X	X		X	X	X				X	X	X	X	X	10
Northern Pearl Dace		X				X				X					3
Ninespine Stickleback	X												X		2
Pugnose Minnow					X		X		X					X	4
Pugnose Shiner	X												X	X	3
Pumpkinseed	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Quillback		X		X	X		X	X	X		X			X	8
Rainbow Darter	X			X	X	X				X	X	X	X	X	9
Rainbow Smelt	X									X		X	X	X	5
Rainbow Trout (NN)	X	X		X						X	X	X	X		7
Redfin Shiner	X	X	X	X	X	X	X	X	X		X	X	X	X	13
River Chub		X		X	X										3
River Redhorse		X													1
River Darter					X		X		X						3
Rock Bass	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Rosyface Shiner	X	X		X	X	X							X		6
Round Goby (NN)	X				X				X	X	X	X	X	X	8
Sand Shiner	X			X		X			X		X		X	X	7
Sea Lamprey															0
Shorthead Redhorse	X	X		X	X	X	X	X	X				X	X	10
Silver Bass															0
Silver Lamprey	X												X		2
Silver Redhorse		X		X	X	X	X	X						X	7
Smallmouth Bass	X			X	X	X			X	X	X	X	X	X	10

Table 40. Fish species occurrences by subwatershed (continued)

COMMON NAME	SYDENHAM HEADWATERS	UPPER SYDENHAM RIVER	BROWN CREEK	MIDDLE EAST SYDENHAM	LOWER EAST SYDENHAM	BEAR CREEK HEADWATERS	LOWER BEAR CREEK	BLACK CREEK	LOWER NORTH SYDENHAM	LAMBTON SHORES TRIBUTARIES	PLYMPTON SHORELINE TRIBUTARIES	COW AND PERCH CREEKS	ST. CLAIR RIVER TRIBUTARIES	LAKE ST. CLAIR TRIBUTARIES	NO. SUBWATERSHEDS OCCUR
Spotfin Shiner	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Spottail Shiner	X	X		X	X	X	X	X	X	X	X	X	X	X	13
Spotted Gar					X										1
Spotted Sucker				X	X	X	X	X	X				X	X	8
Stonecat	X	X	X	X	X	X	X	X	X				X	X	11
Striped Shiner	X	X		X	X			X				X	X	X	8
Tadpole Madtom	X			X	X	X	X	X	X				X	X	9
Threespine Stickleback	X												X	X	3
Trout-Perch	X	X		X	X		X		X	X			X	X	9
Tubenose Goby (NN)	X								X				X	X	4
Walleye	X			X	X		X		X				X	X	7
White Bass				X	X			X	X			X			5
White Crappie	X	X	X		X	X	X	X	X			X	X	X	11
White Perch	X			X	X	X	X		X				X	X	8
White Sucker	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Yellow Bullhead	X		X	X	X	X	X	X	X				X	X	10
Yellow Perch	X	X		X	X	X	X	X	X			X	X	X	11
Total No. Species	**70**	**52**	**27**	**68**	**79**	**58**	**51**	**51**	**58**	**37**	**32**	**42**	**76**	**76**	

NN = Non-native species

Notes: There are a total of 110 fish species present in the St. Clair Region – 104 of which are native and 6 of which are non-native (NN: Alewife, Common Carp, Goldfish, Rainbow Trout, Round Goby, Tubenose Goby).

Based on sampling records from: SCRCA; Mark Poos, Department of Fisheries and Oceans; Ministry of Natural Resources and Forestry; Royal Ontario Museum.

Table 41. Mussel species occurrences by subwatershed

COMMON NAME	SYDENHAM HEADWATERS	UPPER SYDENHAM RIVER	BROWN CREEK*	MIDDLE EAST SYDENHAM	LOWER EAST SYDENHAM	BEAR CREEK HEADWATERS	LOWER BEAR CREEK	BLACK CREEK	LOWER NORTH SYDENHAM	LAMBTON SHORES TRIBUTARIES	PLYMPTON SHORELINE TRIBUTARIES	COW AND PERCH CREEKS	ST. CLAIR RIVER TRIBUTARIES	LAKE ST. CLAIR TRIBUTARIES	NO. SUBWATERSHEDS OCCUR
Black Sandshell		X		X	X										3
Creek Heelsplitter						X									1
Creeper		X				X				X					3
Cylindrical Papershell										X	X				2
Deertoe		X		X	X	X	X	X	X						7
Eastern Pondmussel														X	1
Eastern Floater													X		1
Elktoe		X		X	X		X								4
Fatmucket		X		X		X	X	X	X					X	7
Fawnsfoot					X		X								2
Flutedshell		X		X	X		X	X							5
Fragile Papershell		X		X	X	X	X	X	X				X		8
Giant Floater	X	X		X	X	X	X	X	X	X	X	X	X		12
Kidneyshell		X		X											2
Lilliput								X	X						2
Mapleleaf		X		X	X	X	X	X				X	X		8
Mucket		X		X	X	X									4
Northern Riffleshell				X	X										2
Paper Pondshell							X		X			X	X		4
Pimpleback				X	X										2
Pink Heelsplitter					X	X		X				X	X		5
Plain Pocketbook		X		X		X									3
Purple Wartyback		X		X	X										3
Rainbow Mussel						X								X	2

Table 41. Mussel species occurrences by subwatershed (continued)

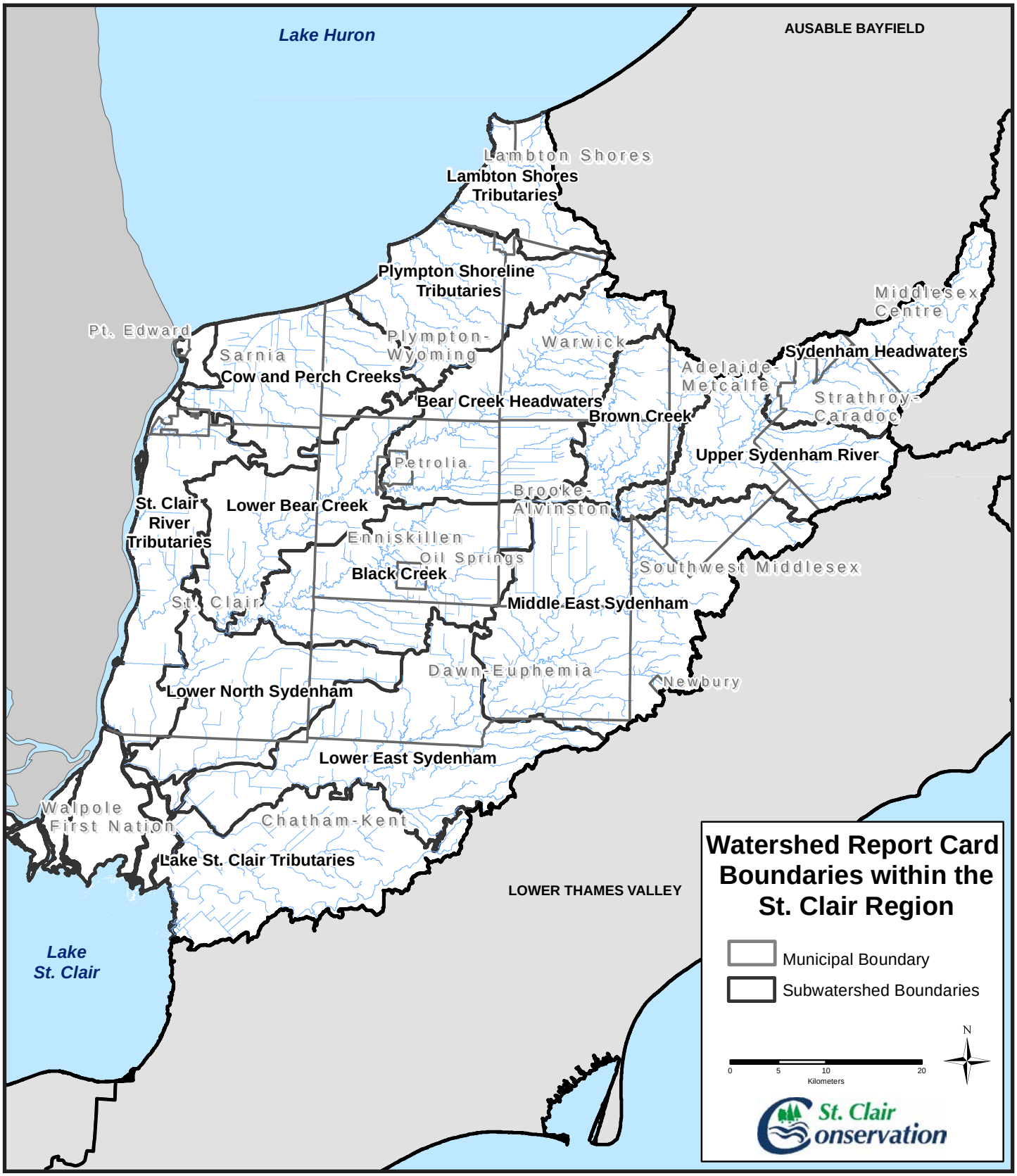
COMMON NAME	SYDENHAM HEADWATERS	UPPER SYDENHAM RIVER	BROWN CREEK*	MIDDLE EAST SYDENHAM	LOWER EAST SYDENHAM	BEAR CREEK HEADWATERS	LOWER BEAR CREEK	BLACK CREEK	LOWER NORTH SYDENHAM	LAMBTON SHORES TRIBUTARIES	PLYMPTON SHORELINE TRIBUTARIES	COW AND PERCH CREEKS	ST. CLAIR RIVER TRIBUTARIES	LAKE ST. CLAIR TRIBUTARIES	NO. SUBWATERSHEDS OCCUR
Rayed Bean				X	X										2
Round Hickorynut		X			X										2
Round Pigtoe		X		X		X	X								4
Salamander/ Mudpuppy Mussel				X	X	X									3
Snuffbox				X	X										2
Spike		X		X		X	X		X						5
Threehorn Wartyback															0
Threeridge		X		X	X	X	X	X						X	7
Wabash Pigtoe		X		X		X								X	4
White Heelsplitter	X	X		X	X	X	X	X			X	X			9
Total No. Species	**2**	**19**	*****	**22**	**19**	**17**	**13**	**10**	**7**	**3**	**3**	**5**	**6**	**5**	

**Lack of mussel records due to lack of sampling effort.*

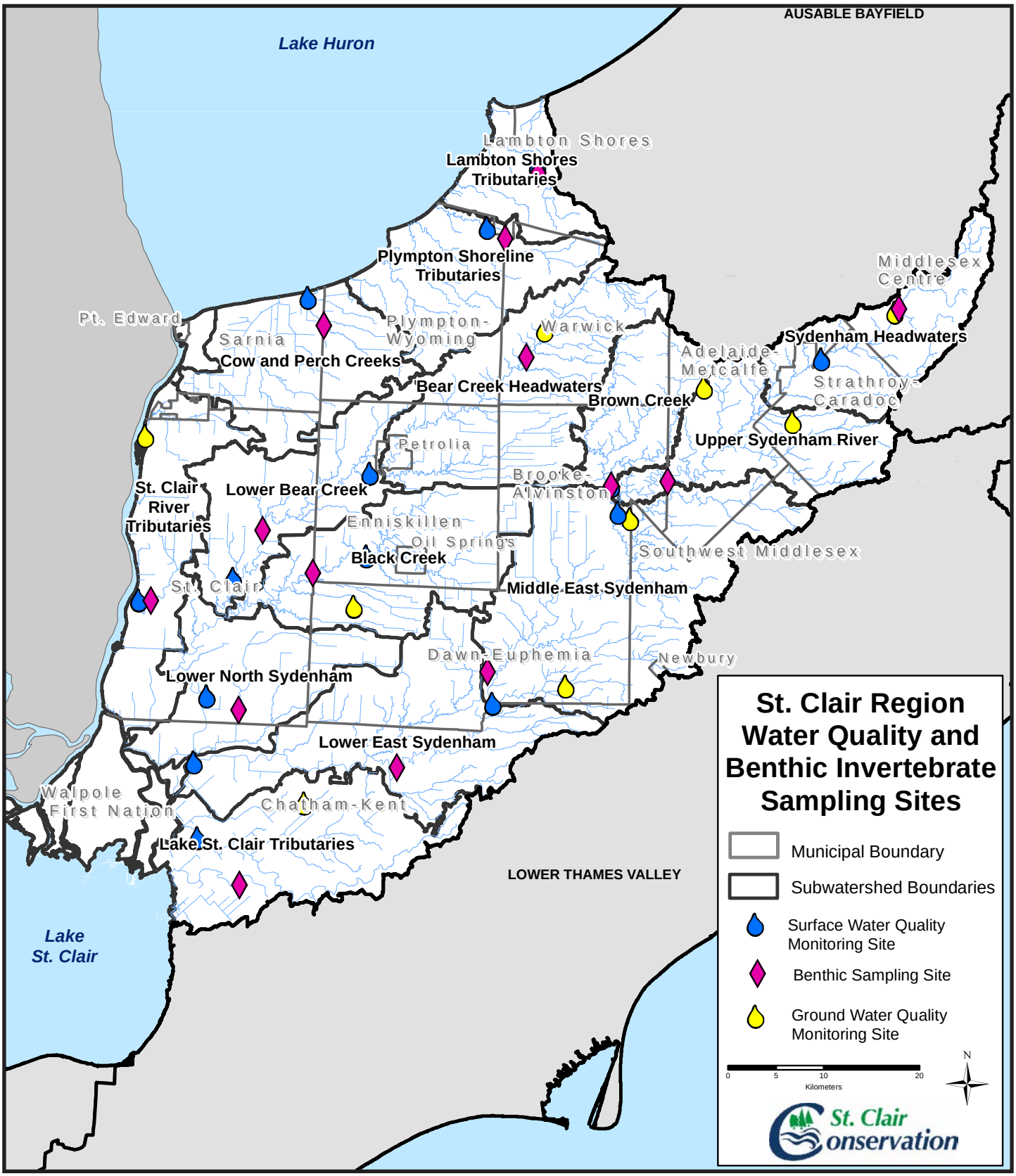
Note: Total of 33 native species recorded live in subwatersheds

Based on sampling records from: SCRCA; Department of Fisheries and Oceans; Royal Ontario Museum; Ecosearch Inc.

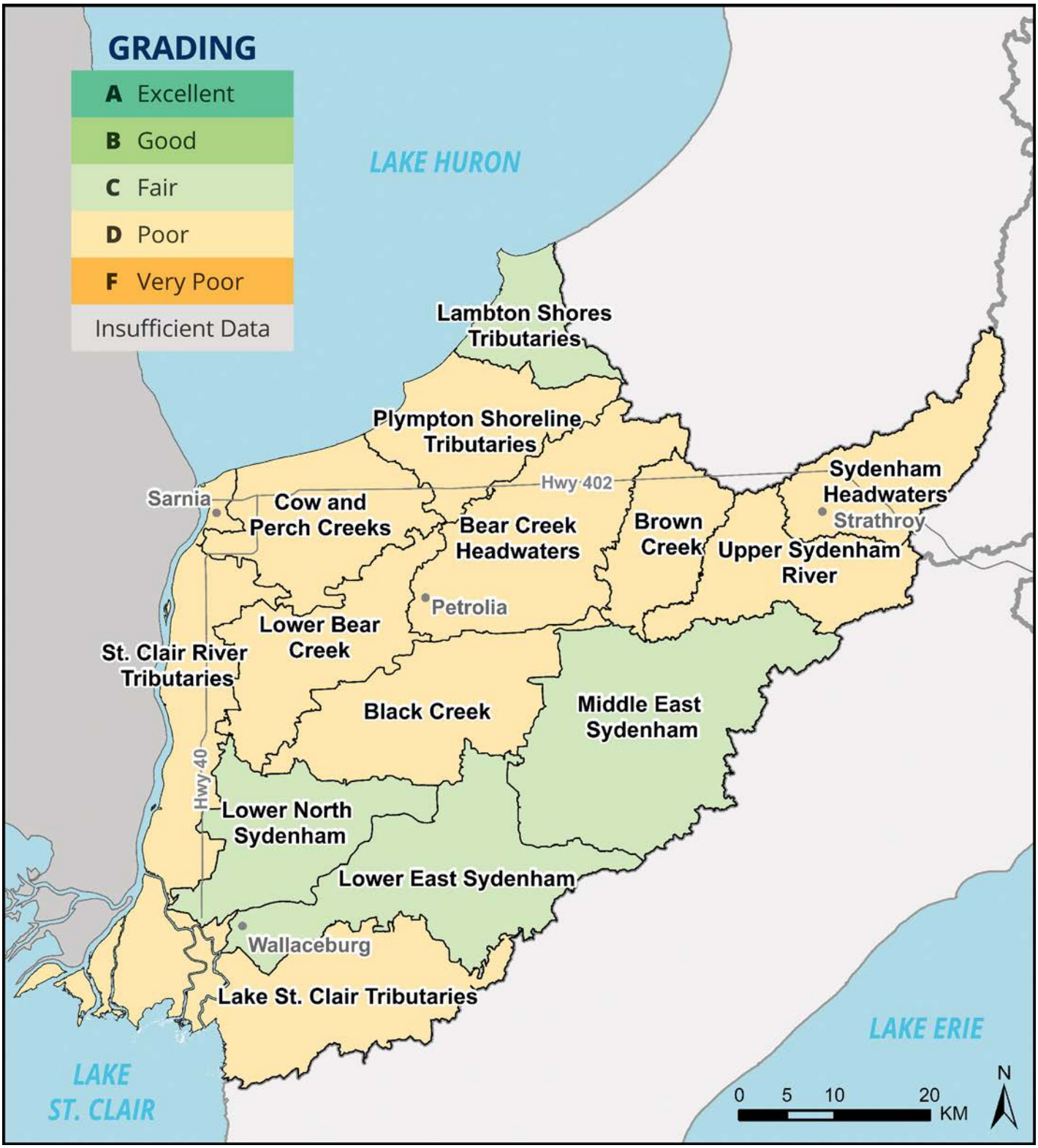
Map 1. Boundaries of the 14 subwatersheds within the St. Clair Region



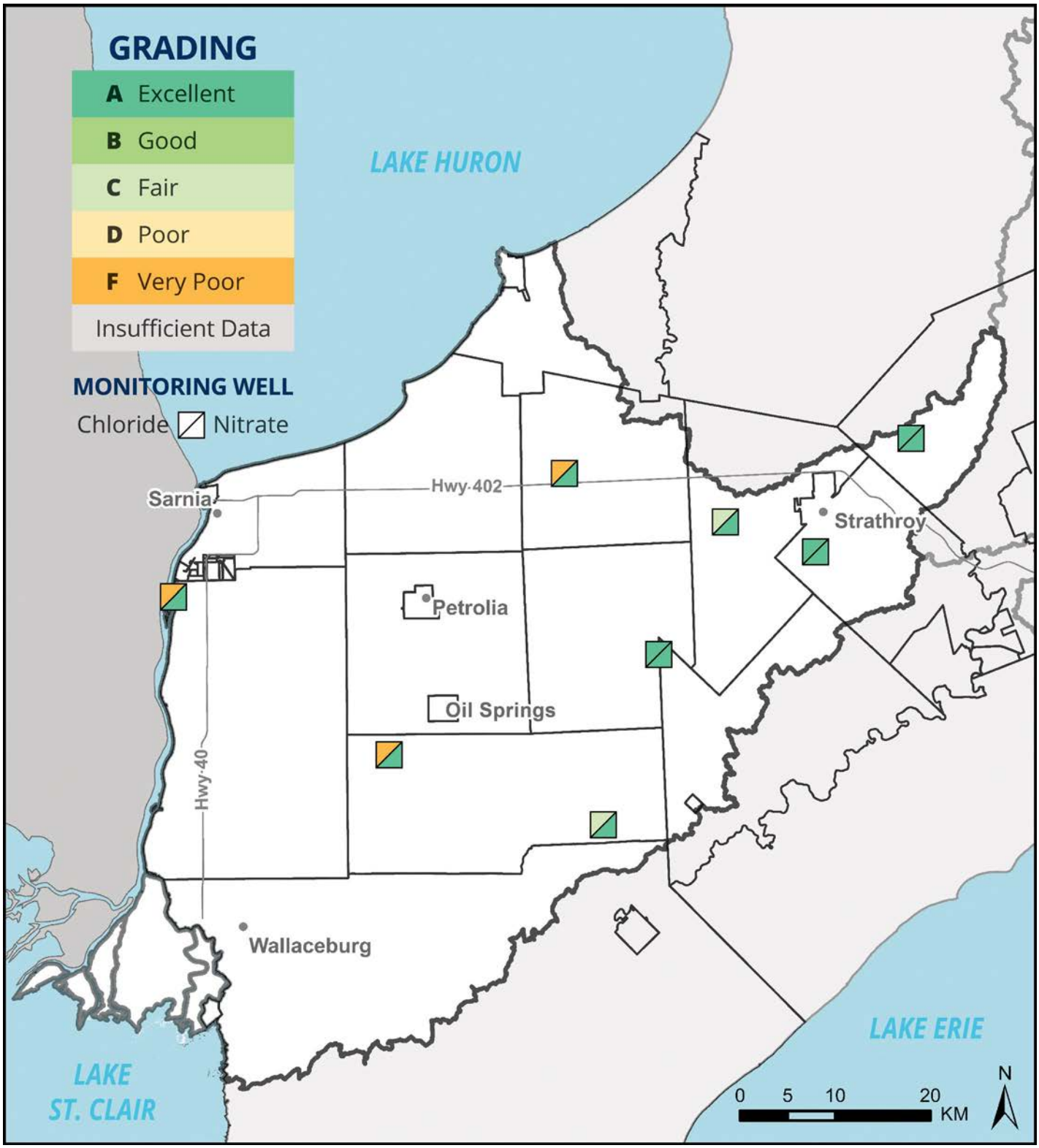
Map 2. Locations of water quality and benthic sampling sites in the St. Clair Region



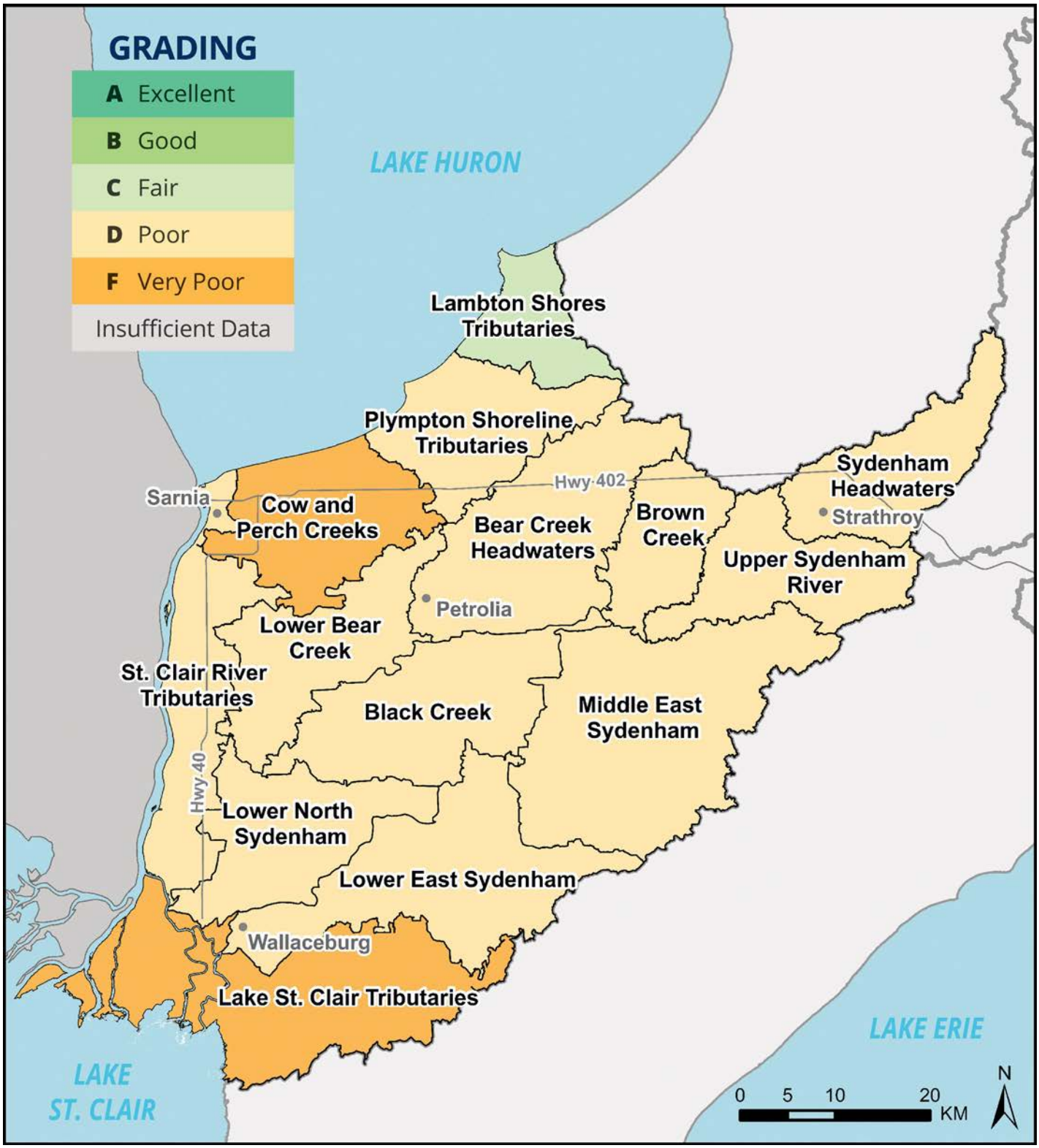
Map 3. Overall surface water quality grades by subwatershed



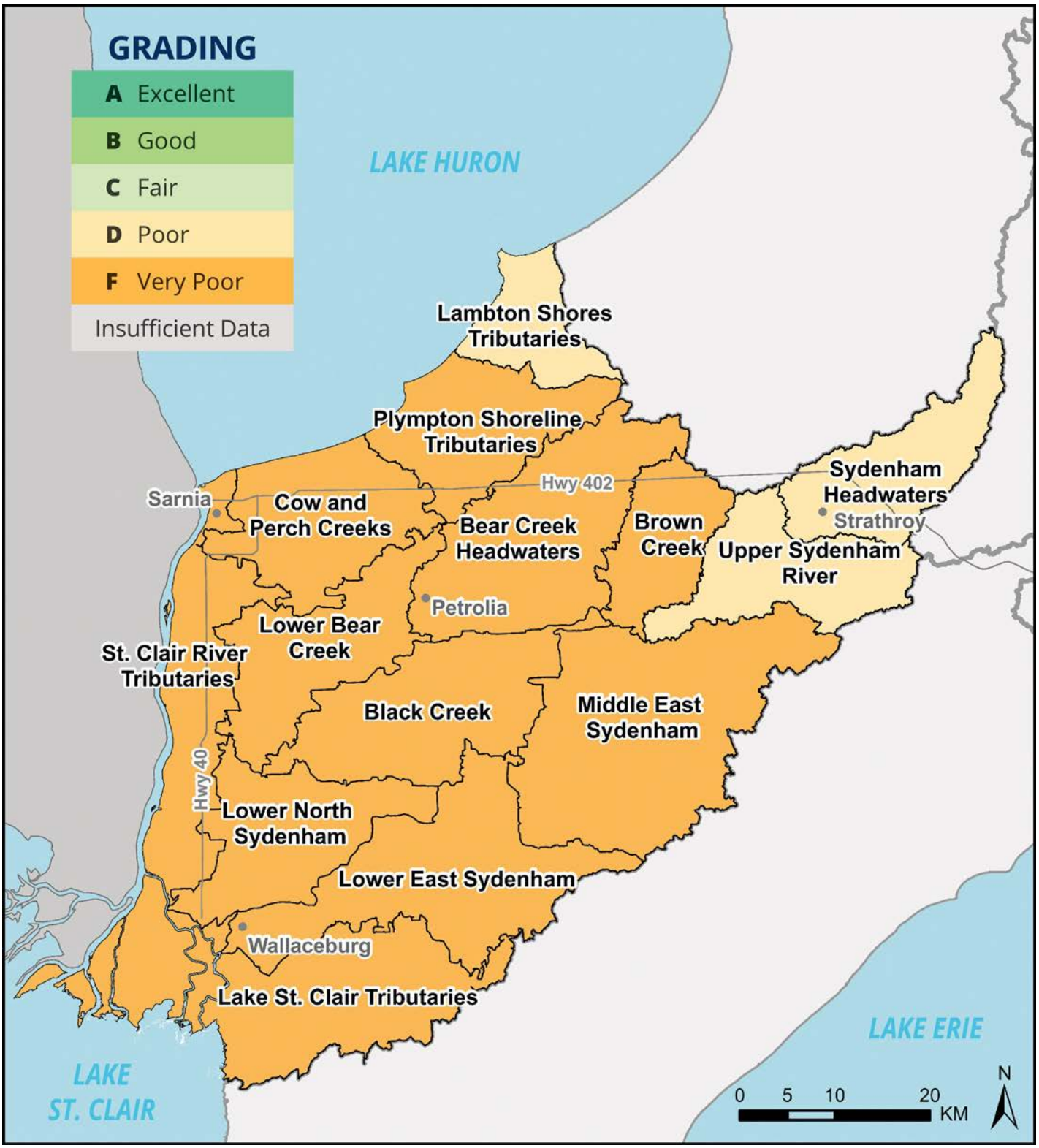
Map 4. Groundwater quality monitoring well sites and grades



Map 5. Overall forest condition grades by subwatershed



Map 6. Wetland cover grades by subwatershed



**Wetland cover calculations do not include First Nations land*

Section 3: Summary Report Cards

A. St. Clair Region Summary Watershed Report Card

B. Subwatershed Report Cards

1. Sydenham Headwaters
2. Upper Sydenham River
3. Brown Creek
4. Middle East Sydenham
5. Lower East Sydenham
6. Bear Creek Headwaters
7. Lower Bear Creek
8. Black Creek
9. Lower North Sydenham
10. Lambton Shores Tributaries
11. Plympton Shoreline Tributaries
12. Cow and Perch Creeks
13. St. Clair River Tributaries
14. Lake St. Clair Tributaries