Ausable Bayfield

SURFACE WATER QUALITY

Rivers, creeks, surface drainage, wetlands, and lakes are common sources of surface water. Having clean and reliable surface water is important for health, recreation, agriculture, and as freshwater habitat.

Our surface water monitoring began in 1964. Current programs focus on monitoring, maintaining and improving water quality. For this report, surface water samples were collected at nine sites through the Provincial Water Quality Monitoring Network (PWQMN). The remaining seven watersheds were sampled as part of an enhanced monitoring program and monitoring in the Bayfield North subwatershed (Map 5, Appendix A).

In most subwatersheds, surface water sampling of total phosphorus, *Escherichia coli* (E. coli), and chloride occurred once per month from March to November, while benthic invertebrate sampling occurred once per year in autumn.

Map 5: Surface water quality monitoring sites in the Ausable Bayfield Conservation Authority area.

Total Phosphorus

Phosphorus is an important nutrient for aquatic plants. Fish and other organisms in the food web rely on those plants. When phosphorus becomes too plentiful, rapid growth of algae and aquatic plants may occur. This process, called eutrophication, may deplete oxygen and thereby damage ecosystems by killing fish and making drinking water unsafe to drink. To prevent eutrophication, the Provincial Water Quality Objective set by the Ontario Ministry of the Environment, Conservation and Parks (MECP) is a total phosphorus concentration of less than 0.03 milligrams (mg) per litre (L).

Sources of phosphorus may be natural or anthropogenic (resulting from human activity), and include soil and organic matter, wildlife waste, detergents, faulty septic systems, and runoff from agricultural fields or fertilized lawns.

Methods – Total Phosphorus

Water samples were analyzed for total phosphorus monthly from March to November at one site per subwatershed over a five-year period (2017-2021) (Appendix A).

The 75th percentile was converted to a point score and a grade for each subwatershed according to Conservation Ontario guidelines (2022) (Table 4). The 75th percentile phosphorus concentration was calculated for each site and represents the value below which 75% of the values occur. The 75th percentile was used instead of a median (*i.e.*, 50th percentile) to account for the tendency of samples to be collected during dry weather. (Samples taken during drier weather do not capture the elevated levels of total phosphorus during storms.)

In addition to this five-year summary, long-term trends were assessed for March 2000 to November 2021. Linear regression was used to evaluate the trends in monthly concentrations for normally distributed datasets, whereas a Mann-Kendall test was used for non-normally distributed datasets. Trends were found to be statistically significant when the magnitude of the change was large relative to the variation of the data around the trend line (*i.e.*, p-value < 0.05).

Table 4. Surface water quality indicator scoring and grading (adapted from Conservation Ontario).

Total Phosphorus (mg/L) – 75th Percentile	*Escherichia coli* (cfu*/100 mL) – Geometric Mean	Benthic Invertebrates (Modified Family Biotic Index†)	Point Score	Grade
<0.020	0-30	<4.25	5	A
0.020-0.030	31-100	4.26-5.00	4	B
0.031-0.060	101-300	5.01-5.75	3	C
0.061-0.180	301-1000	5.76-6.50	2	D
>0.180	>1000	6.51-10.00	1	F

* cfu – colony forming units
† based on New York State tolerance values

Results – Total Phosphorus

Two of the 16 subwatersheds (Old Ausable Channel and Bayfield North) met the Provincial Water Quality Objective of less than 0.03 mg/L (Figure 1). Grades ranged from A to D, with most subwatersheds receiving C or D grades.

An increase in water flow can result in higher levels of phosphorus delivery to watercourses. Without flow data, it is challenging to determine trends over time. Regardless of the constraints, we understand that it is important for the community to know if water quality is improving. Analysis of a long-term dataset of the entire Ausable Bayfield Conservation Authority (ABCA) area showed that there has not been significant change in total phosphorus concentrations over the past 18 years. On a more local scale, there has been significant long-term improvement of concentrations in the Upper Ausable subwatershed. The Ausable Headwaters, Nairn Creek, Lower Ausable, and Mud Creek subwatersheds have seen significant increasing trends in total phosphorus concentrations, indicating worsening conditions. All other subwatersheds have not experienced significant change in total phosphorus concentrations.

High sediment levels (bottle at left) can be associated with elevated phosphorus concentrations.

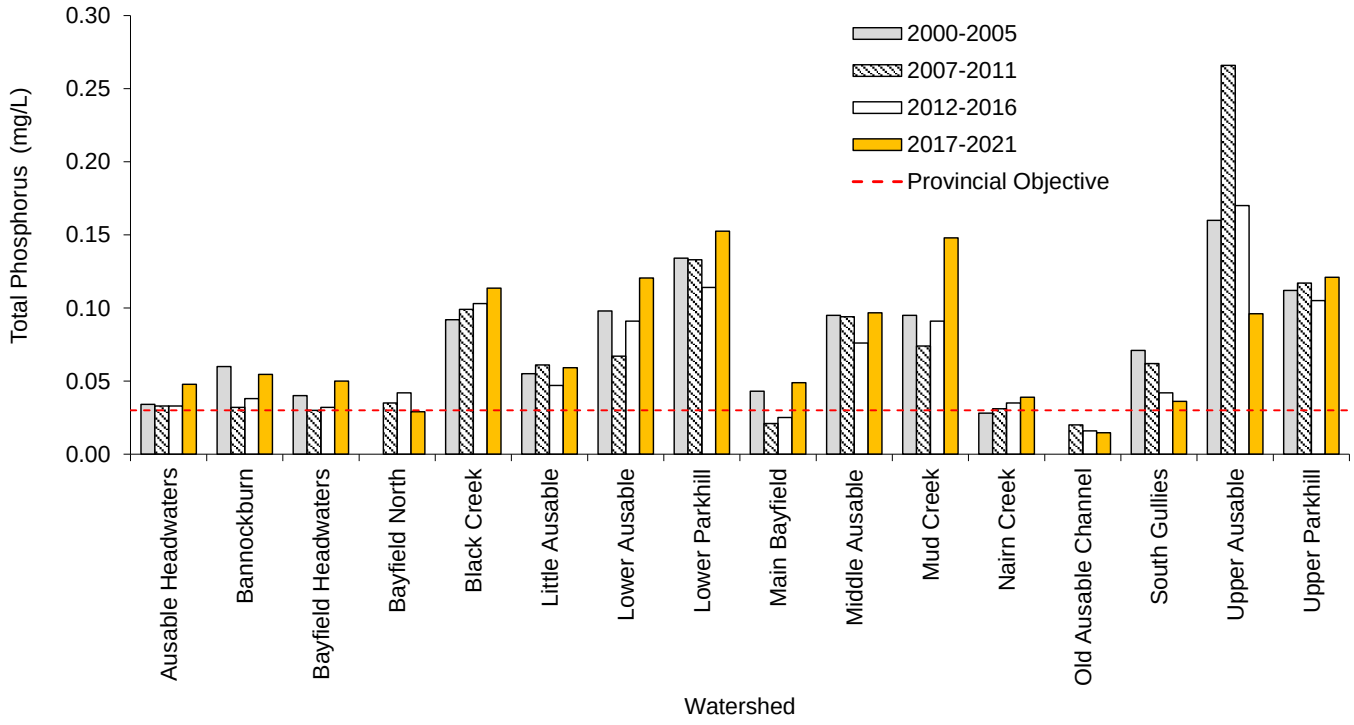


Figure 1: Total phosphorus concentrations in the Ausable Bayfield Conservation Authority area. The dotted red line represents the Provincial Water Quality Objective (0.03 mg/L).

Ausable Bayfield Conservation Authority staff monitor E. coli in streams and rivers, as well as Lake Huron, as upstream surface water is connected to the lake where we swim, fish and obtain drinking water for treatment.

Escherichia coli

Escherichia coli (E. coli) are fecal coliform bacteria commonly found in the intestines of animals and humans. The presence of E. coli in water indicates recent sewage or animal waste contamination, and that there is potential for other disease-causing organisms to exist.

Methods – *Escherichia coli*

Water samples were analyzed for E. coli monthly from March to November at one site per subwatershed over a five-year period (2017-2021) (Appendix A). The geometric mean was used, as opposed to average, to calculate E. coli concentrations for each site as it best represents the true conditions when a set of numbers covers a wide range. A geometric mean is calculated as the *n*th root of the product of *n* numbers. The geometric mean concentration of E. coli was then converted to a point score and grade for each subwatershed according to Conservation Ontario guidelines (2022) (Table 4).

In addition to this five-year summary, long-term trends were assessed for March 2000 to November 2021. Linear regression, which is used to determine the relationship between two variables, was used to evaluate the trends in monthly concentrations for normally distributed datasets. Trends were statistically statistically significant when the magnitude of the change was large relative to the variation of the data around the trend line (*i.e.*, p-value < 0.05).

Results – *Escherichia coli*

Eleven of 16 subwatersheds met the recreational guideline of a geometric mean concentration less than or equal to 200 cfu/100 mL (cfu stands for colony forming unit that estimates the number of microbial cells in a sample) (Figure 2). Grades ranged from A to D, with most subwatersheds receiving a C grade. Some high E. coli concentrations were detected, which may suggest a local point source, but grades suggest concentrations are 'fair' across much of the ABCA area.

Generally, E. coli concentrations appear to have improved over the past fifteen years. Further analysis shows that the Bayfield North and Black Creek subwatersheds had significant decreasing trends *(i.e.*, improvement) in annual geometric mean concentrations. This result is based on 19 years of data for the Black Creek subwatershed (2003–2021), and seven years of data for the Bayfield North subwatershed (2011–2012, 2017–2021). The Old Ausable Channel (OAC) and Mud Creek subwatersheds had increasing trends (*i.e.*, worsening conditions) over the same 19-year period. Although the OAC subwatershed has seen a significant increase, E. coli concentrations remain low and meet the requirements for an A grade. The OAC was the only subwatershed to receive an A grade.

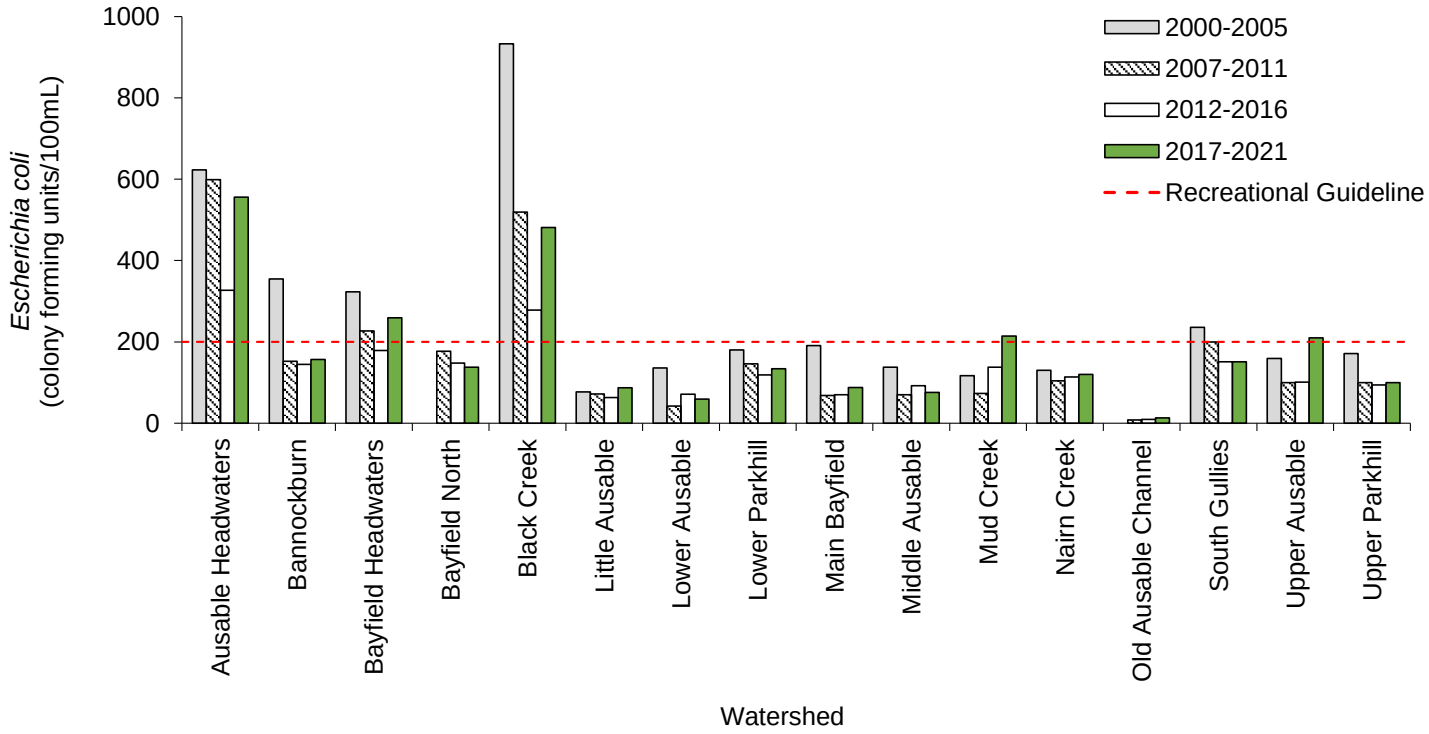


Figure 2: *Escherichia coli* (E. coli) concentrations in the Ausable Bayfield Conservation Authority area. The dotted red line represents the Recreational Water Quality Guideline (200 cfu/100 mL)

Ausable Bayfield Conservation Authority staff kick up sediment on the bottom of a river to collect benthic invertebrates in a net, which are then identified to determine water quality.

Benthic Macroinvertebrates

Benthic macroinvertebrates are commonly used as indicators of aquatic environmental quality. Invertebrates are animals without backbones, such as insects, crustaceans, mollusks, and worms. 'Benthic' refers to the bottom of lakes and rivers, where these invertebrates are found. 'Macro' refers to the subset of larger or visible invertebrates that can be seen without the use of a microscope.

Methods – Benthic Invertebrates

Each species that makes up a benthic community will have a different tolerance to the variety of stressors and pollutants that may be present in the local environment. Tolerance values between zero and 10 can be assigned to these animals, with zero meaning intolerant to pollution and 10 meaning tolerant. The presence of pollution-intolerant species generally indicates a healthy aquatic environment.

A stonefly is an example of a benthic macroinvertebrate that indicates good water quality.

Tolerance values were used to calculate the Hilsenhoff 1988 Family Biotic Index (FBI), as modified by New York State (Smith *et al*. 2009). The FBI index provided a score for each subwatershed (Table 4) that reflected the environmental quality.

Benthic monitoring sites are now sampled on an annual basis; however, some sites had been sampled on an alternating year schedule in the past. The Lower Parkhill subwatershed used a different sampling site (HPDESJ1) than previous years due to high water levels at the former monitoring site. In addition, there is no benthic invertebrate monitoring site for the Old Ausable Channel subwatershed as this habitat is more like a wetland, and the other sites are riverine.

Results – Benthic Invertebrates

The benthic invertebrate scores for most subwatersheds decreased slightly compared with the scores from the 2018 report card, which means a minor shift towards better conditions. The FBI values were generally between four and six, indicating that there were a variety of animals (both tolerant and intolerant to organic pollution) at each monitoring site. Grades ranged from B to F, with most subwatersheds receiving a C grade (Figure 3).

The Main Bayfield (4.80), Nairn Creek (4.92), and Upper Parkhill (4.94) subwatersheds received B grades. Of all the subwatersheds, Bayfield North saw the greatest change since the 2018 report card, dropping from a B grade to a D. The Mud Creek subwatershed had the highest FBI value (6.80) and an F grade, suggesting that this site was more degraded than other sites.

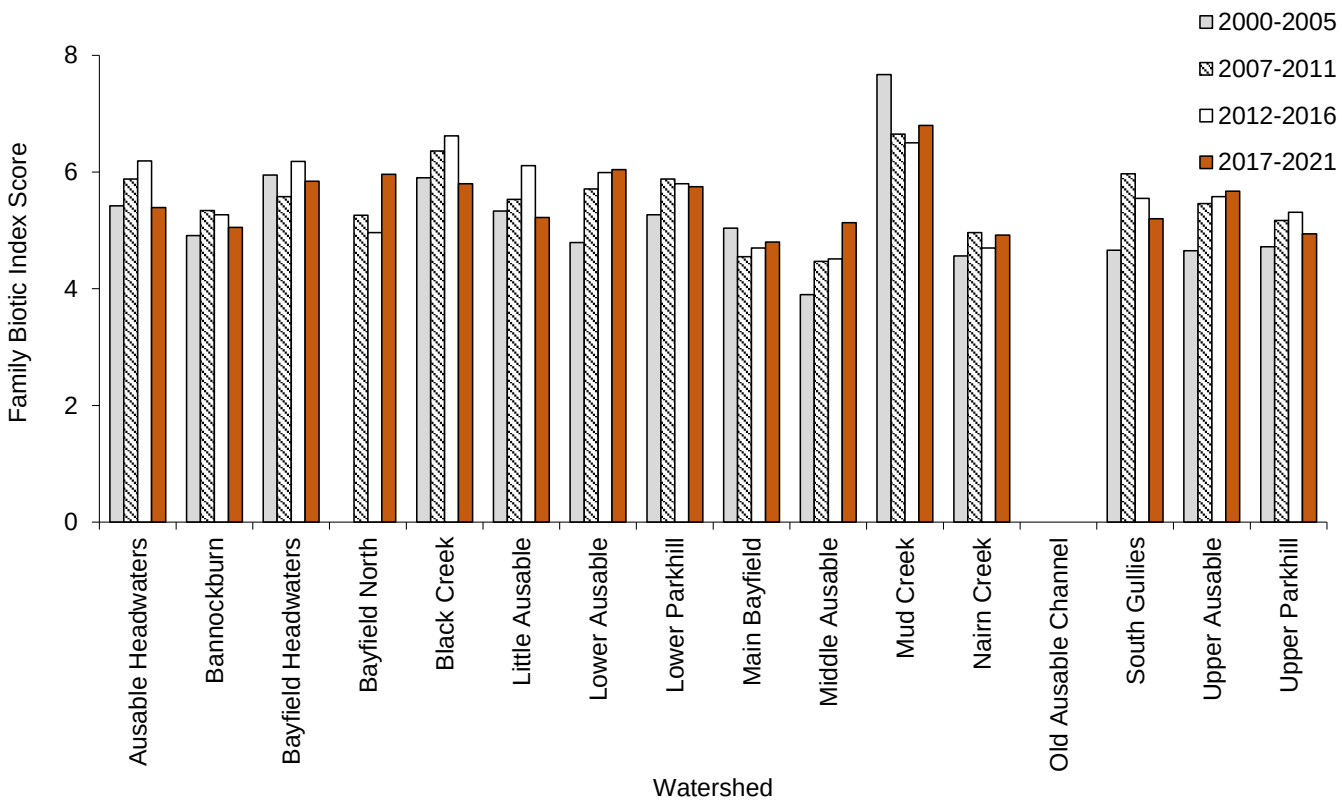


Figure 3: Benthic invertebrate Family Biotic Index (FBI) scores in the Ausable Bayfield Conservation Authority area. A score of 1 represents a healthy watershed and a score of 10 represents a degraded watershed.

Excess chloride can degrade habitat for the Redside Dace (above) and other fish species. Effective use of salt (Sodium chloride) is one tool to melt ice on roads, parking lots and sidewalks, but overuse can negatively impact both surface and groundwater quality.

Chloride

An average of five million tonnes of salts are used as de-icers on roadways in Canada every year (Environment and Climate Change Canada 2022). Salt escapes from salt storage facilities and snow disposal sites by way of roadways and enters the environment in runoff from roadways. This can have major impacts on freshwater ecosystems, soil, and human health.

We must use practices that keep the public safe during icy conditions while, at the same time, protecting aquatic systems and drinking water sources.

Methods – Chloride

The 75th percentile of chloride concentration is reported as milligrams per litre (mg/L) for each subwatershed over a five-year period (2017–2021; March–November). Chloride was measured only at Provincial Water Quality Monitoring Network (PWQMN) sites, meaning that chloride results are available for nine of the 16 subwatersheds. These results were compared to the chronic exposure guideline of 120 mg/L (Canadian Council of Ministers of the Environment 2011).

This is the first time that chloride has been included in a Watershed Report Card as an indicator of surface water quality. At this time, it is considered an optional indicator, and, therefore, was not given a grade or included in the calculations of overall surface water quality (Conservation Ontario 2022).

Results – Chloride

Surface water chloride concentrations ranged from 28.5 mg/L in the Lower Parkhill subwatershed to 60.7 mg/L in the Bayfield Headwaters subwatershed. All subwatersheds were well below the chronic exposure guideline of 120 mg/L, an unsurprising result given the relatively low road density and paved surfaces in this area compared with more urban centres. Although chloride concentrations were relatively low, chloride concentrations appear to be increasing in some subwatersheds, particularly Bayfield Headwaters and Black Creek (Figure 4).

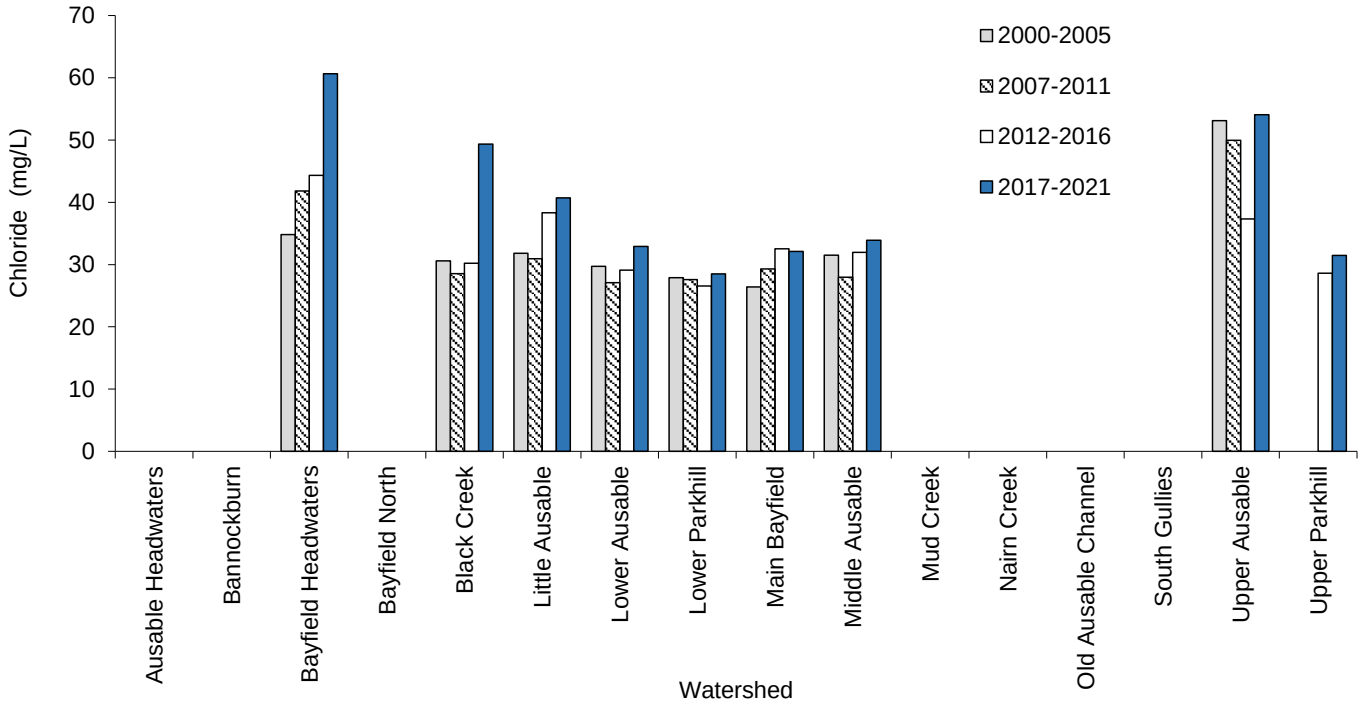


Figure 4: Surface water chloride concentrations (mg/L) in the Ausable Bayfield Conservation Authority area. Chloride is measured at Provincial Water Quality Monitoring Network sites.

Overall Surface Water Quality

The point scores for each water quality indicator (total phosphorus, E. coli, and benthic invertebrates) were averaged to determine an overall point score for a subwatershed. This point score was then given a final grade for each subwatershed according to Table 5. Based on these calculations, 12 out of 16 subwatersheds received C grades, indicating 'fair' surface water quality.

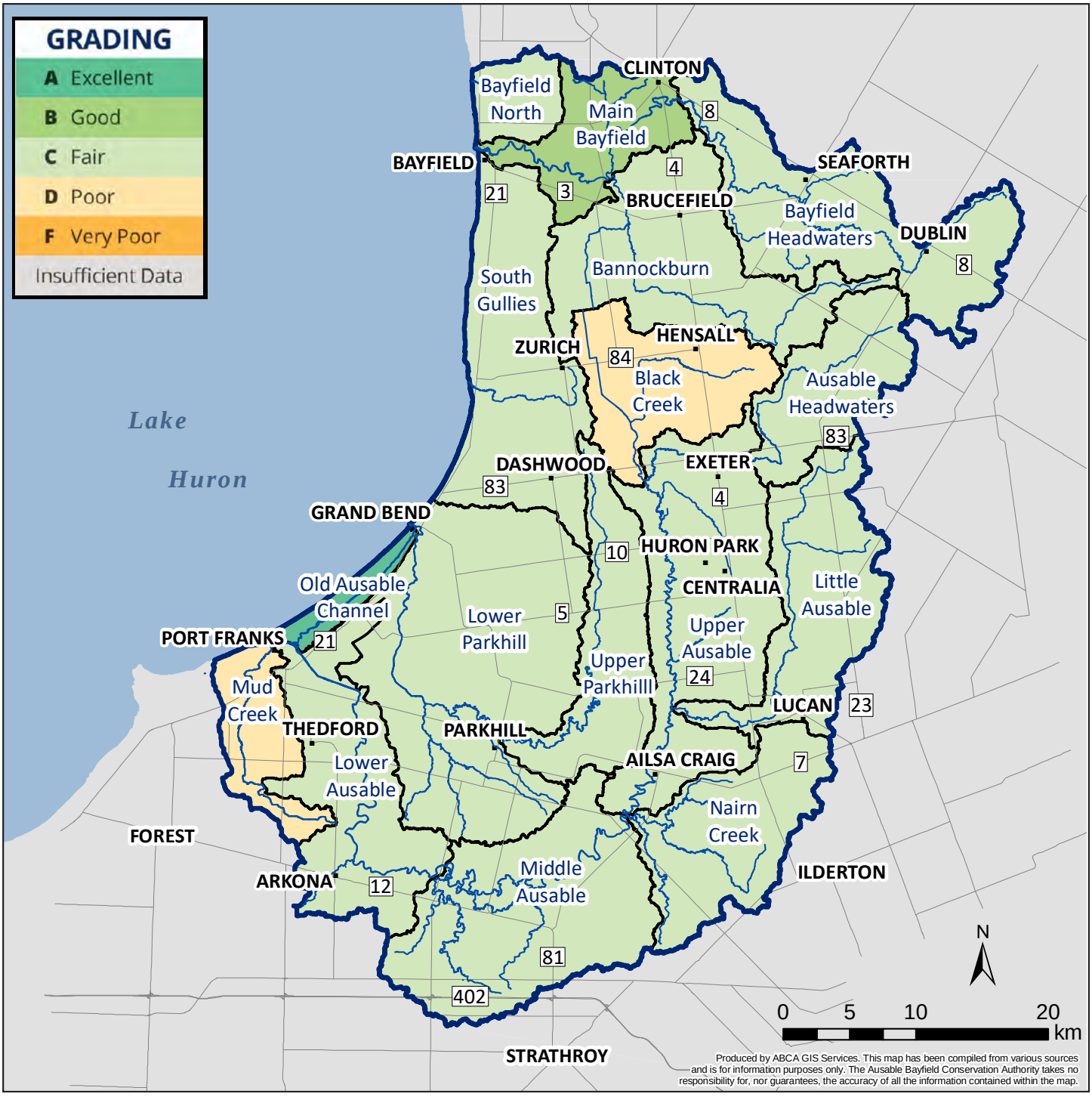
Only the Old Ausable Channel subwatershed received an A grade for overall surface water quality. Water quality was 'excellent' within the channel, most of which is within Pinery Provincial Park (Map 6).

Main Bayfield was the only subwatershed to receive a B grade which indicates 'good' water quality. Detailed studies in this subwatershed have been ongoing since 2013 as this area is a priority watershed for the *Healthy Lake Huron* partnership (**healthylakehuron.ca**).

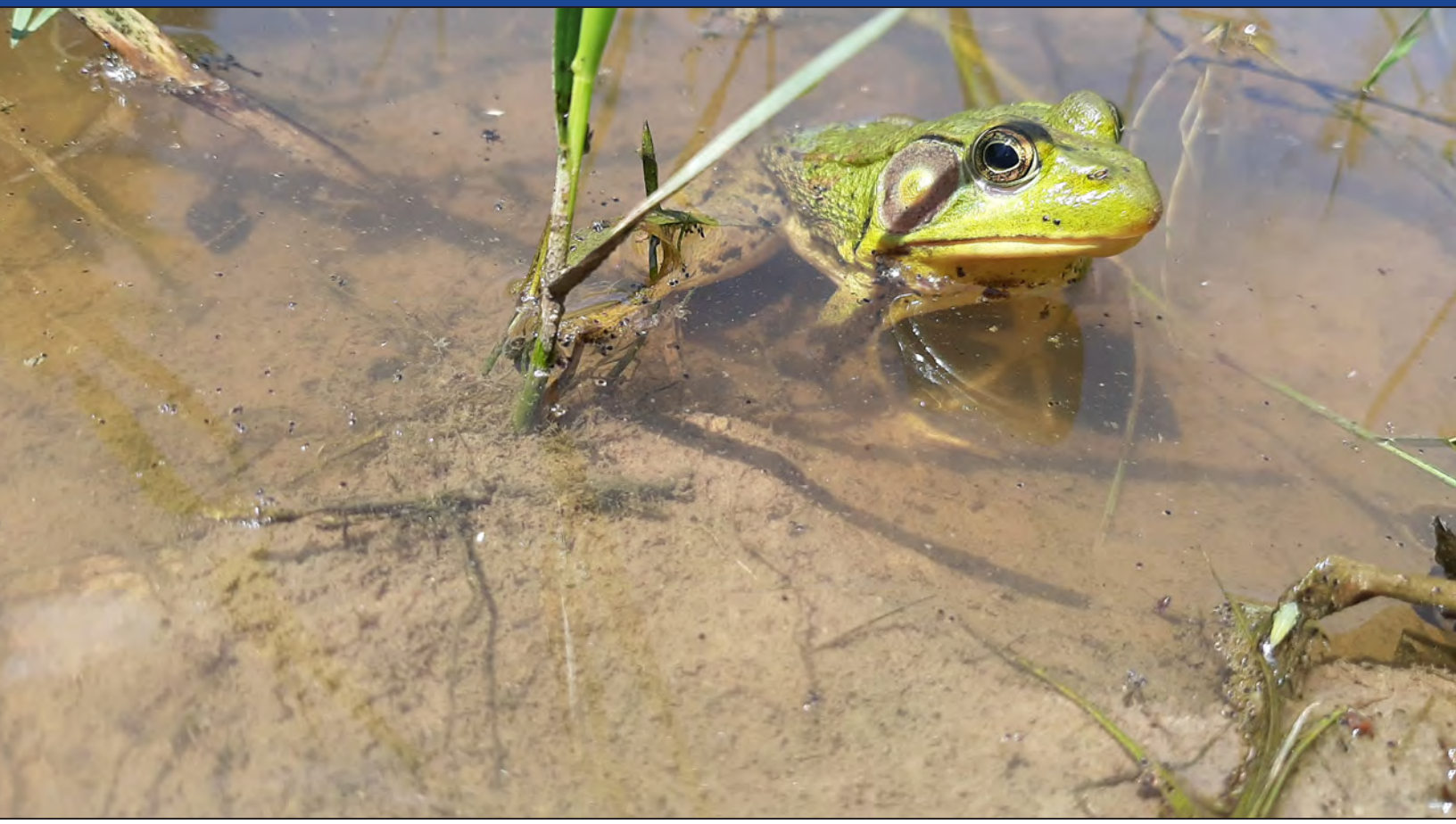
Table 5. Overall surface water quality scoring and grading (adapted from Conservation Ontario).

Average Point Score	Overall Surface Water Quality Grade
>4.4	A
3.5-4.4	B
2.5-3.4	C
1.5-2.4	D
<1.5	F

Grades were largely unchanged from the 2018 report card except for the Ausable Headwaters and Lower Parkhill subwatersheds, both of which have recently moved from a D to a C due to improved benthic scores, despite higher concentrations of both total phosphorus and E. coli.



Map 6: Distribution of surface water quality grades in the Ausable Bayfield Conservation Authority area.



Frogs can be especially sensitive to changes in water quality due to their thin, semi-permeable skin. Actions that support improved water quality benefit us all.

Improving Surface Water Quality

There are many ways to improve surface water quality in local creeks, rivers, and Lake Huron. More than 75% of the land in the ABCA area is used for agricultural production. Given this large proportion, stewardship-based actions that promote agricultural best management practices (BMPs) continue to be very important for surface water quality and the overall health of our area. There are many different practices that could be considered BMPs. Priority BMPs prevent water movement that may contribute to soil erosion. Reduced tillage, cover crop use, and increased vegetative cover are examples of these practices, and improve soil health.

Improved soil health helps to infiltrate water where it lands, therefore avoiding runoff. Water may also be held back by berms and rain gardens that allow sediment to settle before entering a waterway.

If sediment or other pollutants do enter a waterway, additional BMPs that can help trap and treat water include stormwater ponds, and two-stage channel design for drains and ditches.

The Huronview Demonstration Farm near Clinton, Ontario showcases many of these agricultural BMPs and is open to the public for self-guided tours and public events. Visit **abca.ca** to learn more about forestry and stewardship actions and how to get involved through local community projects.