Grand River Conservation Authority

Report number: GM-01-21-04

Date: January 22, 2021

To: Members of Grand River Conservation Authority

Subject: Update on Water Quality in the Grand River

Recommendation:

THAT Report Number GM-01-21-04 - Update on Water Quality in the Grand River be received as information.

Summary:

The waters of the Grand River watershed are highly valued for various purposes. The quality of the Grand River and its tributaries is important, not only for recreational uses and to support a healthy aquatic ecosystem, but to the mental and physical health of watershed residents and to support a robust local economy. Approximately 760,000 people in our watershed rely on surface water, in whole or in part, for their municipal supply.

Water quality is influenced by a complex array of factors including climate and hydrology, soil type, land use and land management practices. Human alteration of the landscape such as draining wetlands and clearing forests for agriculture and urban development, application of manure and inorganic fertilizers and discharge of treated wastewater effluent has degraded water quality.

The Water Quality Index was used to assess water quality relative to provincial or federal guidelines for several parameters of concern including chloride, suspended sediment and nutrients such as total phosphorus, ammonia and nitrate. The results of applying the Water Quality Index across the watershed are provided in this report and details of water quality issues or challenges are discussed for specific reaches or areas in the watershed.

While water quality in the watershed has improved over the years, there is work yet to do. Programs delivered by the GRCA such as the RWQP and the Watershed-wide Wastewater Optimization Program are critical for not only maintaining but improving water quality in the future. The importance of long-term monitoring cannot be understated because we cannot manage what we do not measure and this goes for water quality. The PWQMN represents an important example of the mutually beneficial partnership between MECP and conservation authorities.

Report:

Despite tremendous progress and improvements over the past 50+ years, water quality in many parts of the Grand River remains stressed. GRCA, in partnership with the Ministry of the Environment, Conservation and Parks (MECP), carries out long-term monitoring of water quality conditions across the watershed. Our long-standing partnership with MECP to collect water quality data is critical to our understanding and to support water management. The data collected through the Provincial Water Quality Monitoring Network (PWQMN) serves as the basis for this report.

PWQMN data for the three-year period from 2017 to 2019 was compiled, reviewed for accuracy and summarized using the federally developed Water Quality Index. The index compares the water quality data for each site against guidelines for each parameter of concern and assigns a score out of 100. A higher score indicates better water quality, as shown in Table 1.

Table 1: Classification of Water Quality using the Water Quality Index

Classification	**WQI value**	**Narrative**
Excellent	95 – 100	Water quality meets guidelines all or most of the time
Good	80 – 95	Guidelines are exceeded but not very frequently
Fair	65 – 80	Water quality occasionally exceeds desired guidelines
Marginal	45 – 65	Water quality guidelines are often exceeded
Poor	<45	Water quality is degraded and very frequently or always exceeds guidelines

The Water Quality Index was used to assess water quality relative to provincial or federal guidelines for several parameters of concern including chloride, suspended sediment and nutrients such as total phosphorus, ammonia and nitrate. Nutrients are a long-standing concern in the Grand River as they can promote excessive growth of aquatic plants and algae; potentially affect the quality of raw water for municipal supply; and limit the capacity of the river system to receive treated municipal wastewater effluent. Chloride can have aesthetic impacts on municipal raw water and is potentially toxic to some sensitive aquatic species.

The Water Quality Index enables a comparison of water quality at multiple sites relative to one another but it does not tell the whole story, as one site may be considered marginal due to high nutrients, whereas another site may have high chloride concentrations that result in a marginal score. Figure 1 shows the Water Quality Index rankings for all current PWQMN sites in the watershed.

Figure 1 shows that water quality is good or fair in headwater areas such as the upper Grand River (upstream of Belwood reservoir), the upper Speed-Eramosa subwatershed, Irvine Creek and Mill Creek. Water quality in these areas is generally characterized by low nutrient concentrations, although elevated phosphorus and nitrate concentrations are observed in the spring. The phosphorus delivered to Belwood reservoir in the spring can help to fuel potential algae and cyanobacteria blooms later in the summer and early fall. Urban development pressure is a concern for the upper Grand River, as there are many new homes being built in communities such as Dundalk and Grand Valley, which results in more treated wastewater and urban runoff being released into the Grand River in this sensitive area.

Water quality in the Conestogo River (upstream and downstream of the reservoir) is considered marginal and often exceeds guidelines for phosphorus and nitrate. Elevated levels of these nutrients result from a combination of the fine-grained, till soils and extensive agriculture, including livestock production in this subwatershed. The application of beneficial management practices (BMPs) through the Rural Water Quality Program (RWQP) has yielded positive benefits but there is still a lot of work to be done and the importance of GRCA's RWQP cannot be understated.

Similarly, Canagagigue Creek is heavily influenced by agricultural non-point source inputs and water quality is poor due to consistently elevated levels of nutrients and sediment. Interestingly,

water quality downstream of the Elmira and its wastewater treatment plant outfall is somewhat better than the upstream site, although both sites are poor. Once again, this highlights the essential need for the RWQP to mitigate the water quality impacts of agricultural non-point sources.

As the Grand River flows south of the Conestogo confluence and through the cities of Waterloo, Kitchener and Cambridge, water quality deteriorates and is considered marginal with frequent exceedances of phosphorus and nitrate guidelines. Marginal water quality through the central Grand River and lower Speed River is due to the cumulative effect of upstream agricultural non-point sources (e.g. Conestogo River and Canagagigue Creek) and treated wastewater effluent from Guelph, Waterloo, Kitchener and Cambridge. Despite the marginal scores, water quality in the central Grand River has seen some dramatic improvements in recent years. Upgrades and capital improvements to the Waterloo and Kitchener Wastewater Treatment Plants has resulted in much lower discharges of ammonia, which is toxic to aquatic life at relatively low levels. As a direct result of lower ammonia discharges from Kitchener, there has been a substantial improvement in dissolved oxygen levels at the Blair continuous water quality monitoring station. Researchers from the University of Waterloo have been studying the health of fish in the Grand River near the Waterloo and Kitchener WWTPs using Rainbow Darters, a species of minnow, as an indicator species. They observed an incredible improvement in the health of these fish related to the wastewater treatment upgrades. Further water quality improvements through the central Grand River are expected as some recent wastewater treatment upgrades and optimization activities are not reflected in this data as some of the recent upgrades began operation after 2019.

The Nith River is largely dominated by agricultural non-point sources due to the combination of land use, land management practices and soil type in this subwatershed. Water quality in this area is marginal as phosphorus and nitrate frequently exceed water quality guidelines. The headwaters of the Nith appear to be somewhat more impacted by high phosphorus levels and there is a noticeable decrease in concentration as the river flows south toward Paris, gathering groundwater from the Waterloo Moraine, which helps moderate water quality in the lower Nith. As with other subwatersheds like the Conestogo and Canagagigue that are dominated by non-point sources, the RWQP is an important means of mitigating soil loss and nutrient delivery to the Nith River.

The cumulative nutrient inputs from rural non-point sources, urban runoff and wastewater discharges result in marginal water quality at sites on the main stem of the Grand River in the central and southern watershed such as Glen Morris, Brantford and York. Tributaries in this area including Whitemans Creek and Big Creek are also marginal due to elevated levels of nitrate and phosphorus. Fairchild Creek has poor water quality due to high concentrations of sediment and total phosphorus.

The Grand River at Dunnville is the most downstream water quality sampling site prior to Lake Erie and it is sampled more frequently than the other PWQMN sites as part of the MECP Enhanced Tributary Monitoring Program. Water quality at this site is poor, reflecting all of the cumulative upstream nutrient sources, as well as additional sediment and nutrients loads draining from the clay plains in the watershed south of Brantford. The poor designation results from the fact that total phosphorus, nitrate and suspended sediment concentrations very frequently exceed recommended guidelines.

While water quality in the watershed has improved over the years, there is work yet to do. Programs delivered by the GRCA such as the RWQP and the Watershed-wide Wastewater Optimization Program are critical for not only maintaining but improving water quality in future. The importance of long-term monitoring cannot be understated because we cannot manage what we do not measure and this goes for water quality. The PWQMN represents an important example of the mutually beneficial partnership between MECP and conservation authorities.

Financial implications:

Not applicable

Other department considerations:

Not applicable

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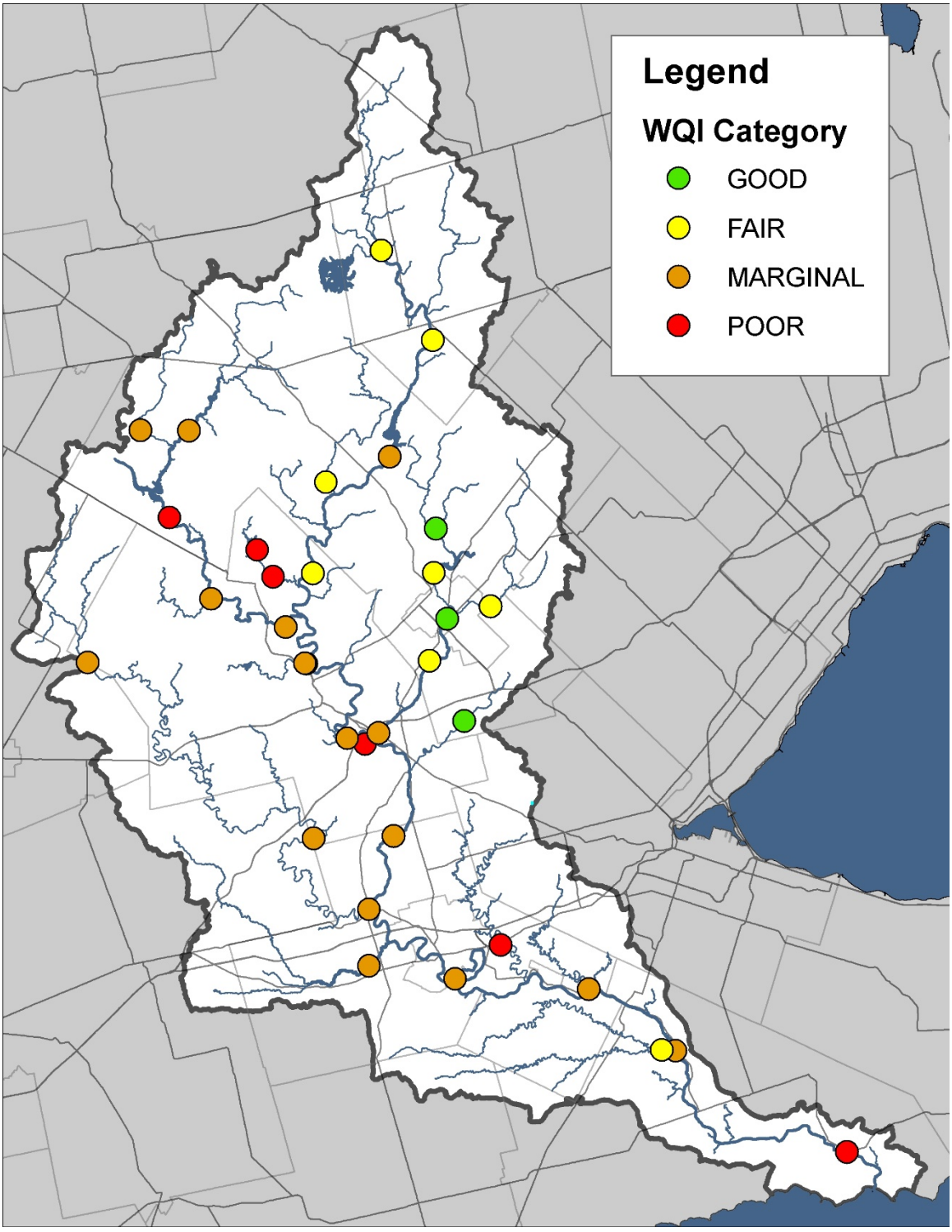

Figure 1: Water Quality Index based on 2017 – 2019 data