Case study:

Lessons Learned on Assessing Vulnerability of WWTPs to Climate Change Impacts

Introduction

The Grand River Conservation Authority (GRCA), along with municipal partners and the Ministry of the Environment, Conservation and Parks (MECP) initiated a Watershed-wide Wastewater Optimization Program (WWOP) in 2010 to optimize wastewater treatment plants (WWTPs) in the watershed to improve water quality in the Grand River and its tributaries. In 2018, the WWOP received funding from the FCM Climate Adaptation Partner Grant. The project consists of two phases: (1) collect data and conduct an assessment of inflow/infiltration (I/I) impacts on the project partner WWTPs and (2) develop an action plan or strategy to address the impacts from Phase 1.

This case study describes the background, approach, results and lessons learned on assessing the vulnerability to climate change impacts on the project partner WWTPs.

The WWOP is a voluntary program focused on skills development, knowledge transfer and capacity building within the watershed.

Background

Climate change is expected to cause more frequent, severe rain and snowmelt events and extended droughts. Rain and snowmelt entering collection systems results in high wastewater flows, so climate change may reduce treatment plant capacity and increase the potential for bypassing. During droughts, treated effluent can stress the Grand River with elevated phosphorus levels (e.g. eutrophication) and potentially toxic levels of ammonia, creating a need for better effluent quality. These climate change impacts pose a serious challenge for Grand River watershed municipalities because the traditional approach is to invest in costly expansions and upgrades. The WWOP takes an alternative approach by addressing performance and/or capacity issues using technical assistance to make the best use of existing infrastructure, potentially resulting in significant capital cost savings.

What did we do?

The GRCA partnered with five watershed municipalities to carry out the project: Region of Waterloo, Brant County, Haldimand County, City of Brantford and Centre Wellington. In July 2018, the GRCA met with the project partners to determine appropriate procedures for using plant data to assess climate change impacts, primarily focusing on I/I, at their WWTPs.

Metrics prepared from annual data included:

- Annual average daily wastewater flows and drinking water production,
- Ratio of peak day to annual average day flow,
- Per capita flow,
- Ratio of maximum month average flow to minimum month average flow,
- Ratio of wastewater flows to drinking water flows,
- Population equivalent of I/I flows,
- Number and total volume of bypasses.

In addition, the following graphs of daily data were generated:

- Wastewater flows and drinking water flows,
- Wastewater flows and wastewater temperatures over time,
- Wastewater flows and river flows in a nearby naturally flowing watercourse over time,
- Wastewater flows versus precipitation over time

Each project partner collected 2017 data for one or two of their WWTPs and submitted to the GRCA to calculate the metrics and graphs and compile an assessment report for each plant. As a result of the assessment, the amount of inflow and infiltration treated at each partner plant was estimated.

Project Partners include:

- ❖ **Region of Waterloo**
- ❖ **Count of Brant**
- ❖ **City of Brantford**
- ❖ **Centre Wellington**
- ❖ **Haldimand County**

What did we find?

Assessment reports were prepared for each of nine project partner WWTPs (Brantford, Fergus, Elora, Paris, St. George, Wellesley, Elmira, Hagersville, Caledonia). The metrics listed above were compiled for each plant using existing data and expressed in both tabular and graphical format in order to fully illustrate the impacts of I/I on the plants. For example, the ratio of average wastewater flow to drinking water flow for the Fergus WWTP was 1.37 whereas Figure 1 below shows the wastewater flows can be as much as 4 times the drinking water flow.

As a result of each WWTP assessment the fraction of I/I treated at each plant (as a percentage of total flow) was determined, which ranged from 3% to 36%.

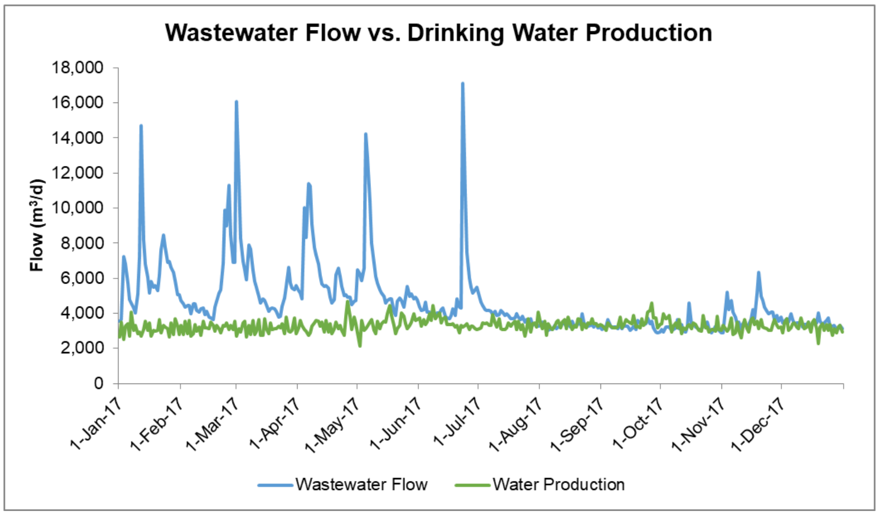

Figure 1 - A comparison of wastewater flow and drinking water flow

Optimization is a continuous improvement process that invests in people to manage wastewater treatment processes more effectively.

This figure shows WWOP staff looking at the rain gauge at the Fergus WWTP. Many plants can experience extraneous flows (I/I) as a result of rainfall events.

What did we learn?

The project team learned a number of lessons during Phase 1 including:

- Developing meaningful metrics to quantify I/I impacts is important.
- Smoke testing, camera inspection and collection system flow monitoring are all tools for identifying and reducing I/I. Such efforts can help the municipality to repair leaks or target public engagement efforts.
- Quantifying I/I before and after remediation efforts may enable the municipality to track the effectiveness of rehabilitation in terms of reducing I/I.
- Metrics that are based on annual averages may not fully capture the impacts of I/I
- In most cases, river flows and WWTP flows track closely because they are influenced by the same environmental conditions. By contrast, WWTP flows do not track very well with daily precipitation totals because not all precipitation events generate surface runoff or contribute to I/I.
- Based on discussions with the project partners, most municipalities have general guidelines which establish the amount of I/I per person that will need to be treated by a new or upgraded wastewater treatment facility. However, municipalities are not quantifying the actual I/I being received at the plant and are not thinking about how I/I may change in future due to climate change.
- I/I can have costs that are not currently being quantified or considered e.g. the cost of additional energy consumption, staffing for after-hours call-ins and possible opportunity costs for additional treatment capacity)
- Many municipalities have by-laws to prevent or prohibit connection of roof leaders, foundation drains and sump pumps to the sanitary sewer system but these by-laws can be difficult to enforce. In some areas, there may not be a suitable alternative where stormwater infrastructure may be lacking or inadequate.

Acknowledgements

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To find out more, go to www.grandriver.ca or contact Mark Anderson, Water Quality Engineer at 519-621-2763 x 2226 or Kelly Hagan, Optimization Extension Specialist at 519-621-2763 x 2295.

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