Appendix I

2023 Nanticoke Intake Protection Zones (IPZs): Evaluation of Changes to IPZs as a result of Water Treatment Plant Capacity Upgrades (Dillon Consulting Limited)

February 24, 2023

J.L. Richards & Associates Limited
107 - 450 Speedvale Avenue West
Guelph, Ontario
N1H 7Y6

Attention: Jane Wilson
Senior Environmental Engineer

Nanticoke Intake Protection Zones (IPZs)
Evaluation of Changes to IPZs as a result of Water Treatment Plant Capacity Upgrades

Dillon Consulting Limited (Dillon) is pleased to provide J.L. Richards & Associates Limited (JLR) will our opinion of whether proposed upgrades to the Nanticoke Water Treatment Plant (WTP) will affect the validity of the existing mapped Intake Protection Zones (IPZs). For reference, Chris Gibbons, co-author of this letter, was involved in the initial hydrodynamic modelling and delineation of the IPZs for these intakes.

Our assessment is limited to evaluation of the IPZs and whether they would be affected by increased water takings of the intakes. Evaluation of any required changes to vulnerability zone scores is not part of this assessment. Our review is based on available information provided to Dillon by others. The analysis considers changes to the intake water taking rate only. It is assumed that the physical location and design of the intakes have not changed from the original IPZ assessment. It has also been assumed that there are no significant changes to storm sewer network or adjacent land drainage patterns as a result of the proposed WTP upgrades or other developments in the area that have occurred since the original IPZs were developed. Changes to these factors may affect the delineation of the IPZs (primarily IPZ-2).

The primary source of information for our review was the following documents:

- Haldimand County Source Protection Planning Technical Study (Stantec, 2010). This study provides a comprehensive surface water vulnerability assessment for the Nanticoke WTP, including a detailed description of the numerical modelling that was used to delineate the IPZs for each of the two Great Lakes intakes.
- Long Point Region Source Protection Area (SPA) Assessment (May 20, 2022). This report is the most recent updated Assessment Report for the SPA, and summarizes the results of the IPZs and the assigned vulnerability scores.

DILLON CONSULTING

130 Dufferin Avenue
Suite 1400
London, Ontario
Canada
N6A 5R2
Mail: Box 426
London, Ontario
Canada
N6A 4W7
Telephone
519.438.6192
Fax
519. 672.8209

Dillon Consulting Limited

Background Information

As described in the Long Point Region Source Protection Area (SPA) Assessment Report (2020), the Nanticoke WTP has three intakes that were shared with the former power generation station. A description of these intakes is as follows:

- Two Great Lake Intakes – located approximately 465 m apart in Lake Erie. The west and east intakes are located approximately 500 m and 520 m offshore, respectively, with depth of both intakes being approximately 6.3 m. These intakes are defined as Type A intakes under the Ontario Clean Water Act Technical Rules.
- One intake located at the Industrial Pumping Station (IPS) – this intake is located in the power generation forebay. Lake water enters the intake (wet well) by gravity flow via a channel located in the west bank of the forebay. This intake is defined as a Type D intake under the Technical Rules.

Proposed Upgrades to Nanticoke Water Treatment Plant

It is our understanding that the proposed upgrades to the WTP capacity would not impact the location or size of the intake structures, but would increase the volume of intake water, from approximately 13 million litres per day (MLD) to 100 MLD. The rated capacity of the WTP and details on the most recent Permit to Take Water (PTTW) are summarized in the table below.

Table 1: **Nanticoke WTP Capacity and PTTW**

	Original	Proposed
WTP Rated Capacity	Rated capacity is 13,636 m^3/day	100,000 m^3/day proposed (consistent with 2006 ESR)
WTP PTTW	Nanticoke WTP Permit to Take Water of 1,818,000,000 L/day.	437,000,000 L/day (Permit No. P-300-1216014316 issued on October 26, 2022)

Review of IPZs for the Two Great Lake Intakes

The following is our review of the intake protection zones associated with the two Great Lake intakes, and our evaluation on whether the increased water taking will affect the existing mapped intake protection zones.

Hydrodynamic Modelling

This section provides a brief overview of the hydrodynamic modelling that was completed as part of the Haldimand County Source Protection Planning Technical Guide (Stantec, 2010). The hydrodynamic model developed for this study provides a description of the currents in the study areas, and was used for IPZ-2 delineation.

The MIKE3 model by DHI was used for the modelling, as this model allows for the use of a flexible mesh. The flexible mesh supports varying grid resolutions to resolve the hydrodynamics. A denser (finer) grid resolution of 30 m was used around the intake, coarser grid resolutions (90 m and 270 m) were used for the rest of the model domain.

The model was simulated using extreme wind events from several different compass directions to define the boundary conditions. The model was run until it reached a steady state, which is a conservative approach, as it assumes the wind conditions driving the model are consistent, and do not change in intensity or direction, throughout the duration of the model run.

The hydrodynamic modelling included inflows from major tributaries such as the Grand River. However, the modelling did not include any outflows or flow sinks, such as the Nanticoke Intakes.

The results from the hydrodynamic modelling were then used as input to the reverse particle tracking model. Particle tracking provides a practical and conservative approach to estimate the time of travel contours in support of the IPZ delineation. The particle tracking essentially releases neutrally buoyant particles at the intake location and runs the model in reverse. Running the particle tracking allows the user to specify the intake as the release point and determine the origin (source) point for various travel times. The particle tracking approach used in this approach is fairly conservative, as even though the intakes are located on the lakebed, particles were released at the surface where currents are much stronger.

Other key results and limitations from the modelling are listed below:

- The results from the numerical modelling activities indicate that current patterns are most strongly influenced by wind conditions.
- The intakes were generally located far enough offshore that the adjacent tributaries did not influence current patterns around the intakes under a two-year flow event for the limited runs undertaken.
- The model does not consider wave-induced currents.

Delineation of IPZs

A detailed description of the delineation of the IPZs is provided in the 2010 Stantec report, and an overview of the delineated IPZ-1 and IPZ-2 is described in this section.

A series of travel time contours were estimated using reverse particle tracking completed as part of the hydrodynamic modelling. These travel time contours were completed for each of the eight model runs. Of particular importance for this study was the two-hour travel time contour, as two hours was the identified time required for the plant operators to respond to a known adverse situation. IPZ-2 was delineated as the furthest extent for each of the eight two-hour travel time contours.

In cases where IPZ-2 intersects the shoreline at the mouth of a tributary, the upstream extent was estimated based on the remaining time and the average velocity during a 2-year flood. For example, at Hickory Creek, the lake-based travel time contour intersects the shoreline at 6,170 seconds. Therefore, the upstream extents of Hickory Creek would be estimated using 1,030 seconds (7,200 – 6,170).

IPZ-1 was simply delineated as a 1 km radius centered on each of the intakes, based on the requirements of the Technical Rules for a Type A intake.

No IPZ-3 was mapped for the two Great Lakes intakes.

Impacts of the Increased Water Intake on Local Hydrodynamics

Although there are several intakes located in this area, and the proposal under review is to increase the flow of these intakes, it is unlikely that these increases will have a material impact on the hydrodynamics of the lake such that the IPZ would need to be adjusted. Any hydrodynamic impacts of the intake are likely to be fairly localized around the intake structures themselves, and well within IPZ-1 and IPZ-2. As mentioned in the 2010 Stantec report, the currents in the lake are mostly governed by wind events. The impacts from the inflows of local tributaries are fairly negligible, and the impacts of the intakes would not have a significant impact on the currents in the lake

The 2010 study was based on what is known as far-field modelling, as it attempted to capture lake-wide events. The finest grid resolution in this model was 30 m, which is much larger than the intake itself. In order to better understand the impact the intakes would have on local hydrodynamic, nearfield modelling would need to be completed. It is likely that the results of this nearfield modelling would show that the impacts of the intake are localized around the intake (e.g., approximate radius of

50 m to 100 m). An excerpt from the 2010 Stantec report that is of particular importance to this component of the review is provided below:

> "The hydrodynamics at Nanticoke are complex due to the presence of multiple high flow intakes and outfalls associated with the industrial complexes located along the shoreline. The impact of the intake flow was evaluated and it was determined that this would not have a significant impact on the IPZ-2. The intake and outfall flows were therefore not included in the model."

Dillon agrees with the Stantec report statement. Hydrodynamic impacts (if any) resulting from increased inflow at the water intakes are likely localized in the immediate vicinity around the intake and well within the existing IPZ-1.

Overall, based on our review of previous work that was used to map the IPZ-1 and IPZ-2 for the two Great Lake intakes, and our understanding of the MECP Technical Rules, it is our opinion that revisions to the IPZs are not required based on increasing the intake flows.

Review of IPZ for IPS Intake

The IPS intake was previously assigned an IPZ-1 and IPZ-2. No IPZ-3 was mapped. IPZ-1 was mapped as the outline of the forebay and a 120 m setback with adjustments made to address the local drainage characteristics. IPZ-2 was mapped as including the forebay and the storm sewer network that drains into it, and all other pathways that contributed water to the forebay. Since neither the mapping of IPZ-1 or IPZ-2 was a function of intake water taking rate, a change in the water taking rate would not change either IPZs. Therefore, no changes to the mapped IPZs are required for increased water takings at the IPZ intake.

Conclusions

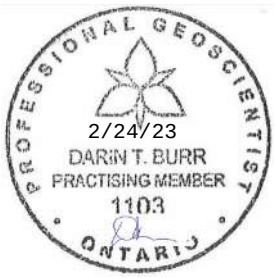
Based on the preceding discussions, it is our opinion that the previous mapped intake protection zone boundaries do not require revision based on increasing the flow from the Nanticoke WTP intakes.

We trust that the information provided in this letter satisfies your requirements. Should you have any questions or concerns, please feel free in contacting us.

Sincerely,

DILLON CONSULTING LIMITED

Chris Gibbons, P.Eng.
Coastal Engineer



Darin Burr, P.Geo.
Project Manager/Senior Hydrogeologist

DTB:rrk

Our file: 23-5768