DEEP DRILLING

Terms of Reference

September 2021

Background

The City of Barrie obtains a significant portion of its municipal water supply from 14 municipal wells constructed into a confined overburden aquifer system. The operational wells are constructed in the deepest two of four overburden aquifers identified in the area, referred to as the A3 and A4 as well as Lower or "Municipal" Aquifer in the South Simcoe Municipal Groundwater Study (2004). Wellhead protection areas (WHPA) have been established for these wells based on time of travel of groundwater within the aquifer to the wellheads, which extend under much of the City limits.

Kempenfelt Bay represents a discharge area for both groundwater and surface water; the recharge for this area is fed by infiltration from the surrounding uplands. Historically, the aquifers near the shore of Kempenfelt Bay were under significant artesian pressure; depending on the pumping rates of the production wells, flowing artesian conditions are present in some parts of the City, notably in the vicinity of Kempenfelt Bay.

There are areas within the City where groundwater contamination impacts are known to exist, primarily within the shallowest aquifer, resulting from historical surface-derived sources associated with industrial and commercial operations. These impacts represent a potential threat to the drinking water supply obtained from the underlying aquifers, which are protected by the presence of overlying finer-grained confining layers.

Purpose

The City is responsible for the management of the municipal water supply within the City, which includes the aquifer system. One area of concern with respect to protection of the quality of the supply is the construction of deep boreholes and wells through the confining layers overlying the Municipal Aquifer, which represent a potential avenue for contamination to the deeper groundwater system in which the City's supply wells are constructed. As part of the overall approach to the City's protection of the groundwater supply the City has developed a Drinking Water Protection Policy, which states the following:

- Drilling activities (boreholes, monitoring wells, etc.) expected or planned to enter the municipal aquifer shall not be undertaken without review and approval from the City.
- Consideration for approval requires that information be submitted to the City by the Owner and the information requirements shall be in accordance with City procedures.
- Any required information may be subject to third-party technical review at the expense of the Owner.
- The Owner shall inform the City of any drilling activities expected or planned to extend beyond the upper aquitard in accordance with City procedures.

The City understands that for some projects, it may be necessary to consider the construction of deep boreholes or groundwater monitoring wells to provide soil and groundwater data to support the design aspects of future development projects. The

following information is required to allow the City to assess and approve construction of deep boreholes or groundwater monitoring wells that may extend to the Municipal Aquifer.

Who Should Prepare This?

The information and assessment should be prepared by a licenced professional geoscientist or engineer experienced in the design and construction of deep wells and an understanding of contaminant hydrogeology as it pertains to protection of groundwater supply overburden aquifers. It is strongly encouraged that a licenced well driller (i.e., under O. Reg. 903) provide input into the well design and proposed well construction methodology.

Required Contents

The drilling and borehole/well construction technique proposed should be sufficiently detailed to allow the City and an external peer reviewer to fully understand all aspects of the process intended to prevent communication of fluids between hydrostratigraphic units throughout the drilling process and following completion of the borehole/well. This will include, as appropriate, detailed descriptions of drilling equipment, methods, drilling fluids, temporary and permanent protective casing, well and annular seal materials and sampling method. The means and methods will remain the responsibility of the party submitting and implementing the plan.

1. Provide a brief description of the intended borehole/well construction including the purpose, required data to be collected from the borehole/well, anticipated date of construction and depth of the well. The proposed location of the borehole should be provided on a suitably scaled map sufficient to illustrate the location relative to any other wells on the property and key surrounding features and wells used to interpret the hydrostratigraphy. The location of the well should also be provided in UTM co-ordinates;

2. Provide a description of the anticipated stratigraphy in the area of the proposed borehole/well including estimated depth to the municipal aquifer, potential presence of artesian conditions and the potential for the presence of groundwater contamination in the shallow aquifers within the area of the development, if known. The City will provide known stratigraphic depths and basic information as outlined in the example below;

3. A hydrostratigraphic cross-section should be developed in vicinity of the Site and should include copies of the original logs/references used to develop the cross-section. This should include key information within 250 metres of the development site (or more, depending on density of information);

4. A Canadian Standard Association (CSA) Phase I ESA (Standard Z768-01), or equivalent, investigation must be provided to determine if potential sources of groundwater quality impact are present at the site or the surrounding area. At a

minimum, this investigation should consist of the following: reviewing readily available records to collect data on past and present activities on the Site; a Site visit, interviewing knowledgeable individual(s) to corroborate or augment the information gathered from the records review and Site visit, a summary of Site and adjacent land uses and any potentially contaminating activities (PCA) and areas of potential environmental concern (APEC), and recommendations of the need for the investigation to confirm conditions prior to drilling to the underlying aquifers;

5. A shallow soils and groundwater investigation such as a CSA Phase II ESA (Standard Z769-00), or equivalent, must be provided where there is known or potential for contamination in the shallow aquifer based on the Phase I ESA or City information. At a minimum, this investigation should include construction and sampling of three monitoring wells, which should be screened to the base of the shallowest aquifer, detailed borehole logs, groundwater levels and flow direction, results of analysis of parameters appropriate to the assessment of APECs, etc.;

6. Completion of a borehole/well construction plan including details as noted in this document that effectively manage the risk for cross-contamination between aquifer units, signed by the qualified professional. It is strongly recommended that this plan should be completed in consultation with a licenced well contractor and meeting the requirements of O. Reg. 903. The drilling plan should consider any identified impacts in the shallow aquifer(s) or suspected sources of contamination, notably in the case of chlorinated solvents. Additionally, the potential for artesian conditions and the approach to controlling this should be outlined;

7. Following approval, the City shall be provided with the field drilling schedule prior to the start of the field work for their review and comment. They should be formally notified when the borehole(s) are being drilled;

8. Provide a detailed plan describing the future well decommissioning procedure of the monitoring well including a complete finalized borehole construction log within six weeks of completion. The City shall be notified in writing when the well owner is proposing to decommission the well including the date and time and confirmation of the method that meets the earlier approved submission.

Sample Output From City Database System

Address of Development

The results below are being provided for informational purposes only and represent an estimate of the anticipated hydrogeological conditions on site based on best available data to date. Site specific conditions should be confirmed by the applicant.

Depth to Water Table	<1	m
Depth to Perched Water	<1	m
Depth to Aquifer A1	1	m
Depth to Aquitard C1	4	m
Depth to Aquifer A2	15	m
Depth to Aquitard C2	26	m
Depth to Confined Municipal Aquifer	42	m
Depth to Uppermost Significant Aquifer	15	m
Cumulative Transmissivity to Base of A1	35	m2/day
Cumulative Transmissivity to Base of A2	861	m2/day
Cumulative Transmissivity to Base of A3	862	m2/day
Transmissivity of Uppermost Significant Aquifer	High	
Transmissivity of Most Significant Aquifer	High	

What Else Should We Know?

If dewatering is expected to be discharged into the municipal storm or sanitary sewers, applications must be made to Business Performance and Environmental Sustainability Department (Environmental Compliance) for their review. Please note that permanent dewatering shall not be permitted. A temporary dewatering agreement may be denied at the sole discretion of the City.

Notes

If the proposed construction is revised in any way, the revisions must be reflected in an updated report by the party responsible for submitting and implementing the plan. This must be sent to Source Water Protection staff for further assessment.