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### Groundwater Resources Studies

The *Groundwater Resources Study* (GRS) series seeks to better the understanding of Ontario's groundwater resources through the collection, evaluation and distribution of geoscience data. The main objective of the series is to provide accurate information on a range of groundwater-related themes, including local- to watershed-scale aquifer characterization and delineation; geologic controls and influences on groundwater quantity and quality; and methods development. Products of the groundwater program include geoscience reports, data sets and protocols for information collection and handling. Geoscience information generated through the series will find application in the protection and sustainable management of the province's groundwater resources.

#### Groundwater Resources Study 17

#### **Geospatial Distribution of Selected Chemical, Bacteriological and Gas Parameters Related to Groundwater in Southern Ontario**

by L.M. Colgrove and S.M. Hamilton

This publication can be downloaded from

[http://www.geologyontario.mndm.gov.on.ca/mndmaccess/mndm\\_dir.asp?type=pub&id=GRS017](http://www.geologyontario.mndm.gov.on.ca/mndmaccess/mndm_dir.asp?type=pub&id=GRS017)

This digital data release comprises a report describing a study that uses select chemical, bacteriological and gas parameters from the Ontario Geological Survey Ambient Groundwater Geochemistry database to spatially map discrete areas of southern Ontario where groundwater has a natural tendency toward elevated concentrations of specific geochemical and bacteriological constituents. The chemical parameters included are arsenic, barium, boron, fluoride, nuisance gases (methane, hydrogen sulphide, hypoxic gas), iodide, nitrate, chloride, selenium and uranium. The report also includes a set of bacteriological maps. For each parameter, individual maps convey (1) geological associations, (2) chemical concentration distribution and (3) a simplified version of the map showing discrete regions with elevated concentrations. Geological features and geochemical mechanisms controlling regional hydrochemical trends are briefly discussed. The report is provided as 1 portable document format (.pdf) file.

Recent regional mapping of the chemical composition of ambient groundwater in Ontario has led to the characterization of large-scale geological influences on groundwater quality and dissolved constituents. This Groundwater Resources Study uses data from the Ontario Geological Survey's Ambient Groundwater Geochemistry (AGG) database (Hamilton 2015) to spatially map discrete areas of southern Ontario where

groundwater has a natural tendency toward elevated concentrations of specific geochemical and bacteriological constituents. This report examines the geological relationships and spatial extent of 13 chemical, bacteriological and gas constituents related to southern Ontario groundwater. The data are derived from chemical analyses of groundwater from more than 1700 drilled wells sampled at a regional uniform density across southern Ontario (Hamilton 2015) as part of the AGG Project. Nine sets of maps for groundwater chemical constituents have been created that outline patterns related to geology. The maps are for arsenic (As), barium (Ba), boron (B), fluoride (F<sup>-</sup>), iodide (I), nitrate (NO<sub>3</sub><sup>-</sup>), chloride (Cl<sup>-</sup>), selenium (Se) and uranium (U). The report also provides a set of maps for some groundwater-related gases including methane (CH<sub>4</sub>), hydrogen sulphide (H<sub>2</sub>S) and hypoxic (i.e., oxygen deficient) gas. An additional map set shows areas of systemic bacteriological occurrence in aquifers as a result of geological factors. Any of these 13 constituents can affect the suitability of groundwater as a resource. Geological features and geochemical mechanisms controlling regional hydrochemical trends are briefly discussed. This report does not capture all aspects of groundwater composition and usability, but rather presents those of greater general interest and which have high potential to be characterized and mapped by the techniques described herein. This work was undertaken to put existing geological information with regard to groundwater into a more accessible format for technical and nontechnical users. The characterization of background concentrations of constituents that affect groundwater utility can aid in effective resource management in Ontario.

## REFERENCES

Hamilton, S.M. 2015. Ambient groundwater geochemistry data for southern Ontario, 2007–2014; Ontario Geological Survey, Miscellaneous Release—Data 283—Revised.