

# GRS013 METADATA

## GENERAL INFORMATION

### Title

Early Silurian Sequence Stratigraphy and Geological Controls on Karstic Bedrock Groundwater-Flow Zones, Niagara Escarpment Region and the Subsurface of Southwestern Ontario

### Alternate Title

GRS013

### Author(s)

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October 30, 2020

### Abstract

The main objective of this study is to delineate potable groundwater resources within the upper few hundred metres of stacked cuesta-forming carbonates of the Niagara Escarpment. The establishment of the Ontario Geological Survey (OGS) groundwater mapping initiative in 2007, in part a response to the Walkerton tragedy in May 2000, is an outgrowth of geoscience activities that have been ongoing for more than half a century. This initiative represents an expanded geoscience mandate comprising three-dimensional (3-D) surficial and Paleozoic bedrock mapping, and ambient groundwater geochemistry. Approximately 346 wells and more than 20 outcrops were examined and sampled during the course of the study to produce the 3-D conceptual models for the Lockport Group.

The Silurian carbonate sedimentary rocks that comprise the Niagara Escarpment region of southwestern Ontario and Manitoulin Island were chosen as the first stratigraphic succession to establish the OGS bedrock aquifer mapping initiative and protocols because the largest population base reliant on deep bedrock groundwaters in southern Ontario occurs in this region. Regional bedrock potable groundwater-flow zone mapping by the Ontario Geological Survey across the Niagara Escarpment region of southern Ontario and Manitoulin Island has revealed the existence of preferred pathways that have taken and are taking advantage of predictable and karstic sequence stratigraphic boundaries. Building upon the revisions to the early Silurian stratigraphy in southwestern Ontario, this study highlights the implications of a new paleogeographic and paleoenvironmental perspective. The new perspective provides important insights into the geological controls and predictability of finding carbonate bedrock potable water pathways. It highlights the importance of characterizing forebulge-tectonic zones on the farfield side of foreland basins, and the value of geologic mapping and acquisition of regional-scale field data to successfully explore, characterize, correlate and name bedrock potable water flow zones in a cost-effective manner.

Additional information can be found within a readme file provided with the product.

### Purpose or Objective

The Paleozoic Bedrock Groundwater Mapping Initiative of the OGS was officially established in 2007. It was preceded and overlapped by a 3-year field- and GIS-based surface and subsurface karst mapping initiative (2005 to 2008), a 3-year GIS-based bedrock topography mapping project (2004 to 2007) and collaborative field-based projects with various southern Ontario conservation

authorities to integrate bedrock geology with karstic groundwater-flow mapping and delineation.

The mapping of karst features across the Silurian dolostone plains and alvars of the Niagara Escarpment has revealed that the Cabot Head Formation shales represent a regional aquitard for potable bedrock groundwaters over an area extending from Cockburn–Manitoulin Islands through to the city of Hamilton. The early Silurian Rochester Formation shales that subcrop and outcrop between the city of Hamilton and Niagara Falls portions of the Niagara Escarpment cuesta form the regional aquitard in this region.

The Silurian carbonate sedimentary rocks that comprise the Niagara Escarpment region of southwestern Ontario and Manitoulin Island were chosen as the first stratigraphic succession to establish the OGS bedrock groundwater mapping initiative and protocols because the largest population base reliant on deep bedrock groundwaters in southern Ontario occurs in this region. Additional motivations to begin subsurface bedrock groundwater mapping in this region include increased population pressures because of the introduction of provincial legislation and response to recommendations associated with the Walkerton Tragedy in the spring of 2000, and subsequent introduction of the *Nutrient Management Act, 2002*, *Safe Drinking Act, 2002* and *Clean Water Act, 2006*.

While mapping karst features across southern Ontario, the OGS and the City of Guelph entered into 2 collaborative subsurface drilling programs to improve the understanding of bedrock geology and groundwater-flow conditions. Various hydrogeological and geological investigations, undertaken to evaluate the geological controls on deeper bedrock groundwater-flow systems in karstic and fractured stacked dolostone formations across the city, assisted the City of Guelph in establishing a 50-year Water Supply Master Plan to provide a 3-D geologic model to assist with Source Water Protection studies, and to develop protocols for a regional groundwater mapping program across the Niagara Escarpment.

The objective of this product is to collect and disseminate geoscience information for Ontario.

### **Keywords**

Geological Survey

Geology

Ministry of Energy, Northern Development and Mines

ENDM

Ministry of Northern Development and Mines

MNDM

Ontario Geological Survey

OGS

Groundwater Resources Study

GRS

Paleozoic Bedrock Geology

Groundwater

Stratigraphy

Stratigraphic Nomenclature (updated, new, changed)

Tectonic

### **Business Themes**

Geological Survey

Geology

### **GEOGRAPHIC INFORMATION**

### Geographic bounding box (decimal degrees)

North bounding latitude:	45.8958°
West bounding longitude:	-85.4256°
East bounding longitude:	-79.0083°
South bounding latitude:	42.9589°

**Description of Completeness:** irregularly shaped study area - completeness not available

### MAPPING INFORMATION:

Grid Coordinate System Used:	Universal Transverse Mercator
Map Projection:	Transverse Mercator
Horizontal Geodetic Datum:	NAD83
Vertical Datum:	Unknown
Horizontal Position Accuracy of Features:	±100 m
Vertical Position Accuracy of Features:	Unknown

### DATA SOURCE INFORMATION

#### Data Source Type and Description

Includes Bibliographic Information: Product includes references to other sources of information

#### Data Source Type and Description

Field work conducted from April 2008 to August 2014

**Current Status of the Data:** Complete

**Frequency of Changes or Additions to be made to the Data:** Not Planned

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## **METADATA**

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