REPORT

Maximum Predicted Water Table Report

Aberfoyle South Pit Expansion

Submitted to:

CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada)
55 Industrial Street
Toronto, Ontario
M4G 3W9

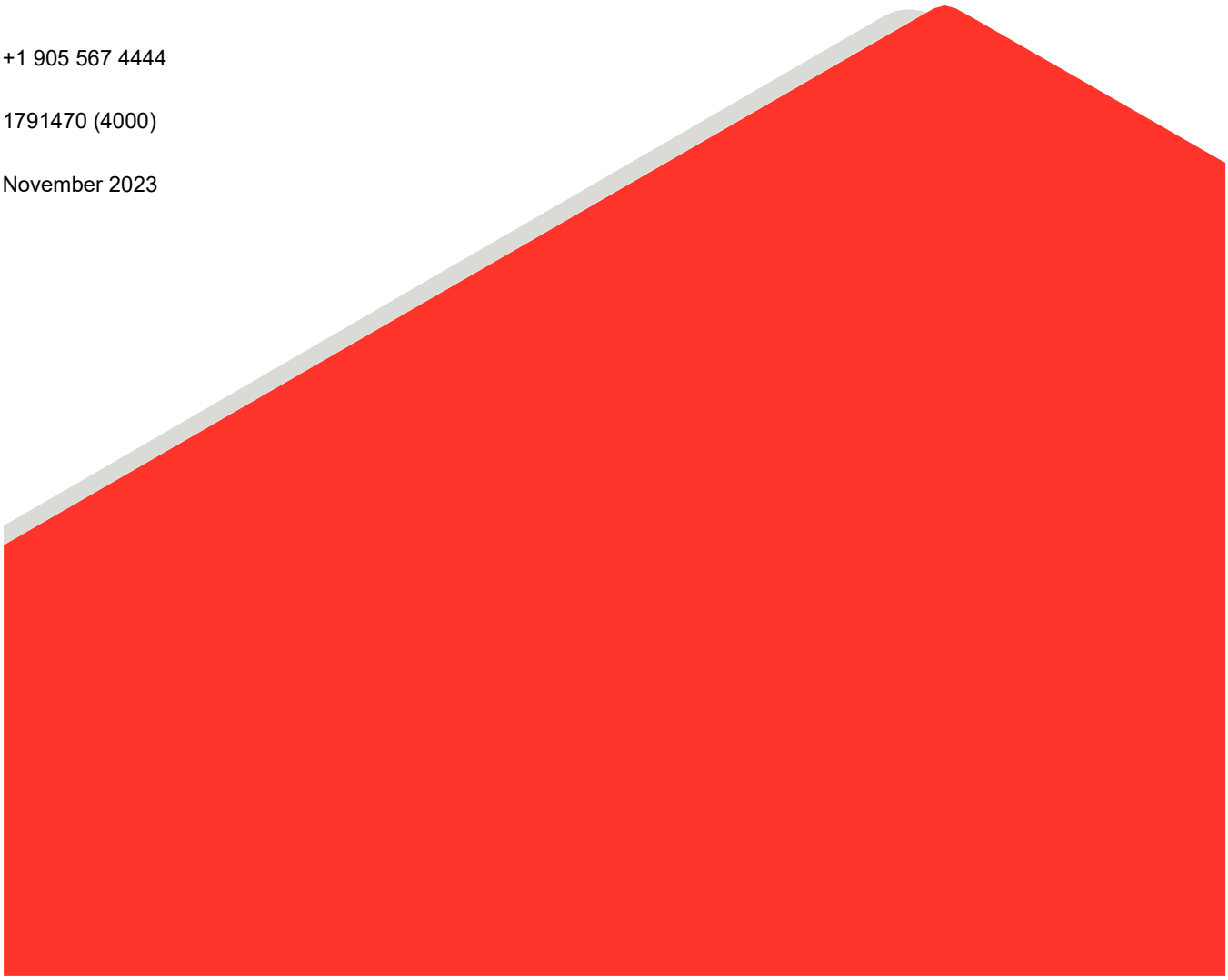
Submitted by:

WSP Canada Inc.
6925 Century Avenue, Suite #100, Mississauga, Ontario, L5N 7K2, Canada

+1 905 567 4444

1791470 (4000)

November 2023



Distribution List

e-copy: CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada)

e-copy: WSP Canada Inc.

Table of Contents

1.0 INTRODUCTION

WSP Canada Inc. (WSP), formerly Golder Associates Ltd. (Golder), is pleased to provide CBM Aggregates, a division of St. Marys Cement Inc. (Canada) [CBM], with this Maximum Predicted Water Table Report in support of a Class A Pit Below Water licence application under the *Aggregate Resources Act (ARA)* at the proposed Aberfoyle South Pit Expansion. The property is approximately 85 hectares (ha) in size and is located at 6947 Concession Road 2, in the Township of Puslinch, County of Wellington, Ontario (Figure 1).

This assessment is completed in accordance with the Ministry of Natural Resources and Forestry (MNRF) requirements as described in *Aggregate Resources of Ontario Standards: A compilation of the four standards adopted by Ontario Regulation 244/97 under the Aggregate Resources Act* (August 2020). A Terms of Reference (ToR) was initially submitted on October 12, 2021 to the County of Wellington, Township of Puslinch Grand River Conservation Authority and later issued in final form on September 7, 2023 incorporating Township, County and agency review comments (Appendix A). For the purpose of this report, the following definitions are used:

Property (Figure 1) – The total area of the property owned by CBM that includes lands not being considered for licensing or extraction. The property area is approximately 85 ha in size.

Site (Figure 1) – The total land area within the property owned by CBM that is proposed for licensing under the ARA. The proposed site / licence area is approximately 44 ha in size.

Extraction Limit (Figure 1) – The extraction limit demarks the area within the site in which aggregate extraction is proposed. The area within the extraction limit is approximately 27 ha in size.

2.0 SITE LAND USE AND PROPOSED DEVELOPMENT

2.1 Existing Conditions Scenario

The Property is roughly rectangular in shape and is comprised of approximately 50% agricultural fields , which are flanked by three wooded areas in the northwest, north-central and southeast portions of the property (Figure 1). An unoccupied residence, including a bungalow, a barn, and two garage/shed buildings, is located in the western portion of the property.

Mill Creek flows from north to south along the eastern and southeastern portion of the property (Figure 2), exits the property along the southern boundary, and then flows westward approximately 150 m to the south of the property boundary. There are five small tributaries to Mill Creek proximal to the property (Figure 2), referred to as Tributary 1, 2, 3, 4 and 5. Tributaries 1, 3 and 5 originate off-property but then flow onto the property and join Mill Creek, while Tributaries 2 and 4 are located entirely off-property. All the woodland areas on the property are part of the Mill Creek-Puslinch Provincially Significant Wetland (PSW).

Land use directly adjacent to the property is largely composed of rural residential properties consisting of single family dwellings surrounded by wooded areas.

2.2 Operations Scenario

The proposed extraction area on the property is approximately 27 ha in size, within a total proposed licenced area of approximately 44 ha (Figure 1). The proposed extraction area limit was established by applying a minimum 30 m setback from watercourses, wetlands and / or property limits as per ARA requirements, and a minimum 60 m offset from Mill Creek.

Reserve estimates indicate that there are approximately 5.5 million tonnes of aggregate present within the proposed extraction area, with over 95% of the resource situated below water, as delineated by the measured high water table elevation (discussed in Section 5). Based on borehole drilling results, the maximum depth of extraction is expected to be up to 20 m below the current ground surface to a maximum lower extraction elevation of 285 m above sea level (masl).

Aggregate extraction will initially begin above the water table in the west-central portion of the extraction area and proceed westward towards the western edge. Aggregate extraction by dragline will then begin below the water table in the westernmost part of the extraction area and proceed in an easterly direction. Above water table and below water table extraction will then proceed generally concurrently in an eastward direction until aggregate extraction has been completed, creating ponding conditions effectively throughout the operational period.

The raw aggregate will be temporarily stockpiled on-site to allow the pore water within the aggregate to drain back to the emerging pit pond prior to transport of the raw aggregate feedstock off-site for processing. The raw aggregate will be processed at the nearby CBM Aberfoyle South Pit operation.

For the purposes of this assessment, it is assumed that aggregate extraction will take place on the Aberfoyle South Expansion over a period of approximately 6 to 10 years, depending on market conditions, with a maximum annual aggregate extraction rate of 1 million tonnes per year. Site operations will not involve any pumping or active dewatering and there will be no direct off-site discharge of water to any watercourse or wetland. Within the extraction area, all drainage will be directed internally to the emerging pit pond.

2.3 Rehabilitated Scenario

Site rehabilitation will result in a permanent pond with a variety of naturalized shoreline features. The pond water elevation is expected to reside at an elevation of +/- 302.0 masl. As part of the final rehabilitation design, the extraction faces will be completed at a 3:1 slope above-water and a 2:1 slope below-water.

3.0 PURPOSE AND SCOPE

This Maximum Predicted Water Table Report for the proposed Aberfoyle South Pit Expansion details how the maximum predicted water table was identified in metres above sea level, relative to the proposed depth of excavation at the Site.

For the purposes of this Report “groundwater table” means the following.

a) For unconsolidated surficial deposits, the groundwater table is the surface of an unconfined water-bearing zone at which the fluid pressure in the unconsolidated medium is atmospheric. Generally, the groundwater table is the top of the saturated zone.

b) For confined water bearing zones or consolidated bedrock materials, the groundwater table, or potentiometric surface, is a level that represents the fluid pressure in the water bearing zone and is generally defined by the level to which water will rise in a well.

Note: The groundwater table is not static and is expected to vary from location to location and over time.

For the purposes of this Report “maximum predicted water table” means the maximum groundwater elevation (metres above sea level) predicted by qualified persons who have considered conditions at the Site and mean annual precipitation levels. For confined water bearing zones the groundwater table is the level to which water will rise in a well.

At the proposed Aberfoyle South Pit Expansion, the maximum predicted water table was determined by the installation of a series of monitoring wells in 2018 across the Site and Study Area, surveying the wells for location and elevation using a licenced Ontario Land surveyor, assessing the measured groundwater levels on the Site from 2018 to 2022, and then preparing a groundwater level contour map showing the maximum predicted groundwater table at the Site. This report was prepared by qualified persons, and their CVs are provided in Appendix B.

4.0 DRILLING AND MONITORING WELL INSTALLATION

An initial borehole drilling program was carried out between January 9 and 17, 2018. During this period a total of 16 boreholes were drilled (BH18-01 to BH18-11 and MW18-01 to MW18-05) at the locations shown on Figure 1. Locations MW18-02 to MW18-05 were completed as monitoring wells in the overburden aquifer. The borehole originally intended to be completed as MW18-01 was drilled, but a monitoring well was not installed at that time.

On June 21, 2018 a new borehole was drilled adjacent to the original location planned for MW18-01 and well MW18-01B was installed at that location.

A sixth overburden monitoring well, MW18-06, located in the north-central portion of the property (Figure 1), was installed on November 23, 2018 to complement the existing overburden monitors around the periphery of the proposed extraction area.

The January 2018 drilling and monitoring well installation was carried out by Choice Sonic Drilling Ltd. (CSD) of Mount Albert, Ontario, under WSP supervision. A track-mounted Sonic SDC 550 rotasonic drill rig was employed. Each borehole was continuously cored to a depth of 14.94 m, producing a 114 mm (4 ½") diameter soil continuous core which was logged and photographed by WSP field personnel. The boreholes were terminated at a depth of 14.94 m (50'), as this was considered to be sufficiently deep to confirm the presence of aggregates at the property, and sufficiently deep to install monitoring wells within the unconfined sand and gravel aquifer.

The June 2018 drilling and installation of MW18-01B install was carried out by Aardvark Drilling Ltd. (Aardvark) of Guelph, Ontario, under WSP supervision. A track-mounted Yamma A45 hollow stem auger drill rig was employed. The borehole was advanced to a depth of 6.55 m, producing a 203.2 mm (8") diameter hole. Soil cuttings were logged by WSP during the drilling.

The November 2018 drilling and installation of MW18-06 was carried out by CSD under WSP supervision with the Sonic SDC 550 rig. The borehole was continuously cored to a depth of 9.14 m, producing a 114 mm (4 ½") diameter soil continuous core which was again logged and photographed by WSP field personnel.

All monitoring wells were installed using 2 m to 3 m long No. 10 slot, 52 mm diameter (2") Schedule 40 PVC well screens and PVC riser pipes. The screens were positioned within the overburden water table aquifer. In general, the annulus of the borehole adjacent to the monitoring well screen was backfilled with silica sand to approximately 0.6 m above the top of the screen. The remainder of the borehole annulus was backfilled with bentonite hole plug up to approximately 0.3 mbgs. The monitoring wells were completed with monument-style above ground casings set in concrete at ground surface and the top of the monitoring well riser pipes were equipped with removable J-plugs.

Records of the monitoring wells installations are provided in Appendix C. The monitoring wells were surveyed by Van Harten Surveying Inc. of Guelph, Ontario on November 30, 2018 using the UTM Zone 17 CSRS 2010 datum, with elevations relative to the CGVD 1928, 1978 Adjustment datum.

A summary of well completion is provided below in Table 1.

Table 1: Borehole and Monitoring Well Summary

Well / Borehole ID	Easting (m)	Northing (m)	Ground Elevation (masl)	Riser Pipe Stick-Up (m)	Drilled Depth (mbgs)	Screen Top (mbgs)	Screen Bottom (mbgs)
MW18-01A/B	565094	4808766	302.66	0.79	14.94	2.59	6.25
MW18-02	565724	4809059	303.35	1.01	14.94	7.32	10.37
MW18-03	566010	4809432	303.66	0.87	14.94	7.32	10.37
MW18-04	566032	4809696	303.81	0.94	14.94	8.84	11.89
MW18-05	565243	4809513	307.17	0.85	14.94	8.84	11.89
MW18-06	565549	4809337	303.07	0.78	9.14	6.09	9.14
TW11-16	565090	4808761	302.39	0.58	41.46	22.26	41.46

5.0 GROUNDWATER MONITORING AND MAXIMUM PREDICTED WATER TABLE

The property groundwater monitoring network consists of six overburden monitoring wells (MW18-01B to MW18-06), one previously existing bedrock well (TW11-16), and six standpipe piezometers (SP18-01 to SP22-02) at the surface water stations (Figure 1), with most locations equipped with pressure transducers (“dataloggers”). Water level monitoring began in April 2018 and has continued to December 2021 with monthly monitoring events for the wells and quarterly events for the standpipes. Groundwater level monitoring continued in 2022 with monitoring events at a quarterly frequency. Monitoring events included manual readings using a water level probe and collecting data from in well dataloggers. The transducers record pressure at 15-minute intervals which is then corrected for barometric pressure changes and converted to water elevations. Groundwater level data presented and analysed in this report comprise the data collected from April 2018 to December 2022.

Manual groundwater level measurements are presented in Table 2 and groundwater hydrographs are presented in Appendix D. The Maximum Predicted Water Table measured on Site for the 4-1/2 year period of record were measured on January 12, 2020 and are presented on Figure 2. These conditions occurred during a winter freshet event, when warm temperatures caused a snow melt, and a significant rainfall event also took place.

Also presented in Appendix D is a hydrograph and location map (Figure D2) for off-site monitoring Well 16-79 located just northeast of the Site along Mill Creek. This well is approximately 9 m deep and screened in the water table aquifer, so its groundwater levels are indicative of the water table at that location. The maximum groundwater level at Well 16-79 for the period of record April 2018 to December 2022 was 303.76 masl, and the maximum water level at Well 16-79 since recording began in 1989 was 303.88 masl, which compares conservatively to the maximum groundwater level of 303.95 masl observed by WSP at the nearest on site well (MW18-04), suggesting the maximum predicted water table interpretation for the Aberfoyle South site is reasonable.

Table 2 - Groundwater Level Measurements
Aberfoyle South Pit Expansion

Date	MW18-01B	MW18-02	MW18-03	MW18-04	MW18-05	MW18-06	TW11-16	SP18-01	SP18-02	SP18-03	SP18-04	SP22-01	SP22-02
2018-04-24	-	302.76	303.28	303.66	304.11	-	301.97	-	-	-	-	-	-
2018-06-04	-	302.51	303.12	303.49	303.68	-	301.75	-	-	-	-	-	-
2018-06-21	-	302.37	302.98	303.34	303.41	-	-	-	-	-	-	-	-
2018-07-06	-	302.41	302.99	303.37	303.38	-	-	302.51	302.98	302.03	301.34	-	-
2018-08-03	301.54	302.33	302.93	303.28	303.15	-	301.41	-	-	-	-	-	-
2018-08-31	301.67	302.42	303.00	303.39	303.26	-	301.48	-	-	-	-	-	-
2018-09-17	-	-	-	-	-	-	-	302.49	302.95	302.00	301.33	-	-
2018-10-04	301.80	302.61	303.21	303.43	303.38	-	301.53	-	-	-	-	-	-
2018-10-29	301.75	302.54	303.15	303.48	303.41	-	301.49	-	-	-	-	-	-
2018-11-30	301.88	302.72	303.27	303.61	303.84	303.00	301.69	-	-	-	-	-	-
2019-01-03	301.89	302.71	303.22	303.57	303.91	302.97	301.76	-	-	302.00	-	-	-
2019-02-05	302.05	302.81	303.35	303.72	303.88	303.14	301.79	-	-	-	-	-	-
2019-03-07	301.80	302.57	303.11	-	303.72	302.76	301.66	-	-	-	-	-	-
2019-03-28	-	-	-	-	-	-	-	302.70	303.10	302.03	301.45	-	-
2019-04-09	301.96	302.82	303.33	303.66	303.98	303.12	301.90	-	-	-	-	-	-
2019-05-08	301.96	302.78	303.27	303.63	304.09	303.00	301.99	-	-	-	-	-	-
2019-06-06	301.97	302.73	303.32	303.66	303.99	303.01	301.94	-	-	-	-	-	-
2019-06-28	-	-	-	-	-	-	-	302.66	303.04	302.03	301.45	-	-
2019-07-03	301.85	302.58	303.15	303.53	303.73	302.75	301.79	-	-	-	-	-	-
2019-08-02	301.70	302.40	303.00	303.38	303.46	302.62	301.62	-	-	-	-	-	-
2019-09-02	301.70	302.38	303.02	303.34	303.27	302.55	301.53	-	-	-	-	-	-
2019-10-03	301.87	302.53	303.18	303.56	303.36	302.74	-	302.59	303.25	302.00	301.48	-	-
2019-11-06	301.88	302.72	303.23	303.60	303.68	303.03	301.71	-	-	-	-	-	-
2019-12-03	301.85	302.64	303.21	303.54	303.76	302.89	-	-	-	-	-	-	-
2019-12-19	-	-	-	-	-	-	-	-	-	302.03	-	-	-
2020-01-07	301.89	302.70	303.21	303.57	303.93	302.95	-	-	-	-	-	-	-
2020-02-04	301.93	302.68	303.22	303.62	304.04	302.93	301.94	-	-	-	-	-	-
2020-03-02	301.88	302.62	303.18	303.56	303.90	302.89	301.84	-	-	-	-	-	-
2020-03-06	-	-	-	-	-	-	-	302.86	303.29	302.03	301.61	-	-
2020-03-31	301.97	302.75	303.28	303.65	304.08	303.03	301.98	-	-	-	-	-	-
2020-04-24	301.86	302.59	303.15	303.52	303.84	302.80	301.83	-	-	-	-	-	-
2020-05-19	301.92	302.69	303.25	303.62	303.84	302.96	301.81	-	-	-	-	-	-
2020-06-17	301.75	302.46	303.05	303.42	303.55	302.70	301.62	302.57	302.96	301.94	301.38	-	-
2020-07-27	301.59	302.33	302.93	303.31	303.20	302.49	301.41	-	-	-	-	-	-
2020-09-04	301.50	302.28	302.90	303.25	302.82	302.43	301.20	-	-	-	-	-	-
2020-09-25	-	-	-	-	-	-	-	301.84	302.97	301.99	301.30	-	-
2020-10-06	301.67	302.43	303.05	303.38	303.03	302.63	301.41	-	-	-	-	-	-
2020-11-05	301.68	302.54	303.09	303.41	303.26	302.76	301.46	-	-	-	-	-	-
2020-12-03	301.86	302.73	303.22	303.59	303.47	302.99	301.56	-	-	-	-	-	-
2020-12-18	-	-	-	-	-	-	-	-	-	301.98	-	-	-
2021-01-05	301.89	302.74	303.23	303.60	303.79	303.00	301.66	-	-	-	-	-	-
2021-02-02	301.76	302.48	303.06	303.44	303.66	302.73	301.58	-	-	-	-	-	-
2021-03-03	301.84	302.63	303.18	303.53	303.70	302.92	301.61	-	-	-	-	-	-
2021-03-29	301.92	302.73	303.25	303.61	303.90	303.03	301.73	302.79	303.39	302.03	301.46	-	-
2021-04-23	301.83	302.58	303.13	303.49	303.84	302.82	301.69	-	-	-	-	-	-
2021-06-07	301.62	302.31	302.70	303.24	303.43	302.50	301.14	-	-	-	-	-	-
2021-06-28	301.63	302.31	-	-	303.35	302.50	-	302.52	303.07	-	301.37	-	-
8/12&16/2021	301.60	302.37	302.93	303.26	303.36	302.60	301.49	-	-	-	-	-	-
2021-08-31	301.55	302.32	302.93	303.27	303.21	302.55	301.34	-	-	-	-	-	-
2021-09-23	302.05	302.89	303.34	303.70	303.71	303.24	301.69	302.80	303.26	302.03	301.77	-	-
2021-10-27	301.94	302.74	303.28	-	303.94	303.03	301.74	-	-	-	-	-	-
2021-12-16	301.91	302.71	303.22	303.56	304.00	302.98	301.80	302.75	303.16	302.03	301.48	-	-
2022-03-14	301.88	-	303.22	303.61	303.95	303.01	301.85	-	-	301.98	-	-	-
2022-06-03	301.70	302.42	303.01	303.41	303.59	302.65	301.64	302.56	303.05	302.03	301.37	302.65	302.02
2022-10-12	301.47	302.27	302.90	303.25	302.91	302.48	301.23	302.01	302.98	302.01	301.29	-	-
2022-12-06	301.70	302.52	303.09	303.44	303.25	302.78	301.42	302.63	303.04	302.03	301.41	302.50	303.15

Notes:
Groundwater levels are in units of metres above sea level (masl)

6.0 CLOSURE

This Maximum Predicted Water Table Report for the proposed Aberfoyle South Pit Expansion has been prepared in accordance with the Aggregate Resources Act Ontario Regulation 244/97. For further information on the water resources on the Site see the Water Report Level 1/2 Proposed Aberfoyle South Pit Expansion (WSP 2023).

Signature Page

WSP Canada Inc.

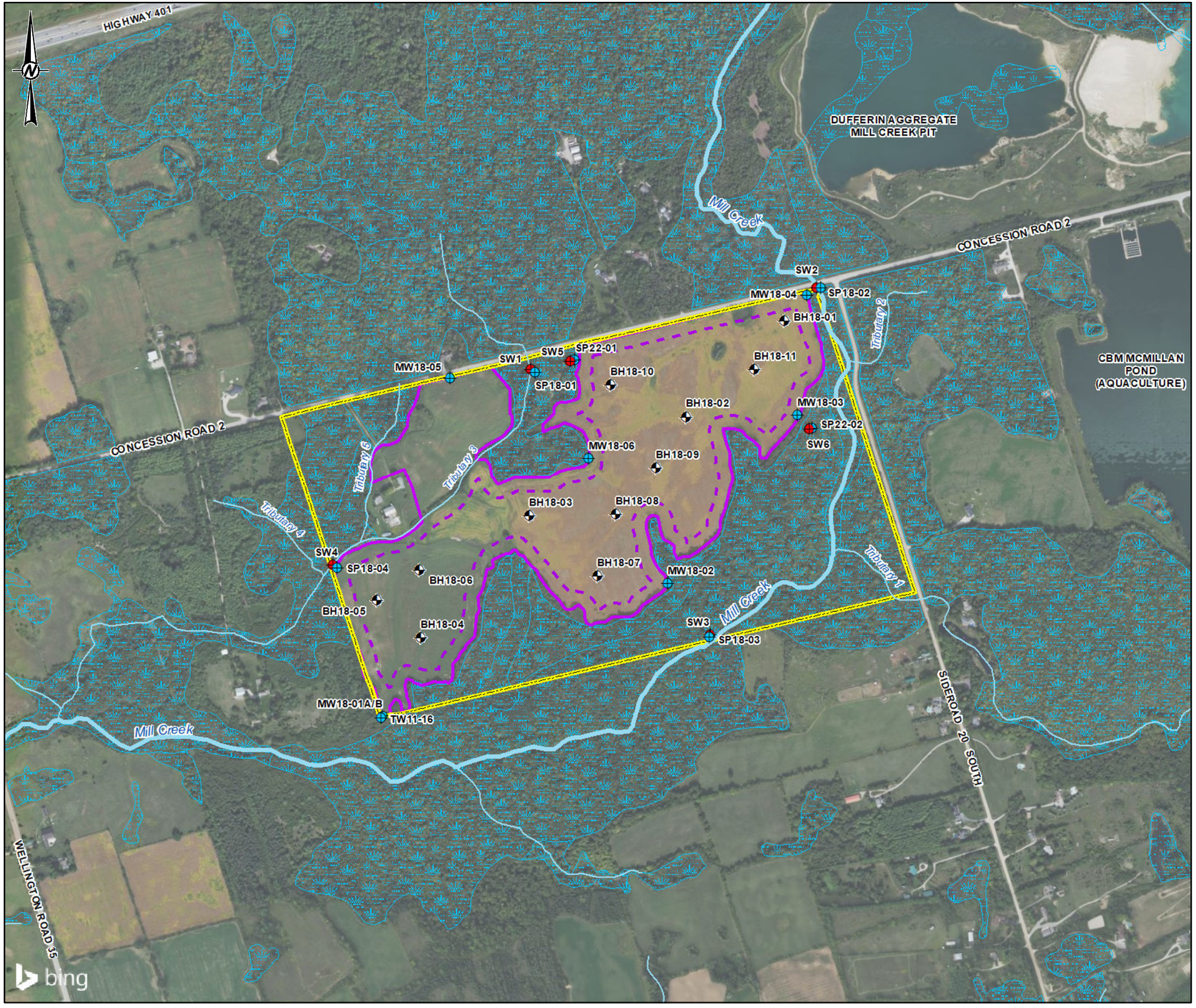
Paul Menkveld, MSc
Environmental Scientist

George Schneider, MSc, PGeo
Senior Geoscientist

PGM/GWS/

C:\GWS-Work\1 - Active\CBM 1791470 Aberfoyle South\08 Max PWT Report 01Nov2023\1791470-4000-Rev1 Aberfoyle S Max PWT Report 01Nov2023.docx

FIGURES



KEY MAP

SCALE: 1:425,000

LEGEND

- Resource Evaluation Borehole
- Groundwater Monitor
- Surface Water Monitor
- Watercourse
- Provincially Significant Wetland (Evaluated)
- Property Boundary
- Proposed Extraction Area

0 100 200 300 400

1:8,500 METRES

REFERENCE(S)

1. MECP WATER WELL RECORD DATA OBTAINED SEPTEMBER 2020.
2. BASEDATA: MNRF LIO, OBTAINED 2019
3. IMAGERY SOURCE: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
© 2023 MICROSOFT CORPORATION © 2023 MAXAR ©CNES (2023) DISTRIBUTION AIRBUS DS IMAGE SEPTEMBER 2016
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC.(CANADA)

PROJECT
ABERFOYLE SOUTH PIT EXPANSION

TITLE
STUDY AREA

CONSULTANT

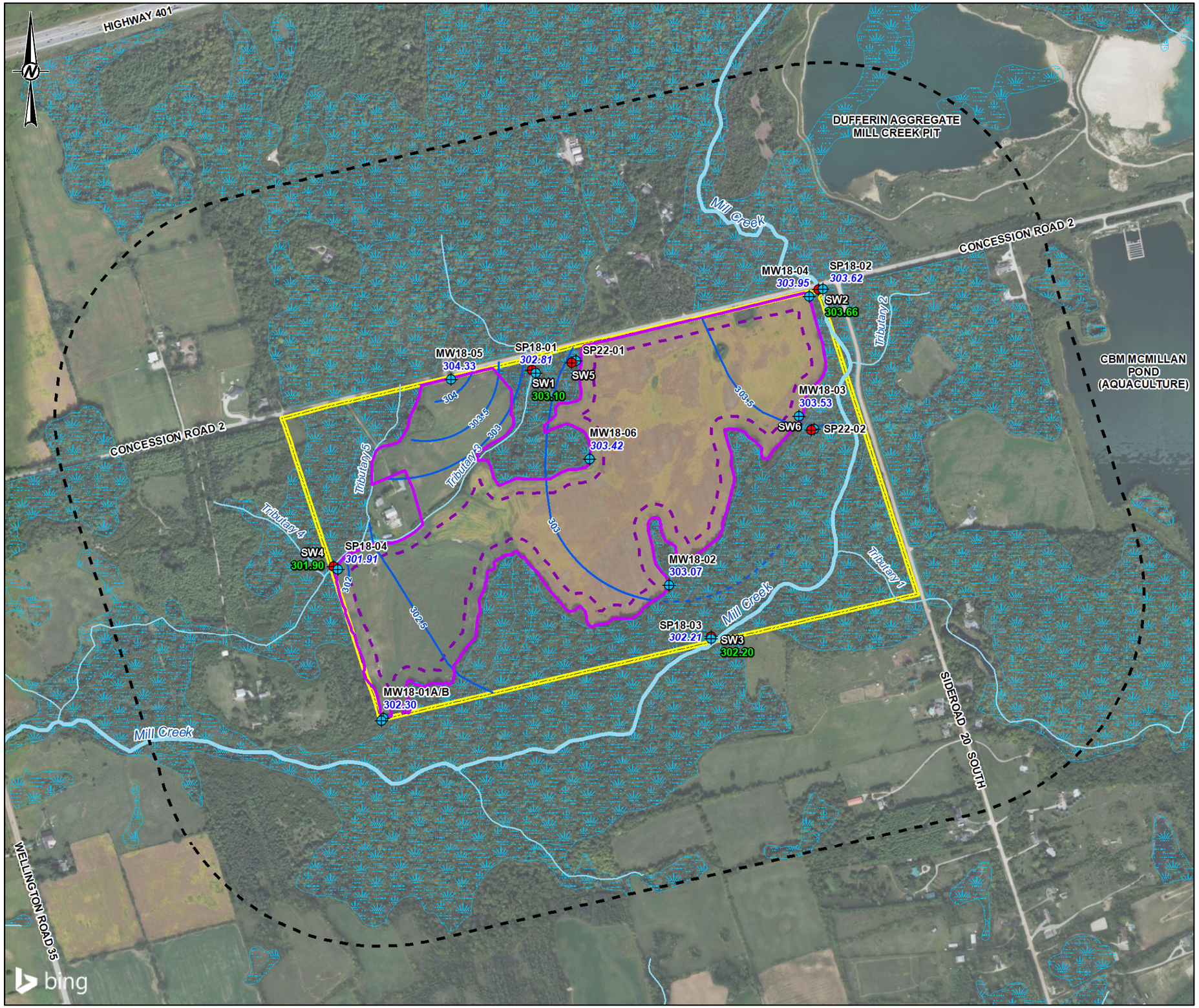
wsp

YYYY-MM-DD	2023-10-29
DESIGNED	SO
PREPARED	SO
REVIEWED	GWS
APPROVED	GWS

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0008	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

Path: S:\Clients\CBM_Aggregates\Aberfoye_Pit\99_PRO\1791470_CBM40_PRO\0008_South_Pit_Extension\1791470-0008-CH-0001.mxd



LEGEND

- Groundwater Monitor
- Surface Water Monitor
- Watercourse
- Inferred Water Table Elevation Contours
- Water Table Elevation Contours
- Provincially Significant Wetland (Evaluated)
- Property Boundary
- Property Boundary 500 m Buffer
- Proposed Extraction Area
- Licence Boundary / Site Boundary
- 303.65 Groundwater elevations observed at January 12, 2020.
- *303.65* Groundwater head above ground surface
- 303.66 Surface water elevations observed at January 12, 2020.

0 100 200 300 400

1:8,500 METRES

REFERENCE(S)

1. GROUNDWATER LEVATIONS SELECTED MARCH 12, 2020.
2. BASEDATA: MNRF LIO, OBTAINED 2019
3. IMAGERY SOURCE: © 2023 MICROSOFT CORPORATION © 2022 MAXAR ©CNES (2022) DISTRIBUTION AIRBUS DS
SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY IMAGE SEPTEMBER 2016
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
ST. MARYS CEMENT INC. (CANADA)

PROJECT
ABERFOYLE SOUTH PIT EXPANSION

TITLE
MAXIMUM PREDICTED WATER TABLE ELEVATION

CONSULTANT

YYYY-MM-DD	2023-02-08
DESIGNED	SO/PGM
PREPARED	SO
REVIEWED	GWS
APPROVED	GWS

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0008	0	**2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

Path: S:\Clients\CBM_Aggregates\Aberfoyle_P#99_PROJ\1791470_CBM#40_PROD\0008_South_Pit_Extension\1791470-0008-CH-0015.mxd

APPENDIX A

Terms of Reference

TECHNICAL MEMORANDUM

DATE September 7, 2023 **Project No.** 1791470

TO CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada)

FROM Heather Melcher **EMAIL heather.melcher@wsp.com**

TERMS OF REFERENCE FOR NATURAL ENVIRONMENT AND WATER RESOURCES TECHNICAL STUDIES FOR THE CBM ABERFOYLE SOUTH PIT EXPANSION, TOWNSHIP OF PUSLINCH, ONTARIO

WSP Canada Inc. (WSP; formerly Golder Associates Ltd. [Golder]) has been retained by CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada) to carry out technical studies in support of Planning Act applications to the Township of Puslinch and the County of Wellington and an application to the Ministry of Natural Resources and Forestry (MNRF) for a Class "A" licence (Pit Below Water) under the *Aggregate Resources Act* (ARA) for the property located at 6947 Concession Road 2, Township of Puslinch, Wellington County, Ontario (the site; Figure 1). The site will be an expansion to CBM's existing Aberfoyle South Pit.

The technical studies for the ARA licence application and Planning Act applications will include a number of disciplines, including hydrogeology, surface water and natural environment.

The technical requirements of these supporting studies are outlined in the County of Wellington Official Plan (2021) and the Aggregate Resources of Ontario Provincial Standards: A Compilation of the Four Standards Adopted by Ontario Regulation 244/97 Under the Aggregate Resources Act (2020). Golder's proposed approach to the project has been developed to meet these requirements.

The above studies will be integrated to ensure that any key linkages between the hydrogeological and hydrological components, and the receiving natural environment features, are holistically evaluated to support the completion of the potential impact assessments for the proposed expansion of the pit and the development of appropriate mitigation measures, if required.

Integrated Water Resource Assessment

The following provides the proposed scope of the water resources program consisting of hydrogeology (groundwater) and hydrology (surface water) components.

Hydrogeology

The program for hydrogeology consists of the following:

- A review of publicly available data and reports relevant to the Site and subwatershed.
- A review of the Grand River Source Protection Plan (GRCA 2021) and any other applicable policies.

- A field investigation program that includes:
  - Borehole drilling, grain size analysis and monitoring well installation (see Figure 1)
  - Baseline groundwater quality monitoring (general water quality parameters including major ions, metals, and petroleum hydrocarbons)
  - Hydraulic conductivity testing (single well response tests) of the monitoring wells installed as part of the field program
  - Groundwater level and temperature monitoring (dataloggers to record water level and temperature hourly and downloaded quarterly)
- A review of local groundwater users based on the Ministry of the Environment, Conservation and Parks (MECP) Water Well Information System (WWIS) and Permit To Take Water (PTTW) databases.
- A private well survey of properties surrounding the site was originally planned for 2020 or 2021. The purpose of such a survey was to supplement the MECP WWIS information and "ground truth" the current condition of neighbouring resident's water supply wells. Activities would have included door-to-door visits and subsequent interactions between field staff and residents. Participation would be entirely voluntary. However, as a result of ongoing COVID-19 concerns this task has been postponed for the time being. It is proposed that this activity be completed at later date prior to any aggregate extraction taking place on the site.
- In conjunction with surface water studies, the development of a Site water budget for Existing, Operations and Rehabilitated Scenarios to determine pre-and post-development surplus, runoff, and infiltration rates.
- The construction and calibration of a 3D numerical groundwater flow model based on the "Tier 3 Model" with high resolution refinement of the model mesh within the immediate area of the site, and subsequent predictive simulations to estimate potential water flow impacts of the proposed below-water extraction on surrounding groundwater and surface water receptors.
- The development of a groundwater analytical model to predict the potential for thermal impacts to local watercourses, including Mill Creek, taking into account the Grand River Conservation Authority (GRCA) Cumulative Effects Assessment Best Practices Paper (GRCA 2010).
- Analysis and qualitative hydrogeologic impact assessment.
- An assessment of groundwater vulnerability and potential changes to water chemistry.
- An analysis of potential cumulative effects in light of the presence of other nearby aggregate operations, taking into account the GRCA Cumulative Effects Assessment Best Practices Paper (GRCA 2010).
- Development of a monitoring plan for groundwater.
- The results of the hydrogeological assessment will be summarized in a Maximum Predicted Water Table Report and a Level 1 and 2 Water Report that fulfills the current County of Wellington Official Plan policies and ARA requirements.

Surface Water Resources

An assessment of surface water resources in the area of the site, as well as adjoining areas that may be affected by proposed expansion, will be completed to allow for quantification of potential effects. The surface water resources assessment consists of the following:

- Background review of the available information pertaining to within approximately 500 metres of the site. the information reviewed will consist of:

i) Aerial photographs and topographic, physiographic, and geologic mapping

ii) Published water resources reports

iii) Any existing permits or monitoring reports from the site, and nearby lands (e.g., Mill Creek Pit)

- Review of GRCA floodplain data for the site, and assessment of potential impacts of extraction on flood elevations on-site and both upstream and downstream.
- Site reconnaissance to identify and confirm drainage features and catchment boundaries adjacent to the pit. The site reconnaissance is also used to corroborate the findings of the information review and identify local features that were not apparent from the background review.
- A water budget and pit water balance using a Thornthwaite water budget tool, developed for the existing pit footprint area (footprint) and the proposed expansion lands. The Thornthwaite water budget information will be used to develop an annual pit water balance for the existing operation. A future pit water balance will be estimated by including future footprint and land-use information.
- The floodplain assessment will provide appropriate flooding intervals through mapping and elevations for the site and the study area.
- The in-stream water level, temperature and flow monitoring in Mill Creek and associated tributaries in the vicinity of the site will allow Golder to characterise the creek reaches and therefore better understand potential effect of the proposed extraction on site. The in-stream water level monitors will be paired with stream piezometer monitoring stations and visited quarterly.
- An effects assessment on features within the catchment of the site that documents the magnitude and significance of expected changes in the water budget of the site.
- Development of a monitoring plan for surface water.
- A report that describes the surface water assessments, including a description of existing and proposed conditions and expected effects, and will ultimately be included as an appendix to the Level 1 and 2 Water Report.

Natural Environment Assessment

Golder is undertaking a work program for a natural environment assessment to evaluate the natural features in the vicinity of the site (see Figure 1). Golder will assess the potential impacts of the proposed below water

extraction on those features and their ecological functions and, if necessary, recommend measures to prevent or mitigate negative impacts on any significant features. The proposed program consists of the following:

- Background data compilation and review of existing documents and information sources which will be focused on designated features in the vicinity of the site. This will include a review of relevant County of Wellington and Provincial policies.
- Review of the water balance completed as part of the surface water assessment, as described above, and assessment of the potential impacts of that water balance on natural features on, and in the vicinity of, the site.
- Species at Risk (SAR) screening focussing on those species listed under the Ontario *Endangered Species Act* (ESA) and federal *Species at Risk Act* (SARA). First completed at a desktop exercise using up to date air photos, and then updated based on the results of the field surveys.
- Communication with the MECP and MNRF for additional information regarding SAR, fisheries data and the Mill Creek Puslinch Provincially Significant Wetland.
- Field surveys including:

i) Plant community assessment using the Ecological Land Classification (ELC) system for southern Ontario (Lee et al. 1998).

ii) Delineate/confirm the boundaries of natural heritage features including wetlands and woodlands using a handheld GPS. Note that wetlands were delineated using Ontario Wetland Evaluation System (OWES). The wetland boundary will be verified in the field with the Grand River Conservation Authority (GRCA). The woodland boundary will be verified in the field with the County and/or Township. CBM will have the boundaries surveyed by a registered surveyor.

iii) Three season botanical inventory, including surveys for butternut and black ash.

iv) Three rounds of anuran call count surveys following protocols from the Marsh Monitoring Program method for vocalizing frog surveys (BSC 2008)

v) Two rounds of amphibian habitat assessment and egg mass surveys following protocols from the Sampling Protocol for Determining the Presence of Jefferson Salamanders (*Ambystoma jeffersonianum*) in Ontario (JSRT 2013)

vi) Assessment of the site and vicinity as habitat for Blanding's turtle.

vii) Three rounds of breeding bird surveys following protocols from the Canadian Breeding Bird Survey (Downes and Collins 2003), and the Ontario Breeding Bird Atlas (Cadman et al. 2007)

viii) Bat habitat and acoustic surveys based on guidance from the MNRF document Survey Protocol for Species at Risk Bats within Treed Habitats (MNRF 2017) and Bat and Bat Habitat: Guidelines for Wind Power Projects (MNR 2011).

ix) Wildlife habitat assessment and general wildlife surveys (Visual Encounter Surveys) following provincially accepted methods (Bookhout 1994; McDiarmid 2012; MNRF 2016; MNRF 2017; Pyle 1994).

x) A qualitative fish habitat assessment in Mill Creek and tributaries on the site and in the vicinity, using MTO Fisheries Assessment Protocols and Golder's Technical Procedures (unpublished file information). These protocols include a description of aquatic habitat (e.g., permanence, stage, confinement), habitat mapping of key habitat features (e.g., riffles, pools, woody debris) and characteristics (e.g., wetted and bankfull width/depth, substrate types, cover, seepage areas), a description of riparian and/or aquatic vegetation, identifying locations of any critical fish habitat areas or barriers to fish movement and observations of any fish and aquatic species.

- Assessment of Significant Wildlife Habitat, per the Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E (2015).
- Assessment of linkages and connectivity for wildlife.
- Analysis of the data collected in conjunction with the background data compilation and integration with the hydrogeological and surface water studies to complete a potential impact assessment.
- Development of the final rehabilitation, including appropriate setbacks, upland and wetland plantings, creation of wetlands and wildlife habitat, and a monitoring plan, where appropriate.
- One single natural environment report that includes a description of existing conditions through the desktop review and results of the field surveys, an assessment of impacts on all natural features, as outlined in the Provincial Policy Statement (MMAH 2020), the rehabilitation plan, a description of any mitigation and monitoring, and will meet the requirements of:
  - Natural Environment Report (NER), based on ARA standards (Ontario 2020).
  - Environmental Impact Assessment (EIA) for the County of Wellington (Wellington 2021).
  - Environmental Impact Study guidelines and submission standards for Wetlands of the GRCA (2005).

Closing

We trust this Terms of Reference meets with your approval. If you have any questions or comments, please do not hesitate to contact the undersigned.

WSP Canada Inc.

[redacted]

Heather Melcher, MSc
Director, Ecology and Water Resources

[redacted]

George Schneider, MSc, PGeo
Principal, Senior Hydrogeologist

HM/GS/ld

Attachments: Figure 1: Study Area, Groundwater and Surface Water Monitoring Locations

References

Bird Studies Canada. Marsh Monitoring Program Participant's Handbook for Surveying Amphibians. 2009 Edition. 13 pages. Published by Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. February 2009.

Bookhout T.A., Editor. 1994. Research and management techniques for wildlife and habitats. Fifth ed. The Wildlife Society, Bethesda M.D. 740 pp.

Cadman MD, Sutherland DA, Beck GG, Lepage D, Couturier AR, editors. 2007. Atlas of the Breeding Birds of Ontario. Toronto ON: Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature. xxii + 706 p.

Downes CM, Collins BT. 2003. Canadian Breeding Bird Survey, 1967-2000. Ottawa ON: National Wildlife Research Centre, Canadian Wildlife Service. http://publications.gc.ca/collections/collection_2013/ec/CW69-9-219-eng.pdf. 40 p.

Grand River Conservation Authority (GRCA). 2010. Cumulative Effects Assessment (Water Quality and Quantity) Best Practices Paper for Below-Water Sand and Gravel Extraction Operations in Priority Subwatersheds in the Grand River Watershed.

Grand River Conservation Authority (GRCA). 2021. The Grand River Source Protection Plan. URL: Grand River - Approved Source Protection Plan - Drinking Water Source Protection (sourcewater.ca).

JSRT (Jefferson Salamander Recovery Team). 2013. Sampling Protocol for Determining the Presence of Jefferson Salamanders (*Ambystoma jeffersonianum*) in Ontario. Unpublished. June 2013.

Lee HT, Bakowsky WD, Riley J, Bowles J, Puddister M, Uhlig P, McMurray S. 1998. Ecological Land Classification for Southern Ontario: First Approximation and its Application. North Bay ON: Ontario Ministry of Natural Resources, South Central Region, Science Development and Transfer Branch. (SCSS Field Guide FG-02). 225 p.

McDiarmid, Mercedes S. Foster, Craig Guyer, J. Whitfield Gibbons, Neil Chernoff (Eds.). 2012. Reptile Biodiversity. Standard Methods for Inventory and Monitoring. University of California Press. 412 pp.

Ministry of Natural Resources and Forestry (MNRF). 2011. July. Bats and bat habitats: guidelines for wind power projects. URL: https://www.ontario.ca/document/bats-and-bat-habitats-guidelines-wind-power-projects.

Ministry of Natural Resources and Forestry (MNRF). 2013. May. Reptile and Amphibian Training Workshop Materials. Elbow Lake Environmental Education Centre, Kingston, Ontario.

Ministry of Natural Resources and Forestry (MNRF). 2016. Survey Protocol for Ontario's Species at Risk Snakes. Ontario Ministry of Natural Resources and Forestry, Species Conservation Policy Branch. Peterborough, Ontario. ii + 17 pp.

Ministry of Natural Resources and Forestry). 2017. Survey Protocol for Species at Risk Bats with Treed Habitats Little Brown Myotis, Northern Myotis and Tri-Colored Bat. April 2017. Ontario Ministry of Natural Resources and Forestry, Guelph District.

Ontario (Government of). 2020. Aggregate Resources of Ontario Standards: A Compilation of the Four Standards Adopted by Ontario Regulation 244/97 under the Aggregate Resources Act.

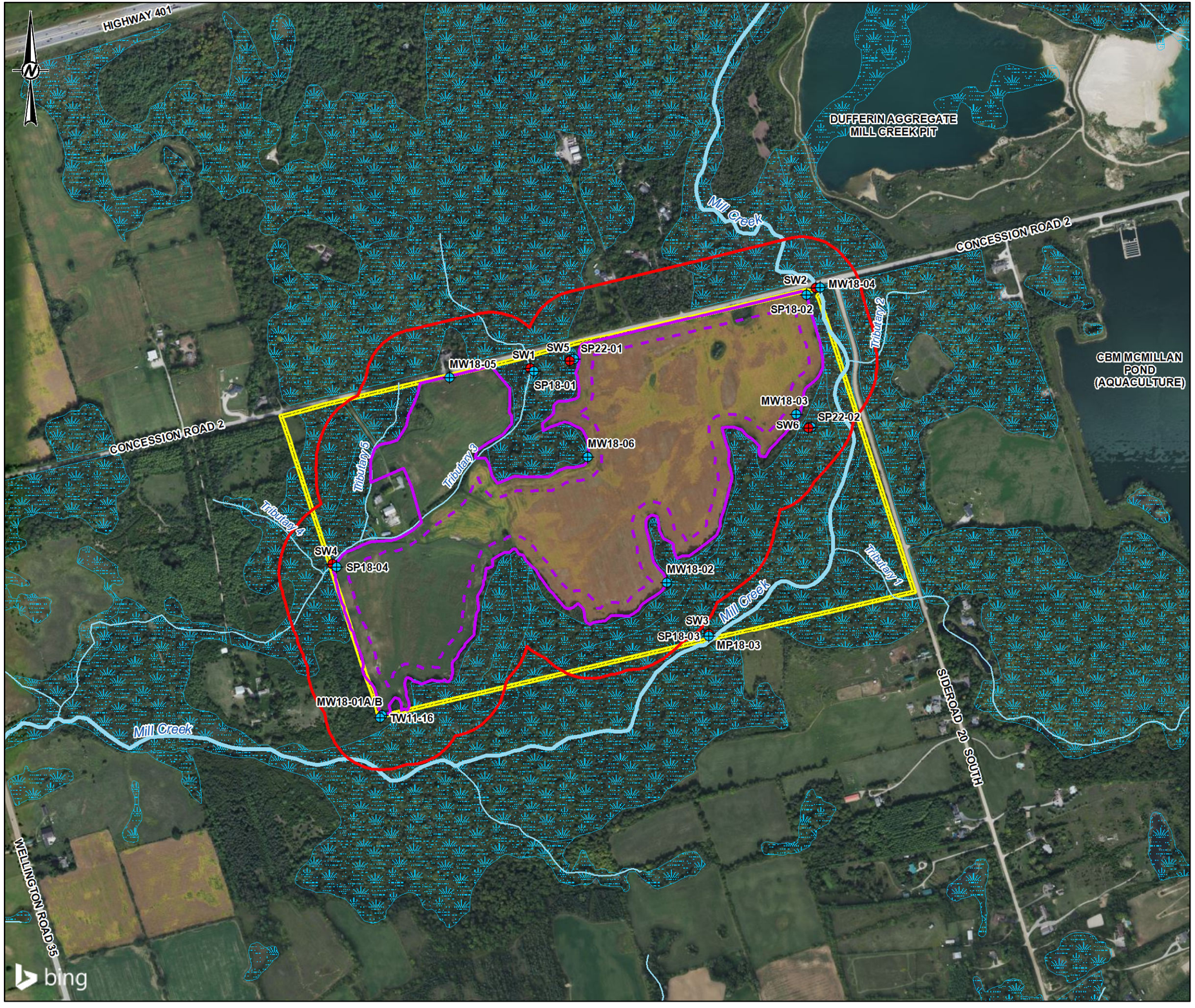
Pyle R.M. 1984. The Audubon Society Handbook for Butterfly Watchers. New York. Charles Schribner's Sons.

Wellington, County of. 2021. Official Plan. URL: Official Plans and Other Land Use Policies - Wellington County.

FIGURE 1

Study Area

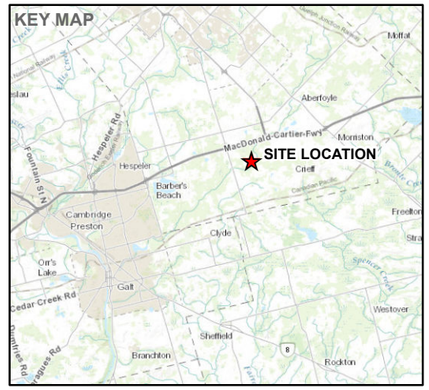
Groundwater and Surface Water Monitoring Locations



LEGEND

- GROUNDWATER MONITOR
- SURFACE WATER MONITOR
- WATERCOURSE
- PROVINCIALLY SIGNIFICANT WETLAND (EVALUATED)
- PROPERTY BOUNDARY
- PROPOSED EXTRACTION AREA
- LICENCE BOUNDARY / SITE BOUNDARY
- STUDY AREA

KEY MAP



0 100 200 300 400

1:8,500 METRES

REFERENCE(S)

1. GROUNDWATER LEVATIONS SELECTED MARCH 12, 2020.
2. BASEDATA: MNRF LIO, OBTAINED 2019
3. IMAGERY SOURCE: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

IMAGE SEPTEMBER 2016
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM

CLIENT
ST. MARYS CEMENT INC. (CANADA)

PROJECT
ABERFOYLE SOUTH PIT EXPANSION

TITLE
STUDY AREA, GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

CONSULTANT

wsp

YYYY-MM-DD	2020-12-04
DESIGNED	SO/PGM
PREPARED	ST
REVIEWED	DH
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0001	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm
0

Path: S:\Clients\CBM_Aggregates\Aberfoyle_P1699_PROJ\1791470_CBM40_PROD\0006_Natural_Environment_Level_1_2\1791470-0006-CH-0005.mxd

APPENDIX B

Author / Qualified Person CVs

Education

MSc. Earth Sciences, University of Waterloo, 1995

BSc. Honours Earth Sciences, Physics Minor, University of Waterloo, 1987

Professional Affiliations

Practising Member, Association of Professional Geoscientists of Ontario

Active Member, Society of Exploration Geophysicists

Member, Canadian Nuclear Society

Professional Summary

George Schneider is a Senior Geoscientist and Principal Fellow at WSP, formerly Golder Associates, with over 30 years of professional experience. George received his B.Sc. (1987) and M.Sc. (1995) in Earth Sciences from the University of Waterloo. From 1987 to 1995, he was a researcher in the Geophysics Laboratory at the Centre for Groundwater Research at the University of Waterloo and has co-authored more than 25 technical publications. George joined Golder in 1995; he became an Associate in 2002 and a Principal in 2006. George is a Professional Geoscientist registered in the Province of Ontario.

Employment History

Principal Fellow / Senior Geoscientist, WSP, formerly Golder Associates (2013 to Present)

Cambridge, Ontario

Project Manager / Director responsible for multi-disciplinary projects including nuclear waste management, explosives site remediation, mine site rehabilitation, aggregate resource studies, and groundwater supply and source water protection studies. George has been with Golder since 1995 and is currently a Principal of the Canadian Nuclear Services Group, responsible for project management, business development and client relations.

George is currently serving as a member of the Lake Erie Source Protection Committee (LESWPC) and the Waterloo-Wellington-Brant Regional Committee of the Ontario Stone Sand and Gravel Association (OSSGA).

Principal / Division Manager, Golder Associates (2006 to 2013)

Mississauga, Cambridge and Whitby, Ontario

Project director responsible for a range of multi-disciplinary projects including: environmental investigations at explosive contaminated sites and mine sites, aggregate resource studies, groundwater supply and management studies and nuclear waste management. Managed the Environmental Services Division in the GTA including: Geosciences, Geophysics, Site Characterization and Restoration, Environmental Due Diligence, Hydrogeology and Waste Management and Field Technician Groups.

Associate / Senior Project Manager, Golder Associates (2002 to 2005)

Mississauga, Ontario

Senior geoscientist responsible for the management of a diverse range of projects including: environmental investigations at explosive contaminated sites, aggregate resource studies, hydrogeological studies and geophysical investigations in support of hydrogeological studies, environmental site assessments, mine site developments, aggregate resource studies and geotechnical investigations.

Intermediate, then Senior Geoscientist, Golder Associates (1995 to 2002)

Waterloo, then Mississauga, Ontario

Responsible for project management, performing geophysical, geological and hydrogeological field investigations, numerical data analysis, data assessment, and reporting for: aggregate resource studies, groundwater resource studies, permits to take water, assessment of contaminated sites, geotechnical investigations and hydrogeologic characterization of mine tailings disposal and open pit mine sites.

Collected, processed and interpreted data for a variety of land and marine geophysical techniques including: time and frequency domain electromagnetics, magnetics, gravity, ground penetrating radar (GPR), seismic reflection and refraction, acoustic tomography, pulse velocity testing of man-made structures, cross-hole seismic testing, leak detection, vertical seismic profiling (VSP), electrical resistivity imaging (ERI), borehole camera logging and geophysical well logging including: natural gamma, gamma-gamma, neutron, temperature, deviation, inductive conductivity, magnetic, caliper, resistivity, heat-pulse flowmeter and optical televiewer.

Geophysicist, Waterloo Centre for Groundwater Research (1987 to 1995)

University of Waterloo, Waterloo, Ontario

Conducted geophysical field investigations and drilling programmes under the direction of Dr. J.P. Greenhouse and Dr. P.F. Karrow in the Waterloo Region related to the quaternary geology and the assessment of water resources in the Region including: seismic surveys, borehole geophysical surveys and two Rotasonic drilling programmes. Compiled three editions of a catalogue of geophysical logs for the Waterloo Region from 1988 to 1993. Co-authored more than 20 research papers, reports and posters, including 13 publications on the quaternary geology and/or water resources of the Waterloo Region.

Designed and constructed borehole and resistivity geophysical instruments, digital data acquisitions systems and developed innovative computer software for geophysical and hydrogeological applications. Carried out surface, borehole and laboratory geophysical investigations in support of more than 85 groundwater-related research projects including: geophysical investigations of DNAPL/LNAPL contamination, delineation of aquifers, groundwater contaminant plumes and karst features.

Other duties included: teaching assistance for University of Waterloo Earth Sciences and Geophysics courses and organization of technical conferences, short courses and field demonstrations.

PROJECT EXPERIENCE – WATER RESOURCES AND SOURCE WATER PROTECTION

Hydrogeological Assessment – Cambridge Zone 3 Class EA – Region of Waterloo (2016-2019)
Cambridge, Ontario

As a subcontractor to GM BluePlan, completed a hydrogeological assessment for the Region of Waterloo of the Cambridge Zone 3 Well Field, as part of a class EA, to examine options to increase the sustainable water supply capacity of the well field. Project Director and Senior Technical Reviewer.

Hydrogeological Assessment – Harrington McAvan (2015 – 2019)
Puslinch, Ontario

Carried out a hydrogeological and geotechnical assessment to support the re-zoning and future redevelopment of a property near Puslinch, Ontario for Farhi Holdings, including a preliminary assessment of potential water resources and septic capacity. Project Manager and Senior Technical Reviewer.

Municipal Well Construction and Testing (2015-2019)
Waterloo Region, Ontario

Project manager, contract administrator and senior technical reviewer for the construction and testing of new municipal supply wells in 2015 at K21, K4A and W6A/B and in 2016 at NH3 and Maryhill. Designed, constructed and permitted new supply wells at each of these sites in order to replace older wells with performance problems, provide system redundancy and help ensure the well fields can deliver their full permitted capacity.

Hydrogeological Assessment of Production Wells K23 and K24 (2014-2018)
Waterloo Region, Ontario

Senior technical reviewer for the hydrogeological assessment of wells K23 and K24, initiated in 2014 to better understand increasing nitrate concentrations in the wells due to nearby anthropogenic sources, primarily septic systems and agricultural fertilizers. The investigation is developing an improved understanding of the hydrogeology, aquifer vulnerability and water quality in areas around the supply wells and the interrelationships between the wells and potential contaminant sources.

Hydrogeologic Data Analysis Software System Update (2014-present)
Waterloo Region, Ontario

Project manager and senior technical reviewer for the selection and implementation of a new hydrogeologic data analysis (HDA) system for the Region. The project involved a detailed assessment of the Region's current and future data needs, the procurement and evaluation of potential commercial software solutions, and the implementation of the new software database and tools.

Hydrogeologic and Source Water Protection Services (2013-2018)
Centre Wellington, Ontario

Senior technical reviewer for hydrogeologic and source water protection services provided on an as-needed basis to the Township of Centre Wellington. The work includes on-going investigations and monitoring related to source water "Issues", as well as the evaluation of the hydrogeological aspects of infrastructure and development projects on behalf of the Township.

Hydrogeologic Services - Cambridge Aggregates (2008-present)
North Dumfries and Brant, Ontario

Senior technical reviewer for various projects for Cambridge Aggregates related to the development of large volume groundwater supply wells and Permits to Take Water for aggregate washing, and hydrogeological assessments in support of new licence applications and licence expansions under the Aggregate Resources Act.

Water Supply Class EA – Region of Waterloo (2010-2012)
West Montrose, Ontario, Canada

Senior technical reviewer for the hydrogeological component of a Water Supply Class Environmental Assessment for West Montrose. The hydrogeological component involved the exploration for an additional water supply within West Montrose. Through a field program involving drilling, hydraulic testing and water quality sampling a potential groundwater supply source was identified and carried forward as part of the assessment.

TICS Project – Region of Waterloo (2009-2012)
Waterloo Region, Ontario

Project manager for the Threats Inventory and Circumstances Survey (TICS) project for the Region of Waterloo. The project involved conducting Canada's largest drinking water census across the Waterloo Region and the evaluation of potential threats to drinking water sources in the Waterloo Region for each well field and surface water intake source.

Waterloo North Water Supply Class EA – Region of Waterloo (2008-2012)
Waterloo Region, Ontario

Senior technical advisor to the class EA project carried out for the Region of Waterloo with AECOM to develop additional groundwater supply wells in North Waterloo and Erbsville. The project involved the drilling of a new test supply well and a long term pumping test of three new supply wells, along with an extensive groundwater monitoring program.

New Wells Project – Region of Waterloo (2008-2009)
Waterloo Region, Ontario

Senior technical advisor to the project to install over 40 new monitoring wells nests throughout the Waterloo Region. Focus was on senior technical review and the interpretation of overburden and bedrock stratigraphy based on core logs, core photographs and samples, grain size analysis and geophysical logs, using nomenclature recently developed by the Ontario Geologic Survey (OGS).

Land Use Designations for Source Water Protection – Brookfield Homes (2007)
Paris, Ontario

Manager and senior technical review on a project to evaluate potential changes in land use designation within WHPAs and the associated change in risk to groundwater to well fields, that have high aquifer vulnerability ratings for a proposed development in Paris, Ontario.

Geophysical Investigation, Middleton Wellfield – Stantec (2005)
Cambridge, Ontario

Manager and senior technical reviewer on a project to use geophysical methods to map the top of bedrock and identify buried infrastructure around the Middleton Wellfield, in order to identify potential contaminant pathways to the shallow bedrock aquifer system.

IUS Project – Region of Waterloo (2005-present)
Waterloo Region, Ontario

The hydrogeological assessment and permitting of existing and potential new Municipal supply Wells for the Region of Waterloo's Integrated Urban Supply System. Assistant project manager, responsible for technical tasks, invoicing, budgeting, tendering and contract administration, presentations, interim and final reporting. Performed a technical role in the water supply development and expansion tasks carried out at the Chicopee, Breslau, Fountain Street, Lancaster, Seagrams and Waterloo North study areas.

Permit to Take Water – Lafarge (2002)
Guelph, Ontario

Completed a hydrogeologic study to support a permit to take water (PTTW) application for Lafarge Canada at the Guelph Asphalt and Ready Mix Concrete Plant in Guelph, Ontario.

Permit to Take Water – Lafarge (2002)
New Lowell, Ontario

Completed a hydrogeologic study to support a permit to take water (PTTW) application for Lafarge Canada at the Home Pit in New Lowell, Ontario.

Permit to Take Water – Heritage Golf Club (2002)
Barrie, Ontario

Completed a hydrogeologic study to support a permit to take water (PTTW) application for Heritage Golf Club near Barrie, Ontario. The work included the supervision and analysis of a 24 hour pumping test.

Geophysical Logging Investigation – Golder (1994)
Cambridge, Ontario

Acquired, processed, interpreted and reported on gamma and neutron geophysical logs in a test supply well in Cambridge East, Ontario as part of a water supply development programme for Golder Associates.

GPR, Seismic Refraction and Borehole

Acquired, processed, interpreted and reported on GPR, seismic refraction and geophysical logging surveys at Municipal well fields in the Town of Walkerton, Ontario in the hydrogeological investigation following the E. coli

Geophysical Logging - Walkerton (2000)
Walkerton, Ontario

tragedy in the summer of 2000. These surveys were used to help develop a conceptual geologic and hydrogeologic model for the site, and to identify fractured rock zones in the wells and assess the integrity of the well casing seal to the formation.

Groundwater Study - Victoria County (2000)
Oak Ridges Moraine, Ontario

Acquired gamma and conductivity geophysical logs in deep boreholes in the Oak Ridges Moraine as part of the Groundwater Study for Victoria County.

Oxford County Groundwater Study – Oxford County (2000)
Stratford, Ontario

Acquired gamma, conductivity, heat pulse flowmeter and optical televiewer geophysical logs in Municipal Supply wells in the Town of Stratford, Ontario, as part of the Oxford County Groundwater Study.

Permit to Take Water – Lafarge (2001)
New Dundee, Ontario

Completed a hydrogeologic study to support a permit to take water (PTTW) application for Lafarge Canada at Warren Bitulithic's Seibert Pit in New Dundee, Ontario.

Rotasonic Drilling Programme – Waterloo Region University of Waterloo (1990-1991)
Waterloo, Ontario

Under the direction of Dr. P.F. Karrow, carried out all aspects of two drilling programmes in 1990 and 1991 including: siting, permitting, utility clearances, drill supervision, well development, geophysical logging, vertical seismic profiling and reporting.

Borehole Geophysical Logging and Well Log Catalogue for the Waterloo Region University of Waterloo (1987-1993)
Waterloo, Ontario

Under the direction of Dr. J.P. Greenhouse, acquired the first digital geophysical logs in the Waterloo Region including: gamma, density, neutron, resistivity, conductivity and caliper log data. Collected and digitized historic logs, as well as digital logs from local consultants. Compiled these logs into a Catalogue in Viewlog format. This log catalogue formed the basis of the current understanding of the quaternary geology and overburden aquifer system in the Waterloo Region.

Seismic Reflection and VSP Studies – Waterloo Region - University of Waterloo (1987-1995)
Waterloo, Ontario

Under the direction of Dr. J.P. Greenhouse, carried out pioneering investigative work to optimise high resolution shallow seismic reflection and vertical seismic profiling geophysical methods for the characterisation of geology and aquifers in the Waterloo Region. This work culminated in the development of a controlled vibratory source for high resolution seismic surveys.

PROJECT EXPERIENCE – AGGREGATES

Aggregate Licence Investigations (2019-present)
Caledon, Ontario

Project Director and Senior Technical Reviewer for resource and hydrogeological technical studies at the Caledon properties for CBM Aggregates for a future below water table quarry licence application near Caledon, Ontario.

Aggregate Licence Investigations (2018-present)
Peterborough, Ontario

Project Director and Senior Technical Reviewer for hydrogeological, natural environment and cultural heritage technical studies at the Blezard property for CBM Aggregates near Peterborough, Ontario.

Resource Evaluation – CBM (2018)
Ayr, Ontario

Project Manager and Senior Technical Reviewer for an aggregate resource assessment at the Bromberg Pit for CBM Aggregates near Ayr Ontario.

Resource and Hydrogeological Investigation – CBM (2018) Dorchester, Ontario	Project Director and Senior Technical Reviewer for aggregate resource and hydrogeological studies at the Dorchester Pit for CBM Aggregates to support a Site Plan Amendment.
Resource and Hydrogeological Investigation – CBM (2018) Thamesford, Ontario	Project Director and Senior Technical Reviewer for aggregate resource and hydrogeological studies at the Thamesford Pit for CBM Aggregates to support a Site Plan Amendment.
Aggregate Licence Investigations – CBM (2018-present) Puslinch, Ontario	Project Director and Senior Technical Reviewer for hydrogeological, natural environment and cultural heritage studies at the Lake property for CBM Aggregates in Puslinch, Ontario.
Resource and Hydrogeological Investigation – CBM (2017) Puslinch, Ontario	Project Director and Senior Technical Reviewer for aggregate resource and hydrogeological studies at the Lanci Pit for CBM Aggregates to support a Site Plan Amendment.
Resource Evaluation – CBM (2017) North Dumfries, Ontario	Project Manager and Senior Technical Reviewer for an aggregate resource assessment at the Dabrowski Pit for CBM Aggregates.
Resource Evaluation – CBM (2017) Puslinch, Ontario	Project Manager and Senior Technical Reviewer for an aggregate resource assessment at the McNally Pit in support the expropriation of land for highway development at the McNally Pit for CBM Aggregates.
Resource and Hydrogeological Investigation – CBM (2016) North Dumfries, Ontario	Project Director and Senior Technical Reviewer for an aggregate resource evaluation and Level 1&2 Hydrogeological Assessment at the Dance Pit for CBM Aggregates in North Dumfries, Ontario.
Imported Fill Investigation – CBM (2016) Limehouse, Ontario	Project Manager for a soil sampling investigation to confirm imported soil quality at the CBM Pit near Limehouse, Ontario.
Resource Evaluation – CBM (2016) Orangeville, Ontario	Project Director and Senior Technical Reviewer for an aggregate resource evaluation at the Gray Pit for CBM Aggregates near Orangeville, Ontario.
Resource and Hydrogeological Investigation – CBM (2016) North Dumfries, Ontario	Project Director and Senior Technical Reviewer for an aggregate resource evaluation and Level 1&2 Hydrogeological Assessment at the Dance Pit for CBM Aggregates in North Dumfries, Ontario.
Aggregate Investigations - MTO Northeast (2015) North Bay, Ontario	Project Manager for aggregate investigations on numerous Crown land sites for MTO Northeast. Work included resource assessments, Level 1 / 2 Hydrogeological, Natural Heritage and Cultural Heritage Assessments, in support of Pit and Quarry Permits.
Resource Evaluation and Expert Testimony- Ministry	Provided specialized forensic engineering / geological advice and services related to aggregate resources on a property in northern Ontario. Work

of Transportation Ontario (2013-2014) Ontario	included resource modelling and resource valuation for a variety of potential land development scenarios.
Resource Evaluation Arriscraft International (2011) Ontario	Conducted a geological testing program and completed a resource evaluation of the Hill Top Pit Property in Kitchener, Ontario. Resource evaluation results were used in the appraisal of the property for the purposes of acquisition.
Aggregate Properties Valuation – Confidential (2011) Ontario, Alberta	Conducted valuation studies of more than a dozen aggregate properties in Ontario and Alberta to estimate the net present value of these properties for the purposes of financing.
Aggregate Source Investigations – MTO (2010-2011) Northeastern Ontario	Project Director and senior technical reviewer for the geological and hydrogeological components of the 2010 Northeastern Region Aggregate Source Investigation (MTO Assignment NO. 5010-E-0003) which included assessment and permitting studies for 23 sites across Ontario.
Resource Evaluation, Weeks Pit and Quarry – Altus Group (2010-2011) Parry Sound, Ontario	Senior technical review for an investigation to estimate the total aggregate resources available at the Weeks Pit and quarry property, in order to assist in the valuation of the property to settle an expropriation dispute with the owner and the MTO.
Feasibility Assessment – Lafarge (2010) Harvey Township, Ontario	Senior technical review for an investigation to assess the feasibility for the development of a limestone quarry on the Buckhorn Property in support of the renewal of a mining lease for the property.
Soil Borrow Search - IBI Group (2009-2010) Niagara, Ontario	Senior technical reviewer for a soil borrow search in the Niagara Region for the MTO, in support of new construction activities on Highway 406.
Geophysical Investigation – Confidential (2007) Ontario	Project manager and senior technical advisor for a geophysical and test pitting investigation at a confidential quarry site in Ontario to assess the potential presence of buried waste, as part of a legal claim.
Preliminary Resource Evaluation – SCAW (2004) Caledon, Ontario	Directed junior staff in a preliminary assessment of the potential for aggregate resources to be present on a property in Caledon, Ontario on behalf of the property owner.
Borehole Geophysical Logging – Confidential (2004) Brechin, Ontario	Acquired gamma and conductivity borehole geophysical logs at a property near Brechin, Ontario for a confidential client.
Acton Quarry Escarpment Seep Investigation - Dufferin Aggregates (2003) Acton, Ontario	Led a multidisciplinary project team in an investigation to assess hydrogeologic conditions at Phase 2 of the Acton Quarry and develop conceptual designs for short term and long term hydrogeologic mitigation systems to maintain seep flow in the Guelph-Amabel Formation along the Niagara Escarpment, immediately adjacent to advancing quarry workings.
Resource Evaluation – Dufferin Aggregates (2003) Ontario	Led a project team to carry out a resource evaluation of the Mosport West Pit property for Dufferin Aggregates. The project involved the integration of high quality coring methods, gradation testing of core samples and ERI (electrical

resistivity imaging) geophysical surveying to develop realistic 3D subsurface geologic models for these properties, from which available resources were then estimated and areas of preferred extraction were identified. Duties included: planning, ERI field QA/QC, ERI interpretation, correlation of geophysical and gradation data to establish empirical relationships between ERI response and resource quality and reporting.

ERI Investigation – Nelson Aggregates (2003)
Burlington, Ontario

Directed junior staff in an ERI geophysical investigation to map overburden thickness and assess the underlying rock for karst potential as part of a Level 2 Hydrogeological Assessment under the Aggregate Resources Act, for the planned expansion of the Nelson Quarry in Burlington, Ontario.

Aggregate Resource Evaluation – Confidential (2003)
Sudbury, Ontario

Carried out an evaluation of the potential aggregate resources present on properties in Dill Township near Sudbury, Ontario in support of the appraisal of the properties, which were to be expropriated from the owner by the MTO for the construction of an interchange and highway realignment.

Overburden Investigation – Dufferin Aggregates (2002)
Milton, Ontario

Conducted an ERI (electrical resistivity imaging) and test pitting investigation to develop a 3D model of overburden thickness and the top of bedrock to assist in planning overburden stripping requirements for Dufferin Aggregates in the Western Extension of the Milton North Quarry. Responsible for all aspects of planning, acquisition, processing, interpretation and reporting, as well as client liaison.

Gravel Pit Evaluation - Township of Perth East (2002)
Shakespeare, Ontario

Conducted an investigation to complete a resource evaluation, assess the net present value and make recommendations for optimization to the Perth East Gravel Pit near Shakespeare, Ontario. The Project Team consisted of Golder Associates Ltd., Beck and Associates GeoConsultants Inc. and MHBC Planning Ltd.

Aggregate Properties Valuation – Confidential (2002)
Ontario

Led a multidisciplinary project team which conducted valuations studies of four large aggregate properties in Ontario to estimate the net present value of these properties for the purposes of obtaining bank financing. The Project Team consisted of Golder Associates Ltd., Beck and Associates GeoConsultants Inc. and MHBC Planning Ltd.

Acton Quarry Resource Evaluation – Dufferin Aggregates (2002)
Acton, Ontario

Conducted a resource evaluation and estimated overburden stripping requirements for Phase 3 of the Acton Quarry, which involved ERI geophysical surveying, test pitting and drilling. Responsible for all aspects of planning, acquisition, processing, interpretation and reporting, as well as client liaison.

Overburden Investigation – Dufferin Aggregates (2001)
Milton, Ontario

Conducted a GPR and test pitting investigation to develop a 3D model of overburden thickness and the top of bedrock to assist in planning overburden stripping requirements for Dufferin Aggregates in the Milton North Quarry. Responsible for all aspects of planning, acquisition, processing, interpretation and reporting, as well as client liaison.

Quarry Resource Assessment – Dufferin Aggregates (2001)
Ontario

Acquired, processed, interpreted and reported gamma and conductivity geophysical log surveys in test boreholes at the Ogden Point Limestone Quarry to identify the stratigraphy within a Regional context and infer the suitability of strata within the quarry for use in the manufacture of cement products, based on experience elsewhere in Ontario.

Resource Evaluations – Dufferin Aggregates (1998-1999)
Ontario

Helped conduct sand and gravel resource evaluations as part of a multidisciplinary project team for Dufferin Aggregates at sand and gravel properties in Ontario including Mosport Pit 1 and 2, Bethany, TRT, Mill Creek, Paris and Naylor properties. The projects involved the integration of high quality coring methods, gradation testing of core samples and ERI (electrical resistivity imaging) geophysical surveying to develop realistic 3D subsurface geologic models for these properties, from which available resources were then estimated and areas of preferred extraction were identified. Duties included: ERI modelling and interpretation, 3D geological modelling, correlation of geophysical and gradation data to establish empirical relationships between ERI response and resource quality, volume and tonnage estimates and reporting.

PUBLICATIONS

Monier-Williams, M.E., Davis, R.K., Paillet, F.L., Turpening, R.M., Sol, S.J.Y. and Schneider, G.W. 2009. Review of Borehole Based Geophysical Site Evaluation Tools and Techniques. NWMO Technical Report TR-2009-25, 174 p.

Emsley, S., Schneider, G.W., Sol, S.J.Y., Fleming, J. and Fairs, J. 2008. Review of Satellite, Airborne and Surface Based Geophysical Tools and Techniques for Screening Potential Nuclear Repository Candidate Sites. NWMO Technical Report TR-2008-15, 143 p.

Gill, J.B. and Schneider, G.W. 2005. Innovative Aggregate Resource Evaluations using Electrical Resistivity Imaging. In the proceedings of the 56th Highway Geology Symposium, Wilmington, North Carolina, May 2005, 15 p.

Schneider, G.W., Nobes, D.C., Lockhard, M.A. and Greenhouse, J.P. 1997. Urban Geophysics in the Kitchener-Waterloo Region, Ontario. In: Environmental Geology of Urban Areas, Geological Association of Canada, Edited by Nicholas Eyles, pp. 457-464.

Nobes, D.C. and Schneider, G.W., 1996. Results of Downhole Geophysical Measurements and Vertical Seismic Profile from the Canandaigua Borehole of New York State Finger Lakes. In: Subsurface Geologic Investigations of New York Finger Lakes: Implications for Late Quaternary Deglaciation and Environmental Change, Special Paper 311, The Geological Society of America, Edited by Henry T. Mullins and Nicholas Eyles, pp. 51-64.

Schneider, G.W. and Vanderkooy, J., 1996. A vibratory seismic system for high-resolution applications. Proceedings of the Symposium on the Application of Geophysics to Engineering and Environmental Problems, Keystone, Colorado, April 28-May 1, 1996, pp. 181-188.

Sanderson M., Karrow P.F., Greenhouse J.P., Paloschi G.V.R., Schneider G., Mulamoottil G., Mason C., McBean E.A., Fitzpatrick P.N., Mitchell B., Shrubsole D., Child E., 1995. Canadian Water Resources Journal, Vol. 20, No. 3, pp. 145-160.

Schneider, G.W., Nobes, D.C., Lockhard, M.L., and Greenhouse, J.P., 1994. Urban Geology 4. Urban Geophysics in the Kitchener-Waterloo Region. Geoscience Canada, Volume 20, Number 4, pp. 149-156.

Sanderson, M., Karrow, P.F., Greenhouse, J.P., Paloschi, G.V.R., Schneider, G.W., Mulamoottil, G., Mason, C., Fitzpatrick, N., McBean, E., Mitchell, B., and Shrubsole, D., 1994. Susceptibility of groundwater to contamination in Kitchener-Waterloo: A case study with policy implications. Waterloo '94, Abstracts of GAC-MAC Annual meeting, May, 1994.

Greenhouse, J.P., and Schneider, G.W., 1994. Geophysics and Groundwater Supply in the Waterloo Region. A Poster. Waterloo '94, Abstracts of GAC-MAC Annual Meeting, May, 1994.

Schneider, G.W., and Greenhouse, J.P., 1994. The Geophysical Log Catalogue for the Waterloo Region. A Poster. Waterloo '94, Abstracts of GAC-MAC Annual Meeting, May, 1994.

Endres, A.L., Coe, R.D., Gilson, E.W., Zawadzki, A.A., Schneider, G.W. and Greenhouse, J.P., 1993. The use of neutron logging methods for the detection and monitoring of chlorinated solvents: A quantitative study. Proceedings of the Symposium on the Application of Geophysics to Engineering and Environmental Problems, San Diego, California, April 18-22, 1993, pp. 39-50.

Karrow, P.F., Greenhouse, J.P., Paloschi, J.V.R., and Schneider, G.W., 1993. The 1990-91 Rotasonic drilling programme. Final Report to the Ontario MOEE as part of work under grant #E564G, 181 p.

Schneider, G.W. 1993b. Geophysical well logs for the Waterloo Region and surrounding areas: A catalogue (Third Edition). Quaternary Sciences Institute Publication #9, Department of Earth Sciences, University of Waterloo, 699 p.

Schneider, G.W., DeRyck, S.M., and Ferre, P.A., 1993a. The application of automated high-resolution DC resistivity in monitoring hydrogeological field experiments. Proceedings of the Symposium on the Application of Geophysics to Engineering and Environmental Problems, San Diego, California, April 18-22, 1993, pp. 145-162.

Annan, A.P., Brewster, M.L., Greenhouse, J.P., Redman, J.D., Schneider, G.W., Olhoeft, G.R., and Sander, K.A., 1992. Geophysical monitoring of DNAPL migration in a sandy aquifer. Expanded Abstracts SEG 62nd Annual Meeting, October, New Orleans, USA.

Brewster, M.L., Annan, A.P., Greenhouse, J.P., Schneider, G.W., and Redman, J.D., 1992. Geophysical detection of DNAPLs: Field experiments. IAH Conference "Modern Trends in Hydrogeology", May 10-13th, Hamilton, Ontario, Canada.

Schneider, G.W., and Greenhouse, J.P., 1992. Geophysical detection of perchloroethylene in a sandy aquifer using resistivity and nuclear logging techniques. Proceedings of the Symposium of the Application of

Geophysics to Engineering and Environmental Problems, April 26-29th, 1992, Oakbrook, Illinois, USA, pp. 619-628.

Greenhouse, J.P., Brewster, M.L., Schneider, G.W., Redman, J.D., Annan, A.P., Olhoeft, G.R., Lucius, J., Sander, K.A., and Mazzella, A., 1991. Geophysics and solvents: The Borden experiments. The Leading Edge, Vol. 12, pp. 261-267.

Greenhouse, J.P., Nobes, D.C., Schneider, G.W. and Lockhard, M.L., 1991. Modification of the Shallow Seismic Reflection Method for Urban Geophysical Studies in Southern Ontario. Ontario Geological Survey Miscellaneous Paper #156, pp. 121-130.

Schneider, G.W., Nobes, D.C., Lockhard, M.L., and Greenhouse, J.P., 1991. Urban geophysics in the Kitchener-Waterloo region. Geological Association of Canada Program with Abstracts, Vol. 16, pp. A111. Presented at the 1991 Annual Meeting of the Geological Association of Canada, Toronto, Ontario, Canada.

Greenhouse, J.P., Nobes, D.C., and Schneider, G.W., 1990. Groundwater beneath the city: A geophysical study. Ground Water Management, Vol. 2, pp. 1179-1191. Proceedings of the Fourth Annual Outdoor Action Conference on Aquifer Restoration, Groundwater Monitoring and Geophysical Methods, Las Vegas, Nevada, USA.

Schneider, G.W., and Greenhouse, J.P., 1989. Geophysical well logs for the Waterloo Region and surrounding areas: A catalogue (Second Edition). Report of the Geophysics Lab, Department of Earth Sciences, University of Waterloo, 158 p.

Schneider, G.W., and Greenhouse, J.P., 1988b. The Columbia Test Site: Targets for EM/Magnetics/GPR Calibration. Report of the Geophysics Lab, University of Waterloo, 55 p.

Schneider, G.W., and Greenhouse, J.P., 1988a. Geophysical well logs for the Waterloo Region and surrounding areas: A catalogue. Report of the Geophysics Lab, Department of Earth Sciences, University of Waterloo, 110 p.

Nobes, D.C., Schneider, G.W., and Hodgson, S., 1987. Discussion on: "Effects of porosity and clay content on wave velocities in sandstones". Geophysics, Vol. 52 pp. 1439.

Golder Associates Ltd. – Cambridge

Paul Menkveld, M.Sc., E.I.T., Environmental Scientist

Mr. Menkveld is an Environmental Scientist in the Geoscience Group at WSP Golder's Cambridge office, with more than 8 years experience in engineering consulting and hydrogeology. He is a graduate of the Geological Engineering (B.A.Sc.) and Master of Science (M.Sc.) programs at the University of Waterloo. During Mr. Menkveld's 6 years at WSP Golder, he has built meaningful experience practicing physical hydrogeology for aggregate, water supply, linear infrastructure, nuclear waste storage, contaminated sites, and mining applications. He is a skilled hydraulic and aquifer test analyst and has extensive field experience to support a range of hydrogeological investigations.

Education

Master of Science Earth Sciences, Hydrogeology, Collaborative Water Program, University of Waterloo, Waterloo, 2019

Bachelor of Applied Science Geological Engineering (Water Resources Option, Honours), University of Waterloo, Waterloo, 2014

Employment History

WSP Golder – Cambridge, Ontario
Environmental Scientist (2016 to Present)

Responsible for the coordination, implementation, analysis, and reporting of hydrogeology projects for a range of applications. Developed project management skills to collect comprehensive environmental data on interdisciplinary teams for permit applications, amendments, and compliance monitoring. Mr. Menkveld has consistently managed projects with attention to detail to implement best practices and meet client expectations.

Mr. Menkveld has coordinated, supervised, and conducted field work including: borehole drilling, soil sampling (including brown field sampling), monitoring well installations, aquifer testing, groundwater sampling, and surface water sampling.

WSP Global Inc. (formerly GENIVAR and Jagger Hims Ltd.) – St. Catharine's, Ontario
Environmental Engineering Intern (2012 to 2012)

Performed data analysis, figure preparation, and technical report writing to support landfill monitoring, aggregate extraction, environmental assessments, and groundwater monitoring. Mr. Menkveld conducted a wide variety of field work including ground water monitoring and sampling, supervising drilling and logging in overburden and bed rock, stream gauging, and surface water sampling.

GeoSolv Design/Build Inc. – Aurora, Ontario
Engineering Intern (2012 to 2012)

Supervised sites of multi-million dollar projects during the geotechnical soil improvement stage and coordinated projects with contractors, clients, drillers, and suppliers to maximize project efficiency. Mr. Menkveld supervised the successful application of specialized geotechnical techniques including helical screw piles and rammed aggregate piers.

PROJECT EXPERIENCE

Maryhill Supply Well Replacement Maryhill, Ontario, Canada	Supervised drilling, including wireline PQ coring and tricone mud rotary methods, of a replacement for a municipal supply well. Supervised hydraulic testing the well, including a large scale aquifer test with the observation of private wells. Performed analysis and reporting for PTTW amendment.
Hydrogeologic Investigation and Closure Application of Closed Landfill Parry Sound, Ontario, Canada	This multi-year project included the evaluation, sale, and development of a brownfield and closed landfill site. The scope included hydrogeologic investigations to identify contaminants of concern, map their transport, assess risk, the development of reasonable use criteria, closure application to the regulator, and subsequent monitoring. Significant project coordination was required to mobilize and support a field team in a remote area to perform a range of tasks.
Mine Site Exploration Drilling and Hydraulic Testing Rankin Inlet, Nunavut, Canada	Coordinated a complex field program and supervised work site in a remote area. Responsible for core logging, fluid management, preparation of drill fluid with a tracer, packer testing, and coordination of personnel and materials via helicopter. Addressed dynamic health and safety risks in a remote location.
KW Habilitation Services Brownfield Redevelopment Kitchener, Ontario, Canada	Supported the completion of an EA Ph1 and 2 and supplemental monitoring during and following construction on a brownfield site to a higher use. Coordinated with construction subcontractors to ensure protection of and access to monitoring network.
Colour Paradise Greenhouses Research Site, Mannheim, Ontario Ontario, Canada	Conducted an extensive field program to assess the vulnerability of a shallow screened well to transient surface water features. During the course of this research program the field work included: well installation, time domain reflectometry, stream gauging, meteorology station deployment, geophysical soil moisture measurements, optical surface water tracking, groundwater sampling, resistivity measurements, and Guelph Permeameter operation. Lab work included, sieve analysis, permeameter, moisture content analysis, and the construction of a high accuracy Buchner Funnel apparatus.
NWMO Ignace Geoscientific Field Investigations Ignace, Ontario	Supervised drilling operations and fluid management of a deep borehole for preliminary deep geologic repository studies for the Nuclear Waste Management Organization. Responsibilities included managing fluid quantities, specifics of drill operation, preparation of tracer tagged drill water, preliminary borehole geophysics, and site supervision.
Metrolinx Subway Hydrogeology Scarborough, Ontario	Supported the hydrogeology and dewatering scope of the project, which included development, single well response testing, groundwater, and headspace sampling, to support design and dewatering calculations.
Free Phase PHC Site Monitoring and Remediation, Hamilton, Ontario	Supported ECA compliance groundwater and surface water monitoring on a long term industrial site with significant free phase hydrocarbon contamination in the shallow bedrock. The project required careful coordination with the requirements of the ECA and on site industrial HSSE procedures.

Cambridge Zone 3
Cambridge, Ontario

Supervised the drilling of boreholes through the Gasport Formation, including complex karst. Supervised characterization, testing, and construction of multilevel monitoring wells. Supported monitoring and analysis of large scale operational testing, including instrumentation and analysis of groundwater surface water interaction.

Hamilton Area Greenhouse
Hamilton, Ontario, Canada

Managed long term Permit to Take Water compliance monitoring, amendment and renewal applications, for greenhouse site with nitrate contamination, including water level monitoring, nitrate species analysis, and spill response. Pioneered the use of no purge hydrasleeve sampling techniques to improve efficiency and technical quality. Improved client relationship and delivered economical and consistent results.

Aggregate Extraction Site Baseline Monitoring
Brantford, Ontario, Canada

Project manager of a multi-year baseline surface water and groundwater data collection, permit to take water application, and revision of threshold triggers for extraction. Monitoring was conducted to characterize the groundwater flow system and surface water features on the site to support dynamic management of operations and mitigate environmental impacts.

Deep Geologic Repository Borehole Sealing
Tiverton, Ontario, Canada

Conducted project coordination multiple subcontractors to achieve complex project objectives and optimize progress. The scope focused on the removal and sealing of >800m boreholes instrumented with Westbay groundwater monitoring systems, across multiple aquifer systems. Successful removal required conceptual model development, creative downhole problem solving, and implementation of specialized and oil field tools.

PROFESSIONAL AFFILIATIONS

Professional Engineers of Ontario

International Association of Hydrogeologists

PUBLICATIONS

Journal Articles

Menkveld, Paul and David Rudolph. A field study of event based, seasonally affected, depression focused recharge in glaciated terrain. *University of Waterloo, Department of Earth and Environmental Sciences* (2019)

Wiebe, Andrew, Paul Menkveld, Ehsan Pasha, Jacqueline Brook, Mike Christie and David Rudolph. Impacts of Event-based Recharge on the Vulnerability of Public Supply. *Sustainability*, 13(14) (2021), 7695.

Wiebe, Andrew, Paul Menkveld, Cailin Hillier, Emilie Mesec and David Rudolph. Meteorological and hydrological data from the Alder Creek watershed. *Federated Research Data Repository*, https://doi.org/10.20383/101.0178 (2019)

APPENDIX C

Records of Monitoring Well Installations

PROJECT: 1791470

LOCATION: N 4808765.98; E 565094.29

RECORD OF BOREHOLE: MW18-01A/B

BORING DATE: January 11, 2018
OFFSET WELL INSTALLED: June 21, 2018

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ○W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		302.66							
0	Sonic Drilling	TOPSOIL - (SM) SILTY SAND, organics; brown, no odour, no staining; moist		0.00 / 302.05	1						
1		(SW/GW) SAND and GRAVEL; brown, no odour, no staining; non-cohesive, wet		0.61 / 299.92	2						Nov 30, 2018 ▽ Bentonite
2		(SW) SAND; golden brown, no odour, no staining; non-cohesive, wet		2.74 / 298.39	3						Sand
3		(SW/GW) SAND and GRAVEL, some silt, cobbles at 4.27 m; brown, no odour, no staining; non-cohesive, wet		4.27 / 296.26	4						Screen
4		(SW) SAND, trace silt, trace gravel; golden brown, no odour, no staining; non-cohesive, wet		6.40	5						
5					6						
6					7						
7											
8											
9											
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE
1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AL
CHECKED: GWS

GTA-BHS 001 S:\CLIENTS\CBM_AGGREGATES\ABERFOLYE_PIT\02_DATA\GINT\ABERFOLYE.GPJ GAL-MIS.GDT 11/11/21

PROJECT: 1791470

LOCATION: N 4808765.98; E 565094.29

RECORD OF BOREHOLE: MW18-01B

SHEET 2 OF 2

BORING DATE: January 11, 2018
OFFSET WELL INSTALLED: June 21, 2018

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Sonic Drilling			292.30	7						
		(SW/ML) SILT and SAND, some clay at 11.89 m; brown, no odour, slight iron staining at 11.89 m; non-cohesive, wet		10.36							
11					8						
12											
13				289.25	9						
		(ML) SILT, some sand; grey; no odour, no staining; non-cohesive, wet		13.41							
14					10						
				287.72							
15		END OF BOREHOLE		14.94							
16											
17											
18											
19											
20											

DEPTH SCALE
1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AL
CHECKED: GWS

GTA-BHS 001 S:\CLIENTS\CBM_AGGREGATES\ABERFOLYE_PIT\02_DATA\GINT\ABERFOLYE.GPJ GAL-MIS.GDT 11/11/21

PROJECT: 1791470

LOCATION: N 4809051.11; E 565727.23

RECORD OF BOREHOLE: MW18-02

BORING DATE: January 16, 2018

SHEET 1 OF 2

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		303.35							
0	Sonic Drilling	(SW) SAND, some gravel at 1.22 m; grey, no odour, no staining; non-cohesive, wet		0.00	1						Nov 30, 2018
1					2						
2											
3					3						Bentonite
4											
5					4						
6					5						
7											Sand
8					6						
				294.51							Screen
9		(SW/GW) SAND and GRAVEL; grey, no odour, no staining; non-cohesive, wet		8.84	7						
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AL

CHECKED: GWS

GTA-BHS 001 S:\CLIENTS\CBM_AGGREGATES\ABERFOLYE_PIT\02_DATA\GINT\ABERFOLYE.GPJ GAL-MIS.GDT 1/27/22

PROJECT: 1791470

LOCATION: N 4809051.11; E 565727.23

RECORD OF BOREHOLE: MW18-02

BORING DATE: January 16, 2018

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
	Sonic Drilling	(SW/GW) SAND and GRAVEL; grey, no odour, no staining; non-cohesive, wet		292.99	7						Screen
		(SM) SILTY SAND; brown, no odour, no staining; non-cohesive, wet		10.36							
11					8						
12											
13					9						Bentonite
14											
				288.41							
15		END OF BOREHOLE		14.94							
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AL

CHECKED: GWS

PROJECT: 1791470

LOCATION: N 4809429.20; E 566018.05

RECORD OF BOREHOLE: MW18-03

BORING DATE: January 10, 2018

SHEET 1 OF 2

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		303.66							
0	Sonic Drilling	(SW) SAND; brown, no odour, no staining; non-cohesive, wet		0.00	1						Nov 30, 2018
1											
				301.83							
2		(SW) SAND, some cobbles at 5.18 m, some silt from 5.18 m to 5.78 m; brown, no odour, no staining; non-cohesive, wet		1.83	2						
3					3						Bentonite
4											
5					4						
6					5						
7											Sand
8				295.43	6						
		(SW/GW) SAND and GRAVEL; brown, no odour, no staining; non-cohesive, wet		8.23							Screen
9					7						
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AL

CHECKED: GWS

GTA-BHS 001 S:\CLIENTS\CBM_AGGREGATES\ABERFOLYE_PIT\02_DATA\GINT\ABERFOLYE.GPJ GAL-MIS.GDT 1/27/22

PROJECT: 1791470

LOCATION: N 4809429.20; E 566018.05

RECORD OF BOREHOLE: MW18-03

BORING DATE: January 10, 2018

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
10	Sonic Drilling	(SW/GW) SAND and GRAVEL; brown, no odour, no staining; non-cohesive, wet		293.30	7						Screen
		(ML) SILT, some clay, some cobbles; grey, no odour, no staining; non-cohesive, wet		10.36							
11					8						
				291.77							
12		(SW) SAND, some gravel, trace cobbles; grey, no odour, no staining; non-cohesive, wet		11.89							
					9						Bentonite
13				290.25							
		(SW) SAND, some silt, trace cobbles; brown, no odour, no staining; non-cohesive, wet		13.41							
14					10						
				288.72							
15		END OF BOREHOLE		14.94							
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AL

CHECKED: GWS

PROJECT: 1791470

LOCATION: N 4809698.57; E 566029.37

RECORD OF BOREHOLE: MW18-04

BORING DATE: January 9, 2018

SHEET 1 OF 2

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		303.81									
0	Sonic Drilling	(SW/GW) SAND and GRAVEL; brown, no odour, no staining; non-cohesive, wet		0.00	1								Nov 30, 2018
1													
2					2								
				301.07									
		(SW) SAND, some gravel at 4.27 m; brown, no odour, no staining; non-cohesive, wet		2.74									
3					3								
4													Bentonite
5					4								
6					5								
7													
8					6								Sand
9													
					7								Screen
10		*CONTINUED NEXT PAGE*											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AL

CHECKED: GWS

GTA-BHS 001 S:\CLIENTS\CBM_AGGREGATES\ABERFOLYE_PIT\02_DATA\GINT\ABERFOLYE.GPJ GAL-MIS.GDT 1/27/22

PROJECT: 1791470

LOCATION: N 4809698.57; E 566029.37

RECORD OF BOREHOLE: MW18-04

BORING DATE: January 9, 2018

SHEET 2 OF 2

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
10	Sonic Drilling	(SW) SAND, some gravel at 4.27 m; brown, no odour, no staining; non-cohesive, wet			7						
11					8						Screen
				292.23							
		(SW) SAND, some gravel from 11.58 m to 11.89 m, some silt from 11.58 m to 14.94 m; brown, no odour, no staining; non-cohesive, wet		11.58							
12					9						
13											Bentonite
14					10						
				288.87							
15		END OF BOREHOLE		14.94							
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AL

CHECKED: GWS

GTA-BHS 001 S:\CLIENTS\CBM_AGGREGATES\ABERFOLYE_PIT\02_DATA\GINT\ABERFOLYE.GPJ GAL-MIS.GDT 1/27/22

PROJECT: 1791470

LOCATION: N 4809511.68; E 565241.19

RECORD OF BOREHOLE: MW18-05

BORING DATE: January 16, 2018

SHEET 1 OF 2

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		307.17							
0	Sonic Drilling	(SM) SILTY SAND, organics; brown, no odour, no staining; moist		0.00	1						
1				305.95							
		(SM) SILTY SAND, some cobbles; golden brown, no odour, no staining; non-cohesive, wet		1.22	2						
2				304.38							
		(ML/SW) SILT and SAND, some gravel, some cobbles and boulders from 7.32 m to 8.84 m, some clay from 13.41 m to 14.94 m; golden brown, no odour, no staining; non-cohesive, wet		2.79	3						Nov 30, 2018
3											
4					4						Bentonite
5					5						
6					6						Sand
7					7						Screen
8											
9											
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AL

CHECKED: GWS

GTA-BHS 001 S:\CLIENTS\CBM_AGGREGATES\ABERFOLYE_PIT\02_DATA\GINT\ABERFOLYE.GPJ GAL-MIS.GDT 1/27/22

PROJECT: 1791470

LOCATION: N 4809511.68; E 565241.19

RECORD OF BOREHOLE: MW18-05

BORING DATE: January 16, 2018

SHEET 2 OF 2

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ○ W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
10	Sonic Drilling	(ML/SW) SILT and SAND, some gravel, some cobbles and boulders from 7.32 m to 8.84 m, some clay from 13.41 m to 14.94 m; golden brown, no odour, no staining; non-cohesive, wet			7						
11					8						Screen
12					9						
13											Bentonite
14					10						
				292.54							
		BEDROCK		14.63							
				292.23							
15		END OF BOREHOLE		14.94							
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AL

CHECKED: GWS

GTA-BHS 001 S:\CLIENTS\CBM_AGGREGATES\ABERFOLYE_PIT\02_DATA\GINT\ABERFOLYE.GPJ GAL-MIS.GDT 1/27/22

PROJECT: 1791470

LOCATION: N 4809336.59; E 565548.98

RECORD OF BOREHOLE: MW18-06

BORING DATE: November 23, 2018

SHEET 1 OF 1

DATUM: UTM 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		303.07				SHEAR STRENGTH Cu, kPa: nat V. + Q - ●; rem V. ⊕ U - ○ (20 40 60 80)	WATER CONTENT PERCENT: Wp W Wl (10 20 30 40)		
0	Sonic Drilling	(SM) SILTY SAND, organics; brown, no odour, no staining; moist		0.00	1						Nov 30, 2018
				302.16							
1		(SW/GW) SAND and GRAVEL; grey, no odour, no staining; non-cohesive, wet		0.91	2						
2											
3					3						Bentonite
				299.41							
4		(SW) SAND; brown, no odour, no staining; non-cohesive, wet		3.66	4						
5											
6					5						Sand
				296.36							
7		(SW/GW) SAND and GRAVEL; grey, no odour, no staining; wet		6.71							
8					6						Screen
9				293.93							
		END OF BOREHOLE		9.14							
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

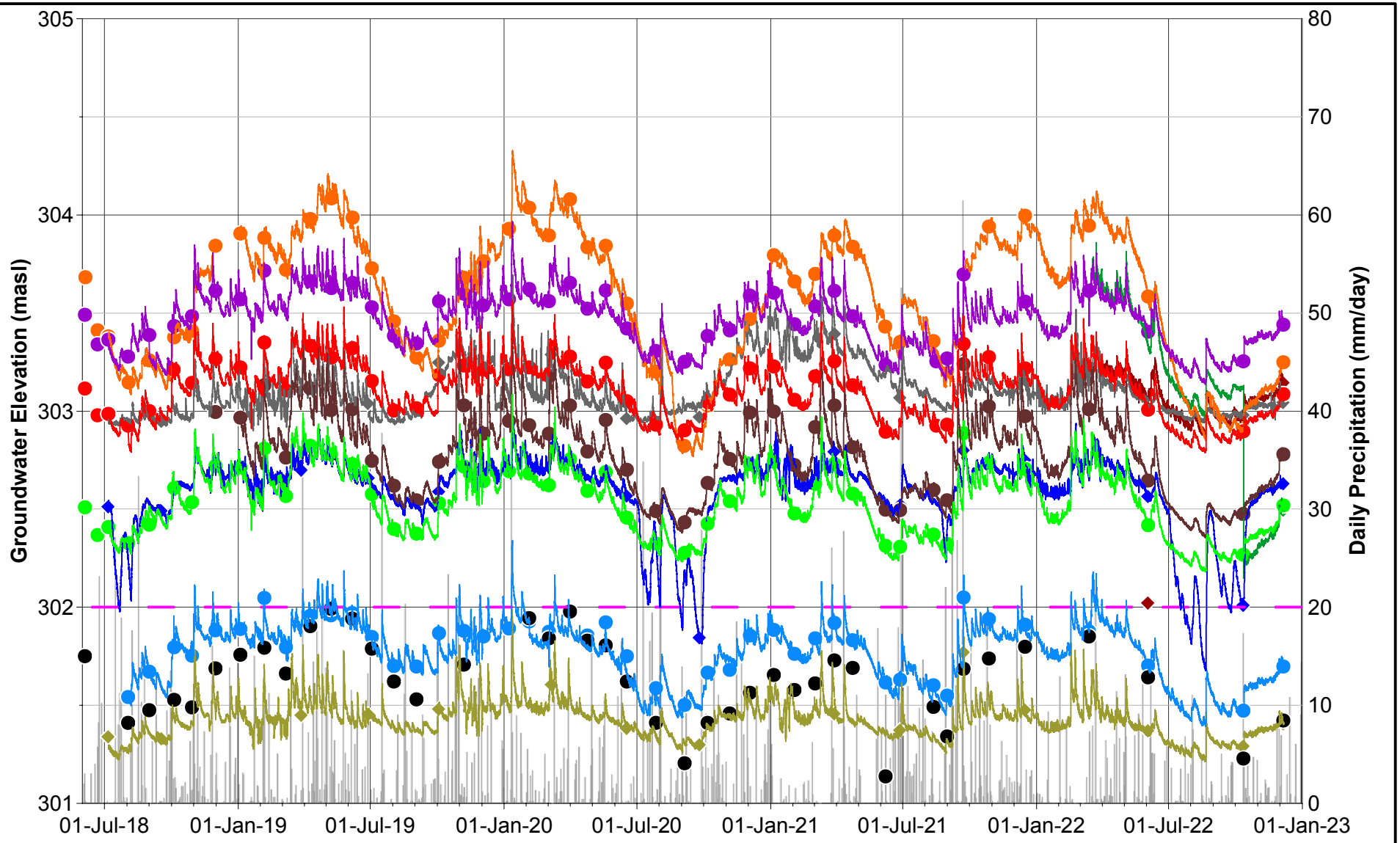
LOGGED: AL

CHECKED: GWS

GTA-BHS 001 S:\CLIENTS\CBM_AGGREGATES\ABERFOLYE_PIT\02_DATA\GINT\ABERFOLYE.GPJ GAL-MIS.GDT 1/27/22

APPENDIX D

Groundwater Hydrographs



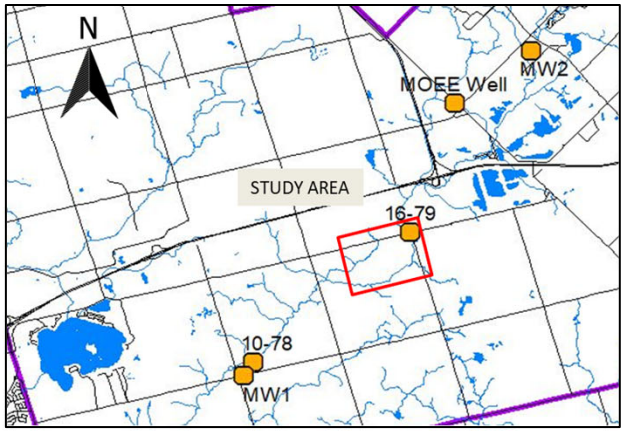
Notes:
1. To be read in conjunction with accompanying report.
2. Precipitation data from Environment Canada (Kitchener/Waterloo Stn).
3. SP18-03 is a minimum head.

DATE	2023-Jan-26
DESIGN	PGM
REVIEW	GWS
APPROVED	GWS

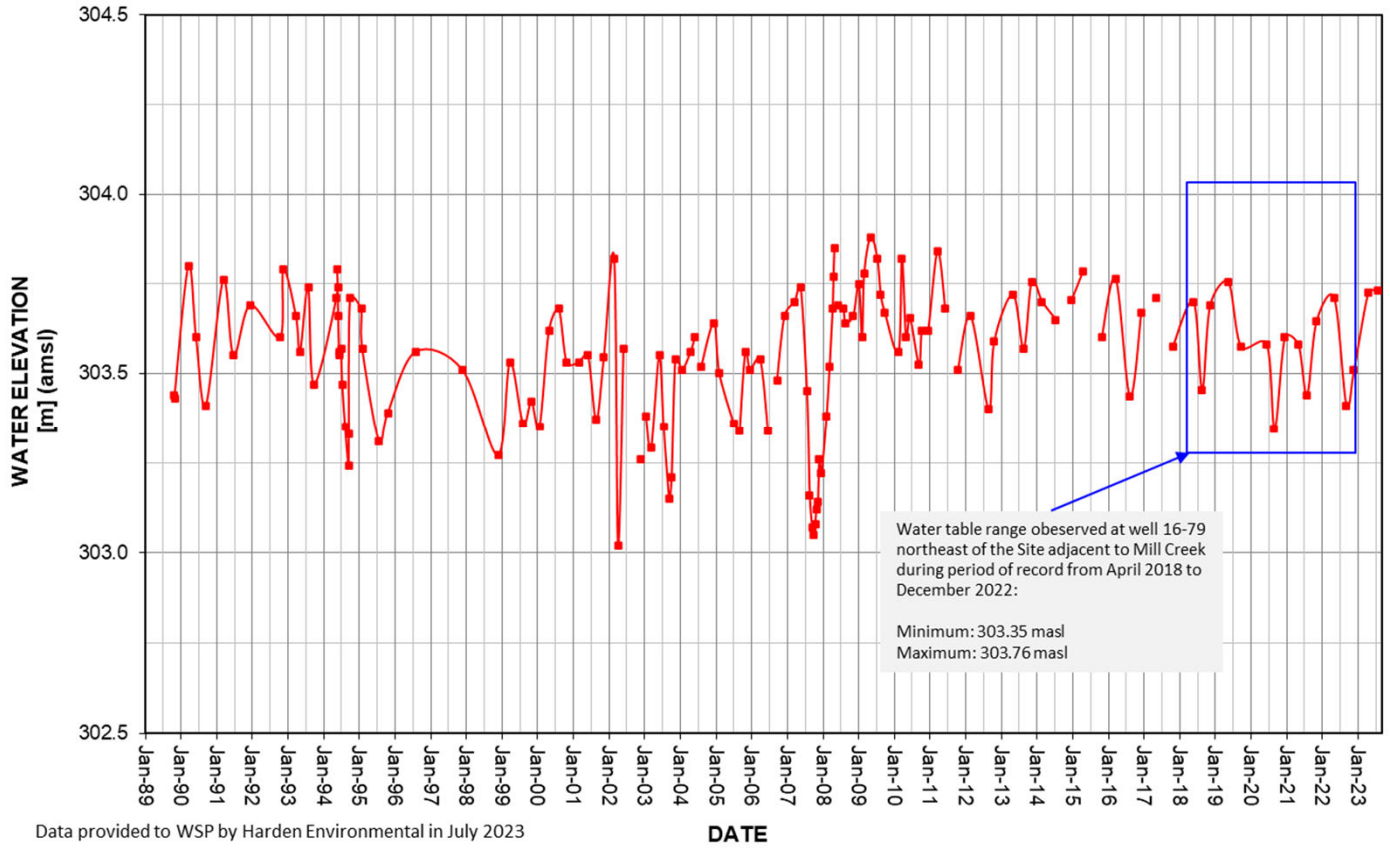
PROJECT
HYDROGEOLOGICAL LEVEL 1/2 ASSESSMENT
PROPOSED ABERFOYLE SOUTH PIT EXPANSION
PUSLINCH, ONTARIO

TITLE
GROUNDWATER ELEVATION HYDROGRAPHS

PROJECT NO.	REV	FIGURE
1791470		D1



Puslinch Monitoring Well 16-79



Data provided to WSP by Harden Environmental in July 2023

CLIENT
CBM Aggregates, a division of St. Marys Cement Inc. (Canada)

PROJECT
Aberfoyle South Pit Expansion - Water Report

CONSULTANT
wsp

YYYY-MM-DD	2023-10-16
PREPARED	N/A
DESIGN	N/A
REVIEW	GWS
APPROVED	GWS

TITLE
Historic Groundwater Levels in the Overburden Aquifer at Monitoring Well 16-79
Located Northeast of the Aberfoyle South Pit Expansion Site

PROJECT No. **1791470 (4000)** Rev. **A** **D2** FIG.

wsp.com