TECHNICAL MEMORANDUM

DATE December 7, 2017 **PROJECT No.** 1791078

TO Frank Cairo
Caivan Communities

FROM Brian Byerley, P.Eng. **EMAIL** bbyerley@Golder.com

REVIEW OF AVAILABLE HYDROGEOLOGICAL INFORMATION
BISSON LANDS
10th LINE ROAD AND MER BLEUE ROAD
OTTAWA, ONTARIO

This memorandum presents a summary of the available hydrogeological information for the Bisson Lands, in Ottawa, Ontario. The information referenced herein was previously complied for the "Concession 10 Lands Development" Environmental Management Plan, and reported in a letter by Golder Associates Ltd. dated May 14, 2015.

SITE DESCRIPTION

The Bisson Lands (the Site) is a parcel of land which extends from Tenth Line Road to Mer Blue Road, in the east-west direction, approximately 600 metres north of Wall Road (see Figure 1). It is understood that the planned development of the Site will generally involve residential subdivisions with full municipal services (including municipal sewer and water services).

Site Geology

Published geological mapping indicates that the Site overburden conditions primarily consist of a thick deposit of sensitive marine clay (see Figure 2). Based on published mapping, the bedrock surface is indicated to be at about 15 to 50 metres depth below the ground surface. The uppermost bedrock unit is mapped as Lindsay Formation limestone. The geologic materials encountered during geotechnical investigations generally confirm the published mapping.

Site Groundwater Conditions

Groundwater level measurements have been obtained in nearby boreholes and are provided in the following table.

Borehole Number	Ground Surface Elevation	Geological Unit	Date of Measurement	Water Level Elevation	Water Level Depth (metres)
1	86.7	Silty Clay	October 28, 2005	85.9	0.8
2	86.3	Silty Clay	October 28, 2005	85.5	0.8
3	86.5	Silty Clay	October 28, 2005	85.2	1.3
4	86.3	Silty Clay	October 28, 2005	85.4	0.9

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Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America

Borehole Number	Ground Surface Elevation	Geological Unit	Date of Measurement	Water Level Elevation	Water Level Depth (metres)
5	86.8	Silty Clay	October 28, 2005	85.9	0.9
6	86.7	Silty Clay	October 28, 2005	85.8	0.9
13-04	87.3	Silty Clay	September 2, 2013	85.7	1.6
13-06	87.1	Silty Clay	September 2, 2013	85.7	1.4
13-07	85.3	Silty Clay	September 2, 2013	84.6	0.7
13-09	85.1	Silty Clay	September 2, 2013	82.5	2.6
13-10	85.0	Silty Clay	September 2, 2013	83.2	1.8

Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

In terms of infiltration potential, the surficial geology of the Site and the numerous local drainage ditches limit the ability of water to infiltrate. The water that infiltrates the ground surface (the surplus water that does not runoff or evaporate) is extracted by plants (evapotranspiration), flows laterally just below ground surface (interflow) to discharge to surface water features on- and off-site or flows vertically downward to the underlying glacial till or bedrock aquifers (deep recharge). Agricultural tile drainage (subsurface drains), where present, would also convey infiltrated water to the surface water features.

It is expected that due to the Site conditions described above, the amount of on-site deep recharge is very small, likely between 0 and 10 millimetres per year.

Water Supply Well Information

The Ministry of the Environment and Climate Change Water Well Information System (MOECC WWIS) was searched for water well records in the vicinity of the Site. The locations of water wells in the vicinity of the Site for which records exist in the MOE WWIS are plotted on Figure 2. Note that a number wells are indicated to be located midway between Mer Bleue Road and Tenth Line Road; it is interpreted that these locations recorded in the WWIS correspond to lot centroids and that the true location of each well is along Mer Bleue Road or Tenth Line Road. The accuracy of the other well locations is indicated to range between 10 and 1,000 metres.

The MOECC WWIS includes records for approximately 32 water supply wells located along Mer Bleue, Tenth Line and Wall Roads within approximately 1 kilometre of the Site. Based on a review of a recent aerial photo, it is interpreted that there may be up to 95 wells in use along these roads, within 1 kilomete of the site. All but nine of the identified WWIS water supply wells are completed in the bedrock, at depths of 20 to 100 mbgs. Nine wells listed in the MOECC WWIS are indicated to be screened in the sand or gravel unit above the bedrock, which is overlain by 18 to 40 metres of clay.

POTENTIAL HYDROGEOLOGICAL IMPACTS OF PROPOSED DEVELOPMENT

The water table is observed to be close to ground surface (less than one metre depth at some locations); therefore, it is likely that excavations for development will extend below the water table, and groundwater inflow to the excavations will occur. The extensive silty clay deposit that is prevalent across the site is expected to have a low hydraulic conductivity; therefore, it is anticipated that groundwater inflow rates to excavations will be limited.

Site development can potentially cause water quantity or quality related impacts. Water quantity impacts would be associated with construction dewatering or changes to the local water budget (i.e., a reduction in groundwater

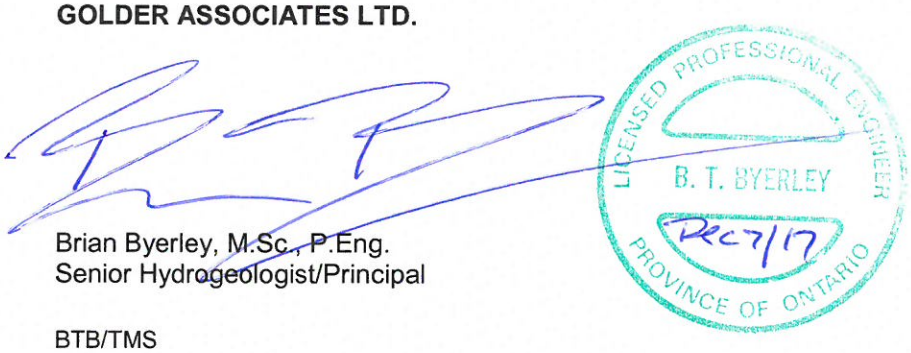
recharge), whereas water quality impacts would be associated with the mobilization of existing groundwater contamination, or the introduction of new contaminants to the groundwater. In both cases, the extensive silty clay deposits across the Site and in the vicinity of the site are expected to minimize any potential impacts to water wells which are completed in the bedrock and sand/gravel aquifers.

Based on the Site hydrogeological conditions and the proposed development, a terrain analysis of the Site (as referenced in Section 4.4.2.1 of the City of Ottawa Official) is not required or recommended.

We trust this memo contains sufficient information for your present requirements. If you have any questions concerning this memo, or if we can be of further service to you on this project, please call us.

Yours truly,

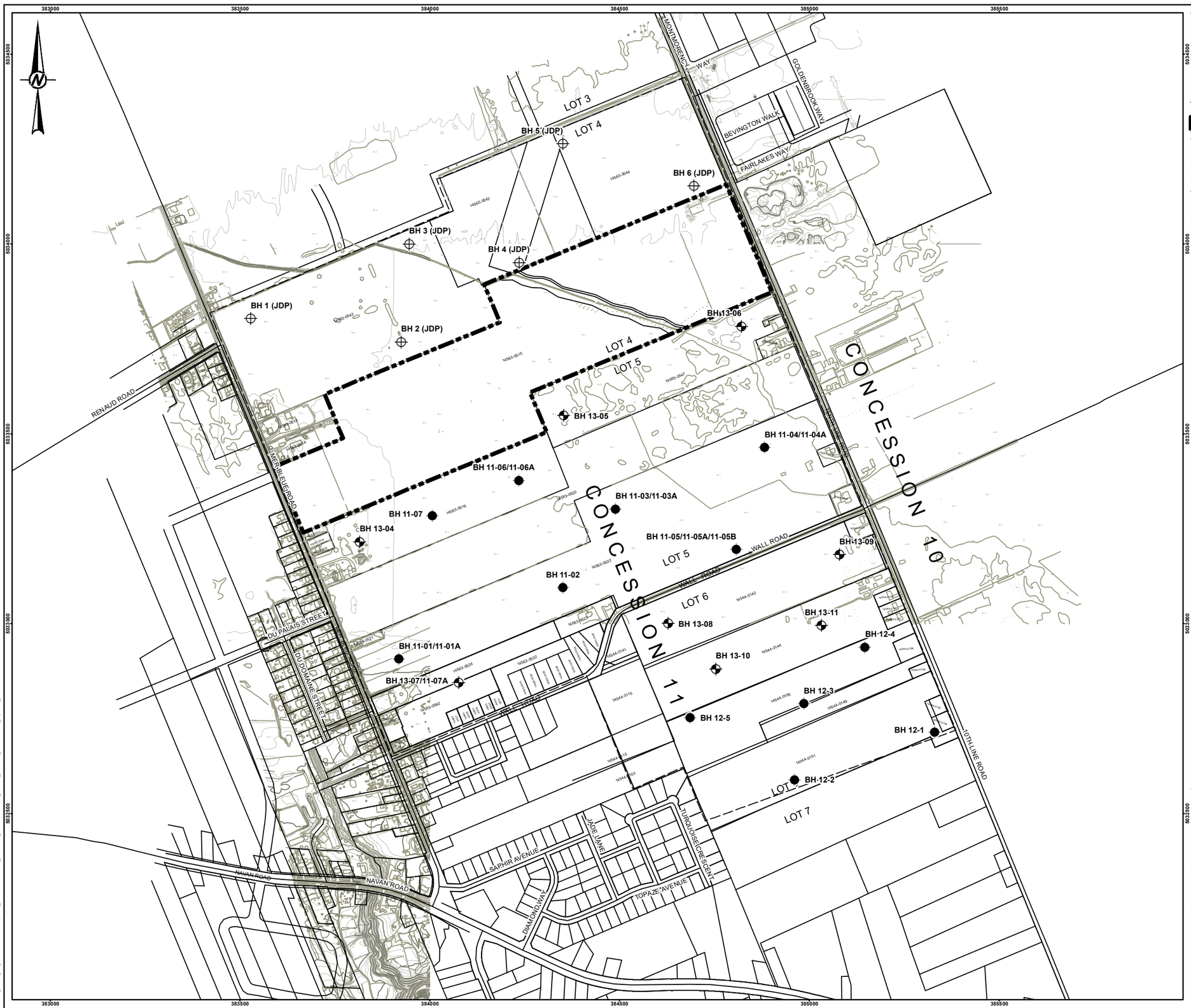
GOLDER ASSOCIATES LTD.



Brian Byerley, M.Sc., P.Eng.
Senior Hydrogeologist/Principal

BTB/TMS

Attached: Figure 1 - Site Plan
Figure 2 – Surficial Geology and Water Well Locations



LEGEND

- APPROXIMATE BOREHOLE LOCATION IN PLAN, CURRENT INVESTIGATION
- APPROXIMATE BOREHOLE LOCATION IN PLAN, PREVIOUS INVESTIGATIONS BY GOLDER ASSOCIATES LTD.
- APPROXIMATE BOREHOLE LOCATION IN PLAN, PREVIOUS INVESTIGATION BY J.D. PATERSON GROUP
- ROADWAY
- PROPERTY BOUNDARY

NOTE(S)

1. ALL CURRENT BOREHOLE LOCATIONS SHOWN ON THIS PLAN WERE DERIVED FROM GPS OBSERVATIONS USING THE CAN-NET VIRTUAL NETWORK REFERENCING THE OTTAWA BASE STATION AND WERE COLLECTED USING THE MTM PROJECTION AND NAD 83 DATUM IN ZONE 9, UNLESS OTHERWISE STATED

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY IBI GROUP
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 100 200 400

1:10,000 METRES

CLIENT
CAIVAN COMMUNITIES

PROJECT
HYDROGEOLOGY REVIEW
BISSON LANDS, OTTAWA, ONTARIO

TITLE
SITE PLAN

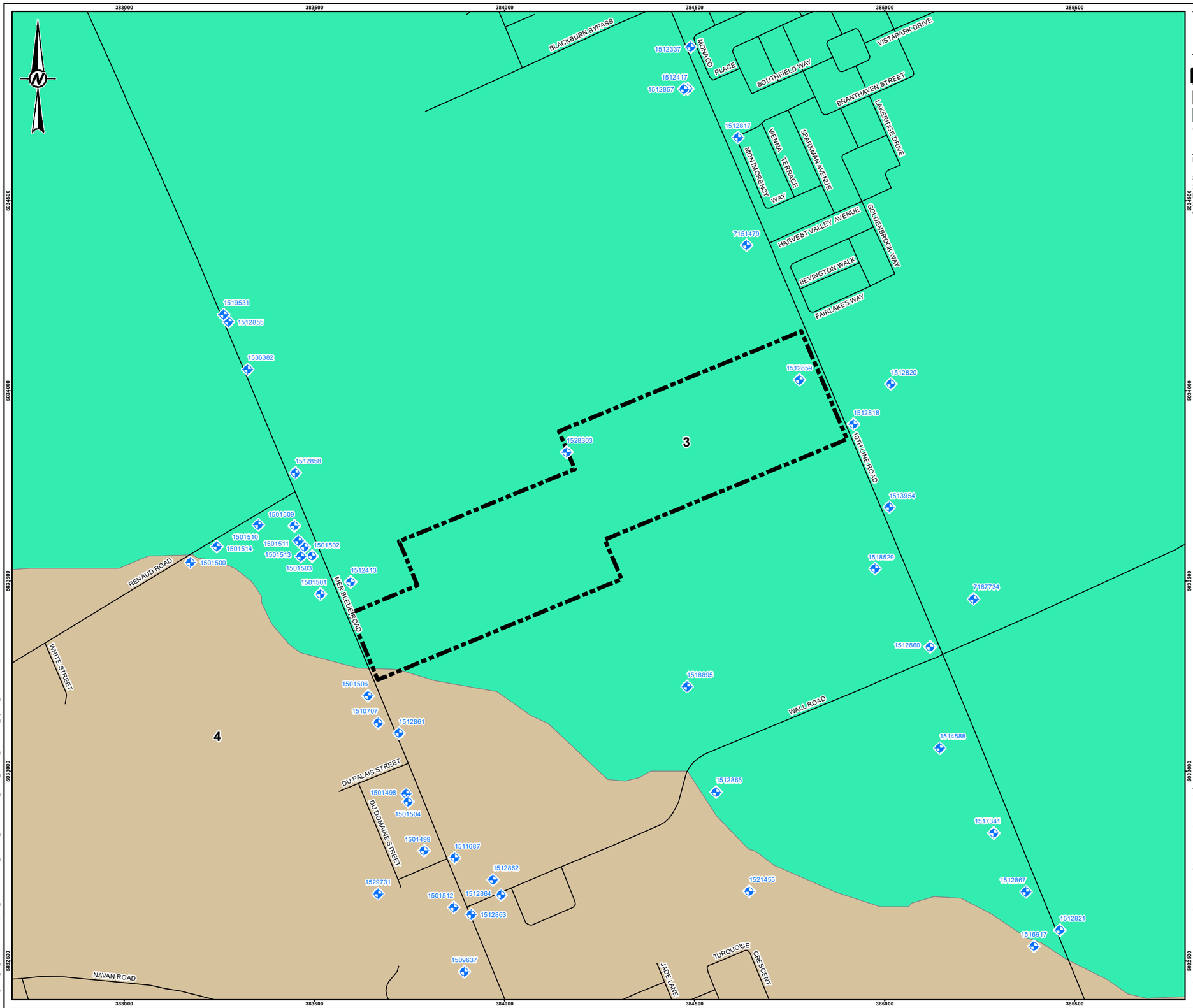
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-12-06
DESIGNED	----
PREPARED	JEM
REVIEWED	BTB
APPROVED	BTB

PROJECT NO.	CONTROL	REV.	FIGURE
1791078	0001	0	1

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

Path: \\golder.gds\gal\Ottawa\Active\Spatial_IM\Caivan\Bisson_Lands\99_PROJ\1791078_Caivan_ EMP40_PROD\0001_HydroG_Review\179 1078-0001-CH-0001.mxd



LEGEND

- MOE WATER WELL
- ROADWAY
- PROPERTY BOUNDARY
- 4. DELTAIC AND ESTUARY DEPOSITS: MEDIUM TO FINE GRAINED SAND
- 3. OFFSHORE MARINE DEPOSITS: CLAY, SILTY CLAY & SILT

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. 1. BÉLANGER, J. R. 2008 URBAN GEOLOGY OF THE NATIONAL CAPITAL AREA, GEOLOGICAL SURVEY OF CANADA, OPEN FILE 5311, 1 DVD.
2. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83,
COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 100 200 400
1:10,000 METRES

CLIENT
CAIVAN COMMUNITIES

PROJECT
HYDROGEOLOGY REVIEW
BISSON LANDS, OTTAWA, ONTARIO

TITLE
SURFICIAL GEOLOGY AND WATER WELL LOCATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-12-06
DESIGNED	----
PREPARED	JEM
REVIEWED	BTB
APPROVED	BTB

PROJECT NO.	CONTROL	REV.	FIGURE
1791078	0001	0	2

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

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