TECHNICAL MEMORANDUM

DATE January 14, 2021 **Project No.** 20144864/5000

TO Zeyad Hassan
Caivan Development Corporation

FROM Caitlin Cooke **EMAIL** ccooke@golder.com

GROUNDWATER IMPACT ASSESSMENT
RESIDENTIAL DEVELOPMENT, GREEN LANDS EAST AND GREEN LANDS WEST
OTTAWA, ONTARIO

This report presents the results of a groundwater impact assessment carried out for two property parcels known as the “Green Lands East” and “Green Lands West”. These two parcels form the next phase of the Fox Run Development and consist of two separate areas located immediately to the west and east of Phases 2 and 3 of Fox Run, and west of Perth Road in Ottawa, Ontario (see Figure 1). The groundwater impact study is required to address preliminary comments by the City of Ottawa (City) on a draft plan of subdivision application for the site.

The purpose of this groundwater impact assessment was to determine the general soil and groundwater conditions across this site, by means of existing on-site borehole information and subsurface data from nearby sites, and to address possible construction-related impacts to private water supply wells in the area of the site. The on-site information was enhanced with published mapping and publicly available information. The water well records in the Ministry of the Environment, Conservation and Parks (MECP) Water Well Information System (WWIS) for nearby water wells were used to provide further information regarding hydrogeological conditions in the area and identify the subsurface zones from which nearby water wells are obtaining their groundwater supply.

1.0 DESCRIPTION OF PROJECT AND SITE

The approximate location of the site is shown on the Key Map insert provided on the Site Plan, Figure 1.
The following is known about the site and project:

- The site is located north of Perth Street directly west and east of the Fox Run Phases 2 and 3 developments in Richmond, Ontario.
- The site of the proposed Green West Parcel is irregular in shape, and measures approximately 650 metres by 230 metres in plan, and the Green East Parcel is rectangular in shape, and measures approximately 650 metres by 100 metres in plan.
- The site has a relatively flat topography and is currently undeveloped, consisting mainly of cultivated agricultural land.
- A creek passes through the Green East Parcel.
- The site will be developed with a conventional suburban subdivision.
- The development will be serviced with municipal sewer and water.

Golder Associates Ltd.
1931 Robertson Road, Ottawa, Ontario, K2H 5B7, Canada T: +1 613 592 9600 F: +1 613 592 9601

It is understood that trenches for installation of site services are anticipated to have depths of about 1.9 to 3.3 metres below existing ground surface (i.e., sanitary sewer inverts ranging from about 91.9 to 94.2 metres above sea level (masl)), and will be made through silty clay, sandy silt to silt, and/or glacial till.

2.0 GEOLOGY

The following sections describe the published local geology and hydrogeology in the vicinity of the site.

2.1 Surficial Geology

The surficial geology in the vicinity of the site is shown on Figure 2. The upper overburden material mapped over the Green East and West Lands is a deposit of marine clay (Unit 3). This generally agrees with the site-specific data gathered by Golder Associates Ltd. (Golder) from test pits and boreholes completed within and near the development site (Golder, 2020).

Published mapping indicates the bedrock surface to be at depths in the range of 5 to 15 metres below the ground surface in the vicinity of the site (Figure 3).

Based on the data collected by Golder, in general, the subsurface conditions in Green Lands East and West consist of topsoil and/or fill over silty clay and silts, overlying glacial till. The locations of the test pits and boreholes are shown on Figure 1 and the test pit and borehole logs are provided in Attachment A. Practical refusal to augering/sampling was encountered below the grey clay, silt and/or glacial till in BH's 20-104, 20-105, 20-202, 20-204, 20-206, 20-208, 20-210, 20-211 and 20-212 as well as previous BH 19-06 at depths ranging from 2.9 to 8.8 m below the ground surface. Refusal could represent the bedrock surface or cobbles/boulders in the glacial till.

It should be noted that refusal was encountered at BH's 20-211 and 20-212 at 'shallower' depths of 3.8 and 2.9 metres below existing ground surface, i.e., elevations of 91.3 and 93.1 masl, respectively. Based on the preliminary plans provided by Caivan, the excavations within this area will not extend into possible bedrock. During the installation of services in the adjacent residential areas, blasting has not been required to excavate trenches in overburden materials.

2.2 Bedrock Geology

Published geological mapping indicates that dolomite bedrock of the Oxford Formation is present in the area of the site. (Williams, 1991).

3.0 HYDROGEOLOGY

3.1 Regional Hydrogeology

The clay and glacial till deposits in the area of the development are generally not capable of supplying sufficient quantities of groundwater to be considered an aquifer. As a result, the principal aquifer within the vicinity of the site is considered to be in the bedrock of the underlying Oxford Formation.

The Oxford Formation is considered to be a highly transmissive aquifer, generally providing an adequate resource for domestic water supplies. Groundwater flow in this formation is controlled predominately by fractures, as the primary porosity has been reduced by cementation.

3.2 Site Specific Hydrogeology

A summary of the groundwater levels and hydraulic conductivity measured in the monitoring wells installed at the site is presented in the following table. It is expected that the groundwater level will be subject to fluctuations both seasonally and as a result of precipitation events.

Testhole	Geologic Unit at Screened Interval	Depth to Groundwater (mbgs)	Groundwater Elevation (masl)	Hydraulic Conductivity (m/s)	Date of Reading
20-101	Silty Clay	1.47	93.77	$1x10^{-8}$	July 3, 2020
20-201	Silty Clay	2.52	94.51	$3x10^{-8}$	
20-206	Silty Clay and Silt	1.88	92.57	$5x10^{-7}$	
20-208A	Silty Clay	1.36	94.53	$3x10^{-6}$	
20-212	Silty Clay (Weathered Crust) and Sandy Silt	2.08	93.92	$6x10^{-7}$	
19-02 A	Silty Clay, Clayey Silt and Sandy Silt	0.44	94.31	$2x10^{-5}$	May 6, 2019
19-02 B	Clayey Silt to Silty Clay	1.11	93.64	$3x10^{-7}$	
19-06	Silty Clay (Weathered Crust)	0.75	93.50	$6x10^{-7}$	May 7, 2019
MW07-1	-	1.1	N/A	N/A	June 20, 2007

Based on the shallow groundwater elevations, the groundwater flow direction is interpreted to be towards the east. An upwards vertical gradient between the unweathered silty clay and the weathered crust exists between the monitoring wells installed in borehole 19-02.

4.0 POTENTIAL IMPACTS TO EXISTING GROUNDWATER USERS

The greatest potential impacts to private wells could occur when groundwater control, for temporary construction dewatering, occurs from servicing trenches that extend into the bedrock; however, servicing trenches at this site are not anticipated to extend into the bedrock and blasting is not anticipated to be required.

The highest measured groundwater elevations at the depth of service installation at the site was 94.53 masl; therefore, assuming that dewatering will be required to 0.5 m below the deepest invert (i.e., 0.5 metres below 91.9 masl), dewatering during construction of site services could require up to 3.1 metres of dewatering. The radius of influence of groundwater level drawdown during construction dewatering can be estimated using the modified Sichart and Kryieleis equation (Cashman and Preene, 2013, equation 7.15):

$$R_o = 1750(H - h)\sqrt{K}$$

where R_o represents the radius of influence in metres, H-h represents the amount of groundwater level drawdown in metres and K represents the hydraulic conductivity of the aquifer in metres per second (m/s). Using the highest estimated overburden hydraulic conductivity (i.e., 2×10^{-5} m/s) and assuming a maximum drawdown of 3.1 metres, the radius of influence is estimated to be about 25 metres from the service trench.

4.1 Groundwater Quantity

It is considered that the only potential for the proposed development to affect the water quantity of any wells that are in use near the site would be in association with temporary pumping from service trenches (i.e., potential for short term impact). The maximum radius of influence associated with dewatering was estimated to be 25 metres; however, to provide a conservative assessment of potential impacts to groundwater users, groundwater use within 250 metres of the site has been reviewed.

The MECP Water Well Information System (WWIS) database contained records for 135 wells (with a location accuracy of less than 300 metres) within 250 metres of the site (see Figure 1). Of these, 2 were records of abandonment, 1 was listed as an observation well and 1 had no information on the use of the well. Table 1

summarizes the well construction details for the remaining 131 water supply wells. Well depths range from 12.2 to 75.6 metres, with an average of 47.0 metres. Static water levels range from 4.3 metres below ground surface to 1.1 metres above ground surface, with an average of 0.3 metres below ground surface. The depths to water found in each well range from 9.1 to 74.4 metres, with an average of 44.0 metres. All 131 water supply wells obtain groundwater from the bedrock.

Five water supply wells fall within the estimated 25 metre radius of influence of site servicing activities, as summarized in the following table. The available drawdown (i.e., the difference between the static water level in each well and the depth to the highest water bearing zone) in each well was greater than 40 metres.

Well ID	Ground Surface Elevation (masl)	Depth to Bedrock (m)	Well Depth (m)	Depth of Water Found (m)	Static Water Depth (m)	Available Drawdown (m)
7042052	94.8	9.1	48.8	46.6	0.0	46.6
7053602	94.8	8.4	45.1	42.7	0.2	42.5
7105857	94.8	11.0	45.1	43.9	0.0	43.9
7299417	95.1	11.3	45.1	44.8	0.0	44.8
7317827	-	11.6	45.1	44.8	0.0	44.8

Since all five water supply wells are cased into the bedrock below the depth of excavation for the installation of site services, and since the site servicing activities are anticipated to be carried out in the overburden without the need for blasting, adverse impacts to the water quality or quantity to nearby private water supply wells are not anticipated.

The temporary nature of the proposed construction dewatering will not result in long-term changes in groundwater flow patterns; as a result, long-term impacts to water quality at active water supply wells are not anticipated.

5.0 LIMITATIONS AND USE OF MEMORANDUM

This technical memorandum was prepared for the exclusive use of Caivan Development Corporation. The technical memorandum, which specifically includes all tables, figures and appendices, is based on data gathered by Golder Associates Ltd., and information provided to Golder Associates Ltd. by others. The information provided by others has not been independently verified or otherwise examined by Golder Associates Ltd. to determine the accuracy or completeness. Golder Associates Ltd. has relied in good faith on this information and does not accept responsibility for any deficiency, misstatements, or inaccuracies contained in the information as a result of omissions, misinterpretation or fraudulent acts.

The services performed as described in this technical memorandum were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

Any use which a third party makes of this technical memorandum, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made, or actions taken based on this technical memorandum.

6.0 CLOSURE

We trust this submission satisfies the requirements for a groundwater impact assessment of the proposed Green Lands East and Green Lands West of the Fox Run residential development, in Ottawa, Ontario. If you have any questions regarding this report, please contact the undersigned.

Golder Associates Ltd.

PROFESSIONAL GEOSCIENTIST
CAITLIN A. MARTIN COOKE
PRACTISING MEMBER
1481
2021-Jan-14
ONTARIO

Caitlin Cooke, M.Sc., P.Geo.
Hydrogeologist

Brian Henderson, M.A.Sc., P.Eng.
Environmental Engineer

CAMC/BH/sg

https://golderassociates.sharepoint.com/sites/128209/project files/6 deliverables/green hydrogeological impact assessment/20144864-tm-green hydrogeology-2021-01-14.docx

Attachments: Table 1
Figures 1 to 3
Attachment A – Borehole and Test Pit Logs

References

Cashman, P.M. and Martin Preene. Groundwater Lowering in Construction: A Practical Guide to Dewatering". 2013.

Golder Associates Ltd., 2020. Geotechnical and Hydrogeological Investigation, Proposed Subdivision Development, Green Lands East and West Parcels. Report No. 20144864-3000-02, July 2020.

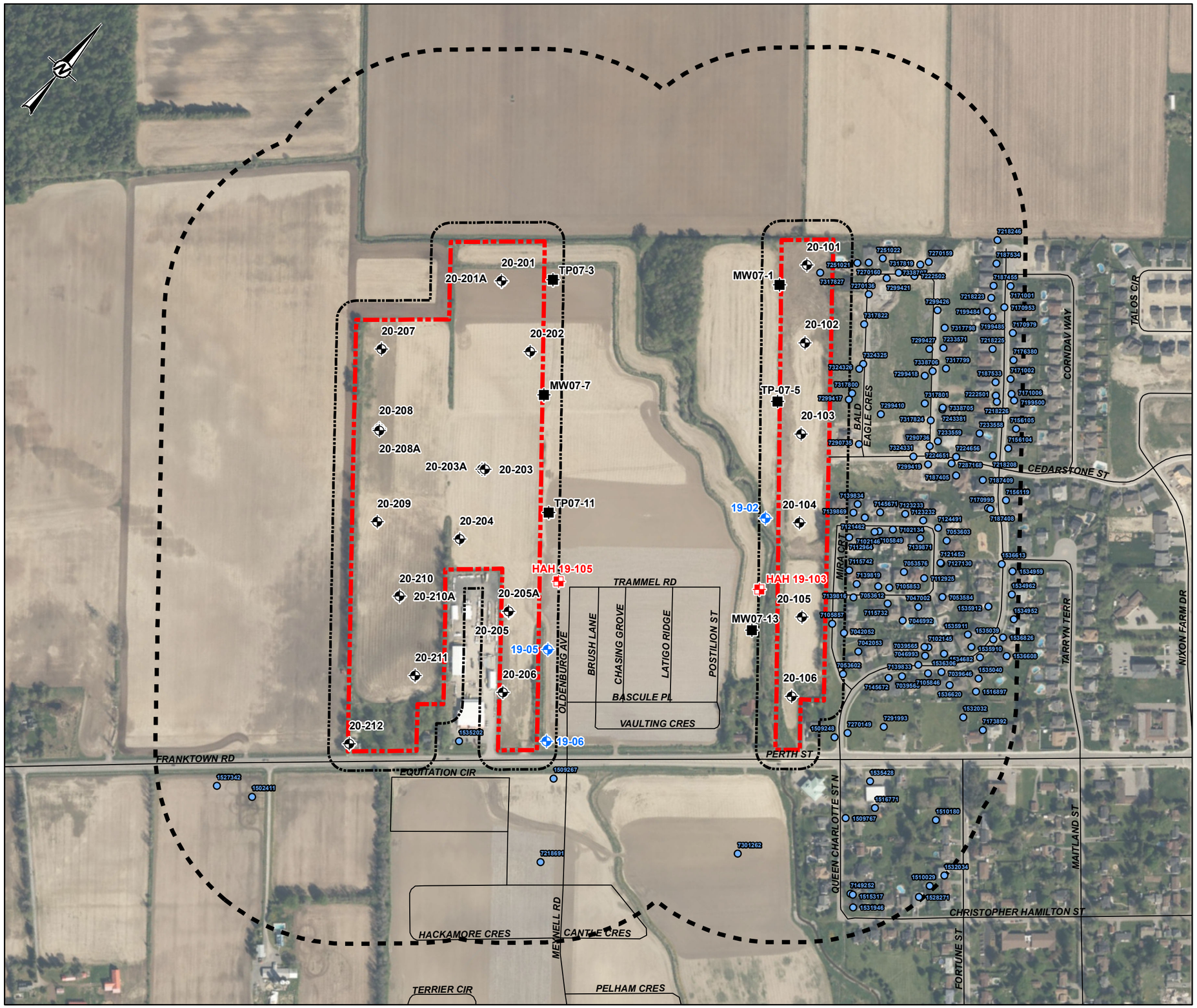
Williams, D.A., 1991. Paleozoic Geology of the Ottawa-St Lawrence Lowland, Southern Ontario; Ontario Geological Survey, Open File Report 5770, 292p.

MECP Water Well Records Near Green East and Green West Lands

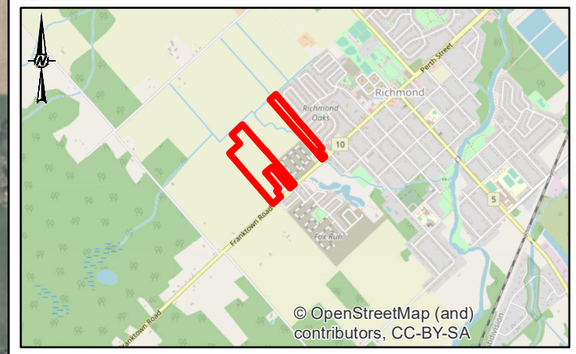
Well ID	Date Completed	Ground Surface Elevation (masl)	Depth to Bedrock (m)	Well Depth (m)	Elevation of Bottom of Well (masl)	Depth of Water Found (m)	Static Water Depth (m)	Static Water Elevation (masl)	Well Status	Well Use
1502411	1959-06-08	96.3	7.6	16.8	79.5	16.8	-0.6	96.9	Water Supply	Domestic
1509248	1961-05-22	94.8	8.2	14.6	80.2	12.2	0.0	94.8	Water Supply	Domestic
1509267	1962-12-03	94.8	6.7	12.2	82.6	12.2	0.6	94.2	Water Supply	Domestic
1509767	1968-08-28	94.1	7.0	15.2	78.9	14.6	0.9	93.2	Water Supply	Domestic
1510029	1968-12-18	94.2	7.6	14.6	79.6	9.1	0.0	94.2	Water Supply	Domestic
1510180	1969-09-02	94.7	7.6	15.8	78.9	15.2	0.0	94.7	Water Supply	Domestic
1515317	1976-03-09	94.4	7.0	22.6	71.9	21.9	2.4	92.0	Water Supply	Domestic
1516771	1978-08-30	94.4	6.7	13.7	80.7	12.5	2.4	92.0	Water Supply	Domestic
1516897	1979-01-10	94.6	9.8	64.0	30.6	62.5	0.0	94.6	Water Supply	Industrial
1527342	1993-07-26	96.6	4.3	19.2	77.4	17.7	1.5	95.0	Water Supply	Domestic
1528271	1994-10-13	94.4	8.2	31.4	63.0	29.9	4.3	90.1	Water Supply	Domestic
1531946	2001-03-25	94.4	6.7	24.4	70.0	19.8	0.6	93.8	Water Supply	Domestic
1532032	2001-06-21	94.3	9.1	68.6	25.8	68.6	2.4	91.9	Water Supply	Domestic
1532034	2001-06-21	94.2	8.5	22.9	71.3	18.9	2.4	91.7	Water Supply	Domestic
1534682	2004-05-10	94.5	9.8	52.7	41.8	51.2	-	-	Water Supply	Domestic
1534952	2004-08-05	94.2	10.4	48.8	45.5	45.1	0.1	94.1	Water Supply	Domestic
1534959	2004-06-15	94.8	10.7	52.7	42.0	50.3	0.0	94.8	Water Supply	Domestic
1534962	2004-06-14	94.6	10.7	52.7	41.9	50.6	1.8	92.8	Water Supply	Domestic
1535039	2004-09-08	94.3	10.1	29.9	64.4	28.0	0.0	94.3	Water Supply	Domestic
1535040	2004-08-27	94.6	10.1	45.1	49.5	42.7	0.0	94.6	Water Supply	Domestic
1535202	2004-10-27	95.3	6.1	27.4	67.9	25.0	-	-	Water Supply	Domestic
1535428	2005-02-18	94.6	7.0	42.7	51.9	41.2	-	-	Water Supply	Domestic
1535910	2005-08-02	94.4	9.4	33.5	60.9	31.1	0.0	94.4	Water Supply	Domestic
1535911	2005-08-02	94.2	9.8	33.5	60.7	30.8	0.0	94.2	Water Supply	Domestic
1535912	2005-08-02	94.4	9.4	45.1	49.3	43.6	0.2	94.2	Water Supply	Domestic
1536306	2006-03-09	94.2	8.5	45.1	49.1	43.6	0.0	94.2	Water Supply	Domestic
1536608	2006-07-14	94.6	10.4	45.1	49.5	43.0	-	-	Water Supply	Domestic
1536613	2006-07-14	94.8	10.7	46.6	48.1	44.5	0.1	94.7	Water Supply	Domestic
1536620	2006-07-11	94.5	9.4	52.7	41.8	51.2	0.0	94.5	Water Supply	Domestic
1536826	2006-08-28	94.3	10.4	45.1	49.2	42.7	0.1	94.2	Water Supply	Domestic
7039565	2006-11-15	94.0	8.8	45.1	48.9	43.9	0.0	94.0	Water Supply	Domestic
7039566	2006-11-15	94.2	9.1	48.8	45.5	46.6	0.0	94.2	Water Supply	Domestic
7039646	2006-12-21	94.3	10.1	53.3	41.0	50.6	0.0	94.3	Water Supply	Domestic
7042052	2007-03-01	94.8	9.1	48.8	46.1	46.6	0.0	94.8	Water Supply	Domestic
7042053	2007-03-01	94.8	9.1	37.5	57.3	33.8	0.0	94.8	Water Supply	Domestic
7046992	2007-05-30	94.2	9.8	47.2	46.9	46.0	0.0	94.2	Water Supply	Domestic
7046993	2007-05-30	94.0	8.8	45.1	48.9	43.6	-	-	Water Supply	Domestic
7047002	2007-05-10	94.0	8.8	45.1	48.9	43.6	-	-	Water Supply	Domestic
7053576	2007-10-15	94.4	10.1	47.2	47.2	45.4	0.4	94.0	Water Supply	Domestic
7053584	2007-10-12	94.3	10.1	47.2	47.0	45.4	0.6	93.6	Water Supply	Domestic
7053602	2007-10-15	94.8	8.4	45.1	49.7	42.7	0.2	94.6	Water Supply	Domestic
7053603	2007-10-12	94.7	10.1	47.2	47.4	45.4	0.7	94.0	Water Supply	Domestic
7053612	2007-11-04	94.8	10.1	47.2	47.5	45.1	0.0	94.8	Water Supply	Domestic
7102134	2008-01-25	94.7	11.3	47.2	47.4	45.4	0.0	94.7	Water Supply	Domestic
7102145	2008-02-05	94.0	9.8	45.1	48.9	42.7	0.0	94.0	Water Supply	Domestic
7102146	2008-02-05	94.8	11.0	48.8	46.1	45.1	0.7	94.1	Water Supply	Domestic
7105846	2008-05-02	94.1	8.8	45.1	49.0	43.3	0.0	94.1	Water Supply	Domestic
7105849	2008-04-28	94.8	11.3	47.2	47.6	45.1	0.0	94.8	Water Supply	Domestic
7105853	2008-05-14	94.7	10.1	45.7	49.0	44.5	0.0	94.7	Water Supply	Domestic
7105857	2008-03-27	94.8	11.0	45.1	49.7	43.9	0.0	94.8	Water Supply	Domestic
7112925	2008-08-06	94.0	10.7	45.1	48.9	43.6	0.6	93.4	Water Supply	-
7112964	2008-07-21	94.9	11.0	45.1	49.8	44.2	-0.4	95.3	Water Supply	Domestic
7115732	2008-11-04	94.5	10.4	45.1	49.4	43.9	-0.6	95.1	Water Supply	Domestic
7115742	2008-11-07	94.8	11.3	45.1	49.7	44.2	0.6	94.2	Water Supply	Domestic
7121452	2009-01-30	94.5	10.7	45.1	49.4	43.6	0.0	94.5	Water Supply	Domestic
7121462	2009-03-04	94.8	10.4	48.8	46.1	46.9	-	-	Water Supply	Domestic
7123232	2009-04-20	94.0	11.0	45.1	48.9	43.9	-0.2	94.2	Water Supply	Domestic
7123233	2009-04-20	94.4	11.0	45.1	49.3	44.5	-0.3	94.6	Water Supply	Domestic
7124491	2009-05-05	94.4	11.0	45.1	49.3	43.9	-	-	Water Supply	Domestic
7127130	2009-06-08	94.5	10.4	45.1	49.4	-	-0.4	94.9	Water Supply	Domestic
7139816	2009-11-04	94.7	10.1	45.1	49.6	44.5	-1.1	95.8	Water Supply	Domestic
7139819	2009-11-04	94.7	10.1	45.1	49.6	44.5	-0.5	95.2	Water Supply	Domestic
7139833	2009-11-19	94.0	8.8	45.1	48.9	43.6	0.0	94.0	Water Supply	Domestic
7139834	2009-11-25	94.8	11.3	45.1	49.7	44.5	-	-	Water Supply	Domestic
7139869	2009-09-09	94.8	11.3	45.1	49.7	44.5	0.0	94.8	Water Supply	Domestic
7139871	2009-09-09	94.0	10.4	45.1	48.9	43.6	-	-	Water Supply	Domestic
7145671	2010-01-28	94.8	11.0	45.4	49.4	44.8	0.5	94.3	Water Supply	Domestic
7145672	2010-01-26	94.5	8.8	45.1	49.4	32.3	0.0	94.5	Water Supply	Domestic
7149252	2010-05-26	94.4	7.3	52.7	41.7	24.4	0.6	93.8	Water Supply	Domestic
7156104	2010-10-18	94.4	11.0	47.2	47.2	45.7	-	-	Water Supply	Domestic
7156105	2010-10-18	95.0	11.0	45.1	49.9	43.9	0.5	94.5	Water Supply	Domestic
7156119	2010-09-17	94.8	10.1	45.1	49.7	43.6	0.5	94.3	Water Supply	Domestic

MECP Water Well Records Near Green East and Green West Lands

Well ID	Date Completed	Ground Surface Elevation (masl)	Depth to Bedrock (m)	Well Depth (m)	Elevation of Bottom of Well (masl)	Depth of Water Found (m)	Static Water Depth (m)	Static Water Elevation (masl)	Well Status	Well Use
7170953	2011-09-20	95.2	11.3	75.6	19.6	74.1	0.9	94.3	Water Supply	Domestic
7170979	2011-07-11	95.2	11.3	70.1	25.1	69.5	0.7	94.5	Water Supply	Domestic
7170995	2011-06-23	94.8	10.7	45.1	49.7	44.2	0.0	94.8	Water Supply	Domestic
7171001	2011-06-20	95.2	11.3	70.1	25.1	66.7	0.0	95.2	Water Supply	Domestic
7171002	2011-06-21	95.1	11.3	71.6	23.5	70.7	0.0	95.1	Water Supply	Domestic
7171006	2011-06-07	95.1	11.0	45.1	50.0	43.6	0.0	95.1	Water Supply	Domestic
7173892	2011-11-04	94.4	8.2	68.0	26.5	25.6	-	-	Water Supply	Domestic
7176380	2011-11-24	95.1	11.3	74.7	20.5	74.4	0.2	94.9	Water Supply	Domestic
7187405	2012-07-05	94.6	11.0	52.7	41.9	51.5	1.0	93.6	Water Supply	Domestic
7187408	2012-07-13	94.8	11.0	52.7	42.1	43.9	1.2	93.6	Water Supply	Domestic
7187409	2012-07-24	94.6	11.0	52.7	41.9	44.5	0.6	94.0	Water Supply	Domestic
7187455	2012-04-03	95.2	12.5	74.1	21.1	71.3	0.0	95.2	Water Supply	Domestic
7187533	2012-08-20	95.1	10.9	61.0	34.1	59.4	0.9	94.1	Water Supply	Domestic
7187534	2012-08-21	95.2	11.3	73.1	22.1	72.5	1.6	93.7	Water Supply	Domestic
7199484	2012-10-25	95.2	10.7	53.3	41.8	51.5	0.3	94.9	Water Supply	Domestic
7199485	2012-10-26	95.2	11.0	45.1	50.1	-	0.6	94.6	Water Supply	Domestic
7199500	2012-11-29	95.1	11.3	68.6	26.5	68.3	0.3	94.8	Water Supply	Domestic
7218208	2013-03-06	94.2	11.0	52.7	41.5	50.9	0.0	94.2	Water Supply	Domestic
7218223	2013-05-27	95.2	11.3	48.8	46.4	46.3	0.0	95.2	Water Supply	Domestic
7218225	2013-05-23	95.1	11.3	68.6	26.5	43.3	0.0	95.1	Water Supply	Domestic
7218226	2013-05-22	95.1	11.3	52.7	42.4	43.9	0.0	95.1	Water Supply	Domestic
7218246	2013-06-19	95.3	12.5	22.2	73.0	21.0	0.0	95.3	Water Supply	-
7218691	2013-08-19	95.0	11.0	52.7	42.3	43.3	0.0	95.0	Water Supply	Domestic
7222501	2014-04-29	95.1	11.0	45.1	50.0	44.8	0.0	95.1	Water Supply	Domestic
7222502	2014-04-14	94.2	11.3	45.1	49.1	44.5	0.0	94.2	Water Supply	Domestic
7233558	2014-07-14	94.4	11.0	45.1	49.3	43.6	0.0	94.4	Water Supply	Domestic
7233559	2014-07-08	94.2	11.0	53.3	40.9	51.8	0.0	94.2	Water Supply	Domestic
7233571	2014-08-22	94.6	11.3	45.1	49.5	44.2	0.0	94.6	Water Supply	Domestic
7243381	2015-03-20	94.5	11.3	45.1	49.4	44.5	-	-	Water Supply	Domestic
7251021	2015-06-17	94.9	11.3	67.1	27.8	62.8	0.0	94.9	Water Supply	Domestic
7251022	2015-06-15	94.6	11.0	48.8	45.8	45.7	0.0	94.6	Water Supply	Domestic
7270149	2016-05-03	94.7	7.6	45.1	49.6	43.3	-	-	Water Supply	Domestic
7270159	2016-05-24	94.1	12.2	70.1	24.0	45.1	0.6	93.5	Water Supply	Domestic
7270160	2016-05-25	94.9	11.9	45.4	49.5	44.8	0.4	94.4	Water Supply	Domestic
7270136	2015-11-23	95.1	11.0	53.3	41.7	48.8	-	-	Water Supply	Domestic
7287168	2016-10-17	94.4	11.0	61.0	33.4	45.1	0.9	93.5	Water Supply	Domestic
7290735	2017-04-25	94.9	11.0	45.1	49.8	43.9	-	-	Water Supply	Domestic
7290736	2017-04-24	94.0	11.0	45.4	48.6	44.2	-	-	Water Supply	Domestic
7299410	2017-08-11	94.9	11.3	45.4	49.5	44.5	-	-	Water Supply	Domestic
7299417	2017-08-24	95.1	11.3	45.1	50.0	44.8	0.0	95.1	Water Supply	Domestic
7299418	2017-08-04	94.0	11.3	45.1	48.9	44.5	-	-	Water Supply	Domestic
7299419	2017-08-14	94.0	11.0	45.1	48.9	42.7	-	-	Water Supply	Domestic
7299421	2017-07-17	95.0	11.9	53.3	41.7	50.6	-	-	Water Supply	Domestic
7299426	2017-07-26	94.7	11.3	53.3	41.4	50.9	-	-	Water Supply	Domestic
7299427	2017-07-28	94.1	11.3	53.3	40.8	45.4	-	-	Water Supply	Domestic
7317798	2018-06-21	-	11.0	70.1	-	69.5	0.1	-	Water Supply	Domestic
7317799	2018-06-25	-	11.0	68.6	-	56.7	0.5	-	Water Supply	Domestic
7317800	2018-06-22	-	11.0	45.7	-	44.8	0.5	-	Water Supply	Domestic
7317801	2018-06-18	-	11.0	45.7	-	44.8	0.2	-	Water Supply	Domestic
7317819	2018-04-09	-	10.4	70.1	-	69.2	0.0	-	Water Supply	Domestic
7317822	2018-04-23	-	10.4	53.3	-	51.5	0.0	-	Water Supply	Domestic
7317824	2018-03-24	-	10.4	53.3	-	45.1	0.0	-	Water Supply	Domestic
7317827	2018-02-28	-	11.6	45.1	-	44.8	0.0	-	Water Supply	Domestic
7324325	2018-08-14	-	10.1	45.7	-	45.1	0.2	-	Water Supply	Domestic
7324326	2018-08-10	-	11.0	53.3	-	51.5	0.4	-	Water Supply	Domestic
7324331	2018-09-05	-	10.7	45.7	-	44.8	0.9	-	Water Supply	Domestic
7338705	2019-03-20	-	3.2	13.8	-	13.6	0.0	-	Water Supply	Domestic
7338706	2019-03-19	-	11.0	67.1	-	66.2	0.0	-	Water Supply	Domestic
7338707	2019-03-13	-	11.3	53.3	-	45.7	0.0	-	Water Supply	Domestic
7224651	2014-02-26	94.3	N/A	2.1	92.2	2.5	-	-	Observation Wells	Monitoring
7224656	2014-06-23	94.3	N/A	-	-	-	-	-	Abandoned-Other	Monitoring
7291993	2017-02-28	94.5	-	-	-	-	-	-	-	-
7301262	2017-08-29	94.4	N/A	6.1	88.3	1.8	-	-	Abandoned-Other	Monitoring



KEY MAP



SCALE 1:50,000

LEGEND

- MECP WWIS WATER WELL LOCATION
- APPROXIMATE BOREHOLE LOCATION, CURRENT INVESTIGATION
- APPROXIMATE HAND AUGERHOLE LOCATION, PREVIOUS INVESTIGATION
- APPROXIMATE BOREHOLE LOCATION, PREVIOUS INVESTIGATION
- APPROXIMATE TESTHOLE LOCATION, PREVIOUS INVESTIGATION BY JACQUES WHITFORD, JUNE 2007
- ROADWAY
- ESTIMATED RADIUS OF INFLUENCE
- APPROXIMATE SITE BOUNDARY
- 250 m BUFFER

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 50 100 200
1:5,000 METRES

CLIENT
CAIVAN (RICHMOND NORTH) LIMITED

PROJECT
GROUNDWATER IMPACT ASSESSMENT
GREEN EAST LANDS AND GREEN WEST LANDS,
RICHMOND, ONTARIO

TITLE
SITE PLAN

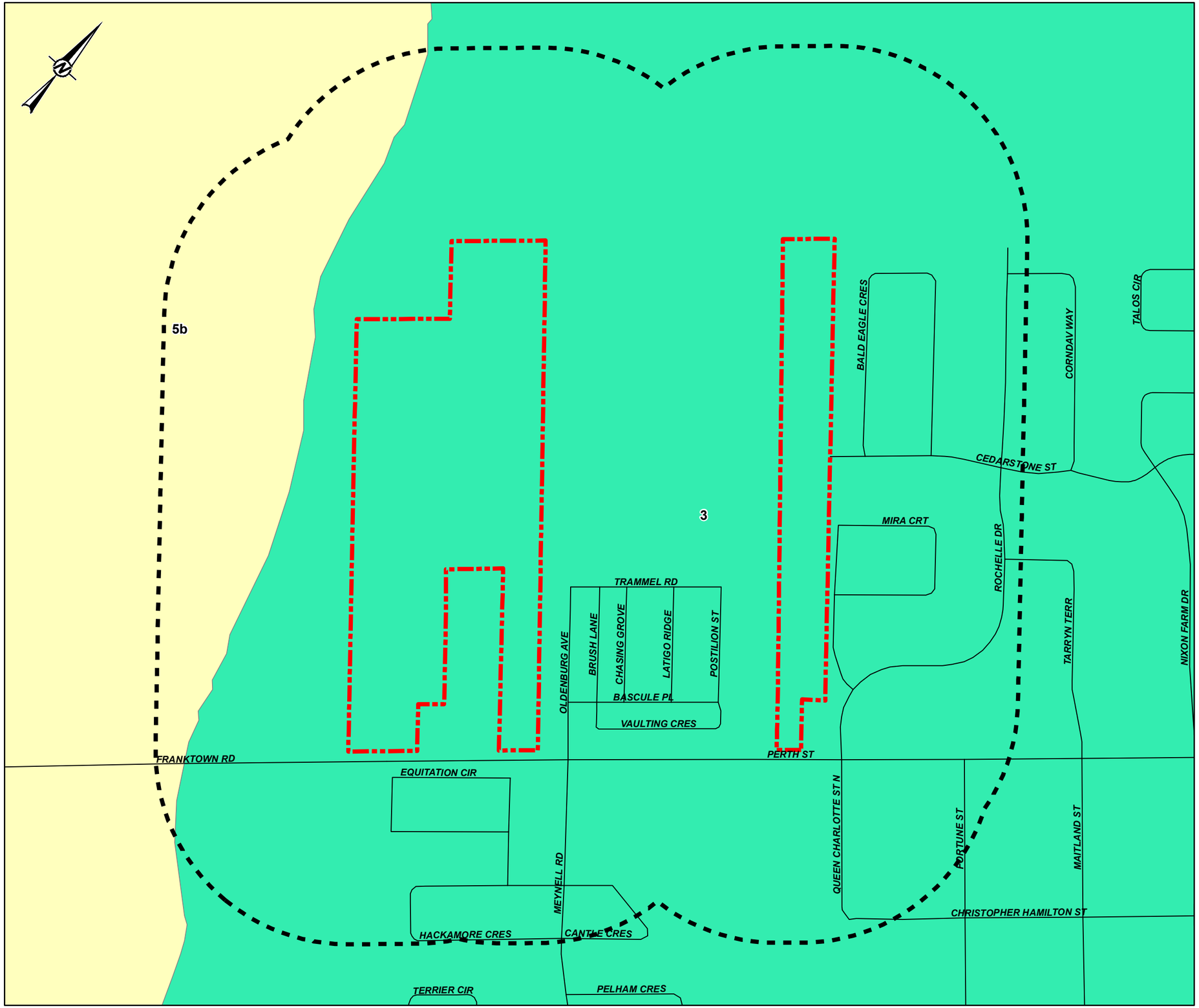
CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-06
DESIGNED	---
PREPARED	JEM
REVIEWED	CAMC
APPROVED	BH

PROJECT NO.	CONTROL	REV.	FIGURE
20144864	0008	0	1

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

Path: N:\Active\Spatial_IM\Caivan\RichmondProposed\WMP99_PRO\20144864_Caivan_Enviro\0008_GW_Impact_Assess_Gree\mxd\20144864-0008-CH-0001.mxd



LEGEND

- ROADWAY
- APPROXIMATE SITE BOUNDARY
- 250 m BUFFER
- 5b: NEARSHORE SEDIMENTS: FINE TO MEDIUM GRAINED SAND
- 3. OFFSHORE MARINE DEPOSITS: CLAY, SILTY CLAY & SILT

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. BÉLANGER, J. R. 2008 URBAN GEOLOGY OF THE NATIONAL CAPITAL AREA, GEOLOGICAL SURVEY OF CANADA, OPEN FILE 5311, 1 DVD.
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 50 100 200
1:5,000 METRES

CLIENT
CAIVAN (RICHMOND NORTH) LIMITED

PROJECT
GROUNDWATER IMPACT ASSESSMENT
GREEN EAST LANDS AND GREEN WEST LANDS,
RICHMOND, ONTARIO

TITLE
SURFICIAL GEOLOGY

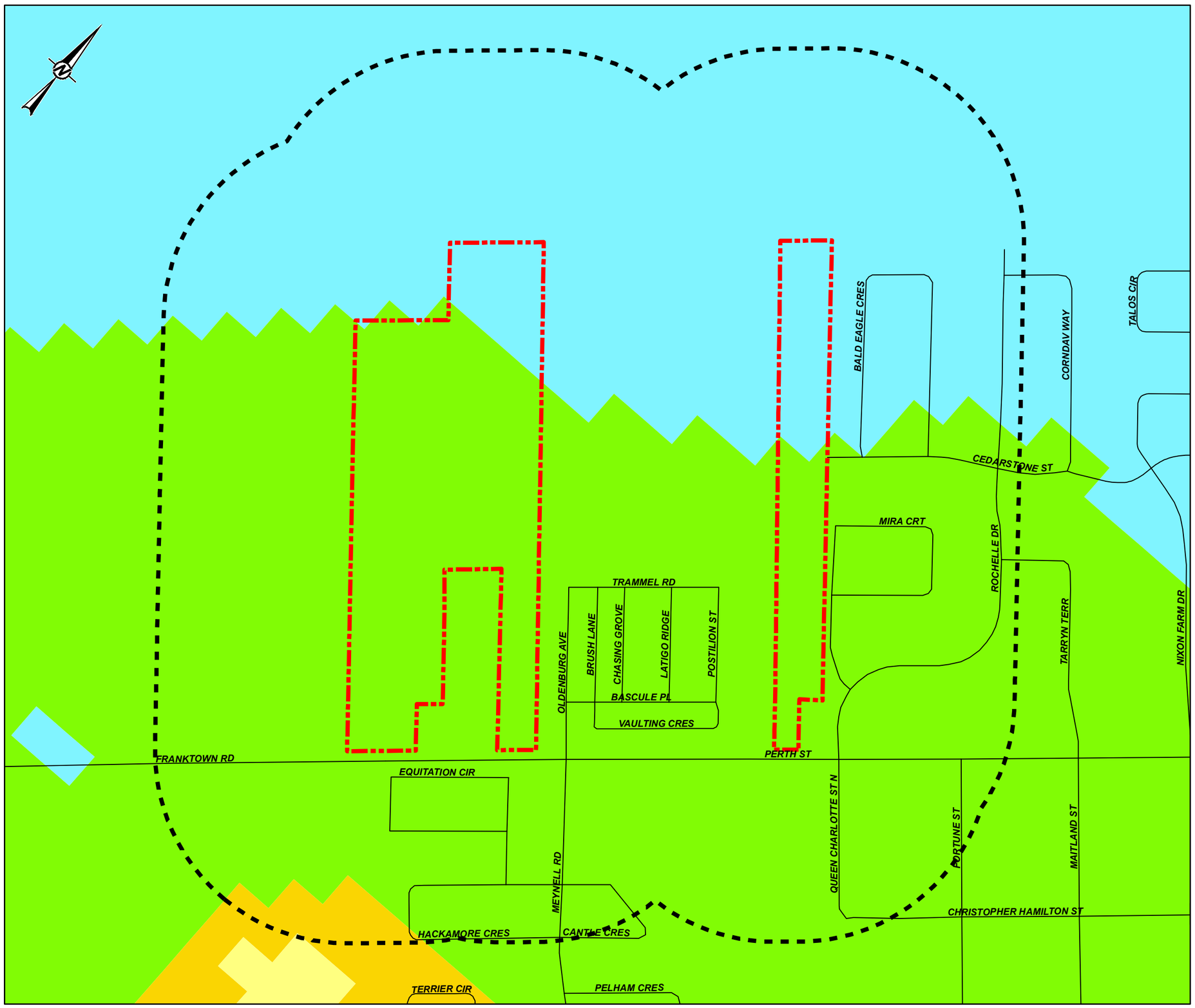
CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-06
DESIGNED	---
PREPARED	JEM
REVIEWED	CAMC
APPROVED	BH

PROJECT NO.	CONTROL	REV.	FIGURE
20144864	0008	0	**2**

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

Path: N:\Active\Spatial_IM\Caivan\RichmondProposed\SWMP\09_PRO\20144864_Caivan_Enviro\0008_GW_Impact_Asees_GreenEW\20144864-0008-CH-0002.mxd



LEGEND

- ROADWAY
- APPROXIMATE SITE BOUNDARY
- 250 m BUFFER

TREND IN DEPTH TO BEDROCK (METRES)

- 2 to 3
- 3 to 5
- 5 to 10
- 10 to 15

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. 2010 BÉLANGER, J. R., URBAN GEOLOGY OF THE NATIONAL CAPITAL AREA, GEOLOGICAL SURVEY OF CANADA, OPEN FILE D3256, 2001
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 50 100 200
1:5,000 METRES

CLIENT
CAIVAN (RICHMOND NORTH) LIMITED

PROJECT
GROUNDWATER IMPACT ASSESSMENT
GREEN EAST LANDS AND GREEN WEST LANDS,
RICHMOND, ONTARIO

TITLE
DRIFT THICKNESS

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-06
DESIGNED	----
PREPARED	JEM
REVIEWED	CAMC
APPROVED	BH

PROJECT NO.	CONTROL	REV.	FIGURE
20144864	0008	0	3

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

Path: N:\Active\Spatial_IM\Caivan\RichmondProposed\SWMP\99_PRO\20144864_Caivan_Enviro\0008_GW_Impact_Assess_Green\EW\20144864-0008-CH-0003.mxd

ATTACHMENT A

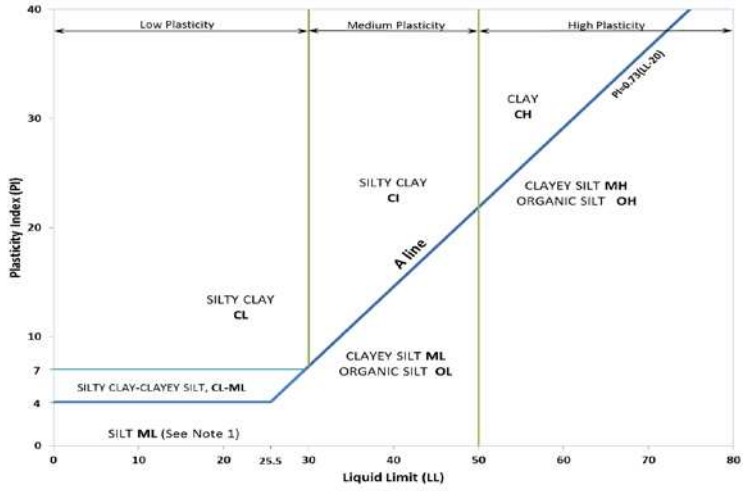
Borehole and Test Pit Logs

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% **(see Note 2)**	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.
2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c′	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

PROJECT: 20144864

RECORD OF BOREHOLE: 20-101

SHEET 1 OF 1

LOCATION: N 5006189.4 ;E 355720.1

BORING DATE: June 8, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.23							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown to black, contains organic matter; cohesive		0.00 94.98							
		(ML/CL) sandy SILT and SILTY CLAY; grey brown, contains sand layers (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		0.25	1	SS	6				
1					2	SS	5				Cuttings
					3	SS	2				
2				92.94							Bentonite Seal
		(CI/CH) SILTY CLAY to CLAY, trace sand; grey with black organic mottling, contains laminations of sand; cohesive, w>PL, firm		2.29	4	SS	1				Silica Sand
3					5	SS	WH				38 mm Diam. PVC #10 Slot Screen
4											Silica Sand
					6	SS	PM				Bentonite Seal
5											
6					7	SS	WH				Spoil/Cuttings
7				87.91							
		End of Borehole		7.32							WL in Screen at Elev. 93.766 m on July 3, 2020
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RI

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-101A

SHEET 1 OF 2

LOCATION: N 5006189.4 ;E 355720.1

BORING DATE: June 12, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.23							
0	Power Auger 200 mm Diam. (Hollow Stem)	Refer to Record of Borehole 20-101 for Stratigraphy		0.00							
1											
2											
3					1	TP	PH				
4											
5											
6								⊕ +			
7				87.61							
8		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm to stiff		7.62	2	SS	WH				
				86.70							
9		(CH/CI) CLAYEY SILT/SILTY CLAY, some sand, trace gravel; cohesive, w>PL, stiff		8.53	3	SS	3				
				86.09							
		(ML) SILT, some sand; grey; non-cohesive, wet, very loose		9.14	4	SS	2				
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RI

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-101A

SHEET 2 OF 2

LOCATION: N 5006189.4 ;E 355720.1

BORING DATE: June 12, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Power Auger	(ML) SILT, some sand; grey; non-cohesive, wet, very loose		84.56							
	DCPT	Dynamic Cone Penetration Testing		10.67					156		
11				84.10					156		
		End of Borehole DCPT Refusal		11.13							
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RI

CHECKED: CH

PROJECT: 20144864

RECORD OF BOREHOLE: 20-102

SHEET 1 OF 1

LOCATION: N 5006112.7 ;E 355785.9

BORING DATE: June 10, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl; 20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.93							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT, some plasticity fines; dark brown, contains organic matter; non-cohesive		0.00							
				94.60	1	SS	9				
		(CL/CI) SILTY CLAY, some sand; grey brown, contains laminations of sand (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		0.33							
1					2	SS	2				
					3	SS	2				
2											
3				91.88							
		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, soft to firm		3.05	4	SS	WH				
4											
					5	SS	WH				
5											
				89.14							
		End of Borehole		5.79							
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

GOLDER

LOGGED: RI
CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-103

SHEET 1 OF 1

LOCATION: N 5006021.4 ;E 355861.1

BORING DATE: June 10, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.73							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) CLAYEY SILT, trace to some sand; dark brown, contains organic matter; cohesive		0.00	1	SS	7				
				94.32							
		(CI/CH) SILTY CLAY to CLAY, trace sand; grey, contains laminations of sand (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		0.41							
1					2	SS	2				
2					3	SS	2			CHEM	
3				91.68							
		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm		3.05	4	SS	WH				
4											
					5	SS	WH				
5											
				88.94							
		End of Borehole		5.79							
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

GOLDER

LOGGED: RI
CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-104

SHEET 1 OF 1

LOCATION: N 5005934.4 ;E 355937.2

BORING DATE: June 10, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.46							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) CLAYEY SILT, trace sand; dark brown, contains organic matter; cohesive		0.00 / 94.05	1	SS	6				
		(CI/CH) SILTY CLAY to CLAY, trace sand; grey brown, contains laminations of sand (WEATHERED CRUST); cohesive, w>PL, stiff to firm		0.41							
1					2	SS	2				
					3	SS	3				
2											
3				91.41							
		(CI/CH) SILTY CLAY to CLAY; grey, contains laminations of silt; cohesive, w>PL, firm		3.05	4	SS	PH			C	
4											
					5	SS	WH				
5											
6				88.36							
		(CL/CI) SILTY CLAY, some sand; grey; cohesive, w>PL, firm to stiff		6.10	6	SS	WH				
7											
				86.84							
		(ML) SILT, some sand; grey; non-cohesive, wet, loose		7.62	7	SS	6			MH	
8				86.23							
		End of Borehole Auger Refusal		8.23							
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RI

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-105

SHEET 1 OF 1

LOCATION: N 5005845.9 ;E 356021.8

BORING DATE: June 16, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.48							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (CL) SILTY CLAY, trace sand; brown, contains organic matter; cohesive		0.00	1	SS	7				
				94.02							
		(CI/CH) SILTY CLAY to CLAY; brown (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		0.46							
1					2	SS	3				
					3	SS	2				
2											
3				91.43							
		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm		3.05	4	SS	WH				
4											
					5	SS	WH				
5											
6				88.38							
		(ML) CLAYEY SILT, some sand; grey; cohesive, w>PL, very stiff		6.10	6	SS	6				
				87.77							
		(ML) SILT, some low plasticity fines to clayey; non-cohesive, wet, very loose to loose		6.71	7	SS	4			MH	
7				87.16							
		End of Borehole Auger Refusal		7.32							
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: SG

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-106

SHEET 1 OF 1

LOCATION: N 5005760.1 ;E 356080.5

BORING DATE: June 18, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.48							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; brown, contains organic matter; non-cohesive		0.00							
		FILL - (ML/SM) SILT and SAND; grey brown, contains layers of silty clay; non-cohesive, moist, loose		0.15	1	SS	11				
1					2	SS	7				
					3	SS	4				
2				92.19							
		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, stiff to firm		2.29	4	SS	3				
3					5	SS	WH				
				90.67							
4		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm to stiff		3.81	6	TP	PH				
5											
					7	SS	WH				
6											
				87.78							
		(ML) SILT, some low plasticity fines; grey; non-cohesive, wet, loose		6.70	8	SS	8				
7											
					9	SS	8				
8	Dynamic Cone Penetration Testing			86.25							
		Dynamic Cone Penetration Testing		8.23							
				85.90							
		End of Borehole DCPT Refusal		8.58							
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: SG

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-201

SHEET 1 OF 2

LOCATION: N 5005908.0 ;E 355439.6

BORING DATE: June 22, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		97.02							
	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (CI/CH) SILTY CLAY; brown; cohesive, w~PL to w>PL, very stiff		0.00							
1					1	SS	16				Cuttings
2				94.73							
		(CI/CH) SILTY CLAY to CLAY; brown (WEATHERED CRUST); cohesive, w>PL, very stiff		2.29	2	SS	8				
3				93.97							Bentonite Seal
		(CI/CH) SILTY CLAY; grey; cohesive, w>PL, soft to firm		3.05	3	SS	2				Silica Sand
4								⊕ +			
								⊕ +			
5					4	SS	WH				38 mm Diam. PVC #10 Slot Screen
								⊕ +			Bentonite Seal
6								⊕ +			
					5	SS	1				
				90.32							
		(ML) SILT, some sand; grey; non-cohesive, wet, compact		6.70							
7					6	SS	19				
				89.55							
	Dynamic Cone Penetration Testing	Dynamic Cone Penetration Testing		7.47							Spoil/Cuttings
8											
9											
10											
		CONTINUED NEXT PAGE									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: RK
CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-201

SHEET 2 OF 2

LOCATION: N 5005908.0 ;E 355439.6

BORING DATE: June 22, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Dynamic Cone Penetration Testing	Dynamic Cone Penetration Testing									
11											Spoil/Cuttings
12				84.42							
		End of Borehole		12.60							WL in Screen at Elev. 94.503 m on July 3, 2020
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-201A

SHEET 1 OF 1

LOCATION: N 5005908.0 ;E 355439.6

BORING DATE: June 22, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		97.02							
0	Power Auger 200 mm Diam. (Hollow Stem)	Refer to Record of Borehole 20-201 for Stratigraphy		0.00							
4					1A	TO	PH				
				92.45							
		End of Borehole		4.57							

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-202

SHEET 1 OF 1

LOCATION: N 5005864.9 ;E 355528.6

BORING DATE: June 22, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.92							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (CL) sandy SILTY CLAY; brown; cohesive, w~PL to w>PL, very stiff		0.00	1	SS	8				
1					2	SS	5				
				93.40							
		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff		1.52	3	SS	2				
2				92.63							
		(CI/CH) SILTY CLAY to CLAY; grey, contains laminations of silt; cohesive, w>PL, firm to stiff		2.29	4	SS	2				
3											
4					5	SS	WH				
5				89.59							
		(ML) SILT, some sand to sandy; grey; non-cohesive, wet, loose to very loose		5.33	6	SS	4				
6					7	SS	4				MH
7				87.76	8	SS	3				
		(SM/ML) SILT and SAND, some gravel and low plasticity fines; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, loose to compact		7.16							
8					9	SS	5				MH
					10	SS	32				
				86.08							
9		End of Borehole Spoon Refusal		8.84							
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-203

SHEET 1 OF 1

LOCATION: N 5005712.0 ;E 355587.2

BORING DATE: June 23, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.06							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (CL) SILTY CLAY, some sand; brown to grey brown; cohesive, w~PL to w>PL, stiff		0.00	1	SS	8				
1					2	SS	4				
				93.54							
		(CI/CH) SILTY CLAY to CLAY; grey brown, contains red brown mottling (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		1.52	3	SS	5				
2					4	SS	3				
				92.16							
3		(CI/CH) SILTY CLAY to CLAY; grey, contains silt seams; cohesive, w>PL, stiff to firm		2.90				⊕ + ⊕ +			
4					5	SS	WH				
5								⊕ + ⊕ +			
				89.42	6	SS	4				
		(ML) SILT, some sand grey; non-cohesive, wet, very loose to loose		5.64							
6											
					7	SS	8				
				88.35							
7	Dynamic Cone Penetration Testing	Dynamic Cone Penetration Testing		6.71							
8											
				86.68							
		End of Borehole DCPT Refusal		8.38							
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-203A

SHEET 1 OF 1

LOCATION: N 5005709.6 ;E 355584.3

BORING DATE: June 23, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.11									
0	Power Auger 200 mm Diam. (Hollow Stem)	Refer to Record of Borehole 20-203 for Stratigraphy		0.00									
1													
2													
3													
4													
5					1A	TP	PH						
				89.93									
		End of Borehole		5.18									
6													
7													
8													
9													
10													

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-204

SHEET 1 OF 1

LOCATION: N 5005623.1 ;E 355623.7

BORING DATE: June 23, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.97							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (CL) sandy SILTY CLAY; grey brown; cohesive, w~PL, stiff		0.00	1	SS	8				
1					2	SS	5				
				93.45							
		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		1.52	3	SS	4			CHEM	
2				92.68							
		(CI/CH) SILTY CLAY to CLAY, trace to some sand; grey, contains clayey silt layers; cohesive, w>PL, stiff to soft		2.29	4	SS	1	⊕ + ⊕ +			
3											
4					5	SS	WH				
				90.40							
		(ML) SILT, some sand to sandy; grey; non-cohesive, wet very loose to loose		4.57	6	SS	3			MH	
5					7	SS	WH				
6					8	SS	9				
7					9	SS	9			MH	
				87.35							
		End of Borehole Auger Refusal		7.62							
8											
9											
10											

DEPTH SCALE
1 : 50

GOLDER

LOGGED: RK
CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-205

SHEET 1 OF 1

LOCATION: N 5005594.9 ;E 355734.5

BORING DATE: June 19, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.54							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (CL) sandy SILTY CLAY; brown, contains organic matter, wood; cohesive, w~PL, very stiff		0.00	1	SS	9				
1					2	SS	5				
				93.17							
		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, stiff		1.37	3	SS	3				
2				92.41							
		(CI/CH) SILTY CLAY to CLAY; grey brown; cohesive, w>PL, stiff to firm		2.13							
3					4	SS	WH				
4											
					5	SS	WH				
5				89.21							
		(ML) SILT, some sand; grey; non-cohesive, wet, loose to compact		5.33	6	SS	10				
6											
					7	SS	12				
				87.83							
	DCPT	Dynamic Cone Penetration Testing		6.71							
7				87.38							
		End of Borehole DCPT Refusal		7.16							
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-205A

SHEET 1 OF 1

LOCATION: N 5005594.9 ;E 355734.5

BORING DATE: June 20, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.54							
0	Power Auger 200 mm Diam. (Hollow Stem)	Refer to Record of Borehole 20-205 for Stratigraphy		0.00							
1											
2											
3											
4					1A	TP	PH				
				90.17							
		End of Borehole		4.37							
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-206

SHEET 1 OF 1

LOCATION: N 5005512.5 ;E 355798.9

BORING DATE: June 19, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.44							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (SP) gravelly SAND, trace to some non-plastic fines, angular; non-cohesive, moist, loose		0.00 / 93.83	1	SS	6				
1		FILL - (CI) sandy SILTY CLAY; brown; cohesive, w>PL, very stiff		0.61 / 92.92	2	SS	6				Cuttings
2		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff to firm		1.52	3	SS	4				
					4	SS	2				
3								⊕ +			Bentonite Seal / Silica Sand
4				90.33				⊕ +			
		(ML) SILT, some sand; grey; non-cohesive, wet, very loose to loose		4.11	5	SS	2				
5					6	SS	10				38 mm Diam. PVC #10 Slot Screen
					7	SS	8				
6				88.04							
		(ML) sandy SILT, some gravel; grey (GLACIAL TILL); non-cohesive, wet, compact		6.40 / 87.73	8	SS	21				
7		End of Borehole Auger Refusal		6.71							WL in Screen at Elev. 92.567 m on July 3, 2020
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: KM

CHECKED: BB

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-207

SHEET 1 OF 2

LOCATION: N 5005738.4 ;E 355382.9

BORING DATE: June 23, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		96.00							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (SM) SILTY SAND; brown; non-cohesive, moist, loose		0.00	1	SS	4				
				95.39							
1		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff		0.61	2	SS	9				
				94.78							
2		(ML) SILT, some sand to sandy SILT; grey; non-cohesive, moist to wet, compact		1.22	3	SS	24				
					4	SS	16				
3					5	SS	12			MH	
4					6	SS	23				
5					7	SS	21				
				90.82							
	Dynamic Cone Penetration Testing	Dynamic Cone Penetration Testing		5.18							
6											
7											
8											
9											
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: RK
CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-207

SHEET 2 OF 2

LOCATION: N 5005738.4 ;E 355382.9

BORING DATE: June 23, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
		End of Borehole DCPT Refusal		85.90 10.10					128		
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-208

SHEET 1 OF 1

LOCATION: N 5005659.2 ;E 355450.2

BORING DATE: June 23, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.94							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (SM) SILTY SAND; brown to dark brown; non-cohesive, moist, very loose		0.00 / 95.48	1	SS	3				
		FILL - (CL) SILTY CLAY; grey brown, contains red brown mottling; cohesive, w>PL, very stiff		0.46 / 94.57	2	SS	4				
2		(CI/CH) SILTY CLAY to CLAY; grey brown, contains red brown mottling (WEATHERED CRUST); cohesive, w>PL, very stiff		1.37 / 93.65	3	SS	4				
		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, stiff to firm		2.29	4	SS	WH				
4					5	SS	WH				
5											
					6	SS	WH				
		(ML) SILT, some sand and low plasticity fines; grey; non-cohesive, wet, compact		5.79 / 90.15							
6					7	SS	21			MH	
		End of Borehole Auger Refusal		6.71 / 89.23							
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-208A

SHEET 1 OF 1

LOCATION: N 5005657.9 ;E 355451.3

BORING DATE: June 23, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.89									
0	Power Auger 200 mm Diam. (Hollow Stem)	Refer to Record of Borehole 20-208 for Stratigraphy		0.00									Cuttings
1													
2													Bentonite Seal
													Silica Sand
3													38 mm Diam. PVC #10 Slot Screen
4					1A	TP	PH					C	
				91.60									Silica Sand
		End of Borehole		4.29									WL in Screen at Elev. 94.530 m on July 3, 2020
5													
6													
7													
8													
9													
10													

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-209

SHEET 1 OF 1

LOCATION: N 5005568.0 ;E 355529.3

BORING DATE: June 24, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) SHEAR STRENGTH Cu, kPa (20 40 60 80) nat V. + Q - ● rem V. ⊕ U - ○	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) WATER CONTENT PERCENT Wp W Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.41							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (SM) SILTY SAND; brown, contains organic matter; non-cohesive, moist		0.00							
				95.11	1	SS	5				
		FILL - (CL) SILTY CLAY; grey brown; cohesive, w>PL, stiff		0.30							
1					2	SS	5				
				94.19							
		(CI/CH) SILTY CLAY; grey brown with reddish brown mottling (WEATHERED CRUST); cohesive, w>PL, very stiff		1.22							
2					3	SS	3				
				93.12							
		(CI/CH) SILTY CLAY; grey; cohesive, w>PL, stiff to firm		2.29	4	SS	WH	⊕ ⊕ + +	○		
3											
4					5	SS	WH		○		
				90.84							
		(ML) SILT, some sand, fine; grey; non-cohesive, wet, compact to loose		4.57	6	SS	13		○		
5											
					7	SS	7		○	MH	
6											
				89.01							
	Dynamic Cone Penetration Testing	Dynamic Cone Penetration Testing		6.40							
7											
8											
9											
				85.81							
		End of Borehole DCPT Refusal		9.60							
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-210

SHEET 1 OF 1

LOCATION: N 5005515.0 ;E 355615.5

BORING DATE: June 24, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.27							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (SM) SILTY SAND; brown to grey brown, contains organic matter; non-cohesive, moist, loose		0.00	1	SS	5				
				94.66							
		FILL - (CL) SILTY CLAY; grey brown; cohesive, w>PL, stiff		0.61							
1				94.20	2	SS	5				
		(CI/CH) SILTY CLAY; grey brown with red brown mottling (WEATHERED CRUST); cohesive, w>PL, very stiff		1.07							
					3	SS	4				
2				92.98							
		(CI/CH) SILTY CLAY; grey; cohesive, w>PL, stiff to firm		2.29	4	SS	1				
3											
					5	SS	WH				
4											
5											
				89.63	6	SS	WH				
		(ML) SILT, some sand to sandy; grey; non-cohesive, wet, loose to compact		5.64							
6											
					7	SS	9			MH	
7											
					8	SS	12				
8					9	SS	14				
				86.89							
		(ML) sandy SILT, some gravel, trace plasticity fines; grey (GLACIAL TILL); non-cohesive, wet, very dense		8.38	10	SS	>50			MH	
				86.58							
		End of Borehole Sampler Refusal		8.69							
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-210A

SHEET 1 OF 1

LOCATION: N 5005515.0 ;E 355615.5

BORING DATE: June 24, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.27							
0	Power Auger 200 mm Diam. (Hollow Stem)	Refer to Record of Borehole 20-210 for Stratigraphy		0.00							
4					1A	TP	PH				
				90.70							
		End of Borehole		4.57							

DEPTH SCALE

1 : 50

GOLDER

LOGGED: RK

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-211

SHEET 1 OF 1

LOCATION: N 5005452.3 ;E 355699.7

BORING DATE: June 24, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.08							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (SM) SILTY SAND; dark brown, contains organic matter; non-cohesive, moist, loose		0.00							
				94.78	1	SS	6				
		FILL - (CL) sandy SILTY CLAY; grey brown; cohesive, w>PL, stiff		0.30							
1					2	SS	7				
				93.56							
		(CI/CH) SILTY CLAY to CLAY; grey brown with red brown mottling (WEATHERED CRUST); cohesive, w>PL, stiff		1.52							
2					3	SS	1				
				92.49	4	SS	6				
		(ML) SILT, some sand to sandy; grey brown; non-cohesive, moist, loose to compact		2.59							
3					5	SS	21				
				91.42							
		(SM) gravelly SILTY SAND; grey (GLACIAL TILL); non-cohesive, wet, compact		3.66							
4				3.76							
		End of Borehole Auger Refusal									
5											
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

GOLDER

LOGGED: RK
CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 20144864

RECORD OF BOREHOLE: 20-212

SHEET 1 OF 1

LOCATION: N 5005329.4 ;E 355695.3

BORING DATE: June 18, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	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) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		96.00									
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (SP/SM) SILTY SAND, some gravel; brown; non-cohesive, moist, loose		0.00	1	SS	9						Flush Mount Casing
				95.24									
1		FILL - (CL/CI) SILTY CLAY, some sand to sandy; cohesive, w>PL, very stiff		0.76	2	SS	8						Cuttings; Silica Sand
				94.48									
2		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, stiff		1.52	3	SS	4						38 mm Diam. PVC #10 Slot Screen
				93.41									
		(ML) sandy SILT, trace plasticity fines; moist, compact		2.59	4	SS	1						
3				93.10									
		End of Borehole Auger Refusal		2.90									WL in Screen at Elev. 93.916 m on July 3, 2020
4													
5													
6													
7													
8													
9													
10													

DEPTH SCALE

1 : 50

GOLDER

LOGGED: KM

CHECKED: CH

MIS-BHS 001 20144864.GPJ GAL-MIS.GDT 7/24/20 JM/JEM

PROJECT: 1522173

RECORD OF BOREHOLE: 19-02

SHEET 1 OF 1

LOCATION: N 5005908.9 ;E 355900.6

BORING DATE: April 23, 2019

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		94.75							
	Power Auger, 200 mm Diam. (Hollow Stem)	TOPSOIL- (ML) sandy SILT; dark brown		0.00 94.50	1	GRAB	-				Bentonite Seal
		(CL-ML) CLAYEY SILT to SILTY CLAY; grey brown, fissured, contains silty sand seams (WEATHERED CRUST); cohesive, w<PL, very stiff		0.25							
1					2	SS	6				
				93.38							Silica Sand
		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, stiff		1.37							
2					3	SS	2				32 mm Diam. PVC #10 Slot Screen 'B'
3				91.70							
		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm		3.05	4	TP	PH				
4											Native Backfill
					5	SS	WH				
5											Bentonite Seal
6				88.65							Silica Sand
		(CI/CH-ML) SILTY CLAY to CLAYEY SILT; grey; cohesive, w>PL		6.10 88.35	6	SS	4				
		(ML) sandy SILT; grey; non-cohesive, wet, loose to very loose		6.40							32 mm Diam. PVC #10 Slot Screen 'A'
7					7	SS	7				
8				86.52	8	SS	2				Silica Sand
		End of Borehole		8.23							WL in screen 'A' at Elev. 94.31 m on May 6, 2019 WL in screen 'B' at Elev. 93.64 m on May 6, 2019
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: PAH

CHECKED: WAM

MIS-BHS 001 1522173.GPJ GAL-MIS.GDT 19-6-12 SGL/JM

PROJECT: 1522173

RECORD OF BOREHOLE: 19-05

SHEET 1 OF 1

LOCATION: N 5005593.1 ;E 355804.6

BORING DATE: April 25, 2019

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.46							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (CL) CLAYEY SILT; dark brown		0.00	1	GRAB	-				
		(CI/CH) SILTY CLAY to CLAY, trace sand grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		0.17							Bentonite Seal
1					2	SS	4				
											Silica Sand
					3	SS	2				
2											32 mm Diam. PVC #10 Slot Screen
				91.56							
3		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm to stiff		2.90							
					4	TP	PH			C	
4											
					5	SS	WH				Native Backfill
5											
6				88.36							
		(ML) sandy SILT, trace gravel; grey, contains clayey silt seams; non-cohesive, wet, loose		6.10	6	SS	6				
7					7	SS	>50				
				87.22							
		End of Borehole Auger Refusal		7.24							WL in screen at Elev. 93.80 m on May 6, 2019
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: PAH

CHECKED: WAM

MIS-BHS 001 1522173.GPJ GAL-MIS.GDT 19-6-12 SGL/JM

PROJECT: 1522173

RECORD OF BOREHOLE: 19-06

SHEET 1 OF 1

LOCATION: N 5005503.4 ;E 355883.6

BORING DATE: April 25, 2019

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		94.25							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (CL) SILTY CLAY; dark brown		0.00 / 94.03	1	AS	-				
		(CI/CH) SILTY CLAY to CLAY; grey brown, contains silty sand seams (WEATHERED CRUST); cohesive, w>PL very stiff to stiff		0.22							Bentonite Seal
1					2	SS	7				
											Silica Sand
2					3	SS	5				
											32 mm Diam. PVC #10 Slot Screen
3				91.20							
		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm		3.05	4	SS	1				
4											
				89.68							Native Backfill
		(CI/CH-ML) SILTY CLAY, CLAYEY SILT and sandy SILT; grey, laminated; cohesive, w>PL, firm		4.57	5	TP	PH				
5											
				88.31							
6		End of Borehole Auger Refusal		5.94							WL in screen at Elev. 93.50 m on May 6, 2019
7											
8											
9											
10											

DEPTH SCALE
1 : 50

GOLDER

LOGGED: PAH
CHECKED: WAM

MIS-BHS 001 1522173.GPJ GAL-MIS.GDT 19-6-12 SGL/JM

TABLE 1

RECORD OF HAND AUGERHOLES

Hand Augerhole Number	Depth (metres)	Description
19-103	0.0 – 0.3	TOPSOIL – (ML) CLAYEY SILT some sand; brown; non-cohesive, moist
	0.3 – 0.5	(ML) CLAYEY SILT, some sand; brown (WEATHERED CRUST); cohesive, w>PL
	0.5 – 1.9	(ML-CI/CH) CLAYEY SILT to SILTY CLAY, trace to some sand; grey brown (WEATHERED CRUST); cohesive, w>PL
	1.9 – 2.5	(CI/CH) SILTY CLAY to CLAY trace sand; grey; cohesive, w>PL
	2.50	END OF AUGERHOLE
		Note: water seepage at 1.1 m depth upon completion

Sample	Depth (m)	Lab Testing
1	1.1 – 1.5	w_n = 51%, PI=35%, LL=56%
2	1.5 – 1.9	
3	1.9 – 2.3	
4	2.3 – 2.5	

19-105	0.00 – 0.20	TOPSOIL – (ML) CLAYEY SILT some sand; brown; non-cohesive, moist
	0.20 – 1.60	(CI/CH-ML) SILTY CLAY to CLAYEY SILT, some sand; grey brown (WEATHERED CRUST); cohesive, w>PL
	1.60 – 2.00	(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL
	2.00 – 2.50	(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL
	2.50	END OF AUGERHOLE
		Note: water seepage at 1.1 m depth upon completion

Sample	Depth (m)	Lab Testing
1	0.7 – 1.1	w_n = 43%, PI=27%, LL=52%
2	1.1 – 1.6	
3	1.6 – 2.0	
4	2.0 – 2.5	

Jacques Whitford

MONITORING WELL RECORD

MW07-1

CLIENT Mattamy Homes

LOCATION Proposed Subdivision, Richmond, ON

DATES: BORING June 18, 2007 WATER LEVEL June 20, 2007

BOREHOLE No. MW07-1

PROJECT No. 1026929

DATUM Local

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	100.32							
	100.2	150 mm TOPSOIL			SS	1	300	4
		Firm to stiff, greyish brown lean CLAY (CL)						
1				▼	SS	2	610	5
2				▽	SS	3	610	6
3	97.3							
		Firm to stiff, grey lean CLAY			SS	4	610	3
4								
5					ST	5	610	
6								
	93.8				SS	6	610	2
7	93.6	Very loose, grey SANDY SILT (ML)						
		End of Borehole						
		Monitoring Well Installed						
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

App'd _____

Date _____

JWL-OLD 1026929.GPJ SMART.GDT 07/06/22

Jacques Whitford

MONITORING WELL RECORD

MW07-7

CLIENT Mattamy Homes

LOCATION Proposed Subdivision, Richmond, ON

DATES: BORING June 18, 2007 WATER LEVEL June 20, 2007

BOREHOLE No. MW07-7

PROJECT No. 1026929

DATUM Local

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	100.21							
		Firm to stiff, greyish brown lean CLAY (CL)						
1				▼	SS	1	610	4
2					SS	2	610	4
3	97.2			▽				
		Firm to stiff, grey lean CLAY			SS	3	610	3
4								
5					SS	4	610	2
6	93.8							
	93.5	Loose, grey SANDY SILT (ML)			SS	5	150	6
		End of Borehole						
7		Monitoring Well Installed						
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m *

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

App'd _____

Date _____

JWL-OLD 1026929.GPJ SMART.GDT 07/08/22

Jacques Whitford

MONITORING WELL RECORD

MW07-13

CLIENT Mattamy Homes

LOCATION Proposed Subdivision, Richmond, ON

DATES: BORING June 18, 2007 WATER LEVEL June 20, 2007

BOREHOLE No. MW07-13

PROJECT No. 1026929

DATUM Local

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.30							
		Stiff, greyish brown lean CLAY (CL)			SS	1	120	8
1				▼	SS	2	75	7
2					SS	3	610	6
3	96.3			▽				
		Firm to stiff, grey lean CLAY			SS	4	40	4
4								
5					ST	5	610	
6	93.2							
		Very loose, grey SANDY SILT (ML)			SS	6	300	1
	92.6							
7		End of Borehole						
		Monitoring Well Installed						
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

App'd

Date

JWL-OLD 1026929.GPJ SMART.GDT 07/06/22

Jacques Whitford

TEST PIT RECORD

TP07-3

CLIENT Mattamy Homes

LOCATION Proposed Subdivision, Richmond, ON

DATES: BORING June 16, 2007 WATER LEVEL

BOREHOLE No. TP07-3

PROJECT No. 1026929

DATUM Local

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	100.27							
	100.0	230 mm TOPSOIL						
		Stiff, greyish brown lean CLAY (CL)		▽				
1					BS	1		
2					BS	2		
	97.7							
		Firm, grey lean CLAY (CL)						
3					BS	3		
4	96.1				BS	4		
		End of Borehole						
5								
6								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m *

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa App'd

△ Pocket Penetrometer Test, kPa Date

JWL-OLD 1026929.GPJ SMART.GDT 07/06/21

Jacques Whitford

TEST PIT RECORD

TP07-5

CLIENT Mattamy Homes

LOCATION Proposed Subdivision, Richmond, ON

DATES: BORING June 16, 2007 WATER LEVEL

BOREHOLE No. TP07-5

PROJECT No. 1026929

DATUM Local

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	100.11							
	99.9	250 mm TOPSOIL			BS	1		
		Stiff, greyish brown lean CLAY (CL)		▽				
1					BS	2		
	98.1				BS	3		
2		Firm, grey lean CLAY (CL)						
					BS	4		
3								
					BS	5		
4	95.9				BS	6		
		End of Borehole						
5								
6								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m *

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

App'd

Date

JWL-OLD 1026929.GPJ SMART.GDT 07/06/21

Jacques Whitford

TEST PIT RECORD

TP07-11

CLIENT Mattamy Homes

LOCATION Proposed Subdivision, Richmond, ON

DATES: BORING June 16, 2007 WATER LEVEL

BOREHOLE No. TP07-11

PROJECT No. 1026929

DATUM Local

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.89							
	99.6	250 mm TOPSOIL						
		Stiff, brown and grey lean CLAY (CL)		▽	BS	1		
1					BS	2		
2					BS	3		
	96.9				BS	4		
3		Firm, grey lean CLAY (CL)						
	96.2				BS	5		
		End of Borehole						
4								
5								
6								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa App'd

△ Pocket Penetrometer Test, kPa Date

JWL-OLD 1026929.GPJ SMART.GDT 07/08/21