PRELIMINARY GEOTECHNICAL INVESTIGATION
DERRY GREEN SIS AREA LOCATED SOUTH INCLUDING THE GOLF COURSE LOCATED SOUTH OD DERRY ROAD W. BETWEEN 6TH AND 5TH LINE, TOWN OF MILTON, ONTARIO

Project No. 30291.222

Prepared for:

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1.0 INTRODUCTION

AME was retained by Neamsby Investment Inc. to carry out a preliminary geotechnical investigation and installing monitoring wells for a future residential/commercial development located south at Derry Road West, between Sixth and Fifth Line in the Town of Milton, Ontario. The Site Location Plan is attached in Appendix A of this report.

A total of twenty (20) boreholes were drilled/advanced at the site between July 8 and July 23, 2019. The locations of boreholes designated as Borehole BH 19-1 through 19-20, as shown on attached Borehole Location Plan- A2 (Appendix A).

It is our understanding that the future development may comprises of residential/commercial lots with local roads and utility services. The purpose of this supplementary investigation was to obtain additional site coverage relating to the subsoil and groundwater conditions by installing eighteen (18) monitoring wells on to determine the relevant geotechnical properties of encountered soils and groundwater condition.

1.1 SITE DESCRIPTION

The property for the future residential/commercial development consists of three rectangular shaped parcels of land located on South of Derry Road W. to 1125m South towards Britannia Road W and approximately 1400m West of Sixth Line to Fifth Line.

The site consists of multiple properties including Trafalgar Golf and Country Club on Southwest corner of Sixth Line and Derry Rd. W.; Neamsby Investment's Area 2 property on Southeast of Derry Rd. W and Fifth Line and Neamsby Investment's Area 3 located south of Area 2 and golf course extended between 6th line from the east to 5th Line from the west.

The ground surface topography at the site relatively flat and is at grade or lower than surroundings. The neighbouring properties consist of agricultural fields and golf course landscaping.

2.0 FIELD WORK

The fieldwork for this investigation was carried out during the period between July 8 to July 23, 2019. It has consisted of advancing a total of twenty (20) exploratory boreholes including eighteen (18) monitoring wells.

The exploratory boreholes were advanced to depths ranging from 5.0m to 8.10 m below existing grade. The depths and locations of the boreholes were determined by Neamsby Investment Inc. and AME Materials Engineering followed stake out accordingly in the field as shown on the attached Borehole Location Plan as Drawing A-2 in Appendix A. The boreholes were laid out in the field by AME. The client shall survey for geodetic elevations and co-ordinates of the boreholes.

The fieldwork was performed under the full-time supervision of experienced geotechnical personnel from **AME**. The boreholes were advanced to the sampling depths by means of continuous flight solid stem augers. Standard Penetration Tests (SPT's) were carried out at frequent intervals of depth in the boreholes. Representative soil samples were recovered using split spoon samplers. The results of the SPT tests, in terms of 'N' values, have been used to infer the consistency of the cohesive soils or relative density of the cohesionless soil. All soil samples were examined in the field and carefully preserved for further examination in the laboratory.

Groundwater conditions were monitored during and upon completion of the borehole explorations.

The borehole\wells locations were surveyed by AME'S surveyor on August 16, 2019.

Table-1 below summarize the borehole numbers, depth of boreholes\wells, ground surface elevation and coordinates in UTM zone 17 CSRS.

Borehole No.	Existing Ground Elevations	*Drilling Depth (m)* *Below Existing Grade\Elevation*	UTM Coordinates		*Monitoring Wells Installed* *(Yes/ No)*
			Northing	Easting	
BH 19 – 1	192.900	*7.67/185.230*	4820931.322	594684.106	*Yes*
BH 19 – 2	192.411	*8.08/184.331*	4820617.021	594949.533	Yes
BH 19 – 3	191.720	8.08/183.640	4820891.836	595051.671	Yes
BH 19 – 4A	190.460	8.08/182.380	4821031.103	595018.879	Yes
BH 19 – 4B	*190.460*	5.03/185.430	4821031.103	595018.879	Yes
BH 19 – 5	*191.439*	8.08/183.359	4821441.883	595003.139	Yes
BH 19 – 6	*188.835*	8.08/180.755	4821668.979	595148.086	No
BH 19 – 7	*189.273*	8.08/181.193	4821945.205	595417.025	Yes
BH 19 – 8	*189.698*	8.08/181.618	4821563.768	595303.825	No
BH 19 – 9	*187.188*	8.08/179.108	4821907.673	595552.975	No
BH 19 – 10	*189.694*	8.08/181.614	4821731.314	595459.161	Yes
BH 19 – 11	*183.576*	8.08/177.026	4821511.757	595678.194	No
BH 19 – 12A	*189.799*	8.08/181.719	4821401.996	595415.978	Yes
BH 19 – 12B	*189.799*	5.03/184.769	4821401.996	595415.978	Yes
BH 19 – 13A	*190.698*	8.08/182.618	4821298.523	595244.962	Yes
BH 19 – 13B	*190.698*	5.03/185.668	4821298.523	595244.962	Yes
BH 19 – 14	*188.070*	6.55/181.520	4821247.243	595522.384	No
BH 19 – 15	*192.391*	8.08/184.311	4820511.674	595053.481	Yes
BH 19 – 16	*189.761*	8.08/181.681	4820220.163	595365.098	Yes
BH 19 – 17	*190.039*	8.08/182.959	4820767.881	595394.341	Yes
BH 19 – 18	*188.897*	8.08/180.817	4821285.585	595682.683	Yes
BH 19 – 19	*188.942*	8.08/180.862	4821148.598	595864.818	Yes
BH 19 – 20	*182.388*	8.08/174.308	4821242.041	596231.39	Yes

3.0 REGIONAL GEOGRAPHY

According to *"The Physiography of Southern Ontario"* (Chapman and Putman, 1984), and Ontario Geological Survey Map 2224 and MRD 228; the proposed project site of approximately 389 acres including three properties underlain by mostly two different deposits such as Glaciolacustrine Deposits (Silt and clay, minor sand, basin and quiet water deposits) and Queenston Formation (Shale, limestone, dolostone and siltstone) in the Town of Milton in the Region of Southern Ontario. Immediately, east of Niagara Escarpment in the regional municipality of Halton, the till plain is fluted, and several recognizable drumlins occur north of Milton. The till here is reddish due to the shale of the Queenston Formation and less calcareous than most of the tills in the south part of the southern Ontario.

Geological References:

- Chapman, L.J. and Putman, D.F., *"The Physiography of Southern Ontario"*, Ontario Geological Survey, Volume 2, 1984.

4.0 SUBSURFACE AND GROUNDWATER CONDITIONS

The subsurface conditions encountered in the boreholes are detailed in the Logs of Boreholes as Figure Nos. B-1 to B-20 provided in Appendix B. An Explanation of Borehole Logs is also presented in Appendix B as Figure B - (i).

It should be noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for geotechnical design, and therefore, should not be construed as the exact plane of geological changes. The soil and groundwater conditions are confirmed at the borehole locations only and it may vary at other locations.

4.1 Topsoil

Topsoil was encountered in almost all boreholes. The thickness of the topsoil at the boreholes varied between approximately 100 mm and 400 mm with an average thickness of 250 mm. It should be noted that the topsoil thickness will vary between boreholes. Thicker topsoil than that found in the boreholes may occur at places.

4.2 Fill

Fine grained fill materials or disturbed soils were found underlying the topsoil at ground surface to depth's ranging from 0.25m to 0.61m below grade with a fill layer thickness between 300mm to 500mm approximately. The fill material is composed of sandy silt to silt, silty sand and clayey silt texture with trace to some gravel and organic material (i.e. topsoil and rootlets).

Standard Penetration resistance in the fill material composed of sandy silt, silty sand, clayey silt, and silt texture with trace to some gravel and organic material had "N"-values ranging from 6 to 16 blows per 300 mm with full SPT penetration indicating a loose to compact relative density for non-cohesive soil and firm to stiff soil consistency for cohesive soil. The measured penetration resistance is indicative of a soil with a very loose to dense relative density for non -cohesive soils or soft to hard soil consistency for cohesive soils respectively.

The moisture content of the selected samples of fill material ranged from about 12.3 to 14.3 percent by weight indicating moist to wet condition. The higher moisture content of soil samples with organics inclusion is attributed to the contained organic matter. The fill was generally brown to dark brown/ grey/ mottled and moist.

4.3 Native: Clayey Silt/ Silty Clay/ Silt/ Sandy Silt/ Sandy Gravelly Silt

Underlying relatively thin layer of fill/disturbed soil, majority of the boreholes encountered undisturbed/ native cohesive soil layer of clayey silt deposits except for

Boreholes BH 19-7, BH 19-11 and BH 19-15, which, comprised of fine to coarse grained non-cohesive matrix of silt, sandy silt to sandy gravelly silt deposits.

Fine grained deposits of cohesive material such as clayey silt found mostly underlying the fill material in almost all boreholes, extending in single layer thickness varying between 0.61m to 1.8m and 0.61m to 2.3m below grade.

Fine to coarse grained deposits of cohesionless silt, sandy silt to gravelly silt with trace clay and gravel texture was encountered below fill in BH 19-7, BH 19-11 and BH 19-15, extending in single layer thickness varying between 0.61m to 1.5m and 0.6m to 2.1m below grade.

Laboratory particle size distribution analysis were completed on a native soil sample taken from selected boreholes and the results according to USCS are summarized below and shown on Figures C1, C3, C5 and C6 in Appendix C:

Gravel (greater than 4.75 mm size)	:	0.1 - 28.9 %
Sand (0.075 mm to 4.75 mm size)	:	5.4 - 23.5 %
Silt (0.002 mm to 0.075 mm size)	:	34.0 - 79.8 %
Clay (less than 0.002 mm size)	:	13.6 - 51.9 %

Standard Penetration resistance in the cohesionless silt, sandy silt, sand, silty sand, and gravelly sand with trace to some clay deposits had “N”-values ranging from 6 to 38 blows per 300 mm with full SPT penetration. The measured penetration resistance is indicative of a soil with a firm to hard (mostly stiff) soil consistency for cohesive soil (silty clay to clayey silt) and loose to dense (mostly compact to dense) relative density for cohesionless soil (sandy silt to silty sand).

The moisture content of the samples of silt / sand / gravel ranged from about 12.3 to 24.7 percent by weight based on laboratory tests, indicating locally moist to wet soil conditions.

4.4 Clayey Silt to Silty Clay Till/ Silt Till /Gravelly to Sandy Clayey Silt/ Silty Sand to Sandy Silt Till:

Fine grained deposits of cohesive materials for clayey silt till /silty clay till matrix with varying amounts of trace to some gravel and embedded sand (i.e., trace to some) were interbedded with non-cohesive soil matrix of silty sand till to sandy silt till with varying amounts of trace to some clay and gravel encountered in almost all the boreholes; underlying the native non-cohesive or cohesive soil layers and extended to depths ranging from 1.5m to 8.1m and to the vertical limit of investigation in respective boreholes.

Laboratory particle size distribution analysis and Atterberg Limits was completed on a native till soil samples taken from selected boreholes and the results according to USCS are summarized below and shown on Figures in Appendix C:

Gravel (greater than 4.75 mm size)	:	3.8 - 28.9 %
Sand (0.075 mm to 4.75 mm size)	:	5.6 - 40.9 %
Silt (0.002 mm to 0.075 mm size)	:	25.3 - 50.9 %
Clay (less than 0.002 mm size)	:	10.5 - 24.7 %

Standard Penetration resistance in the cohesive materials for clayey silt to silty clay till deposits had “N”-values ranging from 22 to 40 blows per 300 mm with full SPT penetration indicative of a very stiff to hard soil consistency and 50 blows per 80 to 130 mm where the test was curtailed due to the high penetration resistance encountered.

Standard Penetration resistance in the non-cohesive materials for sandy silt to silty sand till and gravelly silt deposits had “N”-values ranging from 29 to 91 blows per 300 mm with full SPT penetration indicative of a compact to very dense soil relative density.

The moisture content of the samples of the cohesive deposit ranged from about 5.8 to 13.9 percent by weight based on laboratory tests, indicating locally damp to moist soil conditions.

Atterberg Limits tests performed on two selected samples (BH19-2 SS8 and BH19-10 SS7) from the native gravelly clayey silt and sandy clayey silt deposit yielded the following index values:

Borehole I.D.	-	**BH 19-2 SS8**	-	**BH 19-2 SS7**
Liquid Limit (LL)	-	21.9 %	-	19.3 %
Plastic Limit (PL)	-	14.8 %	-	12.7 %
Plasticity Index (PI)	-	7.1 %-	-	6.6 %

From the USCS plasticity chart included as Figure C10 and C11 of Appendix C, the sample can be classified as clayey silt of low plasticity (CL-ML) with sand and gravel matrix.

It should be noted that these deposits can contain cobbles and boulder size particles that could not be representatively recovered in the small diameter of the samples taken.

5.0 Laboratory Test Results

Laboratory testing and visual examinations were carried out on selected soil samples. Tests were performed in accordance with the materials testing requirements and procedures outlined in the Laboratory Testing Manual of the Ministry of Transportation, or ASTM/AASHTO, as applicable. All laboratory testing was carried out at AME's geotechnical laboratory. All requirements for material testing under MTO's Engineering Materials Testing and Evaluation were met. Laboratory test results are presented as Figure Nos. C1 through C11, Appendix C. The following laboratory tests were completed:

Test	Number of Samples
Natural Moisture Content	27
Sieve and Hydrometer Analysis	25
Atterberg Limits	2

The soil samples secured by the split barrel sampler of the Standard Penetration Test were properly sealed, labeled and transported to our geotechnical laboratory. The soil samples were visually examined in the laboratory for final classification of soil types.

5.1 Grain Size Analysis

Laboratory Grain Size Analysis tests were performed on twenty-five (25) representative samples of the native soils obtained from Boreholes BH 19-1 through BH 19-20. The results of the grain size analysis along with estimates of the Hydraulic Conductivity are presented as Figure Nos. C-1 to C-11 in Appendix C and summarized in Table 2 below.

Table No. 2 – Summary of Grain Size Analysis:

Test No.	Borehole No.	Sample Depth (m)	Sample Description	Percent by Weight				Estimated Coefficient of Permeability (cm/s)
				Gravel	Sand	Silt	Clay	
1.	BH 19-1	1.52 – 1.98	Silt, some clay, trace sand (ML)	0.1	5.4	79.8	14.7	~ 10^{-6} (low permeability)
2.	BH 19-1	4.57 - 5.03	Sandy silt, some clay, trace gravel (CL-ML)	8.9	26.9	46.7	17.5	~ 10^{-5} to 10^{-6} (low permeability)
3.	BH 19-2	6.10 – 6.55	Gravelly silt, some sand, some clay (ML)	26.3	13.6	43.5	16.6	~ 10^{-5} to 10^{-6} (low permeability)
4.	BH 19-3	2.29 – 2.74	Sandy silt, some clay, some gravel (ML)	19.8	27.4	37.5	15.3	~ 10^{-6} (low permeability)
5.	BH 19-3	4.57 - 5.03	Sandy clayey silt, trace gravel (CL-ML)	3.8	23.0	50.9	22.3	~ 10^{-6} to 10^{-7} (low permeability)
6.	BH 19-4	6.10 – 6.55	Sandy clayey silt, trace to some gravel (ML)	10.4	21.4	48.3	19.9	~ 10^{-6} to 10^{-7} (low permeability)
7.	BH 19-5	3.05 – 3.55	Sandy silt, some clay, some gravel (ML)	12.1	29.3	45.4	13.2	~ 10^{-4} - 10^{-5} (low to medium permeability)
8.	BH 19-5	4.57 – 5.03	Gravelly silty Sand, some clay (ML)	23.3	40.9	25.3	10.5	~ 10^{-4} - 10^{-5} (low to medium permeability)
9.	BH 19-7	1.52 – 1.98	Silty clay, trace sand (CL)	0.2	5.6	42.3	51.9	~ Less than 10^{-7} (very low to practically impermeable)
10.	BH 19-7	6.10 – 6.55	Clayey sandy silt, some sand, trace gravel (CL-ML)	8.7	22.2	44.4	24.7	~ 10^{-7} (very low to low permeability)
11.	BH 19-10	2.29 – 2.74	Clayey sandy silt, some sand, trace gravel (CL-ML)	10.8	26.1	40.9	22.2	~ 10^{-7} (very low to low permeability)
12.	BH 19-10	4.57 - 5.03	Sandy silt, some clay, trace gravel (CL-ML)	7.0	30.2	43.9	18.9	~ 10^{-5} to 10^{-7} (low to medium permeability)
13.	BH 19-12	3.05 – 3.51	Sandy silt, some clay, trace gravel (ML)	7.2	28.4	48.2	16.2	~ 10^{-7} (very low to low permeability)
14.	BH 19-12A	6.10 – 6.55	Clayey silt, some sand, trace gravel (ML)	6.1	25.6	45.3	23.0	~ 10^{-7} (very low permeability)
15.	BH 19 - 13A	4.57 - 5.03	Sandy gravelly silt, some clay, (SP-SM)	28.9	23.5	34.0	13.6	~ 10^{-4} - 10^{-5} (low to medium permeability)

16.	BH 19 - 15	1.52 – 1.98	Silty clay, some sand, trace gravel (CL)	3.9	14.0	46.3	35.8	~ Less than 10^{-7} (very low to practically impermeable)
17.	BH 19 - 15	6.10 – 6.55	Sandy clayey silt, trace gravel (CL-ML)	5.7	25.8	47.7	20.8	~ 10^{-5} to 10^{-7} (low permeability)
18.	BH 19-16	4.57 - 5.03	Sandy clayey silt, trace gravel (CL-ML)	4.5	25.4	49.2	20.9	~ 10^{-5} to 10^{-7} (low permeability)
19.	BH 19-17	2.29 – 2.74	Silt, some sand, some clay (ML)	0.0	11.0	78.9	10.1	~ 10^{-6} (low permeability)
20.	BH 19-17	6.10 – 6.55	Sand and silt, some clay, trace gravel (ML)	6.9	39.4	36.4	17.3	~ 10^{-4} - 10^{-6} (low to medium permeability)
21.	BH 19-18	4.57 - 5.03	Clayey silt, some sand, trace gravel (CL-ML)	7.3	26.3	46.3	20.1	~ 10^{-7} (very low permeability)
22.	BH 19-19	3.05 – 3.55	Sandy clayey silt, trace gravel (CL-ML)	8.0	20.5	48.9	22.6	~ 10^{-7} (very low permeability)
23.	BH 19-19	6.10 – 6.55	Sandy clayey silt, trace gravel (CL-ML)	5.6	22.7	50.6	21.1	~ 10^{-5} - 10^{-7} (very low to low permeability)
24.	BH 19-20	2.29 – 2.74	Silty clay, some sand, trace gravel (CL)	5.6	16.6	41.0	36.8	~ 10^{-5} - 10^{-7} (very low to low practically impermeable)
25.	BH 19-20	6.10 – 6.55	Sandy clayey silt, trace gravel (CL-ML)	9.3	26.8	46.3	17.7	~ 10^{-4} - 10^{-5} (very low to low permeability)

Atterberg Limits' tests were performed on two (2) representative sample of the native deposits. The results of these tests are presented in Appendix C, and summarized in Table-3 as follows.

Table 3 – Summary of Atterberg Limits' Tests

Test No.	BH No	Sample Depth (m)	Sample Description	Water Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Classification
1	BH 19-2	6.10 – 6.55	Sandy Clayey Silt, Trace Gravel	8.2	19.3	12.7	6.6	CL-ML
2	BH 19-10	4.57 – 5.03	Gravelly Clayey Silt, Some sand	9.3	21.9	14.8	7.1	CL-ML

The grain size analysis for the above selected samples of native native gravelly clayey silt till and sandy clayey silt till revealed that the soils are fine grained (i.e., silt and clay

size particles passing the 75 µm sieve size > 50%). These soils are estimated to have low to very low or practically impermeable at certain zones with permeability values < 10^{-6} cm/sec. It should be noted the glaciolacustrine till contains preferentially permeable lenses of silty/sandy materials which can contain stored water locally.

6.0 Groundwater Conditions

Ground water observations were made in each of the boreholes as they were drilled and after completion. Water level measurements and depth to cave upon completion of the boreholes are presented in the Logs of Boreholes, Drawing Nos. B-1 through B-20, Appendix B.

In general, the cohesionless silt / sand / gravel deposits encountered in the boreholes around water shed area (stream/creek) are of medium to low permeability and permit the free flow of water into open excavations in a short period of time. The cohesive soil deposits of clayey silt to silty clay soils encountered in the boreholes away from watershed area are of very low to low permeability.

The ground water levels are affected by the topography of the site and the relative permeability of the soil deposits. It should be noted that the groundwater levels are subject to seasonal variations depending on the amount of precipitation, surface runoff and surface infiltration. The water table have been measured in the wells on several occasions. Table No.4 below summarizes the depth and elevations of the ground water level and the dates of the water level measurements at the wells.

Table No. 4: Summary of Groundwater Measurements:

Borehole No.	Groundwater Level (mbgs – meters below ground surface) \ Elevation (m)			
	1st Reading - End of Drilling	2nd Reading – Date July 23, 2019	3rd Reading- Date July 30, 2019/ Elevation	4th Reading- Date August 12, 2019/ Elevation
BH 19-1	3.57	0.49	0.60/ 192.300	0.98/ 191.920
BH 19-2	7.52	0.77	0.65/ 191.761	0.79/ 191.621

Borehole No.	Groundwater Level (mbgs – meters below ground surface) \ Elevation (m)			
	1st Reading - End of Drilling	2nd Reading – Date July 23, 2019	3rd Reading- Date July 30, 2019/ Elevation	4th Reading- Date August 12, 2019/ Elevation
BH 19-3	4.65	1.22	1.33/ 190.390	1.47/ 190.250
BH 19-4A	Dry	6.67	5.64/ 184.82	4.22/ 186.240
BH 19-4B	Dry	4.24	3.58/ 186.88	2.78/ 187.680
BH 19-5	Dry	4.77	1.04/ 190.399	1.16/ 190.279
BH 19-6	Dry	-	-	-
BH 19-7	Dry	Dry	7.20/ 182.073	6.34/ 182.933
BH 19-8	Dry	-	-	-
BH 19-9	Dry	-	-	-
BH 19-10	Dry	3.65	1.23/ 188.464	1.31/ 188.384
BH 19-11	Dry	-	-	-
BH 19-12A	1.53	1.10	1.01/ 188.789	1.19/ 188.609
BH 19-12B	Dry	0.91	0.89/ 188.909	1.06/ 188.739
BH 19-13A	Dry	1.21	1.29/ 189.408	1.41/ 189.288
BH 19-13B	Dry	1.22	1.32/ 189.378	1.43/ 189.268
BH 19-14	Dry	-	-	-
BH 19-15	6.80	0.92	1.10/ 191.291	1.33/ 191.061
BH 19-16	Dry	6.62	5.72/ 184.041	4.56/ 185.201
BH 19-17	2.07	0.65	0.72/ 190.319	0.91/ 190.129
BH 19-18	7.12	1.05	1.16/ 187.737	1.36/ 187.537
BH 19-19	Dry	5.83	4.84/ 184.102	3.92/ 185.022
BH 19-20	Dry	5.98	4.80/ 177.588	3.85/ 178.538

It should be noted that groundwater levels are subject to seasonal fluctuations depending on the amount of precipitation and runoff. The groundwater levels are affected by the topography of the site and the relative permeability of the soil deposits. In general, alternate layers of cohesive and non-cohesive layers of glaciolacustrine deposits with varied combination contains preferentially permeable lenses of sandy materials which can contain stored water locally.

7.0 DISCUSSION AND RECOMMENDATIONS

The following discussion and recommendations are based on the factual data obtained from this geotechnical investigation and are intended for use by the owner and design engineers only.

It should be noted that, there was no information provided to AME in regards to the type of residential\commercial development nor we have been provided with the design drawings.

The recommendations provided here in this report are preliminary and general for residential/commercial or industrial development. Detailed geotechnical investigation will be required in the future.

Contractors bidding or providing services on these projects should review the factual data and determine their own conclusions regarding construction methods and scheduling.

This geotechnical investigation has revealed in general that the site is covered by a surficial layer of topsoil, followed by a thin layer of sandy silt to clayey silt fill (disturbed) material underlain by native sandy silt to silty clay with sand and gravel matrix. Sandy silt to silty clay till material in alternate layers or individually to the full depth of investigation containing moist sand and silt seams below native sandy silt to silty clay layer. Based on our fieldwork, laboratory tests and other pertinent information supplied by the client, the following comments and recommendations are made.

7.1 Foundation Design

The existing topsoil, earth fill is considered to be unsuitable of the support of building foundations. The underlying undisturbed, native sandy silt to clayey silt/ sandy silt till throughout the site are considered suitable for the support of house foundation on conventional spread/ or strip footings. Conventional spread footings founded in the undisturbed, native till soil or on certified engineered fill may be designed using a net

geotechnical bearing resistance at Serviceability Limit States (SLS) of 150 kPa and a factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 220 kPa (vertical, centric) for 25 mm of maximum settlement.

The geotechnical bearing resistance values stated above are for vertical loads only (no inclination) and no eccentricity. The minimum footing widths to be used in conjunction with the above recommended soil bearing pressure should be 0.5 m for continuous wall footings and 0.9 m for individual footings. The total and differential settlements of spread footing foundations designed in accordance with the above recommendations should not exceed tolerable limits of 25 mm and 19 mm, respectively.

All foundation excavations at the site should be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. The founding materials are susceptible to disturbance by construction activity especially during wet weather and care should be taken to preserve the integrity of the materials as bearing strata. Prior to pouring concrete for the footings, the foundation excavations **must** be inspected by AME to confirm that the footings are founded within an undisturbed and competent bearing stratum that has been cleaned of ponded water and all disturbed, softened, loosened, organic and other deleterious material.

If construction proceeds during freezing weather conditions, adequate temporary frost protection for the footing bases and concrete must be provided. All exterior footings and footings in unheated areas should be provided by at least 1.2 meters of soil cover or equivalent artificial thermal insulation for frost protection purposes. Exposed soil foundation subgrades should be protected against freezing and surface water should be kept away from the foundation subgrade areas to prevent softening. If unstable subgrade conditions develop, AME should be contacted in order to assess the conditions and make appropriate recommendations.

The native site soils are primarily not considered free draining. Therefore, perimeter drainage measures for house basements as per the current Ontario Building Code should be implemented.

7.2 Excavation and Groundwater Control

The earth fill materials and cohesionless silt / sand / gravel deposit encountered in the boreholes are classified as Type 3 Soil above and Type 4 Soil below the prevailing ground water level, while the native undisturbed glaciolacustrine till deposits are classified as Type 2 Soil under these regulations. It should be noted that positive dewatering of the Type 4 Soils would alter the soil classification to the corresponding soil above the groundwater table, which in the case of the cohesionless soils would be Type 3 Soil.

Locally, where very loose or soft soil is encountered at shallow depths or within zones of persistent seepage, it will be necessary to flatten the side slopes as necessary to achieve stable conditions. Excavation side-slopes should not be unduly left exposed to inclement weather.

Where workmen must enter a trench or excavation the soil must be suitably sloped and / or braced in accordance with the regulation requirements. The regulation stipulates safe excavation slopes by soil type as follows:

Table 5 – Excavation Slope Details for Different Soil Types

Soil Type	Base of Slope	Steepest Slope Inclination
1	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
2	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
3	from bottom of trench	1 horizontal to 1 vertical
4	from bottom of trench	3 horizontal to 1 vertical

Minimum support system requirements for steeper excavations are stipulated in the Occupational Health and Safety Act and Regulations for Construction Projects, and include provisions for timbering, shoring and moveable trench boxes.

The glacial till deposit encountered in the boreholes may contain larger particles such as cobbles or boulders that were not encountered during the borings. Notwithstanding, shoring or excavation contractors could encounter buried obstructions and provision must be made in excavation and shoring contracts to allocate risks associated with time

spent to remove or penetrate larger particles or obstructions to conventional drilling when encountered. Any excavation below the ground water level will have to be positively dewatered. Surface water should always be directed away from the open excavations.

A qualified Geotechnical Engineer should review the proposed excavation procedures. If shored excavations are contemplated, a licensed engineer should approve the proposed shoring method. Surface water should be directed away from the excavations.

7.3 Bedding for Sewers and Watermains

The undisturbed native soils at the site are suitable for supporting watermains, sewer pipes, manholes, catch basins and other related structures. Based on the anticipated site grades, sewer pipes and watermains will probably be supported on the dense sandy silt till.

Normal Class 'B' bedding is recommended for underground utilities. Granular 'A' or 19 mm crusher run limestone can be used as bedding material. The bedding material should be compacted to 98% Standard Proctor Maximum Dry Density. Bedding details should follow the applicable governing design detail (i.e. Town of Milton, OPSD). Trenches dug for these purposes should not be unduly left exposed to inclement weather.

Pipe bedding and backfill for flexible pipes should be undertaken in accordance with OPSD 802.010, 802.013, 802.014, 802.020, 802.023 and 802.024. Pipe embedment and cover for rigid pipes should be undertaken in accordance with OPSD 802.030, 802.031, 802.032, 802.033, 802.034, 802.050, 802.051, 802.052, 802.053 and 802.054.

If unsuitable bedding conditions occur, careful preparation and strengthening of the trench bases prior to sewer installation will be required. The subgrade may be strengthened by placing a thick mat consisting of 50 mm crusher-run limestone. Field

conditions will determine the depth of stone required. Geotextiles and/or geogrids may be helpful and these options should be reviewed by AME on a case by case basis.

Sand cover material should be placed as backfill to at least 300 mm above the top of pipes. Placement of additional granular material (thickness dictated by the type of compaction equipment) as required or use of smaller compaction equipment for the first few lifts of native material above the pipe will probably be necessary to prevent damage to the pipe during the trench backfill compaction.

7.4 Reuse of On-site Excavated Soils as a Compacted Backfill

Topsoil should not be left in place or utilized in any area requiring structural integrity of founding materials such as houses, roads, sidewalks, structural berms, etc. AME should be contacted to review all proposed topsoil usage strategies.

On-site excavated native materials are considered suitable for reuse as compacted backfill, provided any organic or otherwise unsuitable material is removed from it and the moisture contents are within 2% of their optimum water contents from SPMDD tests. During warm weather, desiccation of the till may become acute; therefore, the lift thickness for compaction and the water content of the soils must be properly controlled during structural backfilling.

If on-site excavated soils become excessively wetter than optimum moisture contents, the subsoil should be partially dried, in order to achieve the specified degree of compaction. If construction is carried out in inclement weather, there is a likelihood that some amount of road sub-base supplement will be required (i.e. some excavation followed by granular replacement).

It is recommended that sewer trenches be backfilled with native on-site material such that at least 98% Standard Proctor Maximum Dry Density. This phase of the work

should be scheduled for drier months. Lift thicknesses shall not exceed 200 mm unless approved by AME and should be compacted using a sheep's foot type compactor.

As an alternative, if suitable on-site native material is not available, the upper part of the subgrade could be improved by placing imported granular material.

In areas of narrow trenches or confined spaces such as around manholes, catch basins, etc., imported sand or OPSS Granular 'B' should be used and compacted to the specified degrees.

7.5 General Site Re-grading

Based on the anticipated proposed grades and the existing topography at the subject site, it is anticipated that some cut and fill operation will be required for general site re-grading. Due to the variation in the composition of the on-site native materials, it is recommended that sufficient Standard Proctor Density tests be performed when construction work begins, and the ground is broken. **AME** should be contacted to verify and evaluate the proposed soil types for general site re-grading.

Materials cut from the site, except for the soils containing excessive organic matter, could be re-used to raise grade levels, provided the materials are placed in large areas where they can be effectively compacted with heavy, sheepsfoot type rollers, and the moisture content is controlled to within optimum or 2 % greater than the material's optimum moisture content.

7.6 Engineered Fill

Based on the anticipated proposed grades and the existing topography at the subject site, it is anticipated that some cut and fill operation will be required for general site re-grading. Due to the variation in the composition of the on-site native materials, it is

recommended that additional Standard Proctor Density tests be performed when construction work begins and the ground is broken. AME should be contacted in order to verify and evaluate the proposed soil types for general site re-grading.

The on-site soils may be used to raise grades of the proposed lands to the desired elevations. The following recommendations regarding construction of engineered fill should be adhered to during construction:

- All topsoil, organic materials, earth fill, highly disturbed and weathered soils must be removed to expose undisturbed, native soil of at least stiff consistency or compact relative density, and the exposed subgrade soils proof-rolled in conjunction with an inspection by the geotechnical engineer prior to any fill placement.
- Engineered fill operations should be monitored, and compaction tests should be performed on a full-time basis by a qualified engineering technician supervised by the project engineer.
- The boundaries of the engineered fill must be clearly and accurately laid out in the field by qualified surveyors prior to the commencement of engineered fill construction. The top of the engineered fill should extend a minimum of 2.5 m beyond the building envelope. Where the depth of engineered fill exceeds 1.5 m, this horizontal distance of 2.5 m beyond the perimeter of the building should be increased by at least 1.0 m for each 1.0 m depth of fill. The edges of the engineered fill should be sloped at a maximum of 3H:1V in order to avoid weakening of the engineered fill edges due to slope movement.
- Due to the potential detrimental effects of differential settlement between the engineered fill and the native soils, any lots where footings are to be placed partly on engineered fill and partly on native soils should include reinforcing steel bars placed within the top of the foundation walls. The foundation walls of house foundations supported entirely on engineered fill should also be reinforced to bridge localized soft spots and zones of non-uniform compaction, and to minimize structural distress due to differential settlement of the engineered fill.

The reinforcing steel should typically consist of two 15 M bars in the top portion of the walls. The bars should be placed as close to the top of the walls as possible allowing for at least 50 mm of concrete cover. Corner bars should have proper factory bends and all tied steel should have at least 600 mm of overlap. At window locations, two 10 M bars should be placed in the foundation wall as close to the sill as possible (allowing for a minimum 50 mm of concrete cover). The bars should extend laterally at least 600 mm beyond the edge of the window opening. The actual steel reinforcement design should be confirmed / designed by the home builder's structural engineer.

- Soils used as engineered fill should be free of organic and/or other unsuitable material. The engineered fill must be placed in lifts not exceeding 200 mm in thickness and compacted to 98% Standard Proctor Maximum Dry Density.
- Imported fill must not be used unless documentation is produced verifying that the material is suitable for Residential usage (as per MOE document "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act,* April 15, 2011).
- If fill is required adjacent to sloped banks (> 3:1, horizontal to vertical), it is imperative that the fill is placed in stepped planes in order to avoid a plane weakness.
- The engineered fill should be placed at least 0.6 m above the elevation of the proposed underside of footing.
- The engineered fill operation should take place in favorable climatic conditions. If the work is carried out in months where freezing temperatures may occur, all frost affected material must be removed prior to the placement of frost-free fill.
- When engineered fill is left over the winter, a minimum of 1.3 m of earth cover must be provided as frost protection.
- If unusual soil conditions become apparent during construction, due to subsurface groundwater influences, our office should be contacted in order to assess the conditions and recommend appropriate remedial measures.

- The footing and underground services subgrade must be inspected by the Geotechnical Engineer that supervised the engineered fill construction. This is to ensure that the foundations are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation. Extended footings and/or steel reinforcement may be required based on the footing inspection.

7.7 Concrete Slab-on-Grade and Basement Floors

Conventional lightly loaded concrete slab-on-grade floors can be placed on the undisturbed, native soil subgrade or on certified engineered fill, below all deleterious materials. A moisture barrier (drainage blanket) consisting of a minimum of 150 mm thickness of 19 mm clear stone (OPSS Form 1010) compacted by a vibratory plate tamper to a dense state should be placed directly below the slab.

To assist in maintaining basements dry from seepage, it is recommended that exterior grades around the house be sloped away at minimum 5% gradient for a distance of at least 1.5 m, and at a 2% gradient or more beyond this distance.

Perimeter foundation drains should be provided, consisting of perforated pipe surrounded by a granular filter (minimum 150 mm thick) and freely out letting. The granular filter should consist of 19 mm clear stone.

The perimeter drains must be properly filtered to prevent an awash of soil fines. The basement wall backfill for a minimum lateral distance of 0.6 m out from the wall should consist of free-draining granular material such as OPSS Granular “B” Type I, or provided with a suitable alternative drainage cellular media. Damp-proofing must be applied to the exterior basement walls. The perimeter foundation and where necessary sub-floor drains must be connected to a positive frost free outlet from which the water can be removed, or connected to a sump located in the lowest level of the basement. The

water from the sump must be pumped out to a suitable discharge point. The installation of the perimeter and sub-floor drains as well as the outlet must conform to the applicable plumbing code requirements.

7.8 Lateral Earth Pressures

The parameters used in the determination of earth pressure acting on retaining walls, basement walls or bracings are defined below.

Parameter	Definition	Units
Φ'	internal angle of friction	**degrees**
γ	bulk unit weight of soil	**kN / m^3**
K_a	active earth pressure coefficient (Rankin)	**dimensionless**
K_o	at-rest earth pressure coefficient (Rankin)	**dimensionless**
K_p	**passive earth pressure coefficient (Rankin)**	**dimensionless**

The appropriate unfactored values for use in the design of structures subject to unbalanced earth pressures at this site are tabulated as follows: Table 5.

Soil	Φ'	γ	K_a	K_p	K_o
Compact Granular Fill (1) - Granular 'A' (OPSS 1010)	35º	23.0	0.27	3.70	0.43
Compact Granular Fill (1) - Granular 'B' (OPSS 1010)	32º	21.0	0.31	3.23	0.47
Disturbed Native-Fill Soil	28º	19.0	0.36	2.77	0.53

Notes:

Compacted to a minimum of 95% Standard Proctor Maximum Dry Density.
Passive and sliding resistance within the zone subject to frost action (i.e. within 1.2 m below finished grade) should be disregarded in the lateral resistance computations.
In the case of a structure below the groundwater table, the use of submerged soil weight should be considered along with the appropriate hydrostatic pressures.
Temporary and/or permanent surcharges at the ground surface should be considered in accordance with the applicable Soil Mechanics methods.

Soil parameters that may be used in the determination of applied loads are tabulated in Table 6 below.

Table 6 – Unfactored Geotechnical Parameters for Native Soil Deposits

Stratum	Bulk Unit Weight of Soil* γ (kN/m^3)	Submerged Unit Weight of Soil γ' (kN/m^3)	Internal Angle of Friction Φ	Lateral Earth Pressure Coefficient K_a
Very stiff Clayey Silt to Silty Clay Till (SPT "N"-value – 15 to 30 blows / 300 mm)	21.0	11.2	30º	0.33
Firm to stiff Clayey Silt to Silty Clay Till (SPT "N"-value – 7 to 15 blows / 300 mm)	20.0	10.2	28º	0.36
Very stiff Silt, some clay to clayey (SPT "N"-value – 15 to 30 blows / 300 mm)	20.5	10.7	30º	0.33
Firm to stiff Silt, some clay to clayey (SPT "N"-value – 7 to 15 blows / 300 mm)	19.5	9.7	28º	0.36
Dense Sandy Silt to Silty Sand Till (SPT "N"-value – 30 to 50 blows / 300 mm)	21.5	11.7	33º	0.29
Compact Sandy Silt to Silty Sand Till (SPT "N"-value – 10 to 30 blows / 300 mm)	20.5	10.7	30º	0.33
Dense Sand to Silty Sand (SPT "N"-value – 30 to 50 blows / 300 mm)	21.5	11.7	33º	0.29
Compact Silt to Sandy Silt / Sand to Silty Sand (SPT "N"-value – 10 to 30 blows / 300 mm)	20.5	10.7	30º	0.33
Loose Silt to Sandy Silt (SPT "N"-value – 6 to 10 blows / 300 mm)	19.0	9.2	28º	0.36
Dense Sand and Gravel / Gravelly Sand (SPT "N"-value – 30 to 50 blows / 300 mm)	22.5	12.7	34º	0.28
Compact Sand and Gravel / Gravelly Sand (SPT "N"-value – 10 to 30 blows / 300 mm)	21.5	11.7	32º	0.31

*****Note: Above the ground water table.

The design earth pressures in compacted backfill should be augmented with the dynamic effects of the compaction efforts, which typically are taken as a uniform 12 kPa pressure over the entire depth below grade where the calculated earth pressure based on the above earth pressure factors is less than 12 kPa. However, this dynamic effect should be ignored when calculating the passive resistance for thrust blocks, or other instances where the general stability of the structure relies on the passive resistance.

The basement walls of the house structures should be designed to withstand lateral earth pressure, P, acting against the wall. On the basis of effective drainage of the

basement wall backfill, the following equation can be used to estimate lateral earth pressure at any depth:

$$P = K(\gamma h + q)$$

where
- **K** = Coefficient of Earth Pressure, (K_0)
- γ = Unit Weight of Soil,
- **h** = Height at any point along the wall in metres
- **q** = Any surcharge load in kPa

This equation assumes that free-draining backfill and positive drainage is provided to ensure that there is no hydrostatic pressure acting in conjunction with the earth pressure.

Consideration must be given to the possible effect of frost on earth retaining structures. Pressures induced by freezing in frost-susceptible soils at this site exert pressures that are effectively irresistible.

7.9 Seismic Site Classification

The Ontario Building Code (OBC) specifies that the structure should be designed to withstand forces due to earthquakes. For the purpose of earthquake design, the information relevant to the geotechnical conditions at this site is the 'Site Class'. Based on the explored soil properties and in accordance with Table 4.1.8.4.A of the Ontario Building Code (2012), it is recommended that Site Class 'D' (Stiff to Very Dense soils) be applied for structural design at this site.

Parameter	Milton, ON	Source
Site Class	D	2012 Ontario Building Code Table 4.1.8.4.A
$S_a(0.2)$	0.197	2015 National Building Code Seismic Hazard Calculation
$S_a(1.0)$	0.055	2015 National Building Code Seismic Hazard Calculation
F_a	1.1	2012 Ontario Building Code Table 4.1.8.4.B
F_v	1.1	2012 Ontario Building Code Table 4.1.8.4.C

The proposed pedestrian bridge as well as the future school must be designed to resist earthquake forces in accordance with the requirements of the Ontario Building Code.

7.10 Frost Penetration Depth

The frost penetration depth for this project is, f = 1.3 m as per OPSD 3090.101.

7.11 Pavement Design

Based on the existing topography of the subject site, assumed proposed grades and the data collected during the field investigation, it is anticipated that the subgrade material for the subdivision roads will generally comprised of sandy silt to clayey silt or similar engineered fill soil. On the basis of the Town of Milton's minimum requirements, available data and our experience in the area, the following pavement design is recommended for the subdivision roads:

TABLE 7 - RECOMMENDED PAVEMENT STRUCTURE

Pavement Layer	Compaction Requirements	Local Residential	Minor Collector Road
Asphaltic Concrete Surface Course	97% Marshall Density	35 mm OPSS HL-3	35 mm OPSS HL-3
Asphaltic Concrete Binder Course *	97% Marshall Density	50 mm OPSS HL-8	70 mm OPSS HL-8
Granular Base	100% SPMDD **	150 mm of Granular 'A'	150 mm of Granular 'A'
Granular Sub Base	100% SPMDD **	300 mm of Granular 'B' Type I	450 mm of Granular 'B' Type I

* On local roadways designated as bus routes, the binder course asphalt thickness must be increased by 50 mm.

** Denotes Standard Proctor Maximum Dry Density, ASTM-D698

The subgrade must be compacted to at least 98% SPMDD for the upper 1 m and 95% SPMDD below this level. All granular backfill should be compacted to 100% SPMDD.

The gradation and physical properties of HL-3 and HL-8 hot mix asphalts, Granular 'A' and 'B' shall conform to the OPSS standards.

The long-term performance of the proposed pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be over-emphasized. The finished pavement surface and underlying subgrade should be free of depressions and should be crowned and sloped (at a crossfall of 2% for the pavement surface and 3% for the subgrade) to provide effective drainage. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. Sub-drains or drainage ditches must be provided to facilitate effective and assured drainage of the pavement structures as required to intercept excess subsurface moisture and minimize subgrade softening. The invert of sub-drains and ditches should be maintained at least 0.3 m and 0.5 m respectively below subgrade level.

Additional comments on the construction of pavement areas are as follows:

As part of the subgrade preparation, proposed pavement areas should be stripped of topsoil and other obvious objectionable material. Fill required to raise the grades to design elevations should be free of organic material and at a moisture content which will permit compaction to the specified densities. The subgrade should be properly shaped, crowned, and then proof-rolled. Soft or spongy subgrade areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98% SPMDD.

The most severe loading conditions on pavement areas and the subgrade may occur during construction during wet and un-drained conditions. Consequently, special provisions such as restricted lanes, half-loads during paving etc., may be required, especially if construction is carried out during unfavorable weather.

For fine-grained soils, as encountered at the site, the degree of compaction specification alone cannot ensure distress free subgrade. Proof-rolling must be carried

out and witnessed by AME personnel for final recommendations of sub-base thicknesses.

8.0 CLOSURE:

The Limitations of Report that follows this section forms an integral part of this report.

This report is intended solely for the Client named. The material in it reflects our best judgement in light of the information available to Aecon Materials Engineering Corp. at the time of preparation. No portion of this report may be used as a separate entity, it is written to be read in its entirety. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

We trust that this report meets with your present requirements. Please do not hesitate to contact us should any questions arise concerning this report.

Yours truly,

AME MATERIALS ENGINEERING

Prepared by:

Reviewed by:

Chandresh Patel, P.Eng.
Geotechnical Engineer

Raid Khamis, P.Eng., PMP., LEED®AP$_{BD+C}$
Senior Geotechnical Engineer

Limitations of Report

The conclusions and recommendations presented in this report are based on the subsurface information determined in the boreholes at the locations indicated on the Borehole Location Plan, Drawing 2, Appendix A. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface conditions between and beyond the test holes may differ from those encountered at the borehole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. Our responsibility is limited to the interpretation of the soil and groundwater conditions that prevailed at the locations investigated.

The findings and recommendations of the geotechnical investigation presented in this report are applicable only to the project described in the text, and then only if the work described is completed substantially in accordance with the details stated in this report.

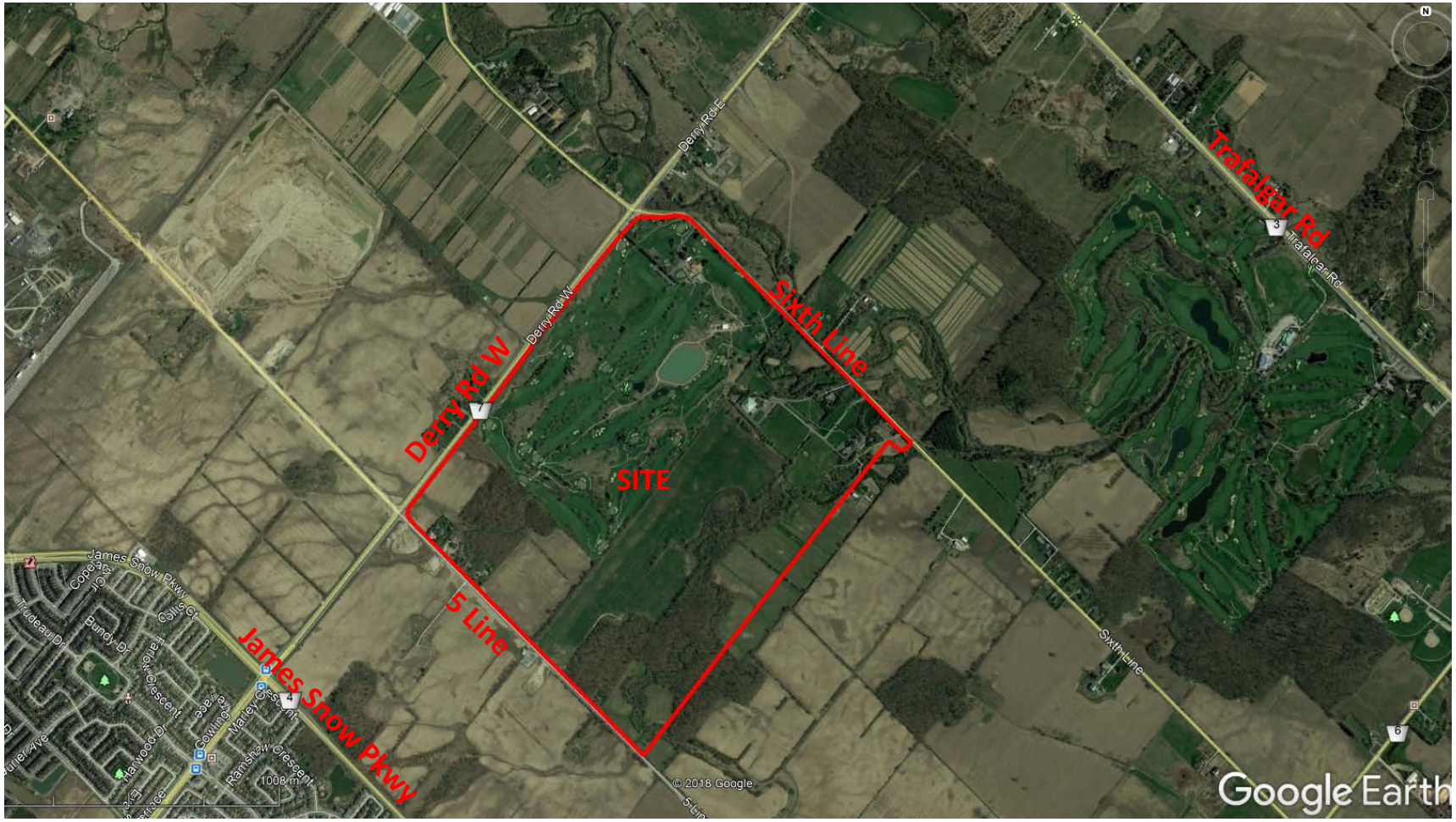
The number of boreholes may not be sufficient to determine all the factors that may affect the horizontal directional drilling and costs. For example, the thickness of granular fill and earth fill layers may vary markedly and unpredictably. Contractors undertaking the implementation of horizontal directional drilling must, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

APPENDIX A

Site Plan
Drawing No., 1

Borehole Location Plan
Drawing No., 2



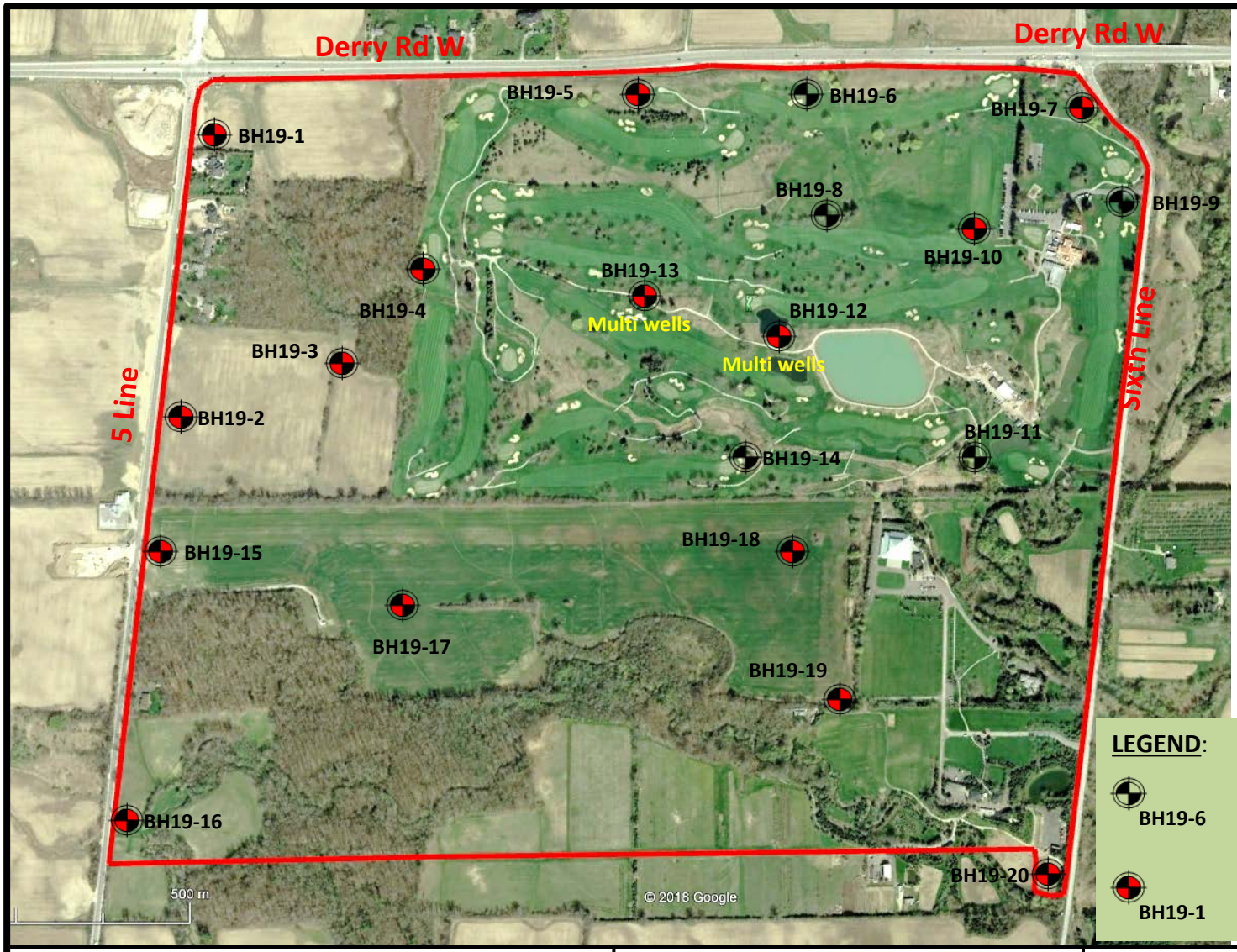
AME Materials Engineering

AME – MATERIALS ENGINEERING
10 Perdue Court Unit 2 & 3,
Caledon, Ontario L7C 3M6

Tel: (905) 840 5914 **Fax: (905) 840 7859**

SITE LOCATION PLAN
Derry Green SIS
Derry Road West and Sixth Line
Neamsby Investments Ltd.
Milton **Ontario**

Project No.:	30291.222
Scale:	N.T.S.
Date:	July 2019
Drawing No.:	1



LEGEND:

BH19-6 — Borehole Location

BH19-1 — Monitoring Well Location

AME Materials Engineering

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10 Perdue Court Unit 2 & 3,
Caledon, Ontario L7C 3M6

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BOREHOLE AND MONITORING WELL LOCATION PLAN
Derry Green SIS
Derry Road West and Sixth Line
Neamsby Investments Ltd.
Milton Ontario

Project No.:	30291.222
Scale:	N.T.S.
Date:	July 2019
Drawing No.:	2

APPENDIX B

Explanation of Borehole Logs
Figure No. B - (i)

Logs of Boreholes
Figure Nos. B - 1 to B - 20

AME
Materials Engineering

EXPLANATION OF BOREHOLE LOGS

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

GENERAL INFORMATION

Project details, borehole number, project location, location coordinates, date of drilling, type of drilling equipment used and elevation reference datum are given at the top of the borehole log.

GWL

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

Symbol

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

Soil Description

This column gives a description of the soil stratums, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the following classification and terminology *(Ref. Unified Soil Classification System)*:

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows *(Ref. Canadian Foundation Engineering Manual)*:

Compactness of Cohesionless Soils	**SPT N-Value**
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

Consistency of Cohesive Soils	**Undrained Shear Strength**	
	kPa	**psf**
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very stiff	100 to 200	2000 to 4000
Hard	Over 200	Over 4000

Elevation and Depth

These columns give the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the General Information.

Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing), measurements of total combustible vapours and laboratory testing (e.g., natural moisture content and Atterberg Limits) executed on the recovered samples are plotted in this section.

Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core
AS	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample

Additional information provided in this section may include sample numbering, sample recovery and numerical testing results (e.g. natural unit weight).

Log of Borehole BH 19 - 1

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-1

Location: Derry Road West and Sixth Line, Milton, ON

N4820931.322 E594684.106

Date Drilled: 3/9/28

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 100 mm TOPSOIL	183.58 183.48	0
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet, trace topsoil, stiff, moist to wet, dark brown/ brown, slightly mottled	182.97	
		SILT TILL Silt till, some clay, trace sand, trace gravel Compact to very dense, moist to wet, brown/reddish brown	182.60	1
		.....occasional thin sand seam		2
		.. Weathered shale pieces traced below 3.05 mbgs...		3
		...becomes reddish grey to grey 4.0mbgs		4
		SANDY SILT TILL: Sandy silt till, some clay, trace gravel, very dense, moist to wet, reddish grey to grey	179.28	
		.....reddish brown with weathered red shale pieces		6
				7
		End of borehole at 7.67 m	175.91	

Standard Penetration Test N Value: 9, 20, 42, 50, 50/150mm, 55, 53, 50/80mm, 50/50mm

Shear Strength (kPa): 20 40 60 80 / 50 100 150 200

Total Organic Vapours (ppm): 25 50 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

Natural Moisture Content: 14.3, 24.7

SAMPLES

Additional Notes

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling	3.57	Open
07/23/2019	0.49	

Sheet No. 1 of 1

Log of Borehole BH 19 - 12A

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-12A

Location: Derry Road West and Sixth Line, Milton, ON

N4821401.996 E595415.978

Date Drilled: 3/10/30

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Combustible Vapour Reading
Auger Sample | Natural Moisture Content
SPT (N) Value | Atterberg Limits
Dynamic Cone Test | Undrained Triaxial at % Strain at Failure
Shelby Tube | Shear Strength by Penetrometer Test
Shear Strength by Vane Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			188.90	0
		~ 200 mm TOPSOIL	188.70	
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet, trace topsoil Compact, moist, brown/dark brown	188.37	
		CLAYEY SILT Clayey silt, trace sand, trace gravel Stiff to very stiff, moist, brown/grey, slightly mottled	187.71	1
				2
			186.61	
		CLAYEY SILT TILL Clayey silt till, trace sand, trace gravel, trace weathered shale pieces Hard, moist to wet, brown/grey	186.16	
		SANDY SILT TILL Sandy silt till, trace clay, trace gravel Dense, moist to wet, brown/grey		3
				4
			183.34	
		CLAYEY SILT TILL Clayey silt till, some sand, trace gravel, Hard, moist to wet, grey		5
				6
		.... red / grey below 7.62 mbgs....		7
			180.82	8
		End of borehole at 8.08 m		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Additional Notes

15 12 21 34 49 40 34 30 37

9 12.3

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling	1.53	Open
07/23/2019	1.10	

Sheet No. 1 of 1

Log of Borehole BH 19 - 12B

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-12B

Location: Derry Road West and Sixth Line, Milton, ON

N4821401.996 E595415.978

Date Drilled: 7/15/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample	▨	Combustible Vapour Reading	□
Auger Sample	⊠	Natural Moisture Content	×
SPT (N) Value	●	Atterberg Limits	⊢○
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	S		

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 200 mm TOPSOIL	188.90	0
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet, trace topsoil, compact, moist, brown/dark brown	188.70	
		CLAYEY SILT Clayey silt, trace sand, trace gravel Stiff to very stiff, moist, brown/grey, slightly mottled	188.37	
			187.84	1
				2
		CLAYEY SILT TILL Clayey silt till, trace sand, trace gravel, trace weathered shale pieces Hard, moist to wet, brown/grey	186.61	
		SANDY SILT TILL Sandy silt till, trace clay, trace gravel Dense, moist, brown/grey	186.16	3
				4
		End of borehole at 5.03 m	183.87	5

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Additional Notes

15 12 21 34 49 9 40 34

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry 0.91	Open

Sheet No. 1 of 1

Log of Borehole BH 19 - 13A

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-13A

Location: Derry Road West and Sixth Line, Milton, ON

N4821298.523 E595244.962

Date Drilled: 7/15/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 350 mm TOPSOIL	188.94	0
		FILL: Clayey silt, trace sand, trace gravel, loose, moist, brown/grey	188.59 188.42	
		CLAYEY SILT Clayey silt, trace sand, trace gravel Very stiff to hard, moist, brown/grey	187.53	1
		SILT TILL Silt till, some clay, trace sand, trace gravel Dense to very dense, moist, brown/reddish brown .... Weathered shale pieces traced below 3.05 mbgs... .....becomeing grey	186.65	2
		SANDY GRAVELLY SILT: Sandy gravelly silt, some clay, Dense, damp to moist, brwon/red/grey	184.29	3
		End of borehole at 8.08 m	180.86	8

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Additional Notes

4 | 31 | 22 | 65 | 64 | 34 | 82 | 5.8 | 37 | 36

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry 1.21	Open

Sheet No. 1 of 1

Log of Borehole BH 19 - 13B

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-13A

Location: Derry Road West and Sixth Line, Milton, ON

N4821298.523 E595244.962

Date Drilled: 7/15/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 350 mm TOPSOIL	188.94	0
		FILL: Clayey silt, trace sand, trace gravel, loose, moist, brown/grey	188.59 188.42	
		CLAYEY SILT Clayey silt, trace sand, trace gravel Very stiff to hard, moist, brown/grey	187.51	1
		SILT TILL Silt till, some clay, trace sand, trace gravel Dense to very dense, moist, brown/reddish brown	186.65	2
		.... Weathered shale pieces traced below 3.05 mbgs...		3
		.....becomes grey		4
		SANDY GRAVELLY SILT: Sandy gravelly silt, some clay, occasional cobbles, very dense, damp to moist, brown/red/grey	184.29 183.92	5
		End of borehole at 5.03 m		

Standard Penetration Test N Value: Shear Strength 20 40 60 80 kPa (50 100 150 200)

SPT (N) values: 4, 31, 22, 65, 64, 34, 82

Total Organic Vapours (ppm) 25 50 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight) 20 40 60

SAMPLES

Additional Notes

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry 1.22	Open

Sheet No. 1 of 1

Log of Borehole BH 19 - 2

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-2

Location: Derry Road West and Sixth Line, Milton, ON

N4820617.021 E594949.533

Date Drilled: 7/9/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 220 mm TOPSOIL	188.07	0
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet, trace topsoil, stiff, moist, brown/ grey, slightly mottled	187.85	
		CLAYEY SILT: Clayey silt, trace sand, trace gravel, Very stiff, moist to wet, red/brown/grey	187.46	
			187.28	1
				2
		SANDY SILT TILL: Sandy silt till, some clay, trace gravel, Compact to very dense, moist to wet, Brown/red/grey	185.94	
		...Weathered shale pieces traced below 3.05 mbgs..		3
				4
				5
		SANDY CLAYEY SILT TILL: Sandy clayey silt till, trace gravel Dense, moist to wet, red/brown/grey .....reddish brown with weathered red shale pieces	182.51	6
		GRAVELLY SILTY SAND: Gravelly silty sand, some clay Dense, wet, grey	180.98	7
		End of borehole at 8.08 m	179.99	8

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES | Additional Notes

15 | 22 | 23 | 50/150mm | 36 | 27 | 40 | 38 | 8.2 | 40

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	7.52 0.77	Open

Sheet No. 1 of 1

Log of Borehole BH 19 - 3

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-3

Location: Derry Road West and Sixth Line, Milton, ON

N4820891.836 E595051.671

Date Drilled: 7/9/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 300 mm TOPSOIL	187.19	0
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet, trace topsoil, very stiff, moist, brown/dark brown/ grey	186.89	
		CLAYEY SILT to SILT Clayey silt to silt, trace sand, trace gravel, Very stiff, moist to wet, red/brown/grey ..Weathered shale pieces below 0.76 mbgs. ...becomes grey below 1.52mbgs	186.58	
		SANDY SILT TILL Sandy silt till, some clay, some gravel Dense to very dense, moist to wet, red/brown/grey	185.72	1
		SANDY CLAYEY SILT TILL: Sandy clayey silt till, trace gravel Dense to very dense, moist to wet, grey	185.06	2
			182.62	3
		End of borehole at 8.08 m	179.11	4 5 6 7 8

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES | Additional Notes

Depth	SPT (N)	Natural Moisture Content (%)
0	16	12.3
1	30	16.3
2	23	15.2
3	34	12.4
4	46	9.7
5	45	9
6	44	11.1
7	45	10.2
8	65	8.8

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling	4.65	Open
07/23/2019	1.22	

Sheet No. 1 of 1

Log of Borehole BH 19 - 4A

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-4A

Location: Derry Road West and Sixth Line, Milton, ON

N4821031.103 E595018.879

Date Drilled: 7/15/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample		Combustible Vapour Reading	
Auger Sample		Natural Moisture Content	X
SPT (N) Value	●	Atterberg Limits	
Dynamic Cone Test		Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 350 mm TOPSOIL:	189.69	0
		FILL Clayey silt, trace sand, trace gravel, loose, moist, brown	189.34 189.19	
		SANDY CLAYEY SILT TILL Sandy clayey silt till, trace to some gravel Compact to dense, moist, brown/grey		1
		.... Weathered shale pieces traced below 1.5mbgs...		2
		.... brown/ reddish grey below 3.05mbgs....		3
			185.47	4
		.... moist to wet between 4.57m and 5.34m...		5
			184.35	
				6
				7
		SILTY SAND TILL Silty sand till, trace to some clay, trace gravel, weathered shale pieces Very dense, damp to moist, red	182.07 181.61	8
		End of borehole at 8.08 m		

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Additional Notes

9 22 39 39 40 30 28 38 8.8 87

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry 6.67	Open

Sheet No. 1 of 1

Log of Borehole BH 19 - 4B

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-4B

Location: Derry Road West and Sixth Line, Milton, ON

N4821031.103 E595018.879

Date Drilled: 7/15/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample	▨	Combustible Vapour Reading	□
Auger Sample	⊠	Natural Moisture Content	×
SPT (N) Value	●	Atterberg Limits	⊢○⊣
Dynamic Cone Test	———	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	✚ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 350 mm TOPSOIL:	189.69	0
		FILL: Clayey silt, trace sand, trace gravel, loose, moist, brown	189.34	
		SANDY CLAYEY SILT TILL Sandy clayey silt till, trace to some gravel Compact to dense, moist, brown/grey	189.18	
		.... Weathered shale pieces traced below 1.5mbgs...		1
				2
		.... brown/ reddish grey below 3.05mbgs....	186.91	3
		.... moist to wet		4
		End of borehole at 5.03 m	184.67	5

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Additional Notes

9 22 39 39 40 30 28

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry 4.24	Open

Sheet No. 1 of 1

Log of Borehole BH 19 -11

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-11

Location: Derry Road West and Sixth Line, Milton, ON

N4821511.757 E595678.194

Date Drilled: 7/8/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 250 mm TOPSOIL	189.80	0
		FILL: Sandy silt, trace clay, trace gravel, loose, moist to wet, brown/grey	189.55	
		SANDY SILT TO SILTY SAND: trace clay, trace gravel Loose, wet, brown	189.27	
		CLAYEY SILT: trace sand, trace gravel Stiff, moist to wet, brown/grey	188.73	1
		CLAEY SILT TILL Clayey silt till, trace sand, trace gravel Very stiff to hard, moist to wet, brown/grey	188.28	2
		End of borehole at 6.55 m	183.25	6

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES | Additional Notes

N values: 5 (0 m), 7 (1 m), 28 (2 m), 30 (3 m), 34 (3 m), 30 (4 m), 40 (5 m), 36 (6 m)

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry -	Open

Sheet No. 1 of 1

Log of Borehole BH19-10

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-10

Location: Derry Road West and Sixth Line, Milton, ON

N4821731.314 E595459.161

Date Drilled: 7/22/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample	▨	Combustible Vapour Reading	□
Auger Sample	⊠	Natural Moisture Content	×
SPT (N) Value	●	Atterberg Limits	⊢○⊣
Dynamic Cone Test	———	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	✚ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value / Shear Strength kPa	Total Organic Vapours (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Additional Notes
		~ 250 mm TOPSOIL	190.70	0				
		FILL: Sandy silt, trace clay, trace gravel, trace topsoil Loose to compact, moist, brown/ dark brown, slightly mottled	190.45		6			
			189.63	1	10			
		CLAYEY SILT : Clayey silt, trace sand, trace gravel, Very stiff, moist, brown with red pockets, slightly mottled	189.39		15			
			188.41	2	24	11.6		
		CLAYEY SILT TILL: Clayey silt till, trace sand, trace gravel, Very stiff, moist to wet, red/brown/grey .....Weathered shale pieces traced below 2.60 mbgs...			15			
			187.04	3				
		SANDY SILT TILL: Sandy silt till, some clay, trace gravel, compact to dense, moist to wet, brown/grey			22			
				4	33	9.3		
			185.14					
		CLAYEY SILT to SILTY CLAY TILL: Clayey silt to silty clay till, trace sand, trace gravel, Stiff to very stiff, moist to wet, grey		5				
				6	22			
				7				
			182.62	8	10			
		End of borehole at 8.08 m						

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry 3.65	Open

Sheet No. 1 of 1

Log of Borehole BH19-14

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-14

Location: Derry Road West and Sixth Line, Milton, ON

N4821247.243 E595522.384

Date Drilled: 7/8/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample		Combustible Vapour Reading	□
Auger Sample	⊠	Natural Moisture Content	×
SPT (N) Value	●	Atterberg Limits	⊢○
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 300 mm TOPSOIL	182.39	0
		FILL: Clayey silt, trace sand, trace gravel Stiff, moist, brown/grey, slightly mottled	182.09 181.78	
		CLAYEY SILT Clayey silt, trace sand, trace gravel, fine sand seams Very stiff, moist, brown		1 2
		SANDY SILT TILL Sandy silt till, trace clay, trace gravel Compact to very dense, moist to wet, red/brown/grey .... red / grey below 3.05 mbgs....	179.89	3 4 5
		SILTY CLAY TILL: Silty clay till, trace sand, trace gravel Very stiff, moist to wet, grey	176.45	6
		End of borehole at 6.56 m	175.83	

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Additional Notes

N Values: 9, 24, 23, 62, 55, 30, 26, 23

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry -	Open

Sheet No. 1 of 1

Log of Borehole BH19-15

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-15

Location: Derry Road West and Sixth Line, Milton, ON

N4820511.674 E595053.481

Date Drilled: 7/8/19

Drill Type: Hollow Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

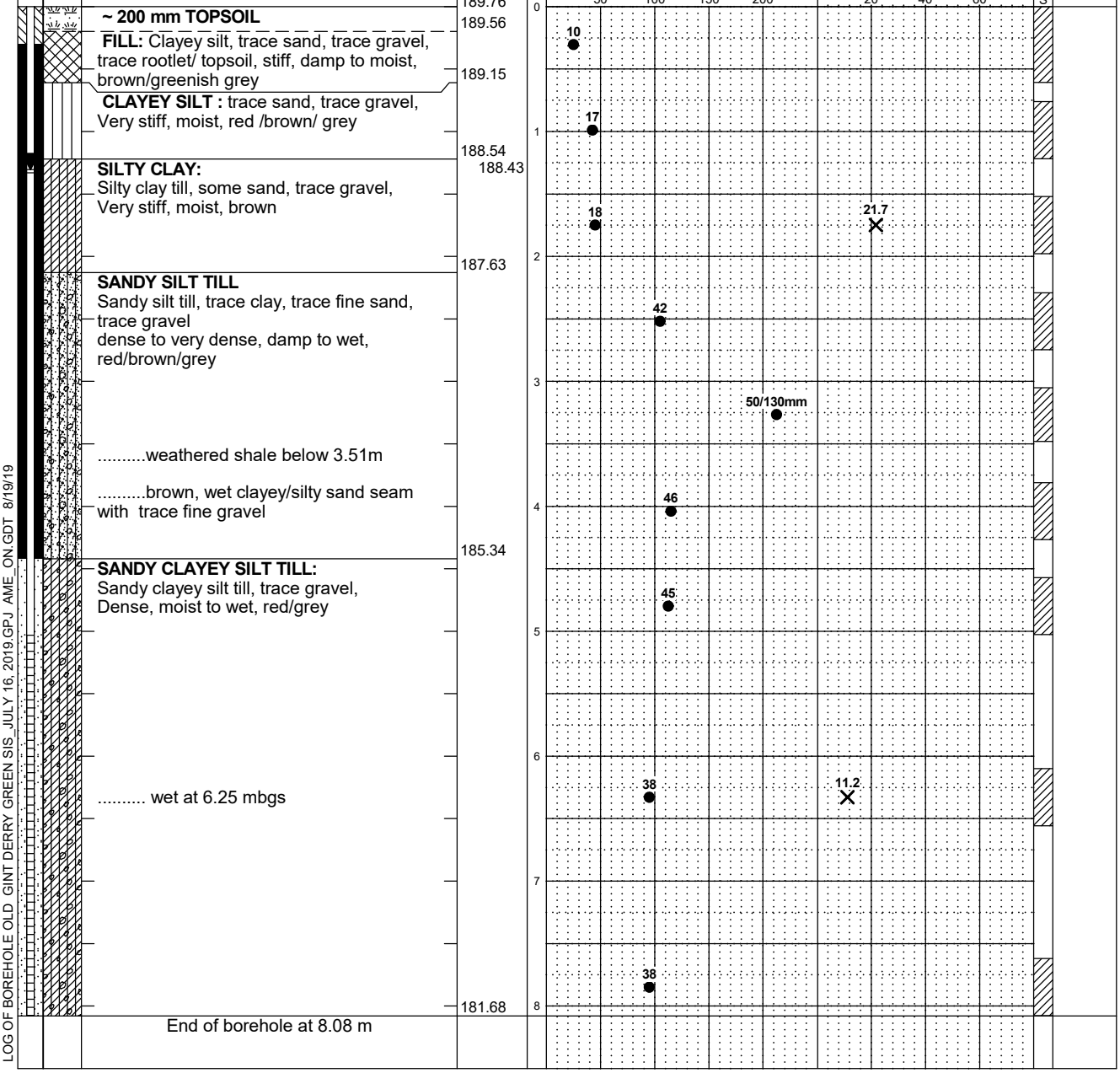
GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 200 mm TOPSOIL	189.76	0
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet/ topsoil, stiff, damp to moist, brown/greenish grey	189.56	
		CLAYEY SILT : trace sand, trace gravel, Very stiff, moist, red /brown/ grey	189.15	1
		SILTY CLAY: Silty clay till, some sand, trace gravel, Very stiff, moist, brown	188.54	
		SANDY SILT TILL Sandy silt till, trace clay, trace fine sand, trace gravel dense to very dense, damp to wet, red/brown/grey	188.43	2
		.....weathered shale below 3.51m	187.63	3
		.....brown, wet clayey/silty sand seam with trace fine gravel		4
		SANDY CLAYEY SILT TILL: Sandy clayey silt till, trace gravel, Dense, moist to wet, red/grey	185.34	5
		..... wet at 6.25 mbgs		6
				7
		End of borehole at 8.08 m	181.68	8

Standard Penetration Test N Value — Shear Strength (kPa): 20, 40, 60, 80; 50, 100, 150, 200

Total Organic Vapours (ppm): 25, 50, 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20, 40, 60

SAMPLES | Additional Notes



LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling	6.80	Open
07/09/2019	5.75	
07/10/2019	4.75	
07/12/2019	2.92	
07/23/2019	0.92	

Sheet No. 1 of 1

Log of Borehole BH19-16

Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-16

Location: Derry Road West and Sixth Line, Milton, ON

N4820220.163 E595365.098

Date Drilled: 7/16/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample	▨	Combustible Vapour Reading	□
Auger Sample	⊠	Natural Moisture Content	×
SPT (N) Value	●	Atterberg Limits	⊢○
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	✚ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			192.39	0
		~ 150 mm TOPSOIL	192.24	
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet/ topsoil, Stiff, moist, brown/dark brown	191.78	
		CLAYEY SILT : Clayey silt, trace to some sand, trace gravel, hard, moist to wet, red/brown		1
		.....Weathered shale pieces traced below 0.76 mbgs		2
			190.26	
		SANDY CLAYEY SILT TILL Sandy clayey silt till, trace gravel Compact to very dense, damp to moist, Brown to brownish grey with red pockets		3
				4
			187.83	
				5
				6
				7
		.....some sand at 7.62m	184.31	8
		End of borehole at 8.08 m		

Standard Penetration Test N Value: 20 40 60 80

Shear Strength kPa: 50 100 150 200

Total Organic Vapours (ppm): 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Additional Notes

10 32 38 31 24 35 36 45 91

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry 6.62	Open

Sheet No. 1 of 1

Log of Borehole BH19-17

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-17

Location: Derry Road West and Sixth Line, Milton, ON

N4820767.881 E595394.341

Date Drilled: 7/9/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Combustible Vapour Reading
Auger Sample | Natural Moisture Content
SPT (N) Value | Atterberg Limits
Dynamic Cone Test | Undrained Triaxial at % Strain at Failure
Shelby Tube | Shear Strength by Penetrometer Test
Shear Strength by Vane Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 250 mm TOPSOIL	191.04	0
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet/ topsoil, stiff, moist, brown/dark brown.	190.79	
		CLAYEY SILT TILL : Clayey silt till, trace to some sand, trace gravel, hard, moist to wet, red/brown	190.43	
		.....occasional oxidized surface	190.13	1
		SILT TILL Silt till, trace clay, trace sand, trace gravel Compact to very dense, damp to moist, red/brown/grey	188.91	2
		.....Weathered shale pieces traced below 3.05 mbgs...		3
				4
				5
		CLAYEY SILT: Clayey silt, trace sand, trace gravel, hard, moist to wet, grey	185.48	
		SANDY SILT TILL Sandy silt till, trace clay, trace to some gravel Dense, wet, grey	184.80	6
				7
		End of borehole at 8.08 m	182.96	8

Standard Penetration Test N Value: 10, 26, 35, 24, 30, 33, 24, 32, 39
Shear Strength kPa: 20 40 60 80 / 50 100 150 200
Total Organic Vapours (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60
Natural Moisture Content: 22.3, 13.9
SAMPLES
Additional Notes

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling	2.07	Open
07/11/2019	0.70	
07/12/2019	0.55	
07/23/2019	0.65	

Sheet No. 1 of 1

Log of Borehole BH19-18

Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-18

Location: Derry Road West and Sixth Line, Milton, ON

N4821285.585 E595682.683

Date Drilled: 7/10/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 200 mm TOPSOIL	192.41	0
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet/ topsoil, stiff, moist, brown/grey.	192.21	
		CLAYEY SILT TILL : Clayey silt till, trace sand, trace gravel, Very stiff to hard, moist to wet, red/brown	191.80	
		.....occasional oxidized surface	191.05	1
				2
		CLAYEY SANDY SILT TILL: Clayey sandy silt till, trace gravel, Dense to very dense, brown/red brown .....Weathered shale pieces traced below 3.05 mbgs...	189.74	3
				4
				5
				6
				7
		End of borehole at 8.08 m	184.33	8

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES | Additional Notes

12 | 29 | 27 | 38 | 80 | 44 | 41 | 10.4 | 34 | 30

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling	7.12	Open
07/12/2019	1.32	
07/23/2019	1.05	

Log of Borehole BH19-19

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-19

Location: Derry Road West and Sixth Line, Milton, ON

N4821148.598 E595864.818

Date Drilled: 7/12/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 150 mm TOPSOIL	191.72	0
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet/ topsoil, stiff, moist, brown to dark brown.	191.57	
		CLAYEY SILT : Clayey silt, sand seam, trace gravel, Hard, moist, brown/ grey pockets, occasional oxidized surface	191.11	1
		SANDY SILT: Sandy silt, trace to some clay, trace gravel Dense, moist, brown	190.35	
		CLAYEY SILT TILL: Clayey silt till, trace sand, trace gravel Very stiff to hard, moist to wet, brown/red/grey	189.59	2
		.....Weathered shale pieces traced below 3.85 mbgs...	187.80	3
		SANDY CLAYEY SILT TILL Sandy clayey silt till, trace gravel Compact to very dense, damp to moist, grey	186.16	4
		.....grey moist sand seam	183.64	5
		End of borehole at 8.08 m		6
				7
				8

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength kPa: 50 100 150 200

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

Depth	SPT N	Shear Strength (kPa)	Total Organic Vapours (ppm)	Natural Moisture Content % / Atterberg Limits (% Dry Weight)
0	14		17.5	
1	38		16.3	
2	38		15.4	
3	30		20.9	
4	41		10.8	
5	27		7.8	
6	34		8.2	
7	50		9	
8	53		11.2	

SAMPLES | Additional Notes

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry 5.83	Open

Sheet No. 1 of 1

Log of Borehole BH19-20

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-20

Location: Derry Road West and Sixth Line, Milton, ON

N4821242.041 E596231.39

Date Drilled: 7/22/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample	▨	Combustible Vapour Reading	□
Auger Sample	⊠	Natural Moisture Content	×
SPT (N) Value	●	Atterberg Limits	⊢○⊣
Dynamic Cone Test	———	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	✚ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 280 mm TOPSOIL	192.90	0
		FILL: Sandy silt, some clay, trace gravel, trace rootlet/ topsoil, firm, moist, brown/ dark brown	192.62	
		CLAYEY SILT : Clayey silt, trace gravel, fine sand seams, stiff, moist, brown with red pockets, slightly mottled	192.29	
		SILTY CLAY: Silt clay, trace sand, trace gravel, Stiff to very stiff, moist, red/brown .....occasional fine sand seam .....Weathered shale pieces traced below 1.83 mbgs...	191.53	1
		SILT TILL Silt till, some clay, some sand, trace gravel Compact to dense, moist to wet, reddish grey	189.24	2
▼		**SILTY CLAY TILL:** Silty clay till, some sand, trace gravel, Hard, moist to wet, grey	187.34	3
			186.92	4
		End of borehole at 8.08 m	184.82	5 6 7 8

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Additional Notes

7 12 25 11 23 28 37 45 40

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry 5.98	Open

Sheet No. 1 of 1

Log of Borehole BH19-5

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-5

Location: Derry Road West and Sixth Line, Milton, ON

N4821441.883 E595003.139

Date Drilled: 1/22/29

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

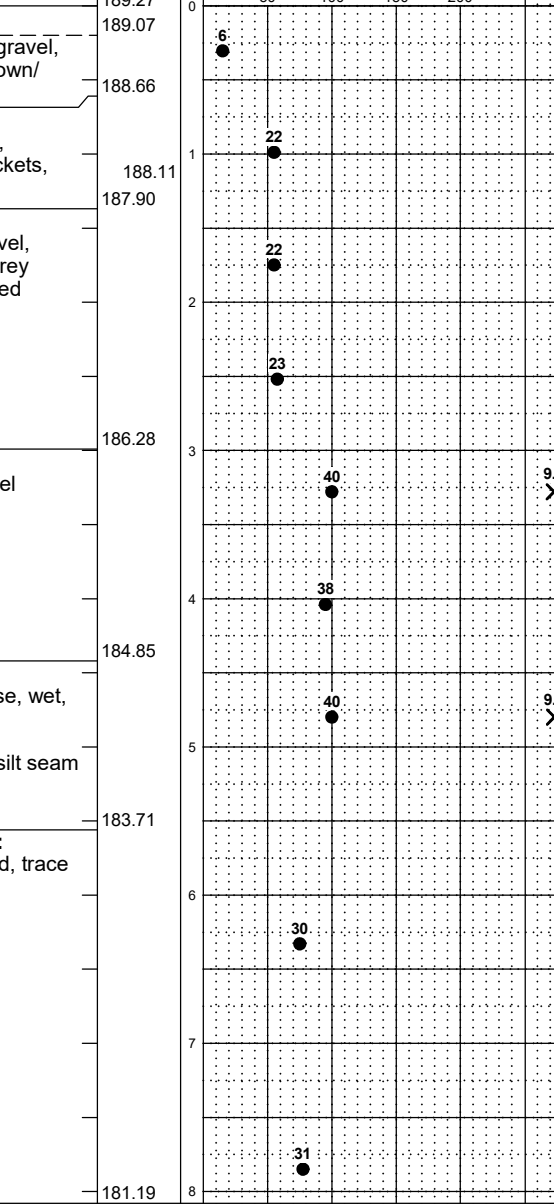
Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			189.27	0
		~ 200 mm TOPSOIL	189.07	
		FILL: Clayey silt, trace sand, trace gravel, trace rootlet/ topsoil, firm, moist, brown/ dark brown.	188.66	
		CLAYEY SILT : Clayey silt, trace sand, trace gravel, Very stiff, moist, brown with red pockets, slightly mottled	188.11	1
		CLAYEY SILT TILL: Clayey silt till, trace sand, trace gravel, Very stiff, moist to wet, red/brown/grey .....Weathered shale pieces traced below 1.83 mbgs...	187.90	
		SANDY SILT TILL Sandy silt till, some clay, trace gravel Dense, moist, reddish grey .....fine sand seam	186.28	3
		GRAVELLY SILTY SAND: Gravelly silty sand, some clay, dense, wet, grey .....occasional grey, wet clayey silt seam	184.85	4
		CLAYEY SILT to SILTY CLAY TILL: Clayey silt to silty clay till, trace sand, trace gravel, Very stiff, moist to wet, grey	183.71	6
		End of borehole at 8.08 m	181.19	8

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES | Additional Notes



LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry 4.77	Open

Sheet No. 1 of 1

Log of Borehole BH19-6

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-6

Location: Derry Road West and Sixth Line, Milton, ON

N4821668.979 E595148.086

Date Drilled: 7/23/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 350 mm TOPSOIL	188.84	0
		FILL: Clayey silt, trace sand, trace gravel, trace organics/ topsoil, firm to stiff, moist to wet, brown/ dark brown.	188.49	
		CLAYEY SILT : Clayey silt, fine sand seam, trace gravel, Stiff to hard, moist to wet, brown	187.47	1
		CLAYEY SILT to SILT TILL Clayey silt to silt till, trace to some sand, trace gravel Compact to dense, damp to moist, red/brown/grey	186.33	2
		.....Weathered shale pieces traced below 3.85 mbgs...		3
		.....becomes grey		4
				5
				6
				7
			180.76	8
		End of borehole at 8.08 m		

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES | Additional Notes

7 | 8 | 12 | 39 | 45 | 19 | 14 | 35 | 13

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry -	Open

Sheet No. 1 of 1

Log of Borehole BH19-7

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-7

Location: Derry Road West and Sixth Line, Milton, ON

N4821945.205 E595417.025

Date Drilled: 7/22/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 300 mm TOPSOIL	189.70	0
		FILL: Sandy silt, some clay, trace gravel, trace rootlets/ topsoil Loose, moist, brown	189.40	
		SANDY SILT : Sandy silt, trace clay, trace gravel, compact, moist to wet, brown	188.79	1
		SILTY CLAY: Silty clay, trace sand, Stiff, wet, grey	188.33	
		CLAYEY SILT TILL Clayey silt till, some sand, trace gravel Stiff to very stiff, damp to moist, red/brown/grey .....becomes grey .....Weathered shale pieces traced below 3.00 mbgs...	187.41	2
				3
				4
				5
				6
			183.36	
				7
		SILTY CLAY TILL: Silty clay till, trace sand, trace gravel, Stiff, wet, grey	182.08	
		End of borehole at 8.08 m	181.62	8

Standard Penetration Test N Value	Shear Strength (kPa)	Total Organic Vapours (ppm)	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Additional Notes
7	50				
12					
15		23			
15					
12					
13					
16					
17		11.4			
14					

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry Dry	Open

Sheet No. 1 of 1

Log of Borehole BH19-8

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-8

Location: Derry Road West and Sixth Line, Milton, ON

N4821563.768 E595303.825

Date Drilled: 7/23/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Shear Strength by Vane Test (S)

Combustible Vapour Reading | Natural Moisture Content | Atterberg Limits | Undrained Triaxial at % Strain at Failure | Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 400 mm TOPSOIL	191.44	0
		FILL: Clayey silt, some sand, trace gravel, trace rootlets/ topsoil, firm to stiff, damp to moist, brown/ dark brown	191.04	
		CLAYEY SILT : Clayey silt, trace sand, trace gravel, Stiff, moist to wet, brown	190.53	1
		SANDY SILT to SILT TILL Sandy silt to silt till, trace clay, trace gravel Compact to Dense, damp to moist, red/brown/grey	189.94	
		.....Weathered shale pieces traced below 2.25 mbgs...		2
		.....becomes grey		3
				4
				5
		CLAYEY SILT to SILT TILL: Clayey silt to silt till, trace sand, trace gravel, Very Stiff, wet, grey	185.34	6
				7
			183.36	8
		End of borehole at 8.08 m		

Standard Penetration Test N Value: 20 40 60 80 — Shear Strength: 50 100 150 200 kPa

Total Organic Vapours (ppm): 25 50 75 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES | Additional Notes

SPT (N) values: 6, 15, 18, 25, 41, 34, 22, 19, 21

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry -	Open

Sheet No. 1 of 1

Log of Borehole BH19-9

AME Materials Engineering

Project No.: 30291.222

Project Name: Derry Green SIS

Figure No. B-9

Location: Derry Road West and Sixth Line, Milton, ON

N4821907.673 E595552.975

Date Drilled: 7/22/19

Drill Type: Solid Stem Auger

Datum: Local

Split Spoon Sample | Combustible Vapour Reading
Auger Sample | Natural Moisture Content
SPT (N) Value | Atterberg Limits
Dynamic Cone Test | Undrained Triaxial at % Strain at Failure
Shelby Tube | Shear Strength by Penetrometer Test
Shear Strength by Vane Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		~ 370 mm TOPSOIL	190.46	0
		FILL: Sandy silt, trace clay & gravel, trace topsoil, loose, moist, brown/ dark brown.	190.09	
		CLAYEY SILT : Clayey silt, fine sand seam, trace gravel, Firm to stiff, moist, brown/ red.	189.85	1
		CLAYEY SILT to SILT TILL: Clayey silt to silt till, trace sand, trace gravel, Very stiff, moist to wet, red/brown/grey .....Weathered shale pieces traced below 1.83 mbgs...	189.09	2
		CLAYEY SILT to SILTY CLAY TILL: Clayey silt to silty clay till, trace sand, trace gravel, Stiff, moist to wet, grey	184.82	3
		SILT TILL: Silt till, trace clay, trace sand, trace gravel, Very Dense, moist, grey	183.46	4
		End of borehole at 8.08 m	182.38	5
				6
				7
				8

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Total Organic Vapours (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES: 6, 6, 20, 27, 23, 21, 16, 8, 51

Additional Notes

LOG OF BOREHOLE OLD GINT DERRY GREEN SIS_JULY 16, 2019.GPJ AME_ON.GDT 8/19/19

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
End of Drilling 07/23/2019	Dry -	Open

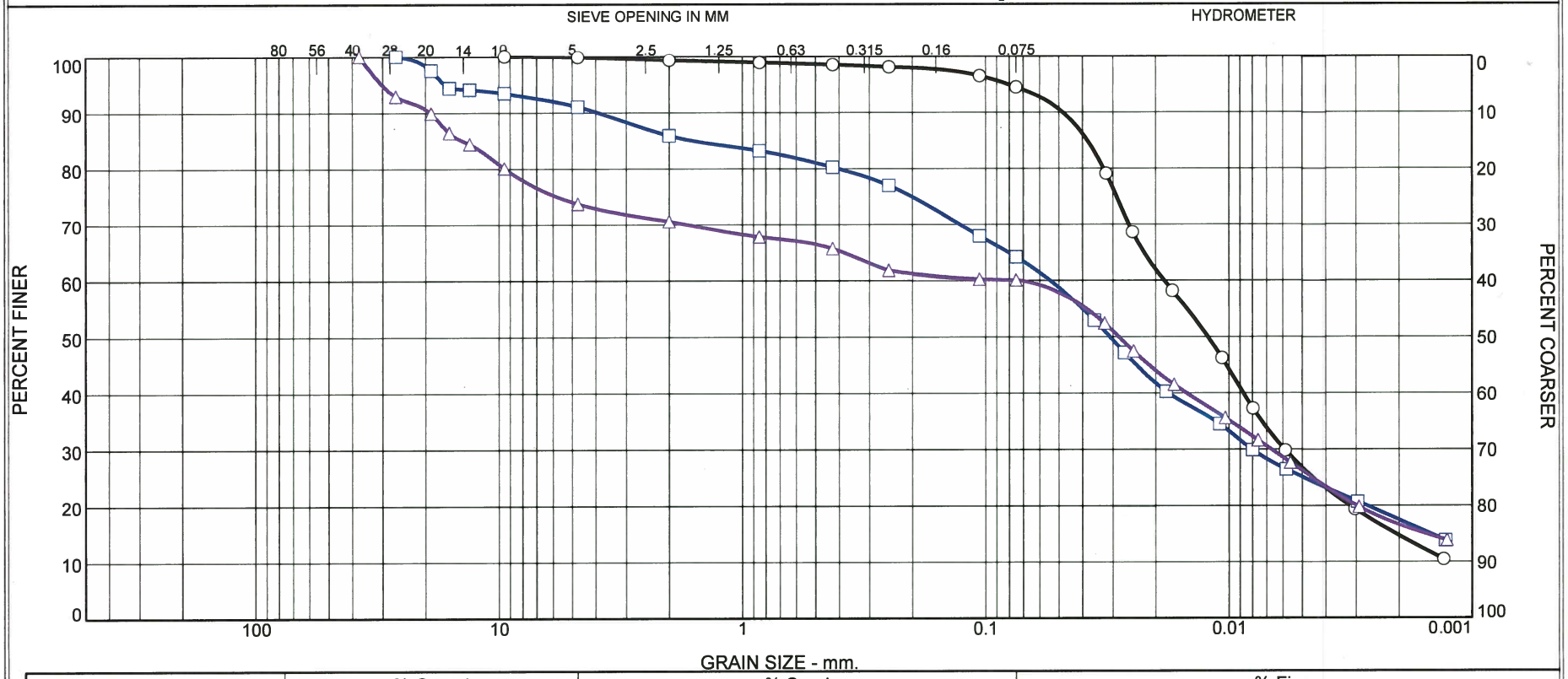
Sheet No. 1 of 1

APPENDIX C

Laboratory Test Results

Particle Size Distribution Reports
Figure Nos. C - 1 to C - 11

Particle Size Distribution Report



	% +75mm	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.1	0.6	0.8	4.0	79.8	14.7
□	0.0	2.4	6.5	5.2	5.7	16.0	46.7	17.5
△	0.0	10.0	16.3	3.1	4.9	5.6	43.5	16.6

	Identification		Date Sampled	Date Received	Date Tested
○	Location: BH19-1 / SS3	Sample Number: MG-30858	July 23, 2019	July 24, 2019	July 30, 2019
□	Location: BH19-1 / SS7	Sample Number: MG-30813	July 18, 2019	July 19, 2019	July 22, 2019
△	Location: BH19-2 / SS8	Sample Number: MG-30814	July 19, 2019	July 20, 2019	July 22, 2019

Client Neamsby Investments Inc.

Project Derry Green SIS

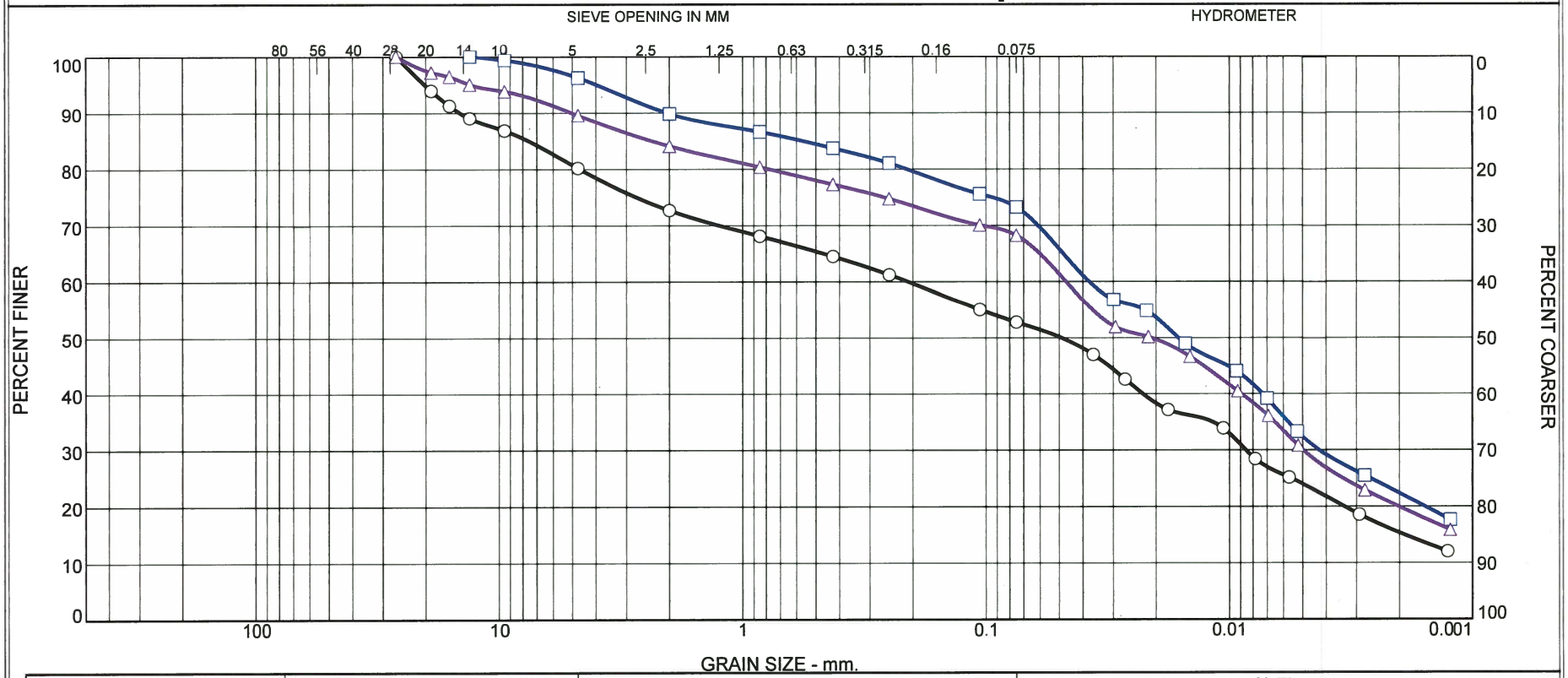
Project No. 30291.222 Fig. No. C1

AME Materials Engineering

○ BH19-1/SS3 - Silt, some Clay, trace Sand, trace Gravel
□ BH19-1/SS7 - Sandy Silt, some Clay, trace Gravel
△ BH19-2/SS8 - Gravelly Silt, some Sand, some Clay

Tested By: TZ **Checked By:** MS

Particle Size Distribution Report



	% +75mm	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	6.0	13.8	7.5	8.2	11.7	37.5	15.3
□	0.0	0.0	3.8	6.3	6.2	10.5	50.9	22.3
△	0.0	2.8	7.6	5.5	6.8	9.1	48.3	19.9

	Identification		Date Sampled	Date Received	Date Tested
○	Location: BH19-3 / SS4	Sample Number: MG-30859	July 23, 2019	July 24, 2019	July 26, 2019
□	Location: BH19-3 / SS7	Sample Number: MG-30815	July 19, 2019	July 20, 2019	July 22, 2019
△	Location: BH19-4 / SS8	Sample Number: MG-30816	July 19, 2019	July 20, 2019	July 22, 2019

Client Neamsby Investments Inc.

Project Derry Green SIS

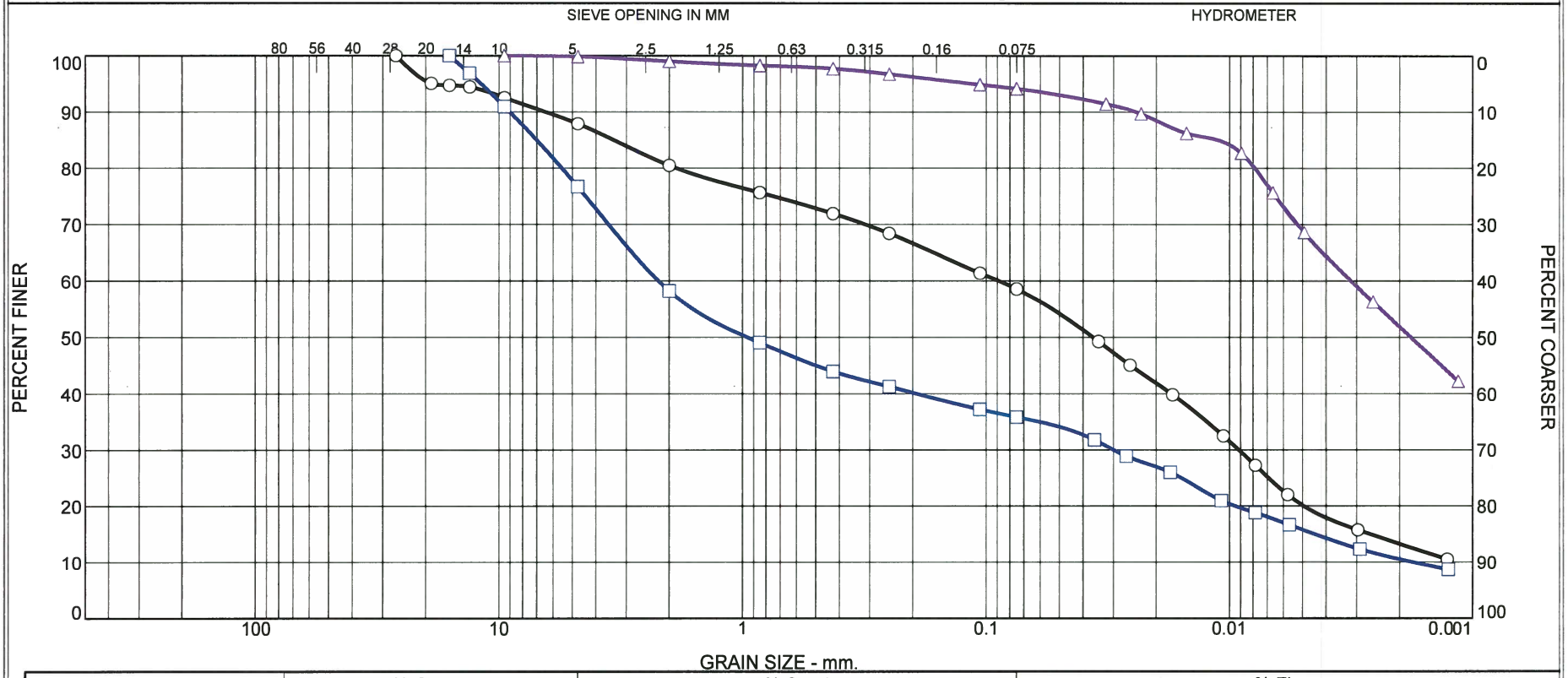
Project No. 30291.222 Fig. No. C2

AME Materials Engineering

○ BH19-3/SS4 - Sandy Silt, some Gravel, some Clay
□ BH19-3/SS7 - ~~Sandy Silt, some Clay, trace Gravel~~ Sandy Clayey Silt, trace gravel
△ BH19-4/SS8 - ~~Sandy Silt, some Clay, some Gravel~~ Sandy Clayey Silt, trace to some gravel

Tested By: TZ **Checked By:** MS

Particle Size Distribution Report



	% +75mm	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.9	7.2	7.4	8.6	13.3	45.4	13.2
□	0.0	0.0	23.3	18.5	14.3	8.1	25.3	10.5
△	0.0	0.0	0.2	0.8	1.3	3.5	42.3	51.9

	Identification		Date Sampled	Date Received	Date Tested
○	Location: BH19-5 / SS5	Sample Number: MG-30860A	July 23, 2019	July 24, 2019	July 26, 2019
□	Location: BH19-5 / SS7	Sample Number: MG-30860B	July 23, 2019	July 24, 2019	July 26, 2019
△	Location: BH19-7 / SS3	Sample Number: MG-30861A	July 23, 2019	July 24, 2019	July 26, 2019

Client Neamsby Investments Inc.

Project Derry Green SIS

Project No. 30291.222 Fig. No. C3

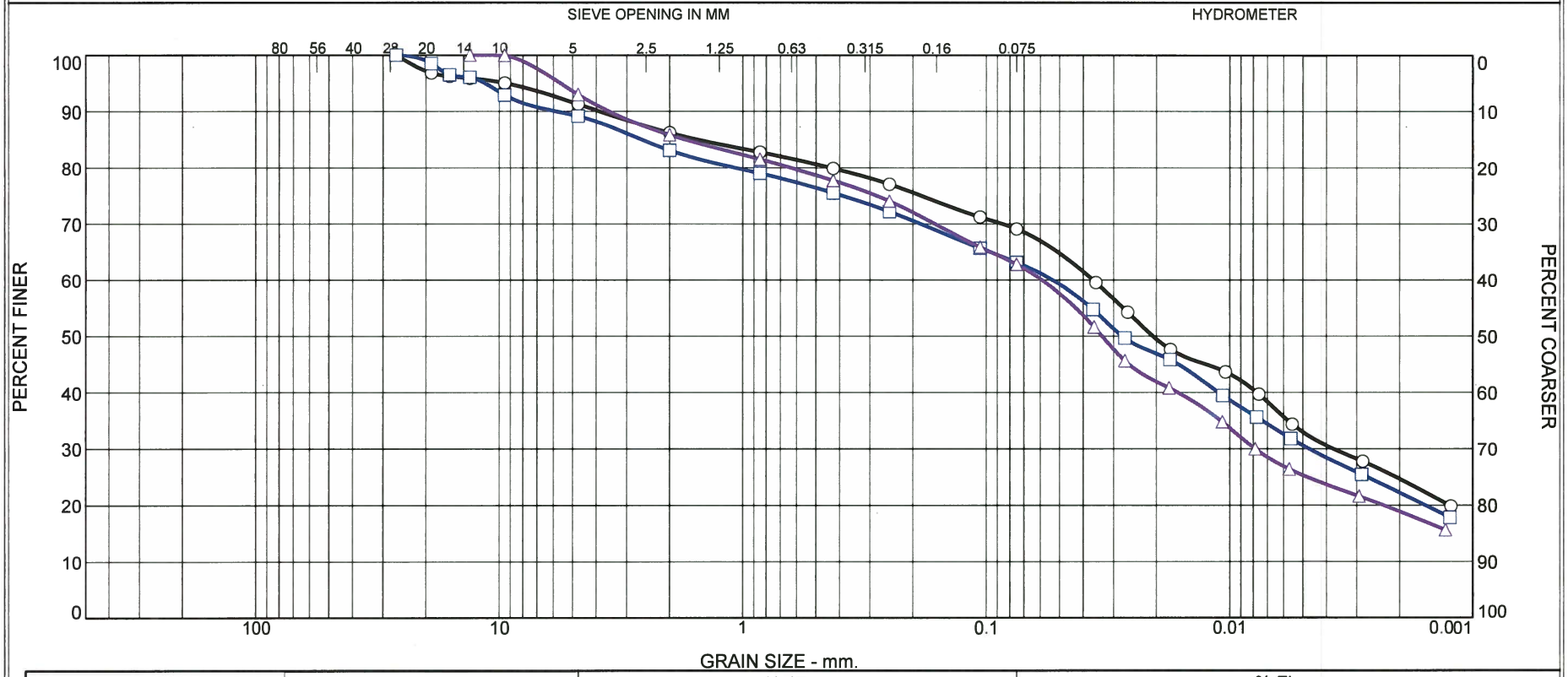
AME Materials Engineering

○ BH19-5/SS5 - Sandy Silt, some Gravel, some Clay
□ ~~BH19-5/SS7 - Silty Sand, some Gravel, trace Clay~~
△ ~~BH19-7/SS3 - Clay and Silt, trace Sand, trace Gravel~~

□ Gravelly Silty Sand, some clay
△ Silty clay, trace Sand

Tested By: TZ **Checked By:** MS

Particle Size Distribution Report



	% +75mm	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	3.2	5.5	5.1	6.3	10.8	44.4	24.7
□	0.0	1.5	9.3	6.1	7.6	12.4	40.9	22.2
△	0.0	0.0	7.0	7.2	8.1	14.9	43.9	18.9

	Identification		Date Sampled	Date Received	Date Tested
○	Location: BH19-7 / SS8	Sample Number: MG-30861B	July 23, 2019	July 24, 2019	July 26, 2019
□	Location: BH19-10 / SS4	Sample Number: MG-30862A	July 23, 2019	July 23, 2019	July 26, 2019
△	Location: BH19-10 / SS7	Sample Number: MG-30862B	July 23, 2019	July 23, 2019	July 26, 2019

Client Neamsby Investments Inc.

Project Derry Green SIS

Project No. 30291.222 Fig. No. C4

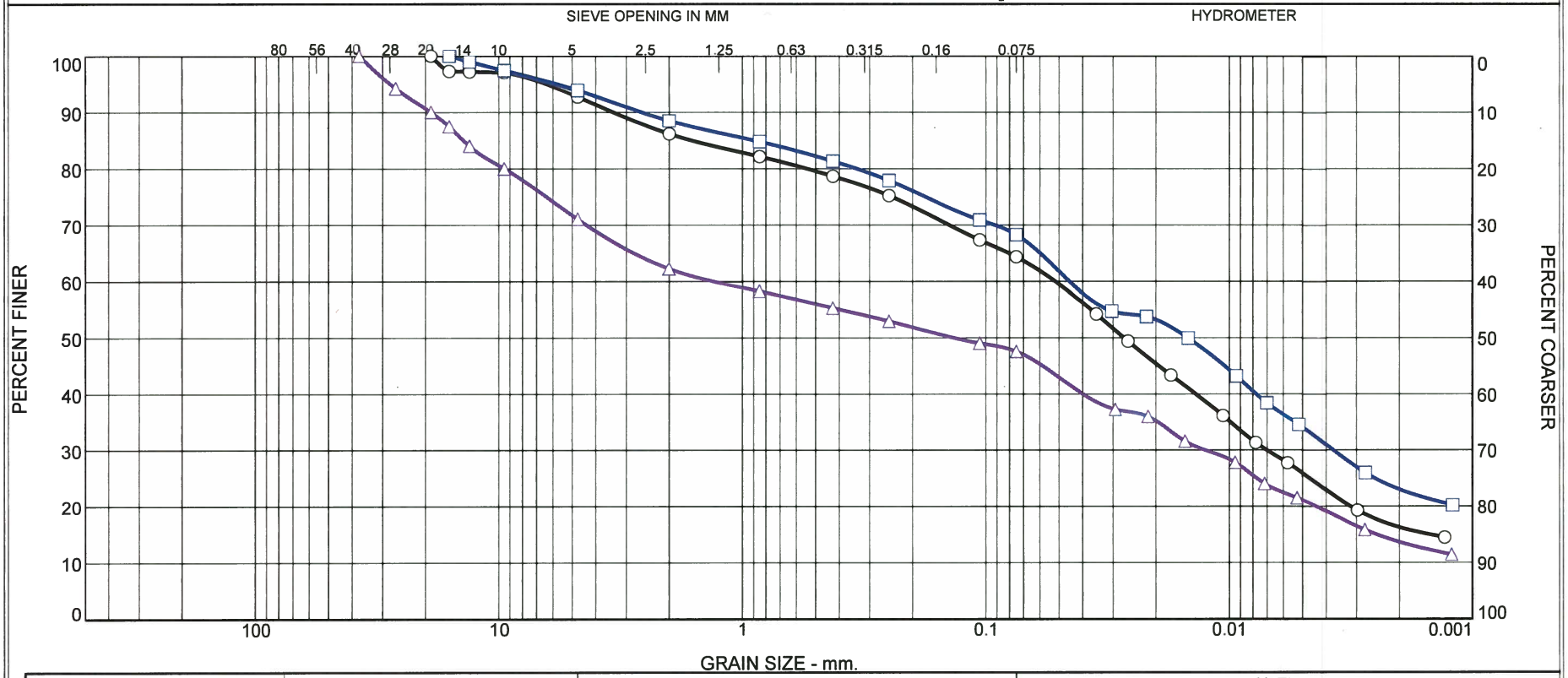
AME Materials Engineering

○ BH19-7/SS8 - Clayey Silt, some Sand, trace Gravel
□ BH19-10 / SS4 - ~~Sandy Silt, some Clay, some Gravel~~
△ BH19-10/SS7- Sandy Silt, some Clay, trace Gravel

□ clayey silt, some sand, trace gravel

Tested By: TZ **Checked By:** MS

Particle Size Distribution Report



	% +75mm	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	7.2	6.6	7.5	14.3	48.2	16.2
□	0.0	0.0	6.1	5.4	7.2	13.0	45.3	23.0
△	0.0	9.9	19.0	8.8	7.0	7.7	34.0	13.6

	Identification		Date Sampled	Date Received	Date Tested
○	Location: BH19-12 / SS5	Sample Number: MG-30863	July 23, 2019	July 23, 2019	July 26, 2019
□	Location: BH19-12A / SS8	Sample Number: MG-30817	July 19, 2019	July 20, 2019	July 22, 2019
△	Location: BH19-13A / SS7	Sample Number: MG-30818	July 19, 2019	July 20, 2019	July 23, 2019

Client Neamsby Investments Inc.

Project Derry Green SIS

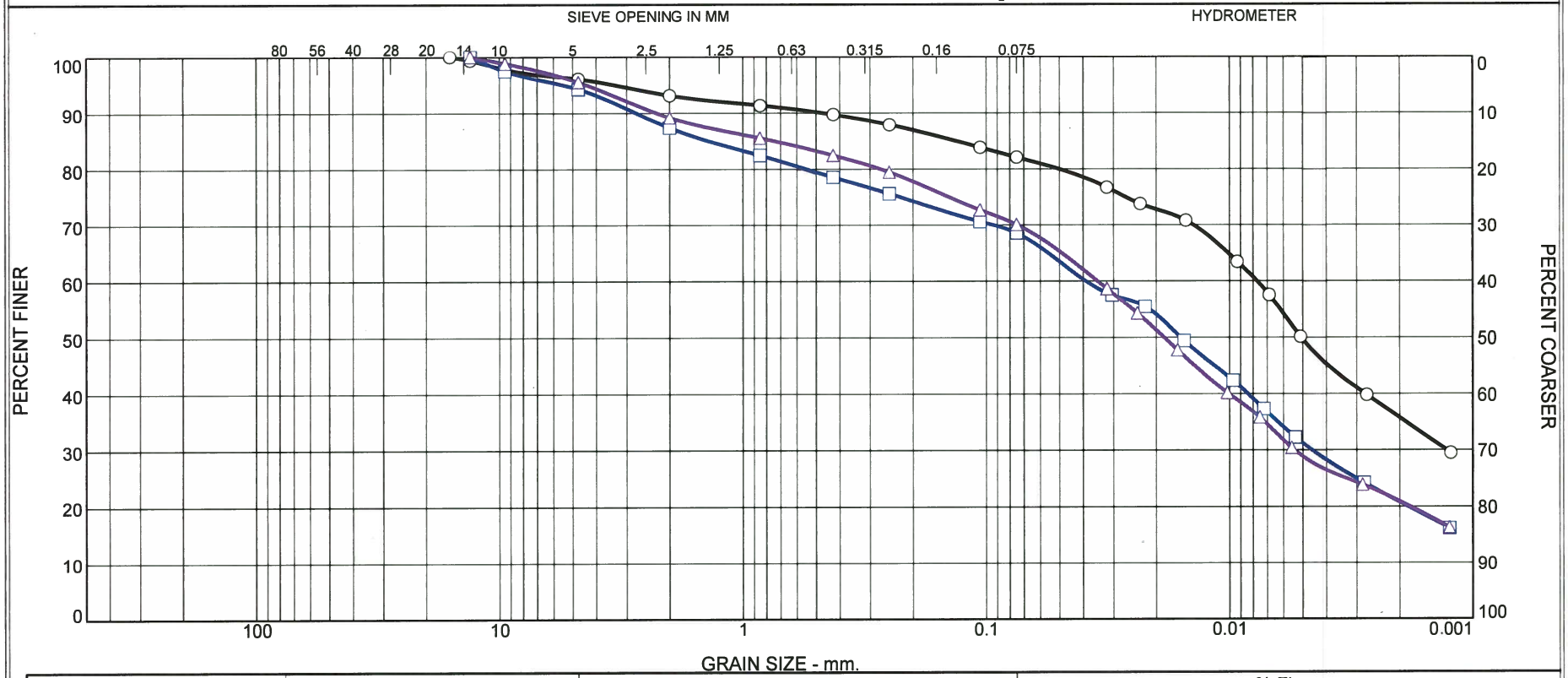
Project No. 30291.222 | Fig. No. C5

AME Materials Engineering

○ BH19-12/SS5 - Sandy Silt, some Clay, trace Gravel
□ BH19-12A/SS8 - Clayey Silt, some Sand, trace Gravel
△ BH19-13A/SS7 - ~~Gravelly and Sandy Silt, some Clay~~
△ Sandy Gravelly Silt, Some Clay

Tested By: TZ **Checked By:** MS

Particle Size Distribution Report



	% +75mm	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.9	3.0	3.4	7.6	46.3	35.8
□	0.0	0.0	5.7	6.9	8.9	10.0	47.7	20.8
△	0.0	0.0	4.5	6.3	6.8	12.3	49.2	20.9

	Identification		Date Sampled	Date Received	Date Tested
○	Location: BH19-15 / SS3	Sample Number: MG-30868	July 23, 2019	July 23, 2019	July 29, 2019
□	Location: BH19-15 / SS8	Sample Number: MG-30819	July 19, 2019	July 20, 2019	July 23, 2019
△	Location: BH19-16 / SS7	Sample Number: MG-30820	July 19, 2019	July 20, 2019	July 23, 2019

Client Neamsby Investments Inc.

Project Derry Green SIS

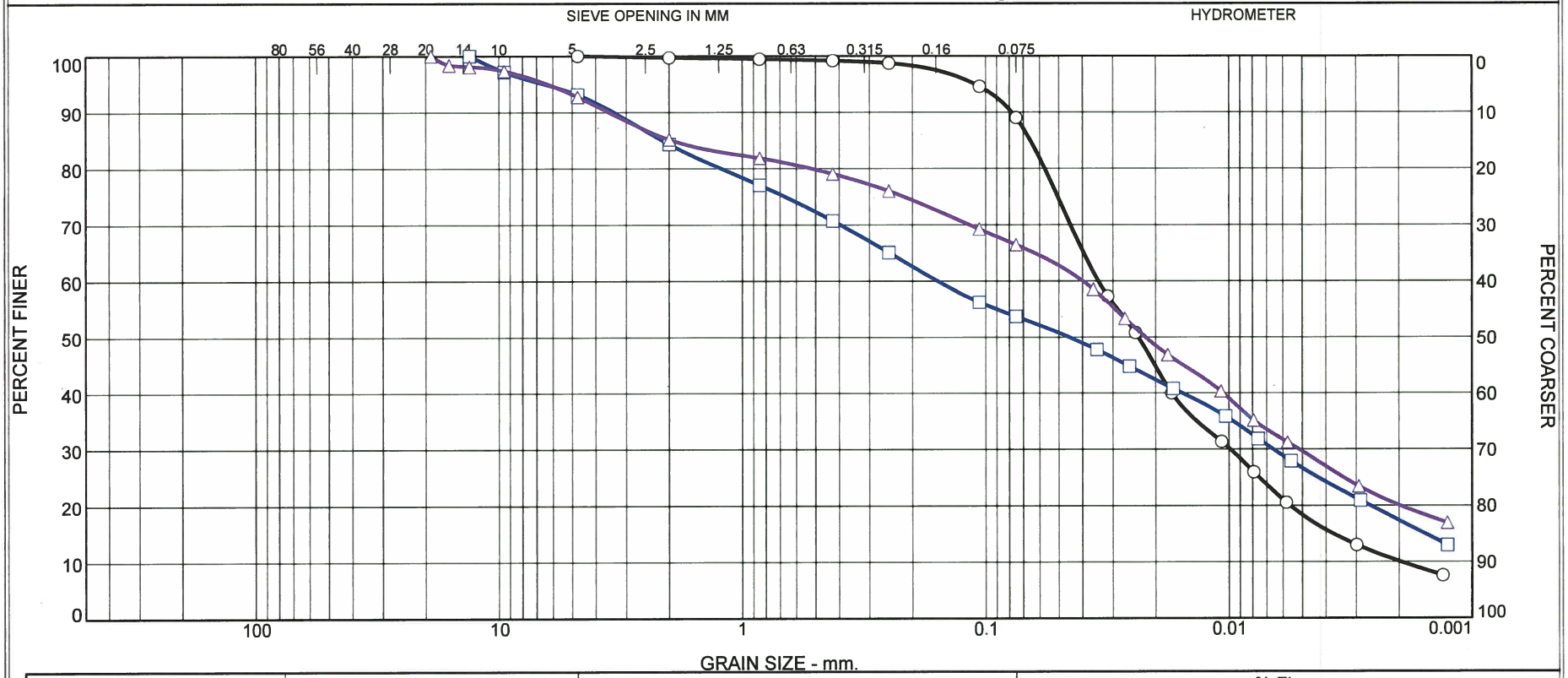
Project No. 30291.222 | Fig. No. C6

AME Materials Engineering

○ BH19-15/SS3 - ~~Clayey Silt, some Sand, trace Gravel~~ Silty clay, some sand, trace gravel
□ BH19-15/SS8 - ~~Sandy Silt, some Clay, trace Gravel~~ Sandy clayey silt, trace gravel
△ BH19-16/SS7 - ~~Sandy Silt, some Clay, trace Gravel~~ Sandy clayey silt, trace gravel

Tested By: TZ **Checked By:** MS

Particle Size Distribution Report



	% +75mm	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.3	0.5	10.2	78.9	10.1
□	0.0	0.0	6.9	8.8	13.6	17.0	36.4	17.3
△	0.0	0.0	7.3	7.6	6.1	12.6	46.3	20.1

	Identification		Date Sampled	Date Received	Date Tested
○	Location: BH19-17 / SS4	Sample Number: MG-30864	July 23, 2019	July 23, 2019	July 29, 2019
□	Location: BH19-17 / SS8	Sample Number: MG-30821	July 19, 2019	July 20, 2019	July 23, 2019
△	Location: BH19-18 / SS7	Sample Number: MG-30822	July 19, 2019	July 20, 2019	July 23, 2019

Client Neamsby Investments Inc.

Project Derry Green SIS

Project No. 30291.222 Fig. No. C7

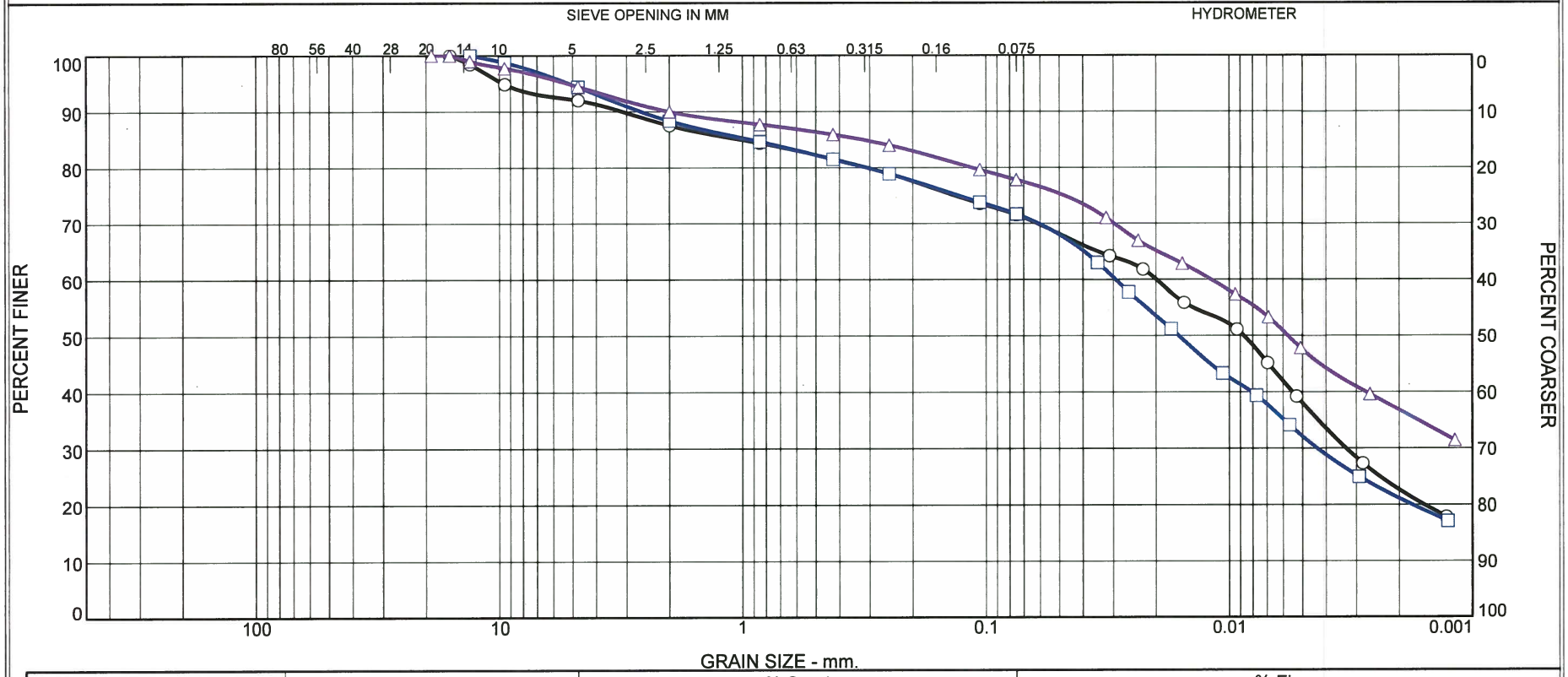
AME Materials Engineering

○ BH19-17/SS4 - Silt, some Clay, some Sand
□ BH19-17/SS8 - Sand and Silt, some Clay, trace Gravel
△ BH19-18/SS7 - Sandy Silt, some Clay, trace Gravel

△ clayey sandy silt, trace gravel

Tested By: TZ **Checked By:** MS

Particle Size Distribution Report



	% +75mm	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	8.0	4.5	6.0	10.0	48.9	22.6
□	0.0	0.0	5.6	6.1	6.8	9.8	50.6	21.1
△	0.0	0.0	5.6	4.4	4.1	8.1	41.0	36.8

	Identification		Date Sampled	Date Received	Date Tested
○	Location: BH19-19 / SS5	Sample Number: MG-30865	July 23, 2019	July 23, 2019	July 29, 2019
□	Location: BH19-19 / SS8	Sample Number: MG-30823	July 19, 2019	July 20, 2019	July 23, 2019
△	Location: BH19-20 / SS4	Sample Number: MG-30866A	July 23, 2019	July 23, 2019	July 29, 2019

Client Neamsby Investments Inc.

Project Derry Green SIS

Project No. 30291.222 Fig. No. C8

AME Materials Engineering

○ BH19-19/SS5 - Clayey Silt, some Sand, trace Gravel
□ BH19-19/SS8 - ~~Sandy Silt, some Clay, trace Gravel~~ Sandy clayey silt, trace gravel
△ BH19-20/SS4 - ~~Silt and Clay, some Sand, trace Gravel~~ Silty clay, some sand, trace gravel

Tested By: TZ **Checked By:** MS

Particle Size Distribution Report

	% +75mm	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	9.3	5.7	7.2	13.8	46.3	17.7

	Identification		Date Sampled	Date Received	Date Tested
○	Location: BH19-20 / SS8	Sample Number: MG-30866B	July 23, 2019	July 23, 2019	July 29, 2019

Client Neamsby Investments Inc.

Project Derry Green SIS

Project No. 30291.222 | Fig. No. C9

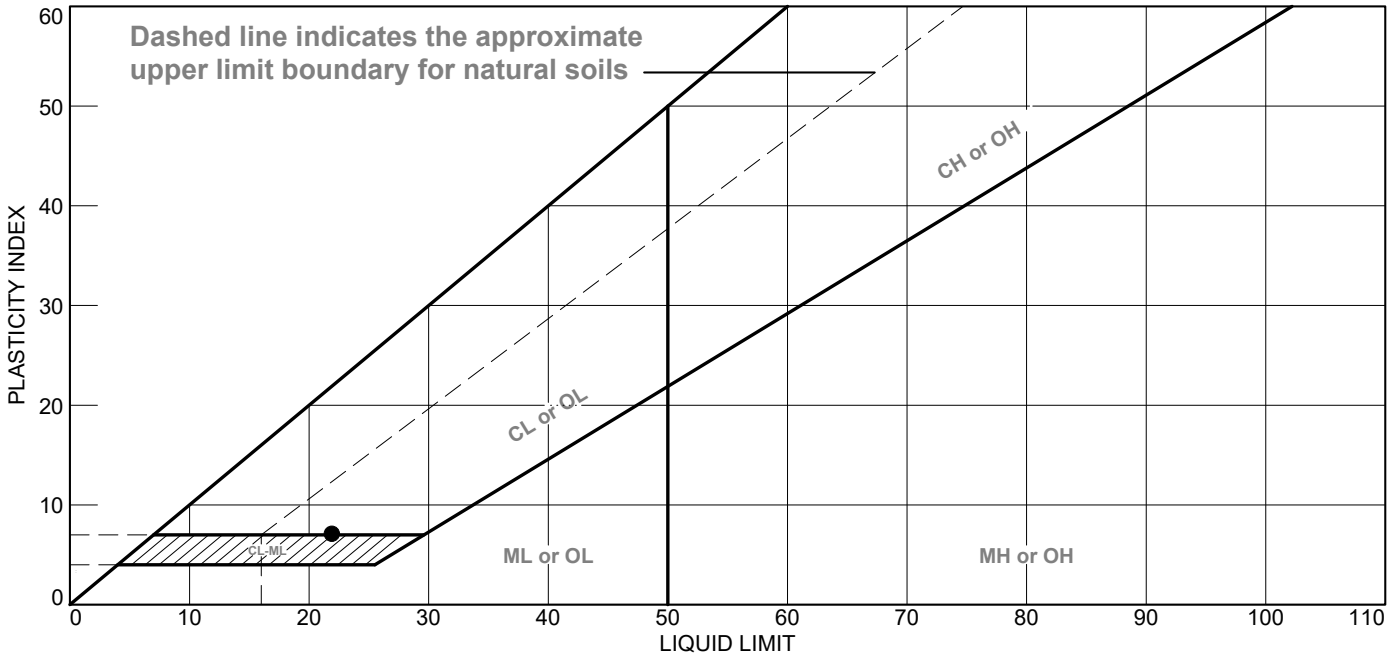
AME Materials Engineering

○ BH19-2-/SS8 - Sandy Silt, some Clay, trace Gravel

Sandy clayey silt, trace gravel

Tested By: TZ **Checked By:** MS

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gravelly Clayey Silt, some Sand	21.9	14.8	7.1	65.7	60.1	CL-ML

Project No. 30291.222 **Client:** Neamsby Investments Inc.

Project: Derry Green SIS

Location: BH19-2 / SS8
Sample Number: MG-30814

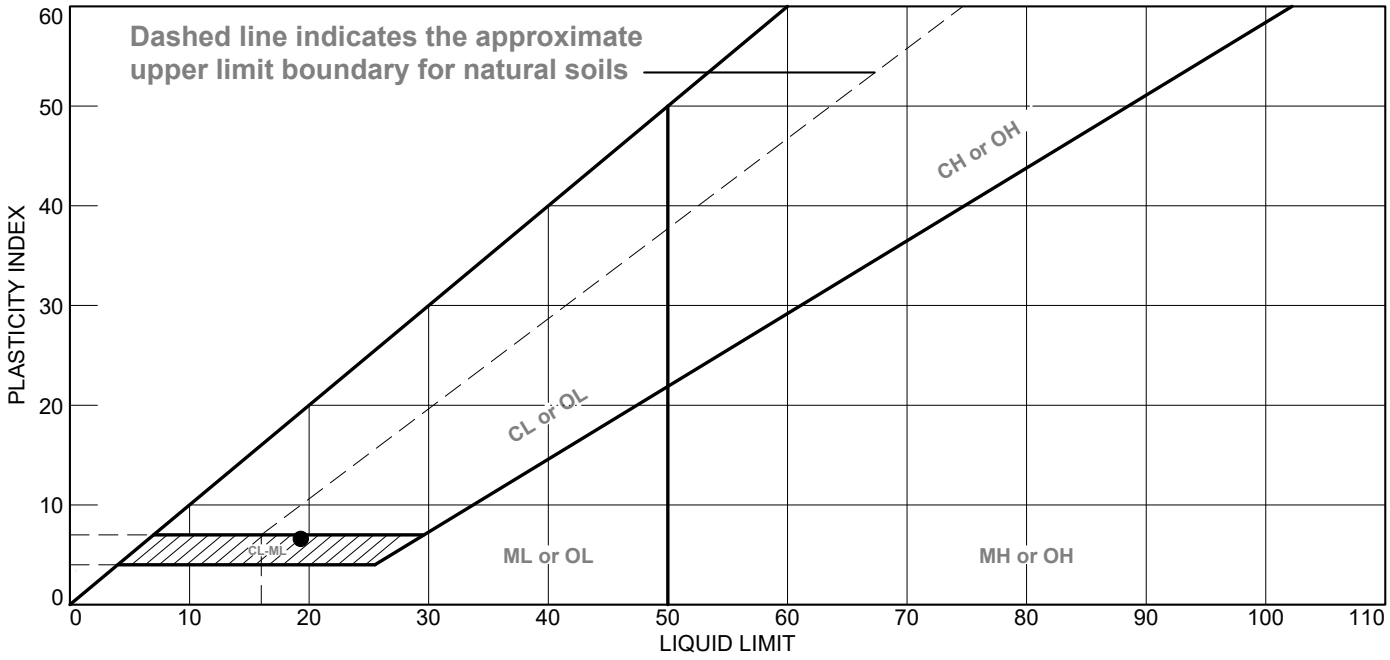
Remarks:

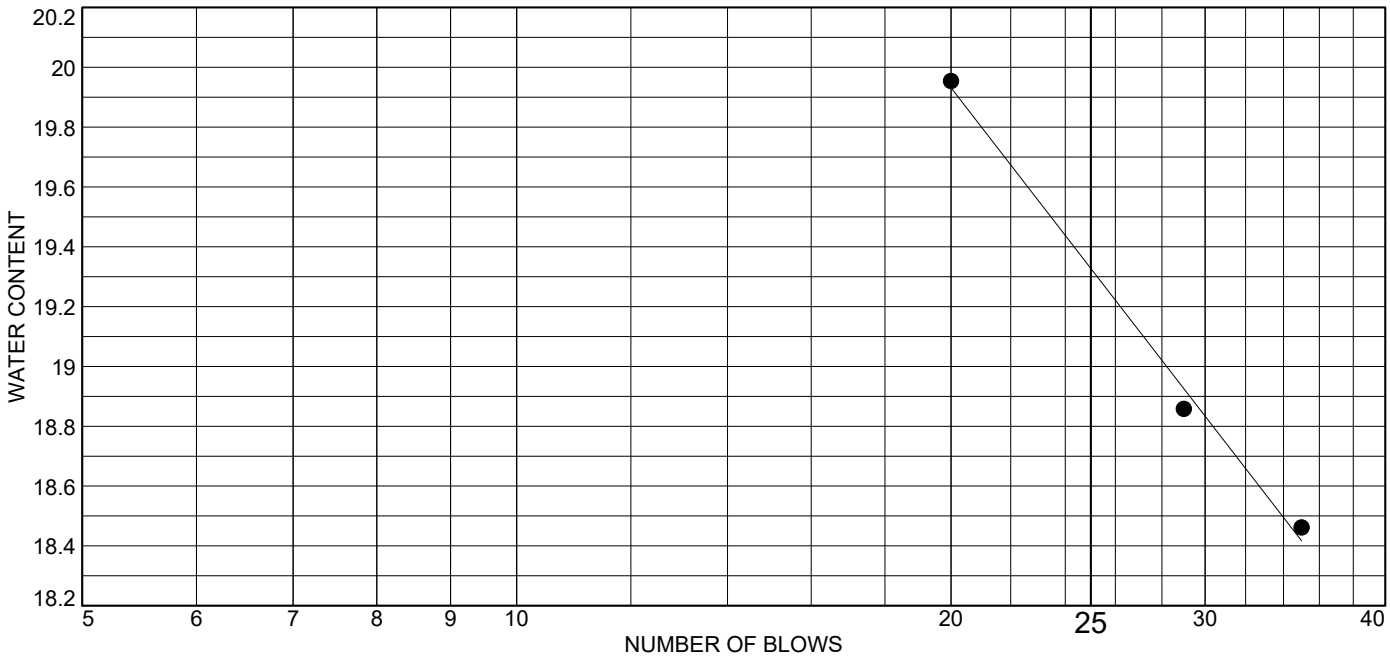
AME Materials Engineering

Fig. No. C10

Tested By: TZ **Checked By:** MS

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Sandy Clayey Silt, trace Gravel	19.3	12.7	6.6	77.7	62.8	CL-ML

Project No. 30291.222 **Client:** Neamsby Investments Inc.

Project: Derry Green SIS

Location: BH19-10 / SS7
Sample Number: MG-30862B

Remarks:

AME Materials Engineering

Fig. No. C11

Tested By: TZ **Checked By:** MS

AME Materials Engineering

Borehole / Soil Sample Moisture Content (LS-700)

Sample No.:	MG-30824	**Date Sampled:**	08-Jul-19
Job No.:	30291.222	**Date Tested:**	23-Jul-19
Job Name:	Derry Green SIS	**Tested By:**	WB
Source:	BH	**Material Code:**	
Material Type:	SS	**Results To:**	

Borehole No.	Tin No.:	Depth Sample Taken (ft)	Wet Sample + Tare (A)	Dry Sample + Tare (B)	Tare (C)	Mass of Sample (D) (B-C)	% Moisture (A-B)/D x100
BH19-1		SS1	1232.20	1168.40	723.70	444.70	14.3
BH19-1		SS3	1269.40	1172.30	778.50	393.80	24.7
BH19-2		SS8	1269.40	1215.50	555.70	659.80	8.2
BH19-3		SS1	173.31	158.82	41.19	117.63	12.3
		SS2	166.51	148.56	38.16	110.40	16.3
		SS3	122.81	111.94	40.37	71.57	15.2
		SS4	159.65	146.40	39.78	106.62	12.4
		SS5	155.08	144.80	39.20	105.60	9.7
		SS6	152.73	143.30	38.98	104.32	9.0
		SS7	1218.70	1169.10	721.30	447.80	11.1
		SS8	126.30	118.32	39.98	78.34	10.2
		SS9	154.92	145.53	38.59	106.94	8.8
BH19-4		SS8	1271.40	1226.70	717.20	509.50	8.8
BH19-5		SS5	1392.70	1325.90	599.60	726.30	9.2
BH19-5		SS7	1274.40	1217.30	605.40	611.90	9.3
BH19-7		SS3	1305.80	1196.40	720.00	476.40	23.0
BH19-7		SS8	1312.60	1251.80	720.20	531.60	11.4
BH19-10		SS4	1518.50	1435.00	717.30	717.70	11.6
BH19-10		SS7	1273.00	1226.00	721.20	504.80	9.3
BH19-12		SS5	1266.40	1209.50	575.30	634.20	9.0
BH19-12A		SS8	1206.60	1153.40	720.20	433.20	12.3
BH19-13A		SS7	1396.80	1359.90	723.90	636.00	5.8
BH19-15		SS8	1263.60	1197.20	605.20	592.00	11.2
BH19-15		SS3	1418.00	1294.20	722.60	571.60	21.7
BH19-16		SS7	1132.40	1085.80	599.50	486.30	9.6
BH19-17		SS4	1106.70	1037.60	727.20	310.40	22.3
BH19-17		SS8	1278.90	1211.60	728.90	482.70	13.9
BH19-18		SS7	1249.90	1200.60	728.20	472.40	10.4
BH19-19		SS1	188.51	166.20	38.61	127.59	17.5
		SS2	145.95	131.12	40.09	91.03	16.3
		SS3	167.56	150.41	39.35	111.06	15.4
		SS4	160.00	139.18	39.49	99.69	20.9

AME - Materials Engineering
Borehole / Soil Sample Moisture Content (LS-700)

Sample No.:	MG-30824	**Date Sampled:**	08-Jul-19
Job No.:	30291.222	**Date Tested:**	23-Jul-19
Job Name:	Derry Green SIS	**Tested By:**	WB
Source:	BH	**Material Code:**	
Material Type:	SS	**Results To:**	

		SS5	156.98	145.50	38.77	106.73	10.8
		SS6	143.92	136.28	38.61	97.67	7.8
		SS7	189.15	177.81	39.85	137.96	8.2
		SS8	1293.30	1245.70	718.20	527.50	9.0
		SS9	146.93	136.10	39.25	96.85	11.2
BH19-20		SS4	1528.40	1352.70	719.10	633.60	27.7
BH19-20		SS8	1343.50	1230.80	576.10	654.70	17.2

Technician:_____ Supervisor:_____