

July 22, 2021

PML Ref.: 21BF002
Report: 4

Ms. Taylor Pratt
Pratt Hansen
301 King Street
Barrie, Ontario
L4N 6B5

Dear Ms. Pratt

**Guelph Permeameter Testing
Proposed Bistro 6 West Development
Kneeshaw Drive
Barrie, Ontario**

Peto MacCallum Ltd. (PML) is pleased to present the results of the Guelph Permeameter (GP) testing recently completed for the above noted project site. Authorization for this work was provided by Mr. D. Richardson, on behalf of the Client, in an email dated June 27, 2021.

The Bistro 6 West site plan comprises three condominium buildings with one level of underground parking similar to the original Bistro 6 condominium buildings on the east side of Kneeshaw Drive. As part of the development, three Low Impact Development (LID) features are proposed, as shown on Drawing 4-1, attached.

The purpose of this investigation was to conduct GP testing in the areas of the LID features in order to determine specific infiltration parameters.

Field Investigation

PML attended site on July 7, 2021 and Test Pits 1 to 3 were advanced to depths 1.5 of 2.7 m below existing grade at the proposed LID locations. The test pit locations were dug to carry out in-situ GP tests. The test pit locations are shown on Drawing 4-1, appended.

The test pit locations were laid out/surveyed in the field by The Jones Consulting Group (TJCG).

The on-site contractor supplied and operated an excavator, and co-ordinated the clearances of underground utilities in the vicinity of the test pits which were further reviewed by PML on-site. The test pits were backfilled upon completion.

All recovered soil samples were returned to our laboratory for detailed examination to confirm field classification. Six samples of the major soil units were submitted for grain size analysis. Grain size analysis results are presented on Figures 4-1 and 4-2, appended.

The Log of Test Pit sheets are appended. In general, the test pits encountered silty sand till and/or sand and silt till with variable clay and gravel content for the entire depth of excavation. Ground water seepage was not observed in any of the test pits.



Infiltration Assessment

Guelph Permeameter Testing

It is understood the base of the LID features range from about elevation 255.50 to 255.65 (near existing grade).

Two GP tests were completed in each test pit in order to determine the field saturated hydraulic conductivity. The first test was carried out near the surface at a depth of 0.4 to 1.2 m and the second at 1.5 to 2.7 m depth. For each GP test, the water level drop in the GP chamber was visually monitored and recorded until a steady infiltration rate was reached.

The field saturated hydraulic conductivity, K_{fs} , was determined utilizing the Zhang et al. (1998) method as follows:

Single Head Method

$$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi \left(\frac{H_1}{a^*}\right)}$$

Where:

- C = shape factor
- Q = the steady-state rate of fall of water in reservoir (cm/s)
- H = hydraulic head (cm)
- α = borehole radius (cm)

An approximate relationship between K_{fs} and the infiltration rate was established in the Toronto Regional Conservation Authority / Credit Valley Conservation (TRCA/CVC) LID Stormwater Management Planning and Design Guide and was utilized to determine approximate infiltration rates:

$$\text{Infiltrate Rate} = \sqrt[3.7363]{\frac{K_{fs}}{6 \times 10^{-11}}}$$



The test locations and results are summarized below:

| TEST PIT | TEST DEPTH (m) / ELEVATION | MATERIAL TYPE | K_{fs} (cm/sec) | INFILTRATION RATE (mm/hr) | FACTORED INFILTRATION RATE (mm/hr) |
|----------|----------------------------|---------------------------------------|--|---------------------------|------------------------------------|
| 1 | 0.6 / 255.1 1.5 / 254.2 | Silty Sand Till | 1.5×10^{-5} 1.4×10^{-5} | 28 27 | 11 |
| 2 | 0.4 / 254.9 1.5 / 253.8 | Silty Sand Till Sand and Silt Till | 1.2×10^{-5} 1.8×10^{-5} | 26 29 | 11 |
| 3 | 1.2 / 255.5 2.7 / 254.0 | Silty Sand Till | 2.4×10^{-4} 6.4×10^{-6} | 32 22 | 9 |

Particle Size Distribution

Soil samples from each LID feature were submitted for grain size analysis and the Hydraulic Conductivities (K) were estimated based on the particle size distribution. The results of the laboratory testing are included in Figures 1 to 2 and the estimate of Hydraulic Conductivities are summarized in the table below.

| SAMPLE | DEPTH (m) | SOIL TYPE | ESTIMATED K (cm/sec) |
|------------------------------------|--------------------------|---------------------------------------|------------------------|
| Test Pit 1 GP 1 Test Pit 1 GP 2 | 0.4 to 0.6 1.3 to 1.5 | Silty Sand Till | 10^{-5} to 10^{-6} |
| Test Pit 2 GP1 Test Pit 2 GP2 | 0.2 to 0.4 1.3 to 1.5 | Silty Sand Till Silt and Sand Till | $<10^{-6}$ |
| Test Pit 3 GP1 Test Pit 3 GP2 | 1.0 to 1.2 2.5 to 2.7 | Silty Sand Till | $<10^{-6}$ |

The Vukovic & Soro method was used to assess K.

The K value derived from the particle size distribution curve does not take into consideration site specific details such as compaction, soil structure, organic content and/or the degree of saturation.

Closure

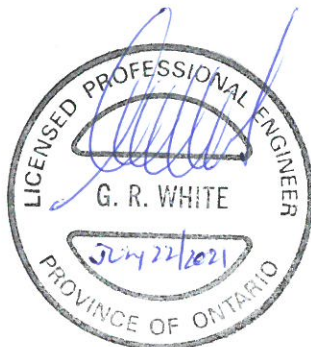
We trust this report is complete within our Terms of Reference. Please do not hesitate to call if you have any questions.

Sincerely

Peto MacCallum Ltd.



Alicia Kimberley, M.Sc., P.Geo.
Associate
Manager, Geoenvironmental and Hydrogeological Services



Geoffrey R. White, P.Eng.
Associate
Manager, Geotechnical Services

AK/GRW:tc

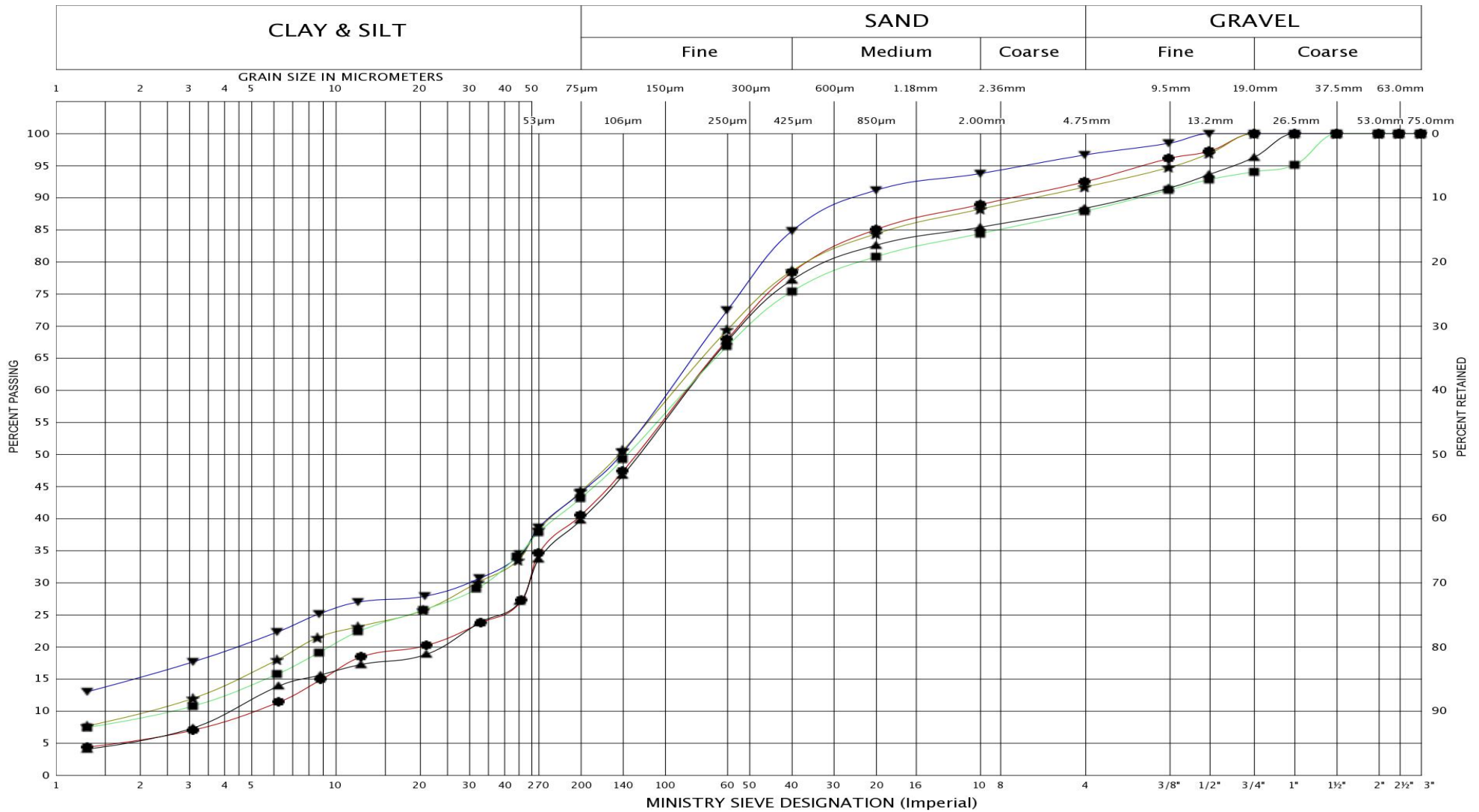
Enclosure(s):

Figure 4-1 to 4-2 – Grain Size Distribution Chart
List of Abbreviations
Log of Test Pit Nos 1 to 3
Test Pit Location Plan Drawing 4-1

Distribution:

1 cc: Ms. T. Pratt, Pratt Hansen (email only)
1 cc: Mr. D. Richardson, The Jones Consulting Group Ltd. (email only)
1 cc: PML Barrie

UNIFIED SOIL CLASSIFICATION SYSTEM



| | | | | | | |
|---------------|---------------|------|------|------|------|------|
| LEGEND | BH | TP 1 | TP 1 | TP 2 | TP 3 | TP 3 |
| | SAMPLE | GS 1 | GS 2 | GS 1 | GS 1 | GS 2 |
| | SYMBOL | ● | ▲ | ★ | ▼ | ■ |

GRAIN SIZE DISTRIBUTION

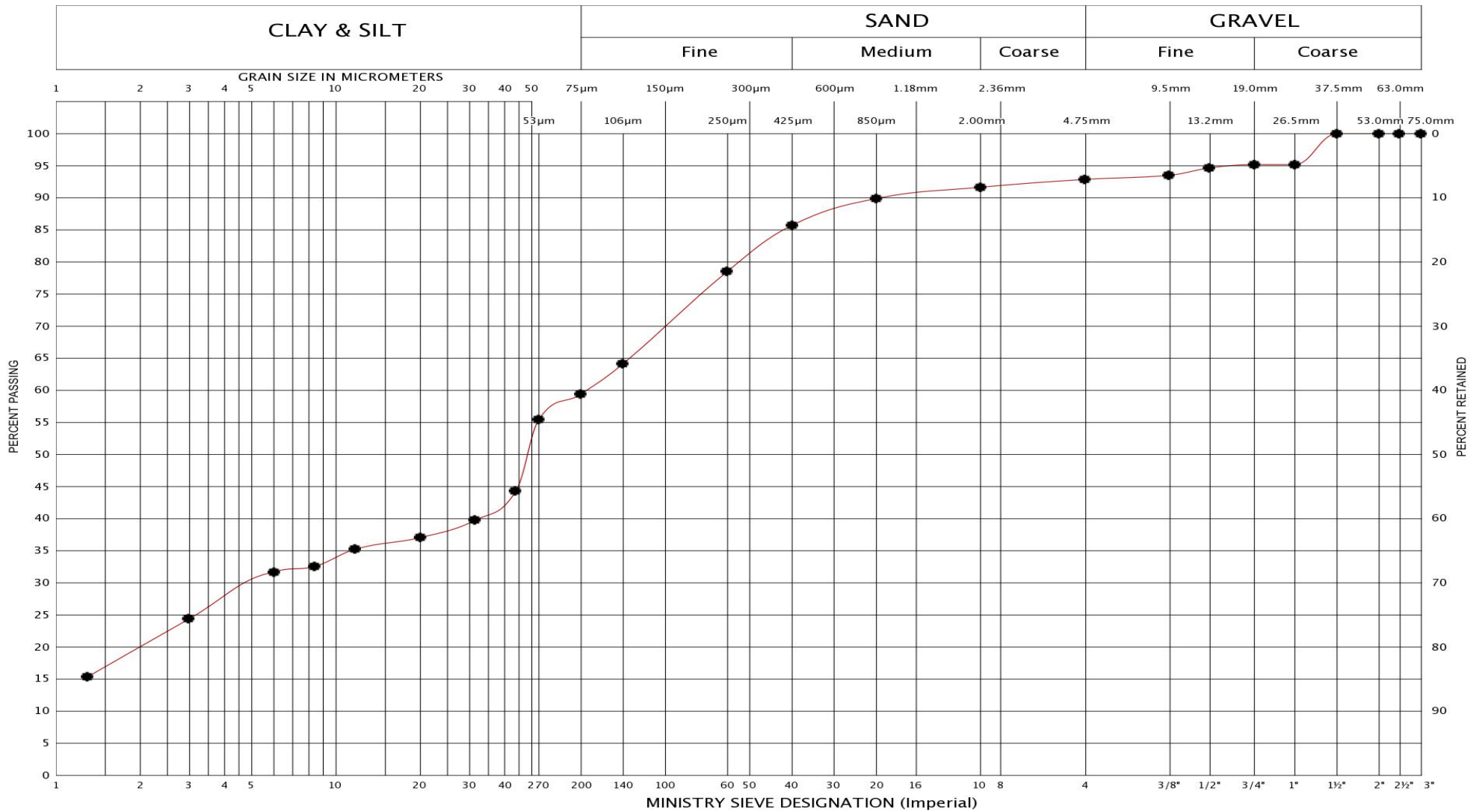
TILL: Silty Sand, Trace to Some Clay, Trace to Some Gravel

FIG No.: 4-1

Project No.: 21BF002



UNIFIED SOIL CLASSIFICATION SYSTEM



| | | |
|---------------|---------------|------|
| LEGEND | BH | TP 2 |
| | SAMPLE | GS 2 |
| | SYMBOL | • |

GRAIN SIZE DISTRIBUTION

TILL: Silt and Sand, Some Clay, Trace Gravel

FIG No.: 4-2

Project No.: 21BF002



LIST OF ABBREVIATIONS



PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

| <u>CONSISTENCY</u> | <u>N (blows/0.3 m)</u> | <u>c (kPa)</u> | <u>DENSENESS</u> | <u>N (blows/0.3 m)</u> |
|--------------------|---------------------------|----------------|------------------|------------------------|
| Very Soft | 0 - 2 | 0 - 12 | Very Loose | 0 - 4 |
| Soft | 2 - 4 | 12 - 25 | Loose | 4 - 10 |
| Firm | 4 - 8 | 25 - 50 | Compact | 10 - 30 |
| Stiff | 8 - 15 | 50 - 100 | Dense | 30 - 50 |
| Very Stiff | 15 - 30 | 100 - 200 | Very Dense | > 50 |
| Hard | > 30 | > 200 | | |
| WTLL | Wetter Than Liquid Limit | | | |
| WTPL | Wetter Than Plastic Limit | | | |
| APL | About Plastic Limit | | | |
| DTPL | Drier Than Plastic Limit | | | |

TYPE OF SAMPLE

| | | | |
|----|-----------------------|-------------------------------|---------------------|
| SS | Split Spoon | ST | Slotted Tube Sample |
| WS | Washed Sample | TW | Thinwall Open |
| SB | Scraper Bucket Sample | TP | Thinwall Piston |
| AS | Auger Sample | OS | Oesterberg Sample |
| CS | Chunk Sample | FS | Foil Sample |
| GS | Grab Sample | RC | Rock Core |
| | PH | Sample Advanced Hydraulically | |
| | PM | Sample Advanced Manually | |

SOIL TESTS

| | | | |
|-----|---------------------------------|----|-----------------|
| Qu | Unconfined Compression | LV | Laboratory Vane |
| Q | Undrained Triaxial | FV | Field Vane |
| Qcu | Consolidated Undrained Triaxial | C | Consolidation |
| Qd | Drained Triaxial | | |

LOG OF TEST PIT NO. 1

PROJECT Proposed Bistro 6 West Development
LOCATION Mapleview Drive East, Barrie, Ontario
EXCAVATION METHOD Excavator

BORING DATE July 7, 2021

PML REF. 21BF002
ENGINEER G. White
TECHNICIAN SG

| SOIL PROFILE | | | SAMPLES | | | SHEAR STRENGTH (kPa) | | | | PLASTIC NATURAL LIQUID | | | UNIT WEIGHT | GROUND WATER OBSERVATIONS AND REMARKS | | | | |
|---------------------|--|------------|---------|------|------------|--|-----|-----|-----|------------------------|------------------|-------|-------------------|--|----|----|----|-----------|
| DEPTH ELEV (metres) | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | + FIELD VANE Δ TORVANE ○ Qu | | | | LIMIT | MOISTURE CONTENT | LIMIT | | | Wp | w | Wl | |
| | | | | | | ▲ POCKET PENETROMETER ○ Q | | | | | | | WATER CONTENT (%) | | | | | |
| | | | | | | DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST × ● | | | | | | | kN/m ³ | GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL | | | | |
| | | | | | | 50 | 100 | 150 | 200 | 20 | 40 | 60 | | | 80 | 10 | 20 | 30 |
| 0.0 | SURFACE ELEVATION 255.65 | | | | | | | | | | | | | | | | | |
| | SILTY SAND TILL: Compact, brown, silty sand, trace to some clay, trace to some gravel, cobbles and boulders, moist | | 1 | GS | | | | | | | | | | | | | | GP Test 1 |
| 1.0 | | | | | | | | | | | | | | | | | | |
| 1.5 | TEST PIT COMPLETED AT 1.5 m | | 2 | GS | | | | | | | | | | | | | | GP Test 2 |
| 2.0 | | | | | | | | | | | | | | | | | | |
| 3.0 | | | | | | | | | | | | | | | | | | |
| 4.0 | | | | | | | | | | | | | | | | | | |
| 5.0 | | | | | | | | | | | | | | | | | | |

NOTES

LOG OF TEST PIT NO. 2

PROJECT Proposed Bistro 6 West Development
LOCATION Mapleview Drive East, Barrie, Ontario
EXCAVATION METHOD Excavator

BORING DATE July 7, 2021

PML REF. 21BF002

ENGINEER G. White

TECHNICIAN SG

| SOIL PROFILE | | | SAMPLES | | | SHEAR STRENGTH (kPa) | | | | PLASTIC NATURAL LIQUID | | | UNIT WEIGHT kN/m ³ | GROUND WATER OBSERVATIONS AND REMARKS | |
|---------------------------|--|------------|---------|------|------------|---|-----------------------------|-----|-----|------------------------|-------|---------------------|---|---|---|
| DEPTH ELEV (metres) | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | ELEVATION SCALE | + FIELD VANE Δ TORVANE ○ Qu | | | | LIMIT | MOISTURE CONTENT | | | LIMIT |
| | | | | | | | ▲ POCKET PENETROMETER ○ Q | | | | | | | | |
| | | | | | | DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST × | | | | WATER CONTENT (%) | | | | | |
| | | | | | | 50 | 100 | 150 | 200 | W _p | W | W _L | 10 20 30 40 | | |
| | | | | | | 20 | 40 | 60 | 80 | | | | GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL | | |
| 0.0 | SURFACE ELEVATION 255.30 | | | | | | | | | | | | | | |
| | SILTY SAND TILL: Compact, brown, silty sand, trace to some clay, trace to some gravel, cobbles and boulders, moist | | 1 | GS | | 255 | | | | | | | | | GP Test 1 |
| 1.00 | 254.30 | | | | | | | | | | | | | | |
| | SILT AND SAND TILL: Compact, brown, silt and sand, some clay, trace gravel, cobbles and boulders, moist | | 2 | GS | | 254 | | | | | | | | | GP Test 2 |
| 1.5 | 253.8 | | | | | | | | | | | | | | TEST PIT COMPLETED AT 1.5 m |
| | | | | | | | | | | | | | | | Upon completion of excavating: No seepage No cave |

NOTES

LOG OF TEST PIT NO. 3

PROJECT Proposed Bistro 6 West Development
LOCATION Mapleview Drive East, Barrie, Ontario
EXCAVATION METHOD Excavator

BORING DATE July 7, 2021

PML REF. 21BF002
ENGINEER G. White
TECHNICIAN SG

| SOIL PROFILE | | | SAMPLES | | | SHEAR STRENGTH (kPa) | | | | PLASTIC NATURAL LIQUID | | | UNIT WEIGHT kN/m ³ | GROUND WATER OBSERVATIONS AND REMARKS |
|---------------------------|---|----------------|---------|-------------|------------|----------------------|--|--|---------------------------------|-------------------------------|--------------------------------|-------------------|----------------------------------|---|
| DEPTH ELEV (metres) | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | ELEVATION SCALE | +FIELD VANE ΔTORVANE ○ Qu | | PLASTIC LIMIT w _p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w _L | WATER CONTENT (%) | | |
| | | | | | | | ▲ POCKET PENETROMETER ○ Q | | | | | | | |
| | | | | | | | DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST | | | | | | | |
| | | 50 100 150 200 | | 20 40 60 80 | | 10 20 30 40 | | | | | | | | |
| 0.0 | SURFACE ELEVATION 256.65 | | | | | | | | | | | | | |
| | SILTY SAND TILL: Loose to compact, brown, silty sand, trace to some clay, trace to some gravel, cobbles and boulders, moist | | | | | | | | | | | | | |
| 1.0 | | | 1 | GS | | | | | | | | | | GP Test 1 |
| 2.0 | | | | | | | | | | | | | | |
| 2.7 | | | 2 | GS | | | | | | | | | | GP Test 2 |
| 254.0 | TEST PIT COMPLETED AT 2.7 m | | | | | | | | | | | | | Upon completion of excavating: No seepage No cave |

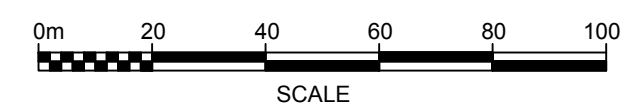
NOTES



KEY PLAN
BARRIE, ONTARIO

- LEGEND:**
- SITE LIMITS
 - APPROXIMATE BUILDING LOCATIONS
 - BH 202
EL. 256.75
BOREHOLE 202
SURFACE ELEVATION
 - BH/MW 201
EL. 256.95
▼ 255.5
BOREHOLE 201 (WITH WELL)
SURFACE ELEVATION
GROUND WATER ELEVATION (2021-04-07)
 - INFERRED HYDROSTATIC GROUND WATER
 - INTERPRETTED GROUND WATER FLOW DIRECTION
 - TP 1
EL. 255.65
TEST PIT 1
SURFACE ELEVATION
 - APPROXIMATE LOCATION OF PROPOSED LID FEATURES

REFERENCE:
BASE PLAN PROVIDED BY CLIENT.



TEST PIT LOCATION PLAN

PROPOSED BISTRO 6 WEST DEVELOPMENT
KNEESHAW DRIVE
BARRIE, ONTARIO



| DRAWN | AK | DATE | SCALE | PML REF. | DRAWING NO. |
|----------|----|-----------|----------|----------|-------------|
| CHECKED | GW | JULY 2021 | AS SHOWN | 21BF002 | 4-1 |
| APPROVED | GW | | | | |