Structural
Environmental
Services

# GEOTECHNICAL REPORT

2-15 unit 2 BR residences
Located at
2345 - 2351 Mer Bleue, Ontario

Prepared for:
Ziad Zamat

Prepared by:
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27 Nov. 2021(1)

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## 1.0 Introduction

EAU Structural and Environmental Services have been retained by Mr Ziad Zamat to carry out a geotechnical study of the land at this address and to determine whether or not, the site is suitable for the construction of the two residential properties.

Each residential property will have 15 two bedroomed apartments.

Each residential property will be fully serviced. There will be a supply of city potable water.

Each residential property will be serviced with a municipal storm and municipal sanitary sewer.

This report is a summary of geotechnical data and design information to support the construction of the two buildings. The report does not investigate the presence of polutants or contaminates or other hazards in the soil. In order to determine whether or not such polutants exist, further testing will have to be undertaken.

## 2.0 Site Information

### 2.1 Observations

A site visit was made in the early part of the month of October and then a second visit was made in the month of November. At the time, there could be seen a bungalow on lot 2345 and a bungalow on lot 2351. These two properties were amid a surounding of new developments.

There was new residential properties to the North, residential properties to the East and also to the South. On the immediate West of the 2 properties was Mer Bleue Road.

Each residence was fully serviced. There was municipal potable water to the East. There was a storm and sanitary sewer to the East.

The two properties were separated by a mature cedar hedge. This was the only natural vegatation at close proximity to the two residences.

The nearby topography around the dwelings, was flat. There were no natural hills or hummocks.

Standing water was seen in the nearby fields in the West. This is an indication of an impermeable horizon, at close proximity to the ground.

Because of the flatness of the two lots and flatness of the terain in the surounding area, there was no possibility of a slope instabilty. Therfore there is no need for a slope stability study.
See Appendix A - Key Location

### 2.2 Test pits

A total of 4 test pits (TP) were dug on the two lots. Two on lot 2345 Mer Bleue and two on 2351 Mer Bleue.
In summary, top soil approximately 150mm thick, represented the first horizon.
Next, approx 300 mm of moist, loosly compacted moist brown sand.
Next, approx 300mm of firm homogenous brown clay.
Next, > 1500mm thick firm, motled brown-grey clay. This clay extended to the bottom of the dig.
The location of the TP's is as shown.
See Appendix B – Original Survey.
See Appendix C – Details of the TPs

### 2.3 Water Table

As mentioned earlier, the TPs were dug in the month of November. We had seen rain in the previous days prior, which explained the reason for the suface water seen at some locations in the West. As the TPs were being dug, this operation typically took about 5mins., in that time no ground water entered the excavations. Therefore the WT (water table) was not found.

## 3.0 Geotechnical Information

### 3.1 Slope Stability

As mentioned earlier, because of the topographical features, i.e., no slope or escarpment in any direction, it is safe to say there is no risk of slope instability.

### 3.2 Native Sand

The native sand horizon at this site was approximately 300mm thick. The native sand was moist to touch. The native sand was sampled, dried and analysed using the standard drying proceedures and standard sieve analysis. The sieve analysis revealed a poorly graded fine sand, type SM, with a poor permeability 20>T>8 mins/cm. The sand had a moisture content MC of 23%. Because of the recent rain, this explains why the sand was wet to the touch and why MC of 23%.
See Appendix C

The shear strength of the native sand was measured, using the in-situ shear vane apperatus. The in-situ un-drained shear strength was found to be as low as 50kPa. and as high as 80kPa.

### 3.3 Native Clay

The in-situ shear strength of the native clay was measured using the shear vane apperatus. The in-situ un-drained shear strength was found to be between 200 – 300kPa. The clay was described as a homogenous, firm, plastic, mouldable clay with good bearing capacity. This clay horizon is an ideal founding layer for the proposed 15 apartment buildings. However a good weeping tile system is required to achieve good drainage below ground level.
See Appendix D

## 4.0 Engineering Considerations

The more this region or location of Mer Bleur is devloped, then the more impermable roofs surfaces, more impermeable asphaltic areas, more impermeable paved areas, we create. When this situation happens, it becomes imperative that we provide a good grading plan and good stormwater management plan. By these methods, we retards the run-off. This may include the design of a retentive structure on the roof, or storing run-off on the access and parking areas, or maximising the area of permeable surface at ground level and or having to think of under-ground storage.

The sand horizon is too thin to be of any Engineering significance, therefore the contractor is expected to remove this layer and make use of the clay horizon for the founding of any major foundations.

The Site Classification for Seismic Site Response has been referenced in the 2014 OBC. In particlar, Table 4.1.8.4.A . Using the un-drained shear strength < 100kPa and an average standard penetration resistance of 50, the Site Class = D whereby the shear wave velocity Vs is between 180 – 360m/s.

For those areas that are paved, i.e., sidewalks, ashaltic driveways etc., the sand can remain in place.

The clay horizon is an ideal founding horizon for the proposed 15 apartment buildings. When it comes to determing the soils bearing capacity, the ULS = 300kPa and the SLS = 200kPa. However a good weeping tile system is required to achieve good drainage below ground level.

When excavating for the deep foundation care should be taken with the side slopes. A safe side slope for most excavations through most materials, be they cohesive or non-cohesive, is 1:1 However, at this site the clay was seen to be very competant, very cohesive, therefore the short term slide slopes can be near vertical.

When excavating for the foundations, care should be taken in preserving the clays in-situ MC. If the MC of the clay is lowered significantly, during the time the excavation is open, then the clay will shrink. If the MC of the clay is increased, then the clay will expand and swell. Both these conditions are un-desireable, so thought must be given to the season that excavation takes place. The use of insulated tarps is one method of protecting the clay from either loosing MC or gaining MC.

The use of a sump pump maybe desirably.
In addition to the weeping tile around the buildings, there will be a need to provide a waterproof membrane to the exterior of the underground foundation walls.

If a shallow foundation is propsed i.e., slab on grade, then the contractor would be wise to remove the sand horizon along with the top soil. These layers should then be stock piled for later use. The contractor is to excavate to un-disturbed soil. The use of Granular “A”, compacted in layers < 300mm thick, to 95% Proctor Standard is required. Then the use of Hi Load 40 styroform. Then the use of a gas barrier. All of these matarials and construction requirements will be required before pouring the Engineer designed concrete slab.

## 5.0 Conclusions

From the site visits, the field work and the lab work done on this project, we can conclude that the site has:

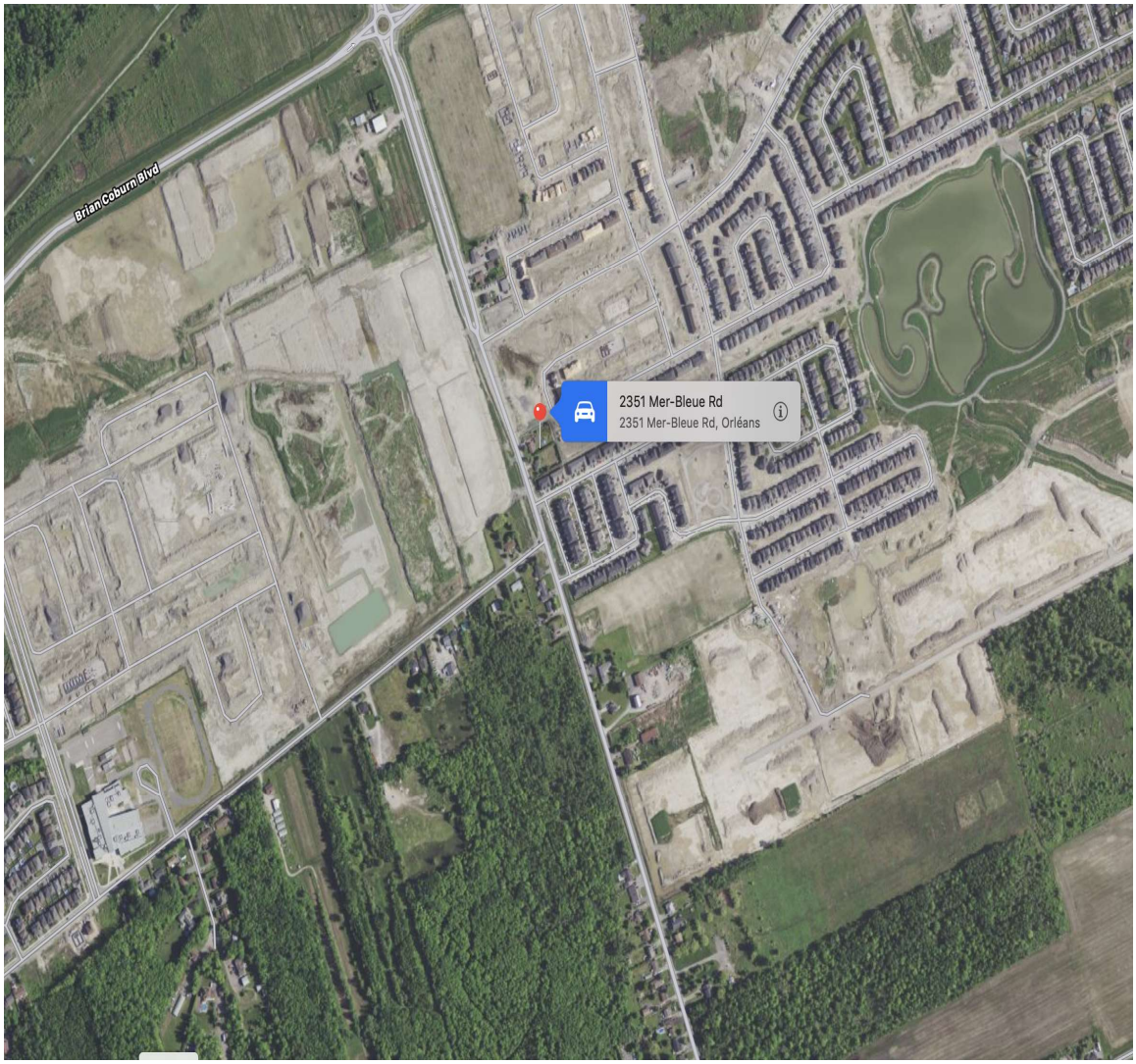
- a BM is in the ROW in the West
- TOG levels in the North - East
- city water in the East
- recent WV's on both lots
- both sanitary and storm sewer mains at close proximity, in the East
- a lot slope of <2% Southerly
- few trees, hedges and shrubs
- a thin vineer of re-usable top soil
- a thin vineer of re-usable native sandy silt of low permeability
- elevated WT due to impermeable clay found at high elevation
- lot drainage problems
- a clay horizon with good bearing properties for foundations
- A basement is feesible however a weeping tile + waterproofing is required
- A slab on grade is feesible however frost protection will be required
- Quality backfill is required therefore imported fill is required

## 6.0 Recommendations

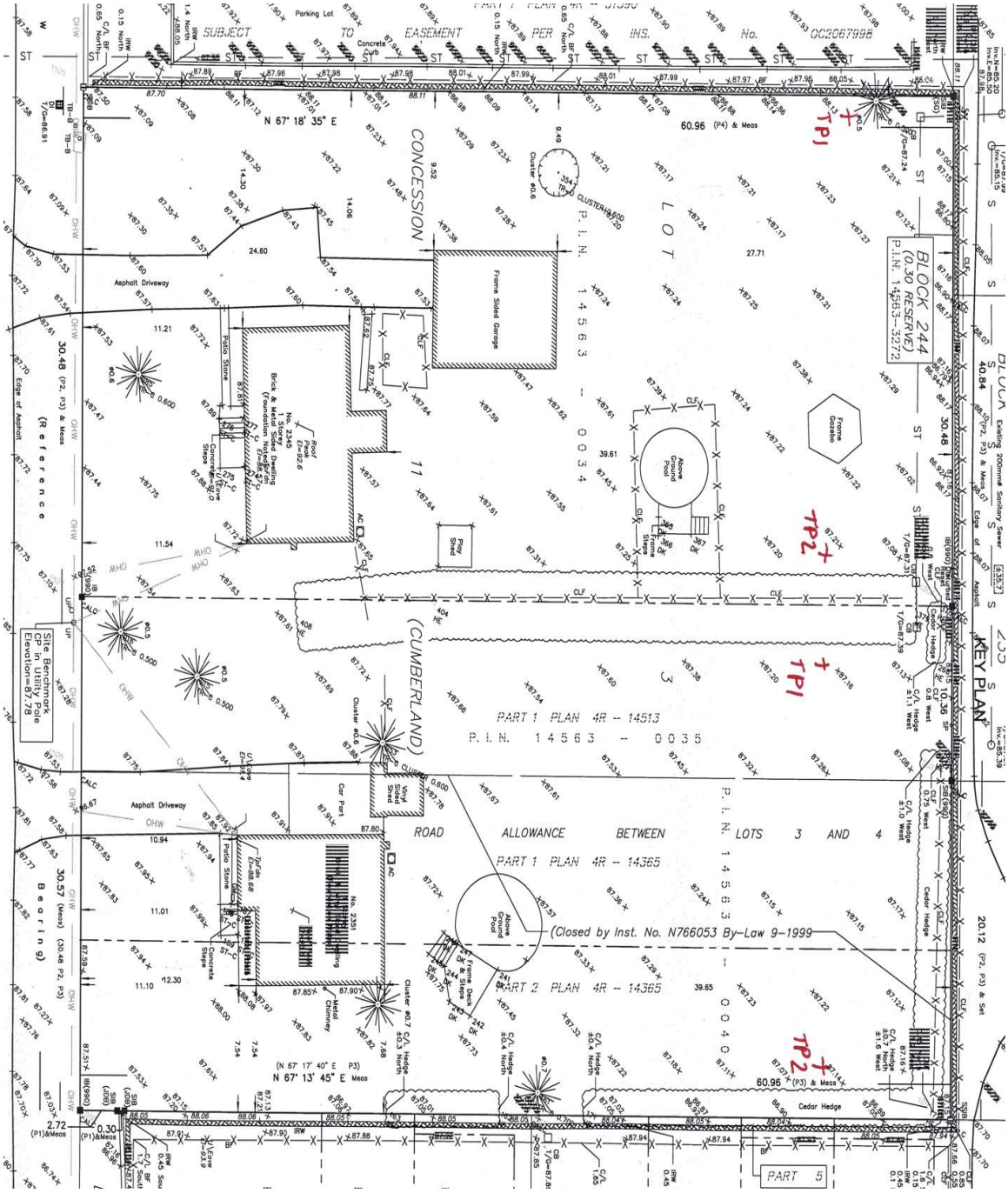
From the work and the site visits made in October and November 2021, we have a number of recommendations to make.
We have seen the site is stable from the point of Slope Stability but there are concerns about the drainage. I suspect, when there are long periods of rain there will be ponding on the surface. Therefore with little to no presence of trees, shrubs etc., a “good” SWM report and Graiding and Drainage plan is needed. As mentioned earlier this may mean having to adopt more than one method of “retenting” run-off.
Where the basement option is selected, we recommend a weeping tile be used together with a waterproof membrane on the foundations.
Where a slab on grade is used, we recommend adequate frost protection be provided together with the removal of the native sand layer.

**D R Clark**

# APPENDIX A – Key Location

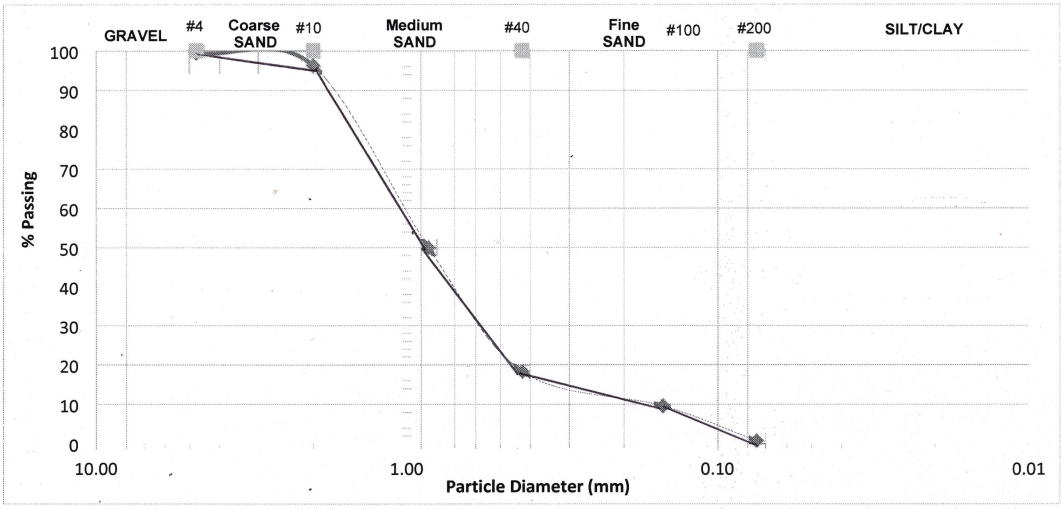


# APPENDIX B – Original Survey



# APPENDIX C – Sieve Analysis

## EAU Structural Environmental Svs




**Grain Size Distribution Curve Results:**

| | | | | | |
|---|---|---|---|---|---|
| **% Gravel:** | 0 | $D_{10}$: | 0.15 | $C_u$: | 1.67 |
| **% Sand:** | 60 | $D_{30}$: | 0.6 | $C_c$: | 0.00 |
| **% Fines:** | 10 | $D_{60}$: | 1 | | |
| | | D50: | 0.85 | | |

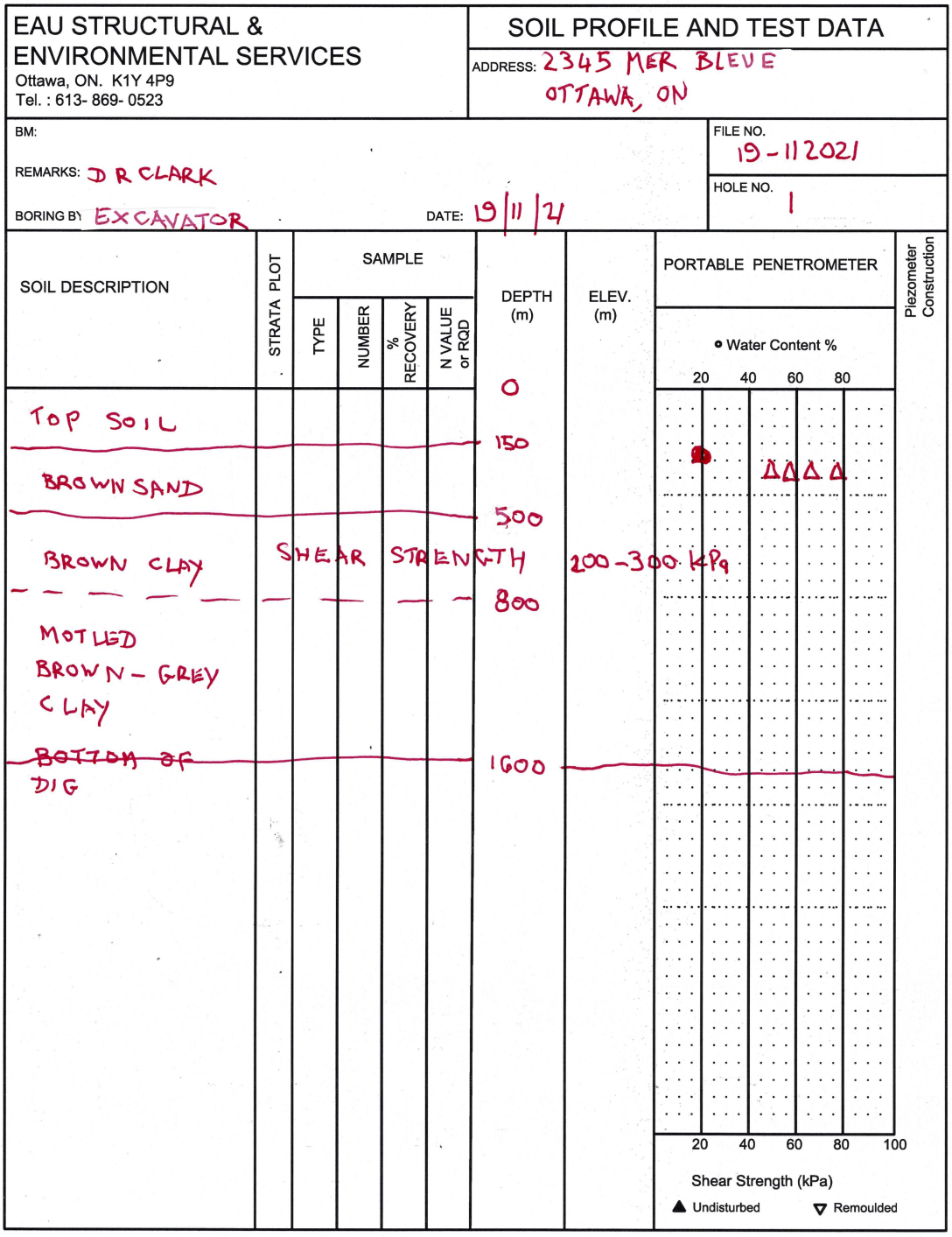
**Comments**

Ziad Zarmat 2345/2351 Mer Bleue

date: 19 Nov. 2021

description: poorly graded fine (brown) sand type SM 20 >T>8 min/cm

# APPENDIX D – TP data



EAU STRUCTURAL & ENVIRONMENTAL SERVICES
Ottawa, ON. K1Y 4P9
Tel. : 613- 869- 0523

SOIL PROFILE AND TEST DATA

ADDRESS: 2345 MER BLEUE
OTTAWA, ON

BM:

REMARKS: J R CLARK

BORING BY: EXCAVATOR

DATE: 19/11/24

FILE NO. 19-112021

HOLE NO. 1

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| TOP SOIL | | | | | | 0 | |
| | | | | | | 150 | |
| BROWN SAND | | | | | | 500 | |
| BROWN CLAY | | | | | | | |
| SHEAR STRENGTH 200-300 kPa | | | | | | 800 | |
| MOTLED BROWN - GREY CLAY | | | | | | | |
| ~~BOTTOM OF~~ DIG | | | | | | 1600 | |

PORTABLE PENETROMETER

Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed ▽ Remoulded

Piezometer Construction

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Tel. : 613- 869- 0523

# SOIL PROFILE AND TEST DATA

ADDRESS: 2345 MER BLEUE
OTTAWA, ON

BM:

REMARKS: D R CLARK

FILE NO. 19-112021

HOLE NO. 2

BORING BY: EXCAVATOR DATE: 19/11/21

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| TOP SOIL | | | | | | 0 | |
| | | | | | | 150 | |
| BROWN SAND | | | | | | 400 | |
| BROWN CLAY | | SHEAR STRENGTH 200-300 KPa | | | | | |
| | | | | | | 800 | |
| MOTLED BROWN-GREY CLAY | | | | | | | |
| ~~BOTTOM OF~~ DIG | | | | | | 1800 | |

PORTABLE PENETROMETER

Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed ▽ Remoulded

Piezometer Construction

EAU STRUCTURAL & ENVIRONMENTAL SERVICES
Ottawa, ON. K1Y 4P9
Tel. : 613- 869- 0523

# SOIL PROFILE AND TEST DATA

ADDRESS: 2351 MER BLEUE
OTTAWA, ON

BM:

REMARKS: D.R CLARK

FILE NO. 19-11202

HOLE NO. 1

BORING BY: EXCAVATOR DATE: 19/11/21

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| TOP SOIL | | | | | | 0 | |
| | | | | | | 150 | |
| BROWN SAND | | | | | | 400 | |
| BROWN CLAY | | SHEAR STRENGTH 200-300 kPa | | | | | |
| MOTLED BROWN-GREY CLAY | | | | | | 700 | |
| BOTTOM OF DIG | | | | | | 2000 | |

PORTABLE PENETROMETER

Piezometer Construction

Water Content %
20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed ▽ Remoulded

| EAU STRUCTURAL & ENVIRONMENTAL SERVICES<br>Ottawa, ON. K1Y 4P9<br>Tel. : 613- 869- 0523 | SOIL PROFILE AND TEST DATA<br>ADDRESS: 2351 MER BLEUE<br>OTTAWA, ON |
|---|---|
| BM:<br>REMARKS: D R CLARK<br>BORING BY: EXCAVATOR DATE: 19/11/21 | FILE NO. 19-11202/<br>HOLE NO. 2 |

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) | PORTABLE PENETROMETER | Piezometer Construction |
|---|---|---|---|---|---|---|---|---|---|
| TOP SOIL | | | | | | 0 | | | |
| BROWN SAND | | | | | | 150 | | | |
| BROWN CLAY | | | | | | 300 | | | |
| | | SHEAR STRENGTH 200 - 300 KPa | | | | | | | |
| MOTLED BROWN-GREY CLAY | | | | | | 700 | | | |
| BOTTOM OF DIG | | | | | | 1800 | | | |

PORTABLE PENETROMETER

Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed ▽ Remoulded