Peto MacCallum Ltd.
CONSULTING ENGINEERS

# GEOTECHNICAL/HYDROGEOLOGICAL INVESTIGATION
# PROPOSED EXPANSION OF MELVILLE COURT SUBDIVISION
# ORO-MEDONTE, ONTARIO

**for**

**DONCOR DEVELOPMENTS INC.**

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PML Ref.: 21BF010
Report: 1
June 2021

Peto MacCallum Ltd.
CONSULTING ENGINEERS

June 7, 2021

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Report: 1

Mr. Rod Miskey
DonCor Developments Inc.
c/o Mr. Marty Veenstra
1004 Line 4 North
Oro-Medonte, Ontario
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Dear Mr. Miskey

**Geotechnical/Hydrogeological Investigation**
**Proposed Expansion of Melville Court Subdivision**
**Oro-Medonte, Ontario**

Peto MacCallum Ltd. (PML) is pleased to present the results of the Geotechnical/Hydrogeological investigation recently completed at the above noted project site. Authorization for the work described in this report was provided by Mr. R. Miskey in the signed engineering services agreement dated February 8, 2021.

It is planned to expand the subdivision on Melville Court in the Township of Oro-Medonte. There are existing residential lots on the south side of Melville Court. The proposed expansion will add fourteen residential lots on the north side of Melville Court and two more lots off of Line 5. The land is currently being utilized for agricultural purposes with a treed area at the east end along Line 5. Full-depth basements are being planned and each lot will have a septic system and a well.

The purpose of this investigation was to assess the subsurface conditions at the site, and based on this information, provide comments and Geotechnical engineering recommendations for earthworks, building foundations and basements, and paraments for septic design. Hydrogeological recommendations include a preliminary water balance, desktop domestic well assessment, ground water flow direction and gradient, and assessment of ground water quality for septic design and sizing of lots.

Four boreholes were advanced across the site. Topsoil was encountered over varying units of till, silty sand to sandy silt, or sand units. Ground water was encountered within 1.0 m in the east of the site.

Typical construction methods should be applicable for the site, and full depth basements can be constructed, however high ground water table on the east side of the site will force a grade raise, if basements are still being considered.

We trust the information in this report is sufficient for your present purpose. If you have any questions, please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.

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

AK/GRW:tc

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## 1. INTRODUCTION

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The comments and recommendations provided in this report are based on the site conditions at the time of the investigation, and are applicable only to the proposed works as addressed in the report. Any changes in the proposed plans will require review by PML to re-assess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.

This report is subject to the Statement of Limitations that is included in Appendix A and must be read in conjunction with the report.

## 2. INVESTIGATION PROCEDURES

### 2.1 Geotechnical Investigation

The Geotechnical field work for this investigation consisted of Boreholes 1 to 4, advanced on March 3, 2021, extending to 5.0 to 6.5 m depth. Borehole locations are shown on Drawing 1, appended.

PML laid out the boreholes in the field. The ground surface elevation at the borehole locations was obtained with a Sokkia SHC5000 Global Navigation Satellite System (GNSS). Vertical and horizontal accuracy of this unit are 0.1 and 0.5 m, respectively. All elevations in this report are geodetic and expressed in metres.

Co-ordination for clearances of underground utilities was provided by PML. The boreholes were drilled cognizant of the underground utilities.

The boreholes were advanced using continuous flight hollow stem augers, powered by a track mounted D-50 drill rig, equipped with an automatic hammer, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of PMLs engineering staff.

Where topsoil was encountered at the surface, the thickness was measured in hand dug divots.

Representative samples of the overburden were recovered at frequent depth intervals for identification purposes using a conventional 51 mm OD split spoon sampler. The sample excluded particles larger than 38 mm. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the subsoil. The ground water conditions in the boreholes were assessed during drilling by visual examination of the soil samples, the sampler, and drill rods as the samples were retrieved, and measurement of the water level in the open boreholes, if any.

Monitoring wells, comprised of 50 mm diameter PVC pipe with a 1.5 m long screen at the bottom, filter sand, bentonite seal and stick-up protective casing, was installed in four boreholes to permit ground water level monitoring. The details of the monitoring well installation are shown on the applicable Log of Borehole sheets. It should be noted that the well becomes the property of the

Owner and will have to be decommissioned by the Owner in accordance with O.Reg. 903. PML would be pleased to assist, if requested.

PML is currently conducting a six-month water level monitoring program. Results will be provided in a separate letter.

All recovered samples were returned to our laboratory for detailed examination and moisture content determinations. Grain size analyses were carried out on four samples of the major soil units. The laboratory test results are provided on Figures 1 to 3, appended.

Geotechnical engineering considerations are addressed in Section 5.

## 2.2 Hydrogeological Investigation

### 2.2.1 Ground Water Sampling

PML returned to site March 30, 2021 to retrieve one representative ground water sample from the monitoring well in Borehole 3. The ground water sample was obtained after well development, which consisted of removing an equivalent of about ten times the well volume. The ground water sample was collected and submitted for chemical testing as described below. The ground water sample was kept cool with ice in a cooler until delivery to the laboratory for analysis.

The ground water sample was delivered to Caduceon Environmental Laboratories (Caduceon) for chemical analyses. Caduceon Laboratories is accredited by The Standards Council of Canada (SCC) and CALA.

The ground water sample was submitted for chemical analysis of nitrate/nitrite and phosphorous.

The Chain-of-Custody Record and the laboratory certificates of analyses are discussed further in Section 6.3.

Hydrogeological considerations are addressed in Section 6.

### 2.3 Geoenvironmental Investigation

A limited chemical testing program was carried out to check the geoenvironmental quality of the site soils in order to provide comments regarding on-site reuse or off-site disposal options for excess excavated soil.

The Chain-of-Custody Record and the laboratory certificates of analyses are discussed further in Section 7.

## 3. SITE SETTING

The site is rectangular in shape and is approximately 6.5 ha in size. The site is located to the north of the existing Melville Court subdivision. The site is currently vacant with residential properties to the south, west and east, and agricultural land use to the north.

### 3.1 Physiography and Topography

The site is located within the physiographic region known as the Simcoe Uplands comprising till plains (Chapman and Putnam, 1984).

The borehole elevations indicate about 6.0 m of relief across the site, with elevations ranging from 290.1 to 296.0, gently sloping down from the west to the east.

### 3.2 Drainage and Surface Water Flow

There are no apparent water courses on-site. A tributary of Shelswell's Creek lies approximately 650 m south of the site and flows towards the south to Lake Simcoe. Surface drainage on the site is expected to follow the topography (east) towards Line 5 and regional surface drainage and ground water flow is believed to be to the south towards Lake Simcoe.

## 4. GEOLOGY AND SUBSURFACE CONDITIONS

### 4.1 Geology

Bedrock below the overburden is mapped as limestone, dolostone, shale, arkose, and sandstone of the Simcoe Group from the Middle Ordovian period of the Paleozoic era of the Phanerzoic eon. Bedrock is anticipated at depths greater than 90 m based on the Ontario Division of Mines preliminary Map P.980 Drift Thickness Series for the Barrie Area.

### 4.2 Subsurface Conditions

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions, including topsoil thicknesses, soil classifications, inferred stratigraphy and thicknesses, Standard Penetration test N Values (N Values, blows per 300 mm penetration of the split spoon sampler), well installation details, ground water level observations, and the results of laboratory moisture content determinations.

Due to the soil sampling procedures and the limited size of samples, the depth/elevation demarcations on the borehole logs must be viewed as “transitional” zones, and cannot be construed as exact geologic boundaries between layers. PML should be retained to assist in defining the geological boundaries in the field during construction, if required.

Topsoil was encountered overlying till, sand and silt and/or sand units. A description of the distribution of the subsurface conditions encountered is provided below.

#### 4.2.1 Soil

Topsoil was present at the surface of all boreholes, ranging from 220 to 280 mm in thickness.

A silt and sand unit was encountered beneath the topsoil in Boreholes 1, 3, and 4, extending to 0.76 to 2.9 m depth (elevation 289.34 to 293.1). A sample of the unit was submitted for grain size analysis and the results are presented on Figure 1, appended. The unit ranged from very loose to very dense with N Values of 3 to greater than 50. The unit was moist with moisture contents of 6 to 17%.

A sand layer was encountered beneath the silt and sand unit in Boreholes 3 and 4, extending to 4.8 m to the 6.5 m depth of exploration, respectively. Sand was below the till in Borehole 1 to the 6.0 m depth of exploration. Two layers of sand were encountered in Borehole 2 from below the topsoil to 2.1 m depth (elevation 289.1) and from 4.0 m depth to 5.0 m depth of exploration. Two samples of the unit were submitted for grain size analysis and the results are presented on Figure 2, appended. The sand was loose to very dense with N Values of 4 to 73 and moist to wet, with moisture contents of 5 to 27%.

A till deposit was encountered in Boreholes 1, 2, and 3, beneath the silt and sand, or sand units. The unit extended to 2.1 to 4.0 m depth (287.2 to 286.0), or to the 6.5 m depth of exploration. A sample of the unit was submitted for grain size analysis, and the results are presented on Figure 3, appended. The matrix consisted of a silty sand with trace gravel and trace clay. Cobbles and boulders were noted during drilling. The unit was compact to very dense, with N Values of 12 to 92, and moist with moisture contents of 9 to 15%.

4.2.2 Ground Water

The first water strike (ground water first encountered during drilling), the ground water/wet cave levels measured in the boreholes upon completion of augering, and ground water level measured in the wells following completion are summarized in the table below, on a borehole by borehole basis.

| BOREHOLE / MONITORING WELL | FIRST STRIKE DURING DRILLING DEPTH (m) / ELEVATION | UPON COMPLETION OF AUGERING DEPTH (m) / ELEVATION | WATER LEVEL IN WELL DEPTH (m) / ELEVATION | |
|---|---|---|---|---|
| | | | 2021-03-30 | 2021-05-20 |
| 1 | 3.1 / 287.0 | 5.2 / 284.9 | 0.9 / 289.2 | 1.3 / 288.8 |
| 2 | 2.1 / 289.1 | No water | -- | -- |
| 3 | 2.1 / 291.3 | 6.0 / 287.4 | 4.3 / 289.1 | 4.2 / 289.2 |
| 4 | 1.7 / 294.3 | 6.0 / 290.0 | Dry | Dry |

The regional ground water table is believed to be below the depth of exploration. Local perched water in the sand and silt/sand/silty sand till stabilized at 0.9 to 4.3 m below existing grade, corresponding to elevation 288.8 to 289.2. It is noted that a ground water monitoring program is on-going, additional ground water monitoring results will be reported separately.

The perched ground water flow direction is towards the east towards Line 5 with a gradient of 0.2%; however, based on source water protection mapping in the area it is anticipated that that regional ground water flow direction is towards the southeast to Lake Simcoe.

Ground water levels will fluctuate seasonally, and in response to variations in precipitation.

## 5. GEOTECHNICAL ENGINEERING CONSIDERATIONS

### 5.1 General

It is planned to expand the subdivision on Melville Court in the Township of Oro-Medonte. There are existing residential lots on the south side of Melville Court. The proposed expansion will add 14 residential lots on the north side of Melville Court and two more lots off of Line 5. The land is currently being utilized for agricultural purposes with a treed area at the east end along Line 5. Full-depth basements are being planned and each lot will have a septic system and a well.

### 5.2 Site Grading and Engineered Fill

Grading was not provided at the time of this report.

A cut may be needed in the west as the grade north of the road is somewhat higher than the road. At the east end of the site, the water table is expected within 1.0 m of the surface. A grade raise will be required if basements are desired. It is recommended that basements be established a minimum 0.5 m above the stabilized ground water level.

Any grade raise below structures should be constructed as engineered fill. The existing topsoil and upper 1.0 to 2.0 m of loose/very loose native soil is not suitable to support footings or floor slabs due to concerns with settlement. In this regard, it is recommended that existing topsoil and upper very loose/loose native soils be removed/reworked. Grades under the buildings can be raised with engineered fill to required levels.

Reference is made to Appendix B for guidelines for engineered fill construction. The following general highlights are provided:

- Strip existing topsoil, fill, upper very loose to lose native soil, and other deleterious materials down to competent native soil, subject to Geotechnical review during construction. The excavated native soil should be segregated and stockpiled separately for reuse or disposal, subject to geotechnical review;

- Proofroll exposed subgrade using a heavy roller to targeted 100% Standard Proctor maximum dry density (SPmdd) for the building areas and 95% SPmdd for other areas, under geotechnical review;

- Following geotechnical review and approval of the subgrade, spread approved material in maximum 200 mm thick lifts and uniformly compacted to 100% SPmdd in building areas and 95% SPmdd in other areas. If wet subgrade conditions are present the use of Granular B Type II may be required for the first lift or two of engineered fill;

- Organics, topsoil, oversized material (over 150 mm in diameter) or otherwise deleterious materials are not suitable for reuse as engineered fill. The excavated site soil is generally considered suitable for reuse as engineered fill, subject to moisture content and geotechnical review during construction. Imported material, if required should comprise OPSS Granular B or OPSS Select Subgrade Material (SSM). Other sources of imported material should be reviewed by our office to ensure suitability;

- The engineered fill pad must extend at least 1 m beyond the structure to be supported, then outwards and downwards at no steeper than 45° to the horizontal to meet the underlying approved native subgrade. In this regard, strict survey control and detailed documentation of the lateral and vertical extent of the engineered fill limits should be carried out to ensure that the engineered fill pad fully incorporates the structure to be supported;

- Engineered fill construction must be carried out under full-time field review by PML, to approve sub-excavation and subgrade preparation, backfill materials, placement and compaction procedures, and to verify that the specified compaction standards are achieved throughout.

## 5.3 Foundations

The basement floor slab is assumed to be established 3.0 m below proposed grade. In the areas to the east of the site, basements will require a grade raise due to the high ground water table.

The available bearing capacity on native soils, on a borehole by borehole basis is provided below:

| BOREHOLE | DEPTH (m) / ELEVATION | ANTICIPATED SUBGRADE SOIL TYPE | GEOTECHNICAL BEARING RESISTANCE AT SLS* (kPa) | FACTORED BEARING RESISTANCE AT ULS** (kPa) |
|---|---|---|---|---|
| 1 | 0.7 / 289.4 | Till | 120 | 180 |
| | 1.5 / 288.6 | Till / Sand | 200 | 300 |
| 2 | 2.1 / 289.1 | Till | 200 | 300 |
| 3 | 2.2 / 291.2 | Silt and Sand | 200 | 300 |
| 4 | 0.7 / 295.3 | Silt and Sand / Sand | 200 | 300 |

* Serviceability Limit State – SLS
** Ultimate Limit State – ULS

As discussed earlier, any upfilling under buildings will need to be constructed as engineered fill. Footings founded on engineered fill, constructed as noted above, can be designed for a net Geotechnical bearing resistance at SLS of 150 kPa and a factored bearing resistance at ULS of 225 kPa.

The bearing resistance at SLS is based on total settlement of 25 mm in the bearing stratum with differential settlement of 75% of this value.

Footings subject to frost action should be provided with a minimum 1.2 m of earth cover or equivalent insulation. If there are any walkout basement areas, footings will have to be stepped down.

Prior to placement of structural concrete, all founding surfaces should be reviewed by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions revealed in the excavation.

Based on the soil profile revealed in the boreholes, Site Classification D is applicable for Seismic Site Response as set out in Table 4.1.8.4.A of the Ontario Building Code (2012). Based on the type and relative density of the soil cover at the site, there is a low to moderate potential for liquefaction of soils to occur.

### 5.4 Basement Walls and Floor Slabs

Based on the available data to date, the stabilized perched ground water, where encountered, is at 0.9 to 4.2 m below existing grade, corresponding to elevation 288.8 to 289.2.

It is recommended that basements be established a minimum 0.5 m above the stabilized ground water level. Underfloor drains will be required when ground water is less than 1.0 m below the basement slab.

Full depth basements are proposed for the buildings. As such, perimeter walls must be designed to resist the unbalanced horizontal earth pressure imposed by the backfill adjacent to the walls. The lateral earth pressure, P, may be computed using the following equation and assuming a triangular pressure distribution:

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

Where
- $P$ = lateral pressure at depth h (m) below ground surface (kPa)
- $K$ = lateral earth pressure coefficient of compacted backfill = 0.5
- $h$ = depth below grade (m) at which lateral pressure is calculated
- $\gamma$ = unit weight of compacted backfill = 21.0 kN/m$^3$
- $q$ = surcharge loads (kPa)
- $C_p$ = compaction pressure

The above equation assumes that drainage measures will be incorporated to prevent the buildup of hydrostatic pressure. In this regard, foundation wall backfill should comprise free draining granular material conforming to OPSS Granular B in conjunction with a weeping tile system. The weeping tiles should be protected by a properly designed granular filter or geotextile to prevent migration of fines into the system. The drainage pipe should be placed on a positive grade and lead to a frost-free outlet. The basement walls should be damp proofed. Alternatively, the native soil can be utilized with a proprietary drainage board product.

Basement wall backfill should be placed in thin lifts compacted to a minimum 95% SPmdd. Over compaction close to the walls should be avoided as this could generate excessive pressure on the walls.

Basement floor slab construction is feasible on native soils or engineered fill, as discussed above. A minimum 200 mm thick base layer of crushed stone (nominal 19 mm size) is recommended directly under the slab. A polyethylene sheet vapour barrier is recommended as a vapour barrier.

Exterior grades should be established to promote surface drainage away from the buildings.

Reference is made to appended Figure 4, for general recommendations regarding drainage and backfill requirements.

### 5.5 Excavation and Ground Water Control

It is anticipated that excavation for the building foundations and septic system (discussed later in the report) will extend as deep as 3.0 m below existing grade. Excavation will encounter native sand and silt, sand, and silty sand till. Cobbles and boulders and harder digging in the till and other very dense soil can be expected.

Subject to the ground water control as discussed below, the site soils encountered at the site should be considered as Type 3 soil requiring excavation sidewalls to be constructed at no steeper than one horizontal to one vertical (1H:1V) from the base of the excavation in accordance with the Occupational Health and Safety Act.

For the western half of the site, the ground water table was more than 4.2 m below the ground surface. As such, conventional sump pumping is anticipated to suffice to control local seepage and surface water runoff for house construction to an anticipated 3.0 m depth of exploration.

For the eastern half of the site, the ground water table was within 1.0 to 2.0 m of the ground surface, and excavation below these levels will require that the ground water table be lowered a minimum 0.5 m below the deepest excavation point to permit excavation in the “dry”. Dewatering will be required. Any dewatering system must be designed and installed by specialists in the field.

Excavation during the dry time of the year, when the ground water table is at its lowest, is recommended in order to reduce ground water control requirements.

Water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) and the Water Takings and Transfer Regulation O. Reg. 387/04. Section 34 of the OWRA requires anyone taking more than 50,000 L/d to notify the Ministry of the Environment, Conservation and Parks (MECP). This requirement applies to all withdrawals, whether for consumption, temporary construction dewatering, or permanent drainage improvements. Where it is assessed than more than 50,000 L/d but less than 400,000 L/d of ground water taking is required, the Owner can register online via the Environmental Activity and Sector Registry (EASR) system. Where it is assessed that more than 400,000 L/d of ground water taking is required then a Category 3 Permit-to-Take-Water (PTTW) is required.

A PTTW or registry on the EASR is not anticipated for building excavations within west half of the site; however, may be required for building excavations within east half of the site. When design details are established, they should be provided to PML for review and assessment for a PTTW on the EASR.

It is recommended that a test dig be undertaken to allow prospective contractors an opportunity to observe and evaluate the conditions likely to be encountered and assess preferred means of excavation and ground water control measures based on their own experience.

### 5.6 Geotechnical Review and Construction Inspection and Testing

It is recommended that the final design drawings be submitted to PML for geotechnical review for compatibility with site conditions and recommendations of this report.

Earthworks operations should be carried out under the supervision of PML to approve subgrade preparation, backfill materials, placement and compaction procedures and check the specified degree of compaction is achieved throughout.

Prior to placement of structural concrete, all founding surfaces must be inspected by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions.

The comments and recommendations provided in the report are based on information revealed in the boreholes. Conditions away from and between boreholes may vary. Geotechnical review during construction should be ongoing to confirm the subsurface conditions are substantially similar to those encountered in the boreholes, which may otherwise require modification to the original recommendations.

## 6. HYDROGEOLOGICAL CONSIDERATIONS

A Hydrogeological investigation has also been requested for the site to provide recommendations for a preliminary water balance, desktop domestic well assessment, ground water flow direction and gradient, and assessment of ground water quality for septic design and sizing of lots.

### 6.1 Aquifers and Local Ground Water Use

The Water Well Records (WWRs) shown on the MECP website within a 500 m study area are tabulated in Appendix C. A total of forty-two WWRs were identified.

The following is summary of the forty-two well records:

- All forty-two WWRs were for water supply (domestic, public/municiapl, and/or irrigation).
- Water wells were installed at depths of 9.7 to 58.0 m below ground surface at the time of drilling within sand units with varibale gravel and silt.
- The water supply wells typically comprised 102 to 762 mm diameter drilled wells. The WWRs indicate the drilling was terminated at depths of 5.5 to 60.0 m below ground surface at the time of drilling.
- Typically fresh water was encountered during drilling, and static water levels were recorded at depths of 1.2 to 12.8 m below ground surface at the time of drilling.
- Pump test have been completed in thrity-nine recorded water wells, with pumping tests ranging from 1.0 to 34.0 hours with pumping rates of 2 to 132 GPM (10,902 to 719,531 L/day). Durign the pumping tests drawdowns of about 1.5 to 36.0 m were observed.

Based on the pump tests completed on the wells in the vicinity of the site (MECP WWRs), it is probable that private potable water supply wells can be developed on-site for each lot. It is noted that the MECP considers a well to be sustainable with a minimum yield of 13.7 L/min (19,728 L/day), considering a four-bedroom dwelling. Following well installation, a pump test will be required to confrim that an adequate water supply can be developed on the property and that the sustained pumping rate will not have an adverse impact on other wells in the area.

During the pumping test it is also recommended that a sample from the on-site test well be collected, follwing installation, and tested to ensure the quality of the water meets the Ontario Drinking Water Standards (ODWS).

It should be noted that the site is not within either a Well Head Protection Area (WHPA) nor an Intake Protection Zone (IPZ) for municipal water supply; however, the western portion of the site is located with in a significant Ground Water Recharge Area (vulnerability score of 2).

## 6.2 Septic System Considerations

### 6.2.1 Grain Size Distribution

Four samples from the near surface site soils were submitted for particle size analysis. Based on the grain size distribution curves (Figures 1 to 3, appended), the estimated permeability, K, and percolation rate, "T", for the sample tested based on OBC (2012) Supplementary Standards SB-6, are summarized as follows:

| BOREHOLE | DEPTH (m) | SOIL DESCRIPTION | ESTIMATED PERMEABILITY K (cm/sec) | "T"-TIME (min/cm) |
|---|---|---|---|---|
| 1 | 1.4 to 1.9 | Silty Sand (Till) | $10^{-5}$ to $10^{-6}$ | 20 to 50 |
| 2 | 1.4 to 1.9 | Sand | $10^{-3}$ to $10^{-4}$ | 8 to 12 |
| 3 | 3.0 to 3.5 | Sand | $10^{-3}$ to $10^{-4}$ | 8 to 12 |
| 4 | 1.4 to 1.9 | Silt and Sand | $10^{-5}$ to $10^{-6}$ | 20 to 50 |

The Vukovic and Soro (1992) method was used to assess K.

The site soils are favourable for septic design however, in the east, due to the high ground water table at the site (water about 0.9 m below existing grade in septic area), a raised septic bed may be required.

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.

## 6.3 Ground Water Sample Chemical Test Results

The laboratory certificate of chemical analyses for the analysis carried out by Caduceon on a ground water sample from BH/MW 3, in accordance with the chain-of-custody records and the protocols described in Section 2.2.3, are in included in Appendix D.

The ground water sample was analyzed for nitrate/nitrite and phosphorous to establish background conditions for septic design.

The chemical test results complied with the applicable PWQO for the parameters tested with the exception of the parameters listed below:

| Location | Parameter | Units | PWQO | Measured Concentration |
|---|---|---|---|---|
| BH/MW 3 | Phosphorous | µg/L | 10 | 3670 |

## 6.4 Preliminary Water Balance

### 6.4.1 Climate

The site is located in Oro-Medonte, northern portion of Lake Simcoe within Simcoe County. The climate of Oro-Medonte is humid-continental, characterized by changeable weather patterns. Orillia's location relative to Lake Simcoe, can result in disparities in weather over short distances. From Environment Canada data, the average annual temperature recorded at the Shanty Bay station, (closest station with required data) located southwest of Orillia, averages 6.8°C. The highest monthly average temperature is in July, at 20.1°C and the lowest monthly average temperature is in

January, at -7.7°C. The average annual precipitation recorded at the Shanty Bay weather station is 968 mm. Climate data is tabulated in Table 1, appended.

### 6.4.2 Water Balance: Pre-Development

To determine the amount of ground water infiltration relative to existing site conditions, a pre-development water balance was carried out to provide an estimate of the volume of infiltrating precipitation at the site. This method is based on classic storm water management principles and generally over-estimates the volume of runoff, providing a conservative assessment of infiltration volume. It is noted that the equations were developed for heavy rainfall events of short duration, where as a large volume of the precipitation occurs at a light to moderate rate over an extended period of time and would result in a much higher volume of infiltration.

For the purposes of our analysis, the following parameters were assumed:

- The annual precipitation at the Shanty Bay weather station was recorded to be 968 mm/year, and the water surplus was computed to be 389.25 mm/year (computed by the Thornthwaite and Mather Method).
- The water available for infiltration was computed using the following infiltration factors:

  Topography……..0.20
  Soil…….0.30
  Cover…….0.10
  **Total……..0.60**

- By multiplying the water surplus of 389.25 mm/year by the infiltration factor of 0.60, the infiltration rate was computed to be 233.6 mm/year.

The total existing catchment area for infiltrating precipitation was computed as follows:

- Total Approximate Site Area = 66,089 $m^2$
- Approximate Area of Existing Buildings = 0 $m^2$
- Approximate Area of Existing Parking Lots and Paved Laneway Areas = 0 $m^2$
- Total Approximate Impermeable Surface Area = 0 $m^2$
- Total Site Area less the Impermeable Surface Area = Area of Potential Infiltration = 66,089 $m^2$

The total pre-development infiltration at the site (potential for ground water recharge) was calculated utilizing the LSRCA procedures and was found to be 15,437,100 L/year (15,437.10 $m^3$/year).

### 6.4.3 Water Balance: Post Development

In order to assess the effect of site development, a post-development water balance for the site was carried out using the same approach and infiltration factors noted above. The proposed lot plans are shown on Drawing 1, attached; however, site plan details have not been finalized. Based on housing and driveway layouts of the existing Melville Court subdivision the following development plan details have been assumed:

- Each lot will house a residential building with a 325 $m^2$ footprint (5,200 $m^2$ total assuming 16 lots); and,
- Each lot will include an impermeable driveway surface with a 70 $m^2$ footprint (1,120 $m^2$ total assuming 16 lots).

The total post-development area for infiltrating precipitation was computed as follows:

- Total Approximate Site Area = 66,089 $m^2$
- Total Impermeable Surface Area (buildings, and paved driveways) = 6,320 $m^2$
- Total Site Area less the Impermeable Surface Area = Area of Potential Infiltration = 59,769 $m^2$

Based on the current site conditions and approximated development plans, the total post development infiltration at the site (potential for ground water recharge) was calculated utilizing the LSRCA procedures and was found to be 13,960,000 L/year (13,960 $m^3$/year), indicating a reduction of site infiltration of approximately 10%.

Once site plan details are finalized Table 2B should be updated to include accurate post-development details.

The results of the preliminary water balance for pre- and post-development are tabulated in Tables 2A to 2C.

## 6.5 Development Considerations

### 6.5.1 Ground Water Recharge Management

The LID guidelines call for the pre and post-development ground water infiltration volumes to be maintained as much as practically possible. The assessment provided above indicates a reduction in the volume of surface water infiltration following redevelopment of the site; hence, implementation of measures to reduce the infiltration deficit (such as the proposed LID features) should be considered.

Mitigation Measures, Opportunities and Constraints

The following measures should be considered to reduce the post-development infiltration:

- Reduce the area of the impermeable surfaces.
- Create swales/depressed areas that will retard the rate of storm water runoff and promote infiltration.
- Promote surface water flow from impermeable surfaces into infiltration facilities, as opposed to directing surface water to catchbasins connected to the municipal storm sewers.
- Ensure that roof drains are not connected to the municipal storm water control system.
- Reduce the slope of the ground surface to promote increased infiltration.

Once mitigation measures are finalized Table 2C should be updated to include a comparison of pre-development to post-development including all mitigation features.

This assessment is subject to the Statement of Limitations that is included with this report (Appendix A) which must be read in conjunction with the report.

# 7. GEOENVIRONMENTAL CONSIDERATIONS

## 7.1 General

A limited chemical testing program was carried out to check the geoenvironmental quality of the soil at selected sampling locations in order to provide comments regarding on site reuse or off-site disposal options for excess excavated soil.

A Phase One Environmental Site Assessment (ESA) was not within the scope of work for this assignment. Accordingly, soil impairment that has not been identified by the limited chemical testing program may exist at the site. The limited chemical testing program does not constitute an Environmental Site Assessment as defined under the Environmental Protection Act and O. Reg. 153/04, as amended.

## 7.2 Chemical Testing Protocols

As part of the geoenvironmental procedural protocol, all recovered soil samples were field examined for visual and olfactory evidence of potential contamination. It is noted that none of the samples displayed visual or olfactory evidence of contamination.

After field examination, selected geoenvironmental soil samples were placed in laboratory air tight glass containers and stored in an insulated cooler for transportation to our laboratory for detailed visual examination.

Soil samples were submitted for chemical analysis to a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory. The chemical analyses conducted were in accordance with the O. Reg. 153/04, as amended Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act dated March 9, 2004, amended as of July 1, 2011.

For general environmental quality characterization, soil samples were tested for the following analyte groups:

- Metals and Inorganics; and,
- Organochlorine Pesticides (OC Pesticides).

The following soil samples were submitted for testing:

Borehole 1 SS2 (silty sand till – 0.8 to 1.4 m)
Borehole 2 SS2 (sand – 0.8 to 1.4 m)
Borehole 3 SS2 (silt and sand – 0.8 to 1.4 m)
Borehole 4 SS2 (silt and sand – 0.8 to 1.4 m)

### 7.3 Site Condition Standards

The Ontario MECP has developed a set of Soil, Ground water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (April 15, 2011) and O. Reg. 153/04, as amended. The standards consist of nine tables (Table 1 through Table 9) that provide criteria for maximum concentrations of various contaminants. In general, the applicable O. Reg. 153/04, as amended, SCSs depend on the site location, land use, soil texture, bedrock depth and the applicable potable or non-potable ground water condition at the investigation site.

In order to determine the Site Sensitivity, Sections 41 and 43.1 of O. Reg. 153/04, as amended, were evaluated by PML as shown in the following table:

| CRITERIA | RESULT |
|---|---|
| Current Property Use | Vacant Land |
| Potable vs. Non-Potable Ground Water | Potable [i] |
| Proximity of Areas of Natural Significance | < 30 m |
| Proximity to a Water Body | > 30 m |
| Shallow Soil Condition | No |
| Land Use | Residential/Parkland/Institutional (RPI) |
| Applicable Site Condition Standard | Table 1: Full Depth Background Site Condition Standards (RPI/Industrial/Commercial/Community (ICC)) |

Notes: i) MECP interactive Water Well Record (WWR) mapping indicates private water supply wells within 250 m of the site.

## **7.4** Analytical Findings and Conclusions

The Certificates of Analyses for Chemical Testing are included in Appendix E.

### 7.4.1 On-Site Reuse

In summary, the concentration of the tested parameters in the submitted soil samples from the boreholes were either not detected (below the method detection limit) or were within the Table 1 RPI/ICC SCSs. As such, the site soil can remain on-site for reuse, subject to Geotechnical requirements.

It should be noted that the soil conditions between and beyond the sampled locations may differ from those encountered during this assignment. PML should be contacted if impacted soil conditions become apparent during future development to further assess and appropriately handle the materials, if any, and evaluate whether modifications to the conclusions documented in this report are necessary.

This assessment is subject to the Statement of Limitations that is included with this report (Appendix A) which must be read in conjunction with the report.

### 7.4.2 Off-Site Reuse/Disposal

It should be noted that the MECP has developed new On-Site and Excess Soil Management Regulations O.Reg. 406/19. These regulatory requirements will come into force on January 1, 2022. This regulation is currently being followed as of January 1, 2021 by most parties. Additional environmental review and management of excess soils will be required, including additional soil sampling and analytical testing requirements, for this project, if O.Reg. 406/19 is to be followed. In addition, an Excess Soil Management Plan (ESMP) may be required depending on the volume to be generated.

Based on the limited chemical testing results, excess excavated soil may be disposed of off-site at a receiving site where the following O.Reg. 153/04, as amended, criterial apply:

- Table 1 (RPI/ICC);
- Table 2 (RPI/ICC);
- Table 3 (RPI/ICC).

In general, when transporting excavated site soil to another site, O.Reg. 406/19 should be followed along with any local bylaws, with the following highlighted below:

- The soil characterization and excess soil destination assessment reports, including all applicable chemical testing results, should be provided to the receiving site authority for approval;
- A tracking system must be implemented by the source site QP such that transportation and placement of the surplus soil is monitored to check the material is appropriately placed at the pre-approved site;
- The receiving site(s) must be arranged and/or approved in advance of excavation such that a site-specific excess soil destination report assessment report is completed for each site prior to fill movement;
- Additional sampling and chemical testing shall be carried out during construction to verify the chemical quality of the excess soil to assess the appropriate management/disposal options for the actual soil to leave the site. The frequency of the addition testing depends on the volume of the soil to be transported and it is noted that additional leachate testing may be required;
- The excavation work should be conducted in accordance with a written Excess Soil Management Plan (ESMP) prepared by a qualified professional to ensure that all surplus excavated material is tested and managed appropriately, and that imported fill material is of suitable quality and meets the SCSs applicable to the receiving site. Reuse of surplus excavated soil on-site is also subject to acceptance for reuse by the Geotechnical consultant at the time of construction based on Geotechnical considerations;

This assessment is subject to the Statement of Limitations that is included with this report (Appendix A) which must be read in conjunction with the report.

## 8. CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.


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


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

AK/GRW:tc

**TABLE 1**

Water Budget Summary (Using Thornthwaite Empirical Approach)

| Month | *Mean Daily Av. Temp (C) | I | *Mean Montly Precipitation (mm) | Days | ^Daylight Hours | Evapotranspiration (mm) | Actual Evapotranspiration Adjusted for Month and Daylight (mm) | Actual Water Balance (mm) |
|---|---|---|---|---|---|---|---|---|
| January | -7.7 | 0.00 | 88.8 | 31 | 9.25 | 0.00 | 0.00 | 88.80 |
| February | -6.5 | 0.00 | 69.8 | 28 | 10.83 | 0.00 | 0.00 | 69.80 |
| March | -1.9 | 0.00 | 63.8 | 31 | 11.97 | 0.00 | 0.00 | 63.80 |
| April | 5.7 | 1.22 | 65 | 30 | 13.52 | 25.42 | 28.64 | 36.36 |
| May | 12.1 | 3.81 | 79.9 | 31 | 14.85 | 57.46 | 73.47 | 6.43 |
| June | 17.4 | 6.61 | 88.6 | 30 | 15.50 | 85.16 | 110.00 | -21.40 |
| July | 20.1 | 8.22 | 73.2 | 31 | 15.13 | 99.57 | 129.72 | -56.52 |
| August | 19.2 | 7.67 | 86.2 | 31 | 13.97 | 94.75 | 113.98 | -27.78 |
| September | 15.2 | 5.38 | 92.2 | 30 | 12.47 | 73.56 | 76.44 | 15.76 |
| October | 8.7 | 2.31 | 78.2 | 31 | 10.93 | 40.19 | 37.83 | 40.37 |
| November | 2.6 | 0.37 | 98 | 30 | 9.57 | 10.86 | 8.66 | 89.34 |
| December | -3.6 | 0.00 | 84.3 | 31 | 8.87 | 0.00 | 0.00 | 84.30 |
| Yearly Av./Total: | 6.78 | 1.58 | **968.00** | | 12.24 | 486.97 | 578.75 | **389.25** |

| | |
|---|---|
| **I (heat index)** | 37.18 |
| a | 1.08 |

a is a function of heat index

*Data from Environment Canada web site - Shanty Bay
^from NSERC database

**TABLE 2A**
Water Budget Pre-Development (Water Balance/Water Budget Assessment)

| Catchment Designation | Cultivated | Paved | Building | Total |
|---|---|---|---|---|
| Area ($m^2$) | 66,089 | 0 | 0 | 66,089 |
| Pervious Area ($m^2$) | 66,089 | - | - | 66,089 |
| Impervious Area ($m^2$) | - | 0 | 0 | - |
| **Infiltration Factors** | | | | |
| Topography Infiltraton Factor | 0.2 | 0.2 | 0.2 | |
| Soil Infiltration Factor | 0.3 | 0.3 | 0.3 | |
| Land Cover Infiltration Factor | 0.1 | 0.0 | 0.0 | |
| MOE Infiltration Factor | 0.6 | 0.0 | 0.0 | -- |
| Actual Infilration Factor | 0.6 | 0.0 | 0.0 | |
| Run-Off Co-efficient | 0.4 | 1.0 | 1.0 | |
| Runoff from Impervious Surfaces | - | 0.8 | 0.8 | |
| **Inputs (per Unit Area)** | | | | |
| Precipitation (mm/yr) | 968.0 | 968.0 | 968.0 | 968.0 |
| Run-on (mm/yr) | 0.0 | 0.0 | 0.0 | 0.0 |
| Other inputs (mm/yr) | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Imputs (mm/yr) | 968.0 | 968.0 | 968.0 | 968.0 |
| **Outputs (per Unit Area)** | | | | |
| Precipitation Surplus (mm/yr) | 389.3 | 774.4 | 774.4 | 389.3 |
| Net Surplus (mm/yr) | 389.3 | 774.4 | 774.4 | 389.3 |
| Evapotranspiration (mm/yr) | 578.7 | 193.6 | 193.6 | 578.7 |
| Infiltration (mm/yr) | 233.6 | 0.0 | 0.0 | 233.58 |
| Rooftop Infiltration (mm/yr) | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Infiltration (mm/yr) | 233.6 | 0.0 | 0.0 | 233.58 |
| Runoff Pervious Areas (mm/yr) | 155.7 | 0.0 | 0.0 | 155.7 |
| Runoff Impervious Areas (mm/yr) | 0.0 | 774.4 | 774.4 | 0.0 |
| Total Runoff (mm/yr) | 155.7 | 774.4 | 774.4 | 155.7 |
| Total Outputs (mm/yr) | 968.0 | 968.0 | 968.0 | 968.0 |
| Difference (Inputs-Outputs) | 0.00 | 0.00 | 0.00 | 0.00 |
| **Inputs (Volumes)** | | | | |
| Precipitation ($m^3$/yr) | 63,974.2 | - | - | 63,974.2 |
| Run-On ($m^3$/yr) | - | - | - | - |
| Other Inputs ($m^3$/yr) | - | - | - | - |
| Total Inputs (m3/yr) | 63,974.2 | - | - | 63,974.2 |
| **Outputs (Volumes)** | | | | |
| Precipitation Surplus ($m^3$/yr) | 25,728.4 | - | - | 25,728.4 |
| Net Surplus ($m^3$/yr) | 25,728.4 | - | - | 25,728.4 |
| Evapotranspiration ($m^3$/yr) | 38,245.7 | - | - | 38,245.7 |
| Infiltration ($m^3$/yr) | 15,437.1 | - | - | 15,437.1 |
| Rooftop Infiltration ($m^3$/yr) | 0.0 | - | - | 0.0 |
| Total Infiltration ($m^3$/yr) | 15,437.1 | - | - | 15,437.1 |
| Runof Pervious Areas ($m^3$/yr) | 10,291.4 | - | - | 10,291.4 |
| Runoff Impervious Areas ($m^3$/yr) | 0.0 | - | - | - |
| Total Runoff ($m^3$/yr) | 10,291.4 | - | - | 10,291.4 |
| Total Outputs ($m^3$/yr) | 63,974.2 | - | - | 63,974.2 |
| Difference (Inputs-Outputs) | 0.0 | 0.0 | 0.0 | 0.0 |

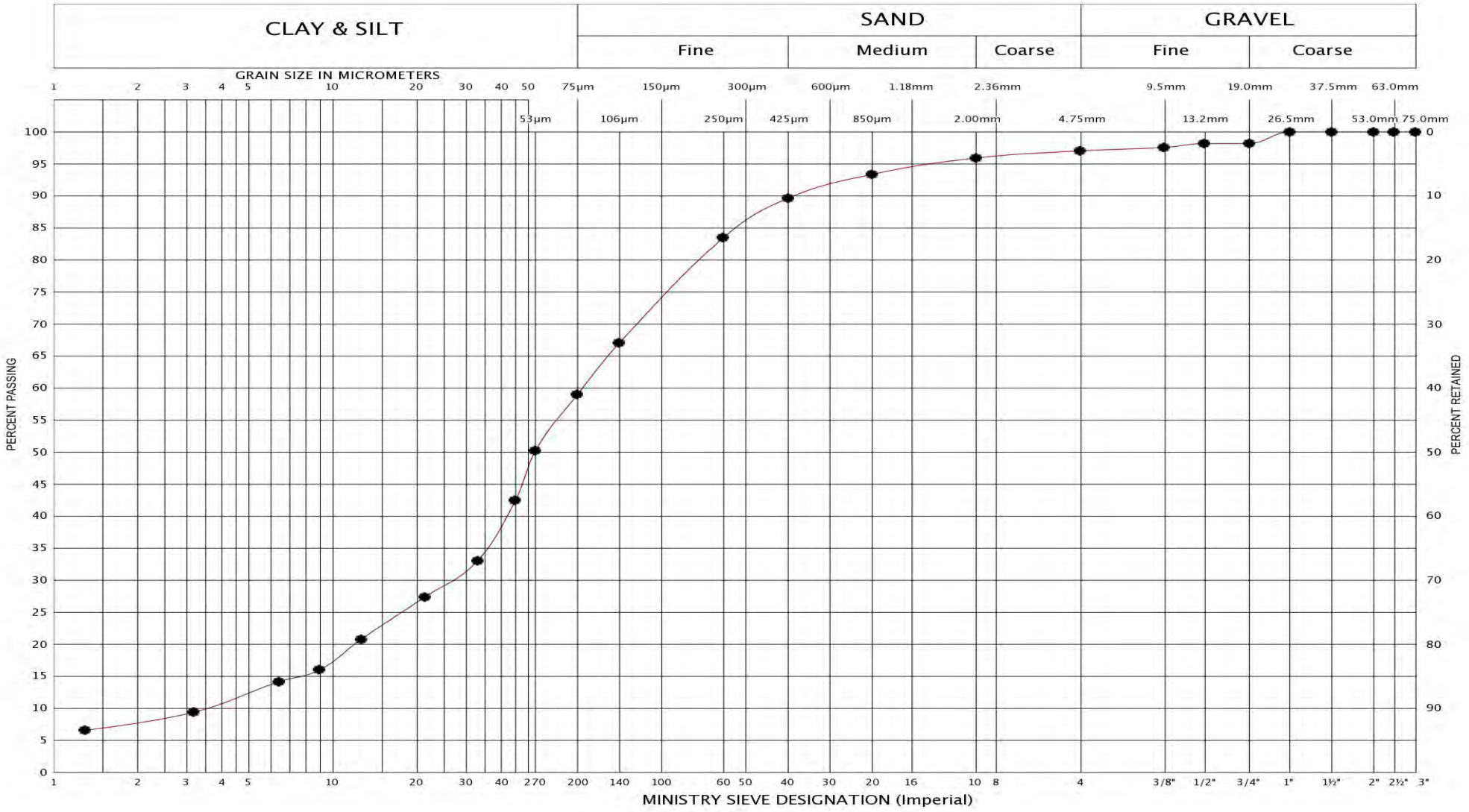
**TABLE 2B**
Water Budget Post-Development (Water Balance/Water Budget Assessment)

| Catchment Designation | Cultivated | Paved | Building | Total |
|---|---|---|---|---|
| Area ($m^2$) | 59,769 | 1,120 | 5,200 | 66,089 |
| Pervious Area ($m^2$) | 59,769 | 0.0 | 0.0 | 59,769 |
| Impervious Area ($m^2$) | 0.0 | 1,120 | 5,200 | 6,320 |
| **Infiltration Factors** | | | | |
| Topography Infiltraton Factor | 0.2 | 0.2 | 0.2 | |
| Soil Infiltration Factor | 0.3 | 0.3 | 0.3 | |
| Land Cover Infiltration Factor | 0.1 | 0.0 | 0.0 | |
| MOE Infiltration Factor | 0.6 | 0.0 | 0.0 | -- |
| Actual Infilration Factor | 0.6 | 0.0 | 0.0 | |
| Run-Off Co-efficient | 0.4 | 1.0 | 1.0 | |
| Runoff from Impervious Surfaces | - | 0.8 | 0.8 | |
| **Inputs (per Unit Area)** | | | | |
| Precipitation (mm/yr) | 968.0 | 968.0 | 968.0 | 968.0 |
| Run-on (mm/yr) | 0.0 | 0.0 | 0.0 | 0.0 |
| Other inputs (mm/yr) | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Imputs (mm/yr) | 968.0 | 968.0 | 968.0 | 968.0 |
| **Outputs (per Unit Area)** | | | | |
| Precipitation Surplus (mm/yr) | 389.3 | 774.4 | 774.4 | 398.7 |
| Net Surplus (mm/yr) | 389.3 | 774.4 | 774.4 | 398.7 |
| Evapotranspiration (mm/yr) | 578.7 | 193.6 | 193.6 | 569.3 |
| Infiltration (mm/yr) | 233.6 | 0.0 | 0.0 | 211.2 |
| Rooftop Infiltration (mm/yr) | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Infiltration (mm/yr) | 233.6 | 0.0 | 0.0 | 211.2 |
| Runoff Pervious Areas (mm/yr) | 155.7 | 0.0 | 0.0 | 155.7 |
| Runoff Impervious Areas (mm/yr) | 0.0 | 774.4 | 774.4 | 74.1 |
| Total Runoff (mm/yr) | 155.7 | 774.4 | 774.4 | 187.5 |
| Total Outputs (mm/yr) | 968.0 | 968.0 | 968.0 | 968.0 |
| Difference (Inputs-Outputs) | - | - | - | - |
| **Inputs (Volumes)** | | | | |
| Precipitation ($m^3$/yr) | 57,856.4 | 1,084.2 | 5,033.6 | 63,974.2 |
| Run-On ($m^3$/yr) | - | - | - | - |
| Other Inputs ($m^3$/yr) | - | - | - | - |
| Total Inputs (m3/yr) | 57856.4 | 1084.2 | 5033.6 | 63,974.2 |
| **Outputs (Volumes)** | | | | |
| Precipitation Surplus ($m^3$/yr) | 23,268.1 | 867.3 | 4,026.9 | 28,162.3 |
| Net Surplus ($m^3$/yr) | 23,268.1 | 867.3 | 4,026.9 | 28,162.3 |
| Evapotranspiration ($m^3$/yr) | 34,588.3 | 216.8 | 1,006.7 | 35,811.9 |
| Infiltration ($m^3$/yr) | 13,960.8 | 0.0 | 0.0 | 13,960.8 |
| Rooftop Infiltration ($m^3$/yr) | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Infiltration ($m^3$/yr) | 13,960.8 | 0.0 | 0.0 | 13,960.8 |
| Runof Pervious Areas ($m^3$/yr) | 9,307.2 | 0.0 | 0.0 | 9,307.2 |
| Runoff Impervious Areas ($m^3$/yr) | 0.0 | 867.3 | 4,026.9 | 4,894.2 |
| Total Runoff ($m^3$/yr) | 9,307.2 | 867.3 | 4,026.9 | 14,201.4 |
| Total Outputs ($m^3$/yr) | 57,856.4 | 1,084.2 | 5,033.6 | 63,974.2 |
| Difference (Inputs-Outputs) | 0.0 | 0.0 | 0.0 | 0.0 |

**TABLE 2C**
Water Budget Summary (Water Balance / Water Budget Assessment)

| | Pre-Development | Post-Developmemt | Change (Pre- to Post-) |
|---|---|---|---|
| **Inputs (Volumes)** | | | |
| Precipitation ($m^3$/yr) | 63,974.2 | 63,974.2 | 0% |
| Run-On ($m^3$/yr) | - | - | 0% |
| Other Inputs ($m^3$/yr) | - | - | 0% |
| Total Inputs (m3/yr) | 63,974.2 | 63,974.2 | 0% |
| **Outputs (Volumes)** | | | |
| Precipitation Surplus ($m^3$/yr) | 25,728.4 | 28,162.3 | 9% |
| Net Surplus ($m^3$/yr) | 25,728.4 | 28,162.3 | 9% |
| Evapotranspiration ($m^3$/yr) | 38,245.7 | 35,811.9 | -6% |
| Infiltration ($m^3$/yr) | 15,437.1 | 13,960.8 | -10% |
| Rooftop Infiltration ($m^3$/yr) | 0.0 | 0.0 | 0% |
| Total Infiltration ($m^3$/yr) | 15,437.1 | 13,960.8 | -10% |
| Runof Pervious Areas ($m^3$/yr) | 10,291.4 | 9,307.2 | -10% |
| Runoff Impervious Areas ($m^3$/yr) | - | 4,894.2 | -- |
| Total Runoff ($m^3$/yr) | 10,291.4 | 14,201.4 | 38% |
| Total Outputs ($m^3$/yr) | 63,974.2 | 63,974.2 | 0% |

## UNIFIED SOIL CLASSIFICATION SYSTEM




| | | |
|---|---|---|
| LEGEND | BH | 4 |
| | SAMPLE | 3 |
| | SYMBOL | ● |

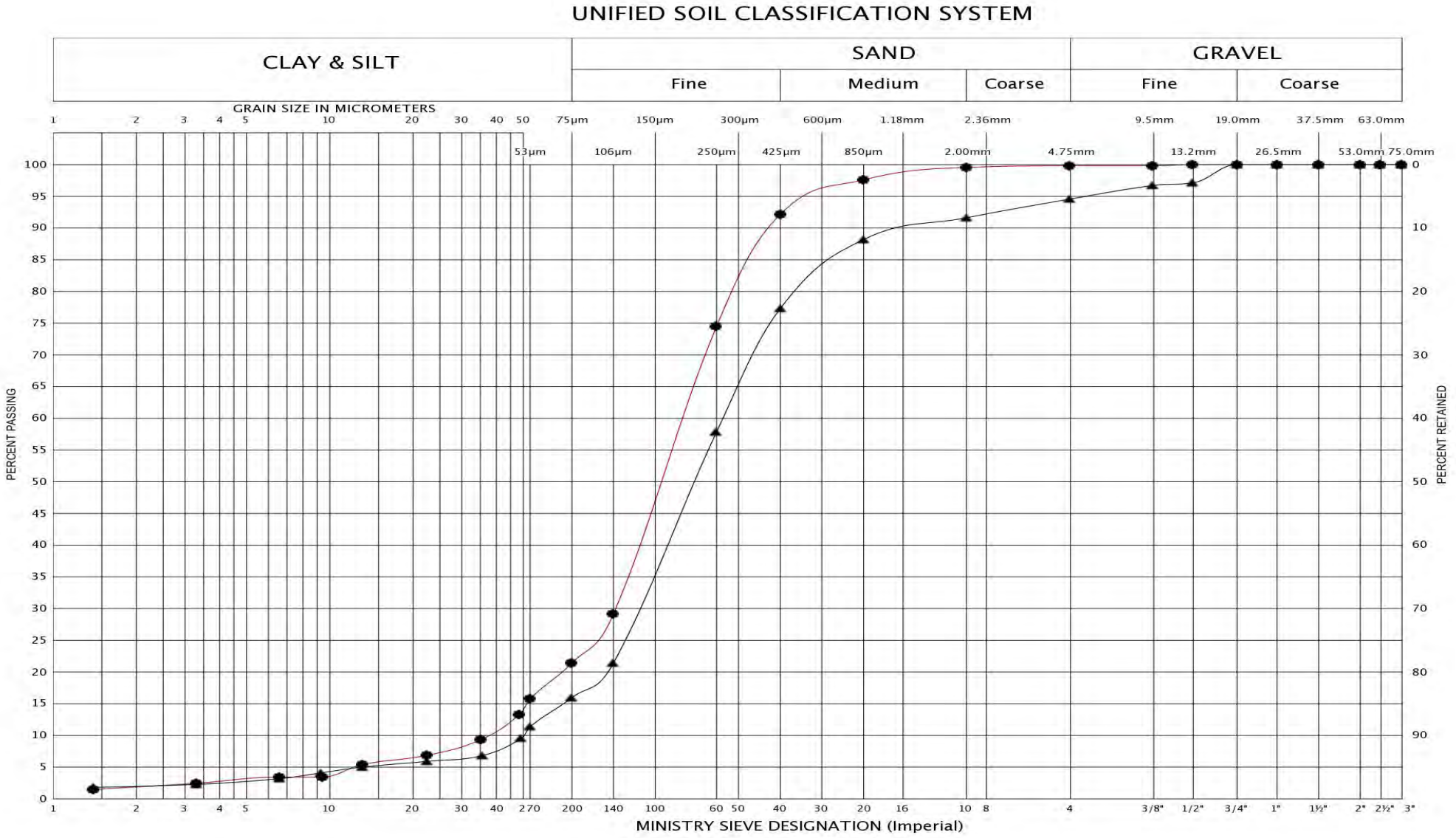
PML Peto MacCallum Ltd. CONSULTING ENGINEERS

**GRAIN SIZE DISTRIBUTION**

SILT AND SAND, Trace Clay, Trace Gravel

FIG No.: 1

Project No.: 21BF010




| | | | |
|---|---|---|---|
| LEGEND | BH | 2 | 3 |
| | SAMPLE | 3 | 5 |
| | SYMBOL | ● | ▲ |

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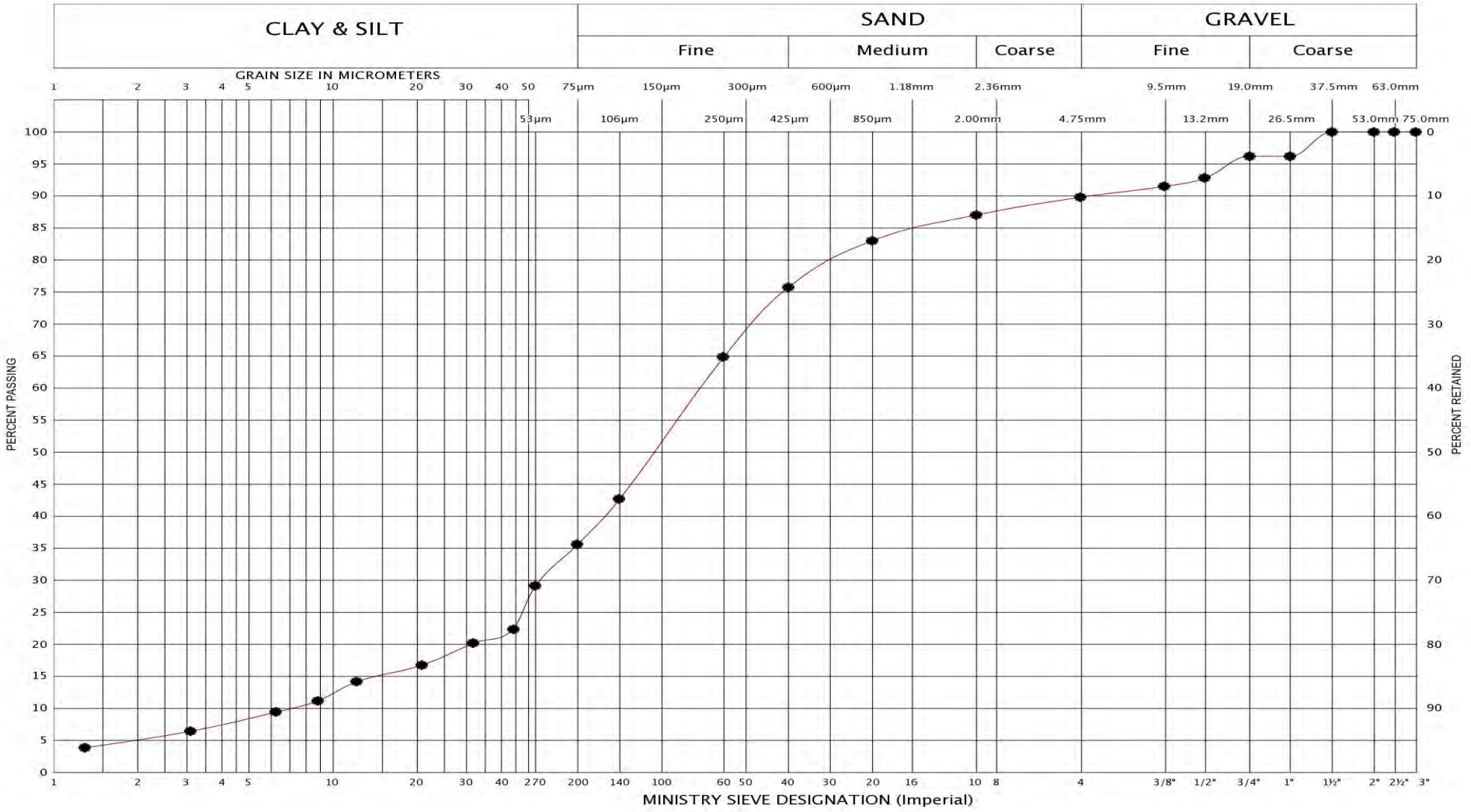
**GRAIN SIZE DISTRIBUTION**

SAND, Some Silt, Trace Gravel, Trace Clay

FIG No.: 2

Project No.: 21BF010

## UNIFIED SOIL CLASSIFICATION SYSTEM




| | | |
|---|---|---|
| LEGEND | BH | 1 |
| | SAMPLE | 3 |
| | SYMBOL | ● |

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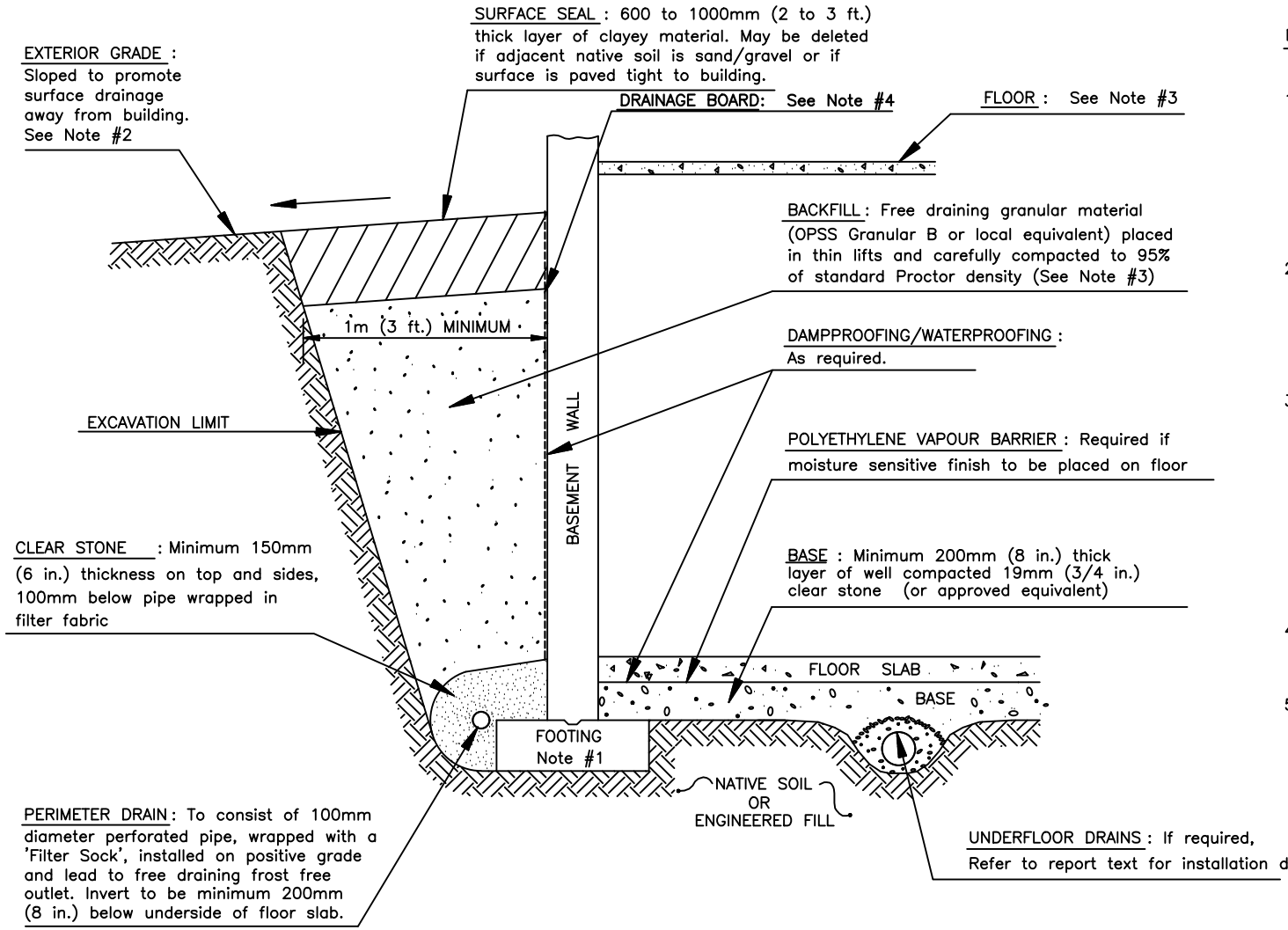
**GRAIN SIZE DISTRIBUTION**

TILL: Silty Sand, Trace Gravel, Trace Clay

FIG No.: 3

Project No.: 21BF010




NOTES

1. Footing may be constructed by placement of structural concrete neat against natural soil. Drain to be installed in a similar manner immediately above footing maintaining 200mm (8 in.) distance between top of drain and underside of floor slab.
2. Exterior grade to be minimum 300mm (12 in.) below interior floor slab, or other means established to prevent entry of surface water into building through building openings.
3. Basement wall to be supported by floor system or interior bracing prior to commencement of backfill placement. Heavy construction equipment should not be permited within a distance from the foundation wall equivalent to half the wall height. Overcompaction of backfill to be avoided as excessive lateral earth pressure may result.
4. A proprietary drainage board product may be used with compacted native soil as backfill against the wall.
5. Refer to text for details regarding founding levels, competent bearing material and construction details specific to particular site.

STANDARD DRAWING

# GENERAL RECOMMENDATIONS REGARDING DRAINAGE AND BACKFILL REQUIREMENTS FOR BASEMENT WALL AND FLOOR SLAB CONSTRUCTION

Peto MacCallum Ltd.
CONSULTING ENGINEERS

| DRAWN: | N/A | DATE | SCALE | JOB NO. | FIGURE NO. |
|---|---|---|---|---|---|
| CHECKED: | GW | JUNE 2021 | N.T.S. | 21BF010 | 4 |
| APPROVED: | GW | | | | |

# *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:

| CONSISTENCY | N (blows/0.3 m) | c (kPa) | DENSENESS | N (blows/0.3 m) |
|---|---|---|---|---|
| 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 | | |

Peto MacCallum Ltd.
CONSULTING ENGINEERS

# LOG OF BOREHOLE/MONITORING WELL NO. 1



17T 613896E 4924771N

**PROJECT** Proposed Expansion of Melville Court Subdivision
**LOCATION** Oro-Medonte, Ontario
**BORING METHOD** Continuous Flight Hollow Stem Augers
**BORING DATE** March 3, 2021
**PML REF.** 21BF010
**ENGINEER** GW
**TECHNICIAN** D. Power

| DEPTH ELEV (metres) | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES "N" VALUES | ELEVATION SCALE |
|---|---|---|---|---|---|---|
| | SURFACE ELEVATION 290.10 | | | | | 290 |
| 0.28 / 289.82 | TOPSOIL: Dark brown to black, silty sand, trace organics, frozen | | 1 | SS | 3 | |
| 0.76 / 289.34 | SILT AND SAND: Very loose to compact, brown, silt and sand, trace clay, moist | | 2[1] | SS | 12 | 289 |
| | SILTY SAND TILL: Compact, brown, silty sand, trace clay, trace gravel, very moist | | 3 | SS | 25 | |
| 2.1 / 288.0 | SAND: Compact to dense, brown, sand, some silt, wet | | 4 | SS | 22 | 288 |
| | | | 5 | SS | 36 | 287 |
| | | | 6 | SS | 22 | 286 |
| 6.0 / 284.1 | BOREHOLE TERMINATED UPON AUGER HEAVE AT 6.0 m | | | | | 285 |

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT $w_P$ | NATURAL MOISTURE CONTENT $w$ | LIQUID LIMIT $w_L$
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Stick-up casing
Concrete
Bentonite seal
First water strike at 3.1 m
50 mm slotted pipe
Filter sand

Upon completion of augering
Wet cave at 5.2 m

Water Level Readings:

| Date | Depth(m) | Elev. |
|---|---|---|
| 2021-03-30 | 0.9 | 289.2 |
| 2021-05-20 | 1.3 | 288.8 |

**NOTES** 1. Samples submitted for chemical testing.

Peto MacCallum Ltd.
CONSULTING ENGINEERS

# LOG OF BOREHOLE NO. 2



17T 613799E 4924698N

**PROJECT** Proposed Expansion of Melville Court Subdivision — **PML REF.** 21BF010

**LOCATION** Oro-Medonte, Ontario — **BORING DATE** March 3, 2021 — **ENGINEER** GW

**BORING METHOD** Continuous Flight Hollow Stem Augers — **TECHNICIAN** D. Power

| DEPTH (metres) | ELEV | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES "N" VALUES | ELEVATION SCALE |
|---|---|---|---|---|---|---|---|
| | | SURFACE ELEVATION 291.15 | | | | | |
| 0.0 | 291.15 | | | | | | 291 |
| 0.22 | 290.93 | TOPSOIL: Dark brown to black, silty sand, trace organics, frozen | | 1 | SS | 4 | |
| | | SAND: Loose, brown, sand, some silt, trace gravel, trace clay, wet | | 2' | SS | 5 | 290 |
| 1.0 | | | | | | | |
| | | | | 3 | SS | 7 | |
| 2.0 | 2.1 | | | | | | 289 |
| | 289.1 | SILTY SAND TILL: Dense to very dense, brown, silty sand, trace clay, trace gravel, very moist | | 4 | SS | 40 | |
| 3.0 | | | | 5 | SS | 63 | 288 |
| 4.0 | 4.0 | | | | | | |
| | 287.2 | SAND: Compact, brown, sand, some silt, trace gravel, trace clay, wet | | 6 | SS | 10 | 287 |
| 5.0 | 5.0 | | | | | | |
| | 286.2 | BOREHOLE TERMINATED UPON AUGER HEAVE AT 5.0 m | | | | | |
| 6.0 | | | | | | | |
| 7.0 | | | | | | | |
| 8.0 | | | | | | | |
| 9.0 | | | | | | | |
| 10.0 | | | | | | | |
| 11.0 | | | | | | | |
| 12.0 | | | | | | | |
| 13.0 | | | | | | | |
| 14.0 | | | | | | | |
| 15.0 | | | | | | | |

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT $w_P$ — NATURAL MOISTURE CONTENT $w$ — LIQUID LIMIT $w_L$
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 2.1 m

Upon completion of augering
No water
No cave

**NOTES** 1. Samples submitted for chemical testing.

Peto MacCallum Ltd.
CONSULTING ENGINEERS

# LOG OF BOREHOLE/MONITORING WELL NO. 3



17T 613625E 4924584N

**PROJECT** Proposed Expansion of Melville Court Subdivision
**PML REF.** 21BF010
**LOCATION** Oro-Medonte, Ontario
**BORING DATE** March 3, 2021
**ENGINEER** GW
**BORING METHOD** Continuous Flight Hollow Stem Augers
**TECHNICIAN** D. Power

| DEPTH (metres) | ELEV | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | TYPE | "N" VALUES |
|---|---|---|---|---|---|---|
| | | SURFACE ELEVATION 293.35 | | | | |
| 0.0 | 293.10 | TOPSOIL: Dark brown to black, silty sand, trace organics, frozen | | 1 | SS | 4 |
| 0.25 | | SILT AND SAND: Loose to dense, brown, silt and sand, trace clay, moist | | 2[1] | SS | 7 |
| 1.0 | | | | 3 | SS | 4 |
| 2.0 | | | | 4 | SS | 32 |
| 2.9 | 290.5 | SAND: Very dense, brown, sand, some silt, wet | | 5 | SS | 57 |
| 3.0 | | | | | | |
| 4.0 | | | | | | |
| 4.8 | 288.6 | SILTY SAND TILL: Dense to very dense, light brown, silty sand, trace clay, trace gravel, very moist | | 6 | SS | 36 |
| 5.0 | | | | | | |
| 6.0 | | | | 7 | SS | 92 |
| 6.5 | 286.9 | BOREHOLE TERMINATED AT 6.5 m | | | | |
| 7.0 | | | | | | |
| 8.0 | | | | | | |
| 9.0 | | | | | | |
| 10.0 | | | | | | |
| 11.0 | | | | | | |
| 12.0 | | | | | | |
| 13.0 | | | | | | |
| 14.0 | | | | | | |
| 15.0 | | | | | | |

ELEVATION SCALE: 293, 292, 291, 290, 289, 288, 287

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT $w_P$ | NATURAL MOISTURE CONTENT $w$ | LIQUID LIMIT $w_L$
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Stick-up casing
Concrete
Bentonite seal
First water strike at 2.1 m
50 mm slotted pipe
Filter sand

Upon completion of augering
Wet cave at 6.0 m depth

Water Level Readings:

| Date | Depth(m) | Elev. |
|---|---|---|
| 2021-03-30 | 4.3 | 289.1 |
| 2021-05-20 | 4.2 | 289.2 |

**NOTES** 1. Samples submitted for chemical testing.

Peto MacCallum Ltd.
CONSULTING ENGINEERS

# LOG OF BOREHOLE/MONITORING WELL NO. 4



17T 613497E 4924501N

**PROJECT** Proposed Expansion of Melville Court Subdivision
**PML REF.** 21BF010
**LOCATION** Oro-Medonte, Ontario
**BORING DATE** March 3, 2021
**ENGINEER** GW
**BORING METHOD** Continuous Flight Hollow Stem Augers
**TECHNICIAN** D. Power

| DEPTH (metres) | ELEV | DESCRIPTION | STRAT PLOT | SAMPLE NUMBER | SAMPLE TYPE | "N" VALUES |
|---|---|---|---|---|---|---|
| | | SURFACE ELEVATION 296.00 | | | | |
| 0.0 | 296.00 | | | | | |
| 0.22 | 295.78 | TOPSOIL: Black, silty sand, trace organics, frozen | | 1 | SS | 4 |
| | | SILT AND SAND: Loose to very dense, brown, silt and sand, trace clay, moist | | 2 | SS | 22 |
| 1.0 | | | | | | |
| | | | | 3 | SS | 23 |
| 2.0 | | | | | | |
| | | | | 4 | SS | 50/200 mm |
| 2.9 | 293.1 | SAND: Dense to very dense, brown, sand, some silt, moist | | | | |
| 3.0 | | | | 5 | SS | 32 |
| 4.0 | | | | | | |
| | | | | 6 | SS | 64 |
| 5.0 | | | | | | |
| 6.0 | | | | | | |
| 6.5 | 289.5 | BOREHOLE TERMINATED AT 6.5 m | | 7 | SS | 73 |
| 7.0 | | | | | | |
| 8.0 | | | | | | |
| 9.0 | | | | | | |
| 10.0 | | | | | | |
| 11.0 | | | | | | |
| 12.0 | | | | | | |
| 13.0 | | | | | | |
| 14.0 | | | | | | |
| 15.0 | | | | | | |

ELEVATION SCALE: 295, 294, 293, 292, 291, 290

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT $w_P$ | NATURAL MOISTURE CONTENT $w$ | LIQUID LIMIT $w_L$
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL


Upon completion of augering
Wet cave at 6.0 m depth

Water Level Readings:

| Date | Depth(m) | Elev. |
|---|---|---|
| 2021-03-30 | Dry | ---- |
| 2021-05-20 | Dry | ---- |

**NOTES** 1. Samples submitted for chemical testing.



KEY PLAN
ORO-MEDONTE, ONTARIO

LEGEND:

- SITE LIMITS
- BH/MW 1 EL 290.10 ▼ 288.8 — BOREHOLE/MONITORING WELL 1 LOCATION, SURFACE ELEVATION, GROUND WATER ELEVATION
- BH 2 EL 291.15 — BOREHOLE 2 LOCATION, SURFACE ELEVATION
- INFERRED REGIONAL GROUND WATER FLOW DIRECTION (BASED ON AVAILABLE SOURCE WATER PROTECTION MAPPING)

REFERENCE:

BASE PLAN PRODUCED FROM AVAILABLE SIMCOE COUNTY INTERACTIVE MAPPING.

0m 30 60 90 120 150

SCALE

# BOREHOLE/MONITORING WELL LOCATION PLAN

PROPOSED EXPANSION OF MELVILLE COURT SUBDIVISION

TOWNSHIP OF ORO-MEDONTE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

| | | | | | |
|---|---|---|---|---|---|
| DRAWN | DP | DATE | SCALE | PML REF. | DRAWING NO. |
| CHECKED | AK | JUNE 2021 | AS SHOWN | 21BF010 | 1 |
| APPROVED | GW | | | | |

# APPENDIX A

Statement of Limitations

## STATEMENT OF LIMITATIONS

This report is prepared for and made available for the sole use of the client named. Peto MacCallum Ltd. (PML) hereby disclaims any liability or responsibility to any person or entity, other than those for whom this report is specifically issued, for any loss, damage, expenses, or penalties that may arise or result from the use of any information or recommendations contained in this report. The contents of this report may not be used or relied upon by any other person without the express written consent and authorization of PML.

This report shall not be relied upon for any purpose other than as agreed with the client named without the written consent of PML. It shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. A portion of this report may not be used as a separate entity: that is to say the report is to be read in its entirety at all times.

The report is based solely on the scope of services which are specifically referred to in this report. No physical or intrusive testing has been performed, except as specifically referenced in this report. This report is not a certification of compliance with past or present regulations, codes, guidelines and policies.

The scope of services carried out by PML is based on details of the proposed development and land use to address certain issues, purposes and objectives with respect to the specific site as identified by the client. Services not expressly set forth in writing are expressly excluded from the services provided by PML. In other words, PML has not performed any observations, investigations, study analysis, engineering evaluation or testing that is not specifically listed in the scope of services in this report. PML assumes no responsibility or duty to the client for any such services and shall not be liable for failing to discover any condition, whose discovery would require the performance of services not specifically referred to in this report.

**STATEMENT OF LIMITATIONS**
**(continued)**

The findings and comments made by PML in this report are based on the conditions observed at the time of PML's site reconnaissance. No assurances can be made and no assurances are given with respect to any potential changes in site conditions following the time of completion of PML's field work. Furthermore, regulations, codes and guidelines may change at any time subsequent to the date of this report and these changes may effect the validity of the findings and recommendations given in this report.

The results and conclusions with respect to site conditions are therefore in no way intended to be taken as a guarantee or representation, expressed or implied, that the site is free from any contaminants from past or current land use activities or that the conditions in all areas of the site and beneath or within structures are the same as those areas specifically sampled.

Any investigation, examination, measurements or sampling explorations at a particular location may not be representative of conditions between sampled locations. Soil, ground water, surface water, or building material conditions between and beyond the sampled locations may differ from those encountered at the sampling locations and conditions may become apparent during construction which could not be detected or anticipated at the time of the intrusive sampling investigation.

Budget estimates contained in this report are to be viewed as an engineering estimate of probable costs and provided solely for the purposes of assisting the client in its budgeting process. It is understood and agreed that PML will not in any way be held liable as a result of any budget figures provided by it.

The Client expressly waives its right to withhold PML's fees, either in whole or in part, or to make any claim or commence an action or bring any other proceedings, whether in contract, tort, or otherwise against PML in anyway connected with advice or information given by PML relating to the cost estimate or Environmental Remediation/Cleanup and Restoration or Soil and Ground Water Management Plan Cost Estimate.

# APPENDIX B

Engineered Fill

# *ENGINEERED FILL*

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

1. Purpose

The site specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

2. Minimum Extent

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and
- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

3. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three dimensional extent of filling.

4. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

5. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

6. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

7. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

8. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

9. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

10. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

11. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.

# APPENDIX C

MECP Water Well Records

| TOWNSHIP CON LOT | UTM | DATE CNTR | CASING DIA | WATER | PUMP TEST | WELL USE | SCREEN | WELL | FORMATION |
|---|---|---|---|---|---|---|---|---|---|
| ORO TOWNSHIP CON 05 020 | 17 613300 4924284 W | 1961/10 4102 | 30 30 | FR 0025 | 20//2/: | DO | | 5703214 () | GRVL 0025 MSND 0030 |
| ORO TOWNSHIP CON 05 020 | 17 614066 4924662 W | 1964/11 4608 | 30 | FR 0013 | 13//2/: | DO | | 5703215 () | MSND GRVL 0015 |
| ORO TOWNSHIP CON 05 020 | 17 613220 4924281 W | 1966/09 2514 | 6 | FR 0052 | 24/48/7/2 :30 | DO | | 5703218 () | BRWN MSND GRVL CLAY 0008 BRWN CLAY STNS 0045 CSND GRVL 0052 |
| ORO TOWNSHIP CON 05 020 | 17 614021 4924632 W | 1967/12 4608 | 30 | FR 0009 | 9//2/: | DO | | 5703219 () | BRWN CLAY 0010 MSND GRVL STNS 0015 |
| ORO TOWNSHIP CON 05 021 | 17 613988 4924480 W | 1964/10 4816 | 6 | FR 0170 | 35/59/13 0/34:0 | PS | 0171 4 0175 3 | 5703220 () | MSND GRVL 0036 BLUE CLAY 0044 GREY FSND 0058 BLUE CLAY 0094 GRVL 0096 CLAY GRVL 0108 BLUE CLAY 0155 FSND 0165 CSND GRVL 0180 |
| ORO TOWNSHIP CON 06 020 | 17 614253 4924716 W | 1962/08 1614 | 4 4 | FR 0078 | 34/39/20/ 2:0 | DO | | 5703256 () | HPAN BLDR 0078 GRVL 0079 |
| ORO TOWNSHIP CON 05 021 | 17 613584 4924094 W | 1968/06 4608 | 30 | FR 0012 | 6///: | DO | | 5705797 () | BRWN CLAY 0018 |
| ORO TOWNSHIP CON 05 020 | 17 613654 4924374 W | 1968/08 4608 | 30 | FR 0008 | 8///: | DO | | 5705799 () | BRWN CLAY 0007 MSND 0018 |
| ORO TOWNSHIP CON 06 021 | 17 614194 4924594 W | 1970/05 4608 | 30 | FR 0018 FR 0025 | 10/18//1: 15 | DO | | 5707169 () | BRWN CLAY STNS 0018 GREY CLAY MSND 0025 |
| ORO TOWNSHIP CON 05 020 | 17 613884 4924544 W | 1972/10 4715 | 4 | FR 0130 | 22/140/5/ 2:0 | DO | 0163 3 | 5709363 () | SAND 0004 CLAY GRVL BLDR 0020 SAND 0045 GREY CLAY 0130 FSND 0166 |
| ORO TOWNSHIP CON 05 020 | 17 613884 4924584 W | 1976/03 3203 | 5 | FR 0021 | 5/19/7/2: 0 | DO | 0031 3 | 5714173 () | FILL 0006 GREY CLAY SNDY 0021 BRWN SAND 0034 |
| ORO TOWNSHIP CON 06 020 | 17 614214 4924724 W | 1976/05 3203 | 5 | FR 0114 | 27/65/10/ 1:30 | DO | 0115 3 | 5714181 () | BRWN LOAM 0001 BRWN GRVL STNS SAND 0038 GREY CLAY SILT FSND 0065 GREY CLAY 0105 BRWN SAND CLAY 0114 BRWN SAND GRVL 0118 |
| ORO TOWNSHIP CON 05 020 | 17 613944 4924614 W | 1976/06 3203 | 5 | FR 0028 | 4/20/5/1: 0 | DO | 0030 3 | 5714190 () | FILL 0004 GREY CLAY 0018 BRWN SAND CLAY 0028 BRWN SAND 0033 |
| ORO TOWNSHIP CON 05 020 | 17 614064 4924624 W | 1978/02 3135 | 5 | FR 0031 | 4/25/3/3: 0 | DO | 0032 3 | 5715007 () | FILL 0003 BRWN SAND 0021 BRWN SAND CLAY 0031 BRWN SAND FGRD 0035 |

| TOWNSHIP CON LOT | UTM | DATE CNTR | CASING DIA | WATER | PUMP TEST | WELL USE | SCREEN | WELL | FORMATION |
|---|---|---|---|---|---|---|---|---|---|
| ORO TOWNSHIP CON 05 020 | 17 613264 4924274 W | 1978/11 4816 | 6 | FR 0139 | 30/72/13 2/24:0 | MN | 0160 10 | 5715897 () | SAND GRVL LYRD 0026 CLAY SAND 0060 CLAY 0139 FSND 0154 MSND 0172 SAND CMTD 0190 CLAY 0198 |
| ORO TOWNSHIP CON 06 021 | 17 614214 4924674 W | 1982/05 3602 | 6 | FR 0102 | 20/85/8/5 :0 | DO | 0102 7 | 5718089 () | BRWN LOAM 0001 GREY CLAY STNS 0020 GREY CLAY SNDS 0040 BRWN SAND CLAY 0050 GREY CLAY STNS HARD 0065 GREY CLAY SNDS 0102 BRWN SAND CLN WBRG 0109 |
| ORO TOWNSHIP 05 020 | 17 613357 4924530 L | 1988/03 1467 | 5 | FR 0031 | 9/28/3/2: 30 | DO | 0038 4 | 5722980 (25853) | BRWN LOAM 0001 BRWN SAND GRVL 0019 GREY CLAY GRVL 0031 BRWN SAND 0042 GREY SAND CLAY 0042 |
| ORO TOWNSHIP CON 05 020 | 17 614076 4924711 W | 1988/08 1583 | 6 5 | FR 0153 | 27/140/6/ 2:15 | DO | 0150 3 | 5723789 (26573) | BRWN CLAY SAND 0005 GREY CLAY 0030 GREY CLAY SILT 0143 SAND CLAY 0149 FSND MGRD 0154 |
| ORO TOWNSHIP CON 06 021 | 17 614206 4924664 W | 1988/11 4793 | 6 | FR 0037 | 12//5/1:0 | DO | | 5724308 (39760) | BRWN LOAM LOOS 0003 GREY CLAY GRVL LOOS 0008 BRWN GRVL STNS DNSE 0037 |
| ORO TOWNSHIP CON 06 021 | 17 614235 4924678 W | 1989/05 1456 | 5 | FR 0080 | 21/60/7/2 :0 | DO | 0076 4 | 5724948 (63127) | BLCK LOAM 0002 RED SAND 0005 BRWN CLAY 0011 GREY CLAY GRVL LYRD 0038 GRVL CLAY LYRD 0070 GRVL 0085 |
| ORO TOWNSHIP CON 05 020 | 17 613691 4925287 W | 1988/10 3135 | 5 | FR 0078 | 34/48/12/ 6:0 | DO ST | 0078 4 | 5724981 (37750) | CLAY 0015 CLAY SAND 0078 SAND 0082 |
| ORO TOWNSHIP CON 05 020 | 17 613703 4924516 W | 1989/05 1851 | 6 | FR 0022 | 10/18/5/2 4:0 | DO | 0022 6 | 5725001 (41566) | BRWN FILL 0005 BRWN SAND CGVL 0022 BRWN SAND WBRG 0030 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1990/09 3660 | 5 | FR 0033 | /30/5/1:0 | DO | 0038 6 | 5727214 (58208) | BRWN CLAY 0011 GREY CLAY GRVL HARD 0026 GREY CLAY SAND HARD 0033 BRWN FSND WBRG 0047 GREY SILT SAND 0047 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1991/12 1456 | 6 | FR 0087 | 20/80/8/2 :0 | DO | 0083 4 | 5728975 (115246) | BRWN CLAY SAND 0020 BRWN CSND 0025 BRWN STNS GRVL 0055 GREY CLAY SILT 0065 GREY SILT 0082 GREY MSND 0095 |
| ORO TOWNSHIP CON 06 021 | 17 614093 4924681 W | 1992/06 2662 | 6 | UK 0170 | 30/54/20/ 12: | DO | 0163 8 | 5729488 (116964) | BLCK LOAM 0001 BRWN SAND 0003 BRWN CLAY STNS SAND 0071 GREY CLAY 0138 GREY CLAY STNS 0170 BRWN SAND 0178 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1996/11 2513 | 6 | FR 0131 | 17/118/1 0/1:30 | DO | 0132 3 | 5732536 (173390) | BRWN SAND GRVL FILL 0002 BRWN SAND SILT 0007 GREY CLAY SAND BLDR 0017 YLLW SAND SILT 0035 GREY CLAY SAND SILT 0131 YLLW MSND 0135 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1997/09 2513 | 6 | FR 0148 | 23/106/2 0/1:30 | DO | 0148 3 | 5733073 (181549) | BRWN CLAY SAND 0008 GREY SILT SAND STNS 0030 YLLW SAND 0046 GREY CLAY 0091 GREY CLAY SAND CMTD 0148 YLLW SAND MGRD 0151 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1997/12 2513 | 6 | FR 0144 | 26/100/1 0/1:30 | DO | 0144 3 | 5733213 (184106) | LOAM 0001 YLLW SAND SILT STNS 0033 GREY CLAY SILT BLDR 0144 YLLW SAND 0147 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1997/12 2513 | 6 | FR 0164 | 28/128/1 0/1:30 | DO | 0165 3 | 5733214 (184107) | YLLW SAND SILT 0037 GREY SAND FGRD 0045 GREY CLAY SILT STNS 0142 GREY SILT CLAY SAND 0164 YLLW SAND CMTD SLTY 0168 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1998/04 2513 | 6 | FR 0149 | 27/136/1 0/2:0 | DO | 0151 3 | 5733474 (184116) | BRWN SAND GRVL BLDR 0039 GREY SILT CLAY SAND 0149 GREY SAND SILT 0154 |

| TOWNSHIP CON LOT | UTM | DATE CNTR | CASING DIA | WATER | PUMP TEST | WELL USE | SCREEN | WELL | FORMATION |
|---|---|---|---|---|---|---|---|---|---|
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1998/06 2513 | 6 | FR 0170 | 26/140/15/1:0 | DO | 0172 3 | 5733534 (184124) | YLLW SAND SILT 0036 GREY SILT CLAY BLDR 0085 GREY CLAY 0137 GREY SILT SAND 0165 GREY SAND SILT 0175 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1998/06 2513 | 6 | FR 0163 | 27/90/10/1:30 | DO | 0163 3 | 5733535 (184123) | BRWN SAND CLAY 0040 GREY SILT CLAY SAND 0073 GREY CLAY 0134 GREY SILT SAND 0152 GREY SAND SLTY GRVL 0166 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1998/07 2513 | 6 | FR 0169 | /165/8/2:0 | DO | 0169 3 | 5733774 (184130) | BRWN SAND SILT BLDR 0019 YLLW SAND 0037 GREY SILT SAND 0045 GREY CLAY 0136 GREY SILT SAND CMTD 0169 YLLW SAND SILT 0172 GREY CLAY 0172 |
| ORO TOWNSHIP CON 05 020 | 17 613358 4924530 L | 1998/11 2513 | 6 | FR 0158 | 39/128/15/1:0 | DO | 0155 3 | 5734036 (181553) | LOAM 0001 YLLW SAND GRVL SILT 0026 YLLW SAND 0052 GREY CLAY BLDR 0118 GREY CLAY SAND 0147 GREY SILT CLAY 0153 YLLW SAND SILT MGVL 0158 |
| ORO TOWNSHIP CON 05 020 | 17 613358 4924530 L | 1999/01 2513 | 6 | FR 0158 | 34/120/20/1:0 | DO | 0155 3 | 5734052 (195327) | LOAM 0002 YLLW SAND SLTY 0014 YLLW SAND CLAY 0021 YLLW SAND 0041 GREY CLAY VERY SAND 0148 GREY SILT SAND 0155 YLLW SAND CSND 0158 |
| ORO TOWNSHIP CON 05 020 | 17 613358 4924530 L | 1999/03 2513 | 6 | FR 0163 | 35/105/25/1:20 | DO | 0160 3 | 5734062 (195334) | YLLW SAND CLAY BLDR 0046 GREY CLAY SAND 0149 GREY SILT SAND 0160 YLLW SAND SILT 0163 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1999/05 2513 | 6 | FR 0168 | 37/145/15/1:30 | DO | 0169 3 | 5734443 (195337) | BRWN SAND SILT BLDR 0052 GREY CLAY SILT 0136 GREY SILT SAND CMTD 0168 YLLW SAND SLTY 0172 |
| ORO TOWNSHIP CON 05 020 | 17 613357 4924530 L | 1999/06 2513 | 6 5 | FR 0190 | 40/140/20/1:0 | DO | 0187 3 | 5734444 (195338) | YLLW SAND SILT BLDR 0054 GREY SILT CLAY SAND 0140 GREY SILT SAND CMTD 0185 YLLW CSND SILT 0190 |
| ORO TOWNSHIP CON 05 020 | 17 613358 4924530 L | 1999/10 1467 | 5 | FR 0061 | 15/20/12/2: | DO | 0063 4 | 5734805 (209775) | BLCK LOAM 0001 BRWN CLAY SAND STNS 0021 BRWN SAND CLAY 0039 GREY CLAY 0052 BRWN SAND 0061 BRWN SAND 0061 |
| ORO TOWNSHIP CON 05 020 | 17 613354 4924528 L | 2002/06 1467 | 5 | FR 0160 | 42/43/6/17:30 | DO | 0161 4 | 5737086 (228105) | BLCK LOAM 0001 BRWN SAND GRVL 0017 BRWN CLAY SAND 0057 GREY CLAY SAND 0063 GREY CLAY 0070 BRWN SAND CMTD 0079 GREY SAND GRVL CLAY 0140 GREY CLAY 0160 BRWN SAND 0165 BRWN SAND 0165 |
| ORO TOWNSHIP 05 020 | 17 613901 4924521 W | 2004/11 5528 | 6.09 5.11 | FR 0167 | 31///: | DO | 0166 4 | 5739498 (Z18512) A018335 | FILL 0002 BRWN SAND 0031 GREY CLAY SAND 0068 BRWN SAND GRVL 0070 GREY CLAY DNSE 0141 BRWN SAND FSND 0146 BRWN SAND MSND 0177 GREY CLAY 0180 |
| ORO TOWNSHIP CON 05 020 | 17 614040 4924734 W | 2005/11 2513 | 6.25 | FR 0138 | 26/51/6/1:0 | DO | 0140 3 | 5740571 (Z15139) A015078 | BRWN MUCK SILT SAND 0004 GREY SILT SAND 0016 YLLW SAND 0035 GREY CLAY SILT SAND 0083 GREY CLAY 0130 GREY SILT SAND 0140 YLLW SAND SILT CMTD 0143 |

# APPENDIX D

Certificates of Analyses for Chemical Testing – Ground Water

CADUCEON™
ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

# CERTIFICATE OF ANALYSIS

Final Report

**C.O.C.: GH0170** **REPORT No. B21-08693**

**Report To:**

**Peto MacCallum Ltd**
19 Churchill Drive,
Barrie ON L4N 8Z5
**Attention:** Alicia Kimberley

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 30-Mar-21
DATE REPORTED: 07-Apr-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:

P.O. NUMBER: 21BF010
WATERWORKS NO.

| Parameter | Qty | Site Analyzed | Analyst Initials | Date Analyzed | Lab Method | Reference Method |
|---|---|---|---|---|---|---|
| Anions | 1 | Holly Lane | VK | 31-Mar-21 | A-IC-01 (o) | SM4110C |
| T. Phosphorus (P) | 1 | Kingston | KD | 01-Apr-21 | A-TP K | E3199A.1 |

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
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# CERTIFICATE OF ANALYSIS

Final Report

**C.O.C.: GH0170** **REPORT No. B21-08693**

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**Attention:** Alicia Kimberley

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 30-Mar-21
DATE REPORTED: 07-Apr-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF010
WATERWORKS NO.

| | Client I.D. | | BH/MW3 | | | | PWQO | |
|---|---|---|---|---|---|---|---|---|
| | Sample I.D. | | B21-08693-1 | | | | Interim PWQO | PWQO |
| | Date Collected | | 30-Mar-21 | | | | | |
| **Parameter** | **Units** | **R.L.** | | | | | | |
| Nitrite (N) | µg/L | 50 | 60 | | | | | |
| Nitrate (N) | µg/L | 50 | 310 | | | | | |
| Phosphorus-Total | µg/L | 2 | **3670** | | | | | 10 |

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON™ ENVIRONMENTAL LABORATORIES
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# CERTIFICATE OF ANALYSIS

Final Report

**C.O.C.: GH0170** **REPORT No. B21-08693**

**Report To:**

**Peto MacCallum Ltd**
19 Churchill Drive,
Barrie ON L4N 8Z5
**Attention:** Alicia Kimberley

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 30-Mar-21
DATE REPORTED: 07-Apr-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF010
WATERWORKS NO.

## Summary of Exceedances

| Provincial Water Quality Objectives | | |
|---|---|---|
| **BH/MW3** | Found Value | Limit |
| Phosphorus-Total (µg/L) | 3670 | 10 |

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

# GENERAL SAMPLE SUBMISSION FORM

CADUCEON ENVIRONMENTAL LABORATORIES

| SAMPLES SUBMITTED TO: | |
|---|---|
| Kingston | |
| Ottawa | |
| Richmond Hill | |
| Barrie | X |
| London | |
| Windsor | |

**TESTING REQUIREMENTS**

| | | | |
|---|---|---|---|
| O'Reg 153/04 | Table (1 - 9) | Record of Site | |
| O'Reg 406/19 | Table (1 - 9.1) | SPLP Table (1 - 9.1) | |
| RPI | ICC | Agricultural | |
| Coarse | Medium/Fine | O'Reg 558 TCLP | |
| MISA | X PWQO | Landfill Monitoring | |
| Other: | | | |

**REPORT NUMBER (Lab Use)**

B21-08693

Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? ☐ Yes ☒ No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

| | | |
|---|---|---|
| Organization: Peto Maccallum Ltd. | Address: 19 Churchill Drive, Barrie, ON L4N 8Z5. barrie@petomaccallum.com | Invoicing Address (if different): |
| Contact: A. Kimberley | | |
| Tel: 705-734-3900 / Fax: 705-734-9911 | | |
| Email: akimberley@petomaccallum.com | Quote #: | Project Name/#: 21BF010 |
| Additional Info (email, cell, etc): sgriffith@petomaccallu.com | P.O. #: | Additional Info: |

**ANALYSES REQUESTED**

NO2/NO3; Phosphorous PWQO; Suspected Highly Contaminated

**TURNAROUND SERVICE REQUESTED (see back page)**

*Must be arranged in advance

| | | |
|---|---|---|
| ☐ | Platinum* | 200% Surcharge |
| ☐ | Gold* | 100% Surcharge |
| ☐ | Silver | 50% Surcharge |
| ☐ | Bronze | 25% Surcharge |
| ☒ | Standard | 5-7 days |
| ☐ | Specific Date: | |

* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil

| Lab No. | Sample Source and/or Sample Identification | S.P.L. | Sample Matrix * | Date Collected (yy-mm-dd) | Time Collected | Indicate Test For Each Sample By Using A Check Mark In The Box Provided | | | | | | | | | | X | Field pH | Field Temp. | # Bottles/ Sample | Field Filtered Y/N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BH/MW 3 | | GW | 21-03-30 | 1:45:00 PM | X | X | | | | | | | | | | | | 2 | N |
| | | | | | | | | | | | | | | | | | | | | |
| | Gen Chem → O | | | | | | | | | | | | | | | | | | | |
| | nutrients → K | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | |

**SAMPLE SUBMISSION INFORMATION**

| | Sampled by: | Submitted by: |
|---|---|---|
| Print: | S. Griffith | S. Griffith |
| Sign: | | |
| | 21-03-30 | 21-03-30 |
| | Date (yy-mm-dd)/Time: | Date (yy-mm-dd)/Time: |

**SHIPPING INFORMATION**

| | | | |
|---|---|---|---|
| Courier (Client account) | ☐ | Invoice | |
| Courier (Caduceon account) | ☐ | | |
| Drop Off | X | # of Pieces | |
| Caduceon (Pick-up) | ☐ | | |

**REPORTING / INVOICING**

| | |
|---|---|
| Report by Fax | ☐ |
| Report by Email | X |
| Invoice by Email | X |
| Invoice by Mail | ☐ |

**SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)**

| | | | |
|---|---|---|---|
| Received By (print): | ASHLS M | Signature: | |
| Date Received (yy-mm-dd): | 21-03-30 | Time Received: | 14:40 |
| Laboratory Prepared Bottles: | ☒ Yes | ☐ No | |
| Sample Temperature °C: | 14.8 | Labeled by: | AM |

Comments:





H0170

# APPENDIX E

Certificates of Analyses for Chemical Testing – Soil

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

# CERTIFICATE OF ANALYSIS

## Final Report

**C.O.C.: G0341** **REPORT No. B21-06513 (i)**

**Report To:**

**Peto MacCallum Ltd**
19 Churchill Drive,
Barrie ON L4N 8Z5
**Attention:** Alicia Kimberley

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 08-Mar-21
DATE REPORTED: 12-Mar-21
SAMPLE MATRIX: Soil

JOB/PROJECT NO.:

P.O. NUMBER: 21BF010
WATERWORKS NO.

| Parameter | Qty | Site Analyzed | Analyst Initials | Date Analyzed | Lab Method | Reference Method |
|---|---|---|---|---|---|---|
| Cyanide | 4 | Kingston | US | 12-Mar-21 | A-CN s K | in house |
| Conductivity | 4 | Holly Lane | ROD | 12-Mar-21 | A-COND-01 (o) | SM 2510B |
| pH | 4 | Richmond Hill | HAZ | 10-Mar-21 | A-pH-02 (rh) | MOEE3530 |
| Chromium (VI) | 4 | Holly Lane | LMG | 11-Mar-21 | D-CRVI-02 (o) | EPA7196A |
| Mercury | 4 | Holly Lane | PBK | 12-Mar-21 | D-HG-01 (o) | EPA 7471A |
| Sodium Adsorption Ratio | 4 | Holly Lane | AHM | 12-Mar-21 | D-ICP-01 SAR (o) | SM 3120 |
| Metals - ICP-OES | 4 | Holly Lane | AHM | 12-Mar-21 | D-ICP-02 (o) | EPA 6010 |
| Metals - ICP-MS | 4 | Holly Lane | TPR | 12-Mar-21 | D-ICPMS-01 (o) | EPA 6020 |

µg/g = micrograms per gram (parts per million) and is equal to mg/Kg
F1 C6-C10 hydrocarbons in µg/g, (F1-btex if requested)
F2 C10-C16 hydrocarbons in µg/g, (F2-napth if requested)
F3 C16-C34 hydrocarbons in µg/g, (F3-pah if requested)
F4 C34-C50 hydrocarbons in µg/g
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
Any deviations from the method are noted and reported for any particular sample.
nC6 and nC10 response factor is within 30% of response factor for toluene:
nC10,nC16 and nC34 response factors within 10% of each other:
C50 response factors within 70% of nC10+nC16+nC34 average:
Linearity is within 15%:
All results expressed on a dry weight basis.
Unless otherwise noted all chromatograms returned to baseline by the retention time of nC50.

Unless otherwise noted all extraction, analysis, QC requirements and limits for holding time were met.
If analyzed for F4 and F4G they are not to be summed but the greater of the two numbers are to be used in application to the CWS PHC
QC will be made available upon request.

O. Reg 406/19 - Ontario Regulation 406/19
Tbl. 1 - Res/Park/Insti - Bulk - Residental/Parkland/Institutional

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

# CERTIFICATE OF ANALYSIS

## Final Report

**C.O.C.: G0341** **REPORT No. B21-06513 (i)**

**Report To:**

**Peto MacCallum Ltd**
19 Churchill Drive,
Barrie ON L4N 8Z5
**Attention:** Alicia Kimberley

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 08-Mar-21
DATE REPORTED: 12-Mar-21
SAMPLE MATRIX: Soil

JOB/PROJECT NO.:
P.O. NUMBER: 21BF010
WATERWORKS NO.

| | Client I.D. / Sample I.D. / Date Collected | | BH1 SS2 B21-06513-1 03-Mar-21 | BH2 SS2 B21-06513-2 03-Mar-21 | BH3 SS2 B21-06513-3 03-Mar-21 | BH4 SS2 B21-06513-4 03-Mar-21 | O. Reg 406/19 Tbl. 1 - Res/Park/Insti | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **R.L.** | | | | | | |
| pH @25°C | pH Units | | 7.99 | 6.03 | 6.38 | 7.81 | | |
| Conductivity @25°C | mS/cm | 0.001 | 0.112 | 0.058 | 0.054 | 0.15 | 0.57 | |
| Cyanide (Free) | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 0.051 | |
| Sodium Adsorption Ratio | units | | 0.0722 | 0.127 | 0.141 | 0.0994 | | |
| Antimony | µg/g | 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | 1.3 | |
| Arsenic | µg/g | 0.5 | 0.7 | 0.8 | 0.9 | 1.0 | 18 | |
| Barium | µg/g | 1 | 42 | 40 | 51 | 74 | 220 | |
| Beryllium | µg/g | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 2.5 | |
| Boron | µg/g | 0.5 | 3.0 | 1.5 | 1.8 | 4.1 | 36 | |
| Cadmium | µg/g | 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | 1.2 | |
| Chromium | µg/g | 1 | 11 | 12 | 13 | 18 | 70 | |
| Chromium (VI) | µg/g | 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | 0.66 | |
| Cobalt | µg/g | 1 | 3 | 4 | 4 | 5 | 21 | |
| Copper | µg/g | 1 | 7 | 4 | 5 | 9 | 92 | |
| Lead | µg/g | 5 | < 5 | < 5 | < 5 | < 5 | 120 | |
| Mercury | µg/g | 0.005 | < 0.005 | 0.017 | 0.017 | 0.008 | 0.27 | |
| Molybdenum | µg/g | 1 | < 1 | < 1 | < 1 | < 1 | 2 | |
| Nickel | µg/g | 1 | 6 | 6 | 6 | 8 | 82 | |
| Selenium | µg/g | 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | 1.5 | |
| Silver | µg/g | 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | 0.5 | |
| Thallium | µg/g | 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1 | |
| Uranium | µg/g | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 2.5 | |
| Vanadium | µg/g | 1 | 28 | 27 | 28 | 31 | 86 | |
| Zinc | µg/g | 3 | 17 | 15 | 19 | 23 | 290 | |

O. Reg 406/19 - Ontario Regulation 406/19
Tbl. 1 - Res/Park/Insti - Bulk - Residental/Parkland/Institutional

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

# CERTIFICATE OF ANALYSIS

Final Report

**C.O.C.: G0341** **REPORT No. B21-06513 (i)**

**Report To:**

**Peto MacCallum Ltd**
19 Churchill Drive,
Barrie ON L4N 8Z5
**Attention:** Alicia Kimberley

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 08-Mar-21
DATE REPORTED: 12-Mar-21
SAMPLE MATRIX: Soil

JOB/PROJECT NO.:
P.O. NUMBER: 21BF010
WATERWORKS NO.

**Summary of Exceedances**

O. Reg 406/19 - Ontario Regulation 406/19
Tbl. 1 - Res/Park/Insti - Bulk - Residental/Parkland/Institutional

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
Lab Manager

CADUCEON™ ENVIRONMENTAL LABORATORIES
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# CERTIFICATE OF ANALYSIS

## Final Report

**C.O.C.: G0341** **REPORT No. B21-06513 (ii)**

**Report To:**

**Peto MacCallum Ltd**
19 Churchill Drive,
Barrie ON L4N 8Z5
**Attention:** Alicia Kimberley

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 08-Mar-21
DATE REPORTED: 12-Mar-21
SAMPLE MATRIX: Soil

JOB/PROJECT NO.:

P.O. NUMBER: 21BF010
WATERWORKS NO.

| Parameter | Qty | Site Analyzed | Analyst Initials | Date Analyzed | Lab Method | Reference Method |
|---|---|---|---|---|---|---|
| OC Pesticides | 4 | Kingston | CS | 12-Mar-21 | C-PESTCL-01 K | EPA 8080 |

µg/g = micrograms per gram (parts per million) and is equal to mg/Kg
F1 C6-C10 hydrocarbons in µg/g, (F1-btex if requested)
F2 C10-C16 hydrocarbons in µg/g, (F2-napth if requested)
F3 C16-C34 hydrocarbons in µg/g, (F3-pah if requested)
F4 C34-C50 hydrocarbons in µg/g
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
Any deviations from the method are noted and reported for any particular sample.
nC6 and nC10 response factor is within 30% of response factor for toluene:
nC10,nC16 and nC34 response factors within 10% of each other:
C50 response factors within 70% of nC10+nC16+nC34 average:
Linearity is within 15%:
All results expressed on a dry weight basis.
Unless otherwise noted all chromatograms returned to baseline by the retention time of nC50.

Unless otherwise noted all extraction, analysis, QC requirements and limits for holding time were met.
If analyzed for F4 and F4G they are not to be summed but the greater of the two numbers are to be used in application to the CWS PHC
QC will be made available upon request.

O. Reg 406/19 - Ontario Regulation 406/19
Tbl. 1 - Res/Park/Insti - Bulk - Residental/Parkland/Institutional

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

# CERTIFICATE OF ANALYSIS

## Final Report

**C.O.C.: G0341** **REPORT No. B21-06513 (ii)**

**Report To:**

**Peto MacCallum Ltd**
19 Churchill Drive,
Barrie ON L4N 8Z5
**Attention:** Alicia Kimberley

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 08-Mar-21
DATE REPORTED: 12-Mar-21
SAMPLE MATRIX: Soil

JOB/PROJECT NO.:
P.O. NUMBER: 21BF010
WATERWORKS NO.

| | Client I.D. / Sample I.D. / Date Collected | | BH1 SS2 B21-06513-1 03-Mar-21 | BH2 SS2 B21-06513-2 03-Mar-21 | BH3 SS2 B21-06513-3 03-Mar-21 | BH4 SS2 B21-06513-4 03-Mar-21 | O. Reg 406/19 Tbl. 1 - Res/Park/Insti | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **R.L.** | | | | | | |
| Aldrin | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 0.05 | |
| Chlordane (alpha) | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | | |
| Chlordane (Gamma) | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | | |
| Chlordane Total (alpha+gamma) | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | | |
| DDD, 2,4- | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | | |
| DDD, 4,4- | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | | |
| DDD Total | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 0.05 | |
| DDE, 2,4- | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | | |
| DDE, 4,4- | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | | |
| DDE Total | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 0.05 | |
| DDT, 2,4- | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | | |
| DDT, 4,4- | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | | |
| DDT Total | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 1.4 | |
| Dieldrin | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 0.05 | |
| Lindane (Hexachlorocyclohexane, Gamma) | µg/g | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | 0.01 | |
| Endosulfan I | µg/g | 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 | | |
| Endosulfan II | µg/g | 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 | | |
| Endosulfan I/II | µg/g | 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 | | |
| Endrin | µg/g | 0.04 | < 0.04 | < 0.04 | < 0.04 | < 0.04 | 0.04 | |
| Heptachlor | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 0.05 | |
| Heptachlor Epoxide | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 0.05 | |
| Hexachlorobenzene | µg/g | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | 0.01 | |

O. Reg 406/19 - Ontario Regulation 406/19
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Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
Lab Manager

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# CERTIFICATE OF ANALYSIS

Final Report

**C.O.C.: G0341** **REPORT No. B21-06513 (ii)**

**Report To:**

**Peto MacCallum Ltd**
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Barrie ON L4N 8Z5
**Attention:** Alicia Kimberley

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 08-Mar-21
DATE REPORTED: 12-Mar-21
SAMPLE MATRIX: Soil

JOB/PROJECT NO.:
P.O. NUMBER: 21BF010
WATERWORKS NO.

| | Client I.D. / Sample I.D. / Date Collected | | BH1 SS2 B21-06513-1 03-Mar-21 | BH2 SS2 B21-06513-2 03-Mar-21 | BH3 SS2 B21-06513-3 03-Mar-21 | BH4 SS2 B21-06513-4 03-Mar-21 | O. Reg 406/19 Tbl. 1 - Res/Park/Insti | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **R.L.** | | | | | | |
| Hexachlorobutadiene | µg/g | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | 0.01 | |
| Hexachloroethane | µg/g | 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | 0.01 | |
| Methoxychlor | µg/g | 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 0.05 | |

O. Reg 406/19 - Ontario Regulation 406/19
Tbl. 1 - Res/Park/Insti - Bulk - Residental/Parkland/Institutional

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
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# CERTIFICATE OF ANALYSIS

Final Report

**C.O.C.: G0341** **REPORT No. B21-06513 (ii)**

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DATE RECEIVED: 08-Mar-21
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SAMPLE MATRIX: Soil

JOB/PROJECT NO.:
P.O. NUMBER: 21BF010
WATERWORKS NO.

**Summary of Exceedances**

O. Reg 406/19 - Ontario Regulation 406/19
Tbl. 1 - Res/Park/Insti - Bulk - Residental/Parkland/Institutional

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
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Christine Burke
Lab Manager

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**TESTING REQUIREMENTS**

X O.Reg 406 Table _1_ Medium/Fine Coarse MISA Guidelines
RPI ICC Agricultural (O.Reg 153) O.Reg 558 Leachate Analysis
Yes No Record of Site Condition (O.Reg 153) Disposal Site: _____
Provincial Water Quality Objectives Landfill Monitoring
Sewer Use By-Law: _____ Other: _____

**REPORT NUMBER (Lab Use)**

B21-06513

Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? Yes X No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

Indicate Laboratory Samples are submitted to: Kingston Ottawa Richmond Hill Windsor X Barrie London

| | | |
|---|---|---|
| Organization: Peto MacCallum Ltd. | Address and Invoicing Address (if different) | |
| Contact: A. Kimberley | 19 Churchill Drive, Barrie, ON L4N8Z5, barrie@petomaccallum.com | |
| Tel: 705-734-3900 | | |
| Fax: 705-734-9911 | Quote No.: | Project Name: 21BF010 |
| Email: akimberley@petomaccallum.c | P.O. No.: | Additional Info: aturner@petomaccallum.com |

**ANALYSES REQUESTED (Print Test in Boxes)**

Metals & Inorganics; OC Pesticides; Suspected Highly Contaminated

**TURNAROUND SERVICE REQUESTED (see back page)**

Platinum 200% Surcharge
Gold 100% Surcharge
Silver 50% Surcharge
Bronze 25% Surcharge
X Standard 5-7 days

Specific Date: _____

* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil

| Lab No: | Sample Identification | S.P.L. | Sample Matrix * | Date Collected (yy-mm-dd) | Time Collected | Indicate Test For Each Sample By Using A Check Mark In The Box Provided | ✓ | Field pH | Field Temp. | # Bottles/ Sample | Field Filtered(Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BH1 SS2 | | S | 2021-03-03 | | X X | | | | 2 | |
| 2 | BH2 SS2 | | S | 2021-03-03 | | X X | | | | 2 | |
| 3 | BH3 SS2 | | S | 2021-03-03 | | X X | | | | 2 | |
| 4 | BH4 SS2 | | S | 2021-03-03 | | X X | | | | 2 | |
| | ~~Jar~~ → K → jar | | | | | | | | | | |
| | Jar → C | | | | | | | | | | |
| | ~~Jar~~ → RH → pump | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**SAMPLE SUBMISSION INFORMATION**

| | Sampled by: | Submitted by: |
|---|---|---|
| Print: | D. Power | |
| Sign: | | |
| | 03/03/2021 | |
| | Date (yy-mm-dd)/Time: | Date (yy-mm-dd)/Time: |

**SHIPPING INFORMATION**

Client's Courier
Caduceon's Courier
Drop Off X
Caduceon (Pick-up)
Invoice
# of Pieces

**REPORTING / INVOICING**

Report by Fax
Report by Email X
Invoice by Email X
Invoice by Mail

**SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)**

Received By (print): Nick Orleni Signature: [signature]
Date Received (yy-mm-dd): 21-03-03 Time Received: 16:50
Laboratory Prepared Bottles: (Yes) No
Sample Temperature °C: 11.7 Labeled by: NO

Comments:
extra jar submitted for leachate testing. Samples will be requested following review of these results → NO extra jar - submitted C13.

Page _1_ of __1____
G 0341

White: Lab Copy / Yellow: Invoicing Copy / Pink: Client Copy

CofC, May 2019, Revision No: 22