September 22, 2023
Our File: 223084

Matt Brown
[redacted]

Via Email: [redacted]

RE: Feasibility Assessment for Private Sewage System Servicing
D-5-4 Study, Lot Severance of
440 Princess Street, Shallow Lake
Township of Georgian Bluffs

Dear Mr. Brown,

GM BluePlan Engineering Limited (GMBP) has been retained to provide hydrogeologic services to support the approval for a residential lot severance in the community of Shallow Lake within the Township of Georgian Bluffs. The lands under consideration (i.e., the "Site") are located in the vicinity of 440 Princess Street directly adjacent to the right-of-way of Ontario Highway 6. The current property is further defined as *Part Lot 22, Concession 2 SCD, Registered Plan 857, in the Geographic Township of Keppel, Township of Georgian Bluffs, County of Grey*. The approximate location of the subject property is presented in Figure 1.

The Site is approximately 0.59 ha (1.46 acres) and currently supports an individual residence with an on-site sewage system and municipal water supply service. The proposed severance will ultimately result in one additional property for a total of two (2) individual lots. The retained lot is proposed to be reduced to a size of 0.33 ha (0.82 acres) while the severed lot is proposed to have an approximate size of 0.26 ha (0.64 acres). The retained lot will continue to be under residential use. See Figures 1 and 2 for the Site Location and approximate Site Layout, respectively.

The severed lot is proposed to be used for residential purposes (i.e., a fourplex dwelling) equipped with a private on-site sewage system and municipal water supply service. This preliminary hydrogeological feasibility assessment is intended to establish whether it will be feasible to service the severed lot with a private on-site sewage system. This study is completed with reference to the Ministry of Environment, Conservation and Parks (MECP) Guideline D-5-4 for water quality impact risk assessment for on-site sewage systems.

GEOLOGICAL SETTING

The subject property is in the physiographic region known as the Bruce Peninsula. This region is characterized by generally flat topography with shallow overburden and abundant bedrock exposed at the ground surface. Regionally, the bedrock dips gradually to the southwest, toward Lake Huron. The exposed bedrock surfaces are sourced from glacial activity and are typically irregular due to weathering. Karstic features may exist as the shallow bedrock is described as highly fractured. At the Site, the overburden primarily consists of silt and sand with stones, which vary in thickness and is underlain by weathered dolostone/sandstone bedrock and shale of the Amabel Formation. According to map sets available from the Ontario Ministry of Northern Development and Mines (NDMNRF, 2000; 2010; 2011), the geological materials underlying the Site are summarized as fine-textured glaciolacustrine deposits consisting of silt and clay with minor quantities of sand and gravel.

The Site has been identified with soils that are part of the Osprey Soil Series. This soil generally consists of dark brown to brown loam over clay loam and grey-brown stony calcareous till. These soils are derived from medium-textured dolomitic limestone till and generally portray irregular slopes moderate to steep in grading, containing a generous number of stones. As a result of loam dominated stratigraphy in the local area, the hydraulic conductivity is expected to be moderate to high, reflecting the coarse-grained soils noted through the native soils exhibiting good drainage conditions (Gillespie & Richards, 1954). Influencing factors for the drainage conditions for the Site are the depth of overburden thickness, soil particle distribution characteristics, karstic and fractured underlain bedrock, and local topography.

Based on the topographic mapping of the immediate area, the elevation of the Site and immediate surrounding lands are moderately sloped with elevation decreasing from northwest to southeast within the Site. A relatively small scarp is located along the northwesterly boundary with site.

General knowledge of the area suggests that the groundwater table is expected to be more than one metre below the ground surface at the subject site. It is inferred that the local groundwater flow direction is generally easterly to southeasterly towards the Park Head Creek, situated approximately 270 m east-southeast of the eastern Site property boundary.

Nearby water well records indicate that the depth to bedrock is in the range of approximately 0 to 7.5 mbgs (metres below ground surface), with an average depth of 2.5 mbgs based on the surrounding wells within a 300 m radius of the Site. Additional information from the well records reports that the average measured static water level with these wells is approximately 9.3 mbgs. However, static water level measurements are subject to change based on subsurface conditions and localized fluctuations in groundwater flow. A summary of the information found in the near by well records can be found in Enclosure A.

FIELD INVESTIGATION

Three test holes (i.e., TH-1 to TH-3) were advanced by excavator at the Site on May 26, 2023. GMBP staff attended the Site to record the stratigraphic conditions and collect subsurface soil samples. The soil samples and photographs were submitted to the GMBP Materials Testing and Inspection Laboratory in Owen Sound for soil characterization analyses. TH-1 and TH-3 were advanced on western and eastern portions of the proposed severed lot, respectively, while TH-2 was advanced approximately at the centre of the lot. The collected soil samples were submitted to further understand the subsurface conditions in the area of the proposed lot. The test hole locations are shown in Figure 2 for reference.

A grain size distribution analysis was completed for the soil samples taken from TH-1 and TH-3 at a depth of 1.0 and 0.5 mbgs (metres below ground surface), respectively, to determine the particle size distribution and percolation time (i.e., T-time) in various portions of the proposed lot. The analyses indicate that the soils vary across the site. The soil materials on the northwesterly portion of the lot are classified as fine sand with a trace amount of silt and produced a recorded T-time of 5 min/cm. The soil materials on the southeasterly portion of the lot are classified as silt with sand and some clay with a T-time of greater than 50 min/cm. The T-time documented on the northwesterly portion of the lot indicates good drainage qualities, while the T-time on the easterly portion indicate the native soil will be insufficient to provide adequate drainage for an on-site sewage system. A sewage system constructed in southeasterly portion of the proposed lot is anticipated to require imported fill with a lower T-time to provide adequate drainage conditions for this property.

The documented subsurface materials can be found in the Test Hole Logs presented in Enclosure B, while the results of the soil characterization analyses of the submitted soil samples can be found in Enclosure C.

SERVICING CONSIDERATIONS

D-5-4 Guideline Approach for On-Site Sewage Systems

The D-5-4 Guideline is a stepwise process that allows for differing methodologies to be applied to demonstrate sufficient attenuation of nitrate. Typically, this stepwise process is divided into three steps. Step 1 involves Lot Size Considerations in which the risk that exceedances imposed from individual sewage systems is considered acceptable for a private residence development on lots one hectare or larger. Step 2 involves System Isolation Considerations in which an assessment of the potential risk of sewage effluent impacting potential water supply aquifers is required and typically completed through a Site specific and comprehensive hydrogeological assessment and monitoring program. Step 3 involves Contaminant Attenuation Consideration through the use of a Monitoring-Based Assessment or Predictive Assessment.

In this case, to support the proposed severance on the subject property, a Predive Assessment for Contaminant Attenuation Consideration (Step 3) has been used since the proposed lots will be less than one hectare in size and there is no evidence of hydraulic separation of the local aquifer system used for water supply.

On-Site Sewage Systems: Nitrogen Attenuation

The primary concern related to on-site sewage systems is the effect that these systems may have on the concentration of nitrate in local groundwater. The proposed developments must ensure that the sewage disposal does not negatively impact groundwater quality and preclude its use for other purposes or for other off-site users. The most prevalent use for groundwater is domestic consumption and so typically this means that a given development must not result in nitrate concentration of 10 mg/L or grater (per Ontario Drinking Water Standards) in the groundwater going off-site.

To estimate the potential for impacts to shallow groundwater, nitrogen attenuation calculations have been calculated as per the method given in the MECP Guideline D-5-4 (1996) and are summarized in Table 1. The calculations are typically completed for the Site holistically (i.e., the combined lot size and with the combined use) using a metric of nitrate loading of 40 g/lot/day per residential dwelling.

It is understood that the retained lot contains an existing residential dwelling equipped with a Standard Class IV on-site sewage system, while the proposed lot will be developed with a fourplex structure equipped with four one-bedroom apartments with its own on-site sewage system outfitted with a tertiary treatment system (i.e., Double-Pass Waterloo Biofilter System) capable of removing 50% of nitrate-nitrogen.

For the purposes of this Study, we are proposing the use of a tertiary system with enhanced nitrogen removal that can achieve at least 50% nitrate removal from the fourplex structure (i.e., four one-bedroom apartments total). The Ontario Building Code (OBC) specifies that the sewage system design flow for a one-bedroom apartment is set to 750 L/day while the Guideline reports a minimum concentration of 40 mg/L of nitrate-nitrogen is applied based on actual discharged produced from a Class IV sewage system. Using the adjusted loading volume, standard nitrate loading quantity, and consideration of 50% nitrate removal, one unit in the proposed fourplex will produce approximately 15 g/day of sewage nitrate. Therefore, the proposed development will contribute approximately 60 g/day, as shown below:

$$750\ \frac{L}{day} \times\ 40\ \frac{mg}{L} \times \frac{1\ g}{1000\ mg}\ =\ 30\frac{g}{day}$$

$$30\ \frac{g}{day} \times 4\ \text{units} = 120\ \frac{g}{day}$$

$$120\ \frac{g}{day} \times\ 50\%\ \text{removal}\ =\ 60\ \frac{g}{day}$$

Additionally, it is acknowledged the retained lot contains an existing residential dwelling, equipped with an on-site sewage system. In applying the D-5-4 Guideline, it is reasonable to assume this system contributes the typical amount of 40 g/day of nitrate loading.

Table 1: Nitrogen Attenuation for the Site

Line	Item	Value	Source
1	Average Annual Precipitation (mm/yr)	1,294	Environment Canada (Tara)
2	Average Annual Evapotranspiration (mm/yr)	550	MNR (1984)
3	Impervious Area Factor	0.40	Estimated, for woodland rolling slopes with open sand loam usage (MTO Drainage Management Manual, Chart 1.07)
4	Lot Area (m^2)	5,922	From Conceptual Plan (see Figure No. 2)
5	Hydrologic Input (L/yr)	2,643,581	Line 4 * (Line 1 – Line 2) * (1 – Line 3), units converted
6	Number of Single Detached Dwellings	1 lot, 1 dwelling	Retained Lot contains one single detached home
7	Number of Dwellings in Multi-Unit Complex	1 lot, 4 dwellings	Proposed Lot contains one fourplex structure
8	Sewage Effluent Input Rate for Single-Detached Dwellings (L/lot/day)	1,000	Specified by Procedure D-5-4
9	Sewage Effluent Input Rate for Multi-Unit Complexes (L/dwelling/day)	750	Specified by the Ontario Building Code
10	Annual Sewage Effluent Input (L/yr)	1,460,000	(Line 6 * Line 8) + (Line 7 * Line 9), units converted
11	Total Water Input (L/yr)	4,103,581	Line 5 + Line 10, units converted
12	Nitrate Output – Single Detached Dwellings (g/day)	40	1 Lot x 40 g/day
13	Nitrate Output – Multi-Unit Complex (g/day)	60	4 dwellings x 30 g/day with 50% removal
14	Total Nitrate Output (g /day)	100	Line 12 + line 13
15	Annual Nitrogen Loading (g/yr)	36,500	Line 14, units converted
16	Attenuated Nitrogen Concentration (mg/L)	8.89	Line 15 / Line 11, units converted

Using the dilution approach, the attenuated nitrogen concentration for the entire Site (i.e., retained property and proposed fourplex) is estimated to be 8.89 mg/L and meets the maximum allowable concentration of 10 mg/L. These calculations are considered to be a conservative estimate since they do not account for other attenuation mechanisms that are known to occur, such as dilution in groundwater and biological/geochemical attenuation processes. Consequently, the servicing of the proposed fourplex would be feasible for the Site holistically with Tertiary Sewage System with 50% nitrate removal and constructed under the requirements of the Ontario Building Code (OBC).

On-Site Sewage Systems: Sewage System Sizing

The feasibility of the sewage servicing also depends on whether the lot is large enough to accommodate the proposed system to be added to the subject lands. With respect to the existing residential property, an approved sewage system already exists, showing that the lot is sufficient sized to accommodate sewage system infrastructure. The proposed lot will be developed using a dispersal bed, which has a smaller footprint than a conventional leaching bed. Therefore, it is reasonable to expect the proposed sewage system would be accommodated with respect to lot sizing. However, to provide more certainty, we have also reviewed the standard sizing calculations prescribed under the OBC.

Assuming the proposed lot will contain one fourplex structure completed with four one-bedroom apartments, the expected rate of sewage generation would be 3,000 L/day for the proposed lot.

The on-site subsurface soils at the southeasterly portion of the proposed lot have been shown to have poor drainage conditions, while the groundwater is likely more than one metre below the ground surface.

For the purposes of establishing feasibility of the proposed servicing scheme, a preliminary sizing of a Type-A Dispersal Bed is provided herein for the easterly portion of the proposed lot, as a conservative measure. Regardless of the information provided herein, it is recommended that the design of the sewage system be completed by a licensed septic

system installer with respect to the OBC, locations of other features (i.e., buildings, property lines, and setbacks), and the soil/groundwater conditions occurring at the Site.

The underlying soils at the eastern portion of the proposed lot are reported to have a T-time greater than 15 min/cm, therefore the sand layer for the Type-A Dispersal Bed will be determined by Sentence 8.7.7.1.(5) of the OBC. Assuming a sewage generation rate of 3,000 L/day and a T-time of 50 min/cm, the sand layer must be at least 375 m^2 in size. Under Sentence 8.7.7.1.(6), the stone layer is to be at least 20 m^2, which is the result of the sewage generation rate "Q" divided by the maximum allowable surface loading rate of 75 $L/m^2/day$.

Due to the T-time of the shallow soils, the dispersal bed must also extend a minimum of 15 m beyond the distribution pipe in any direction that the effluent may flow, known as a "mantle". Assuming a square shaped dispersal bed, an area of 375 m^2, the dimensions correlate to a bed size of approximately 19 m by 34 m, including the mantle length. Based on the proposed lot dimensions, it appears that this would be a manageable size for the construction of the leaching bed while still retaining some amenity space on the lot.

It is recommended that a Site Plan be developed as part of the construction/development to ensure that adequate spacing remains once access, setbacks, and building sizes are known.

CONCLUSION

This preliminary hydrogeological assessment has been completed to support a proposed property severance to create one additional lot from the existing property at 440 Princess Street, Shallow Lake, within the Township of Georgian Bluffs. This study has been conducted to assess the feasibility for the Site to support the proposed severance, which will be serviced with a private on-site sewage system. The retained lot and severed lot (i.e., a total of two (2) lots) are propsoed to have an area of approxiamtely 0.59 ha (1.46 acres).

Based on the above analysis, the findings of this assessment indicate that:

- with respect to nitrogen attenuation, the proposed severance has been determined to be suitable for servicing with an on-site sewage system with a low potential for impact to local water resources. Using the MECP D-5-4 Predictive Assessment, the resultant attenuated nitrogen concentration for the entire proposed layout (i.e., one retained and one severed lot) was calculated to be 8.89 mg/L, which is below the *Ontario Drinking Water Standards* criteria of 10 mg/L;

- to achieve an attenuated nitrogen concentration value below 10 mg/L with an existing on-site sewage system already installed on the subject lands, the proposed severance must utilize a sewage system equipped with tertiary treatment that can remove at least 50% of nitrate-nitrogen from the sewage effluent and meet the Level IV treatment criteria, as per the *Ontario Building Code*, Section 8.6.2.2.; and

- it is reasonable to expect that the proposed lot will be able to accommodate a sewage system constructed with a Type-A Dispersal Bed and allow for amenities, setbacks, and contain a reasonable building envelope.

We recommend that:

- the construction of the sewage system conforms to the *Ontario Building Code* with respect to the T-time of soils underlying the proposed Dispersal Bed, minimum separation from the bedrock or high groundwater table, and required setbacks from all applicable features confirmed as part of the design and construction;

- a Site Plan be developed as part of the construction/development to ensure that adequate spacing remains once access, setbacks, and building sizes are known;

- the proposed severance utilizes the use of a sewage system equipped with tertiary treatment systems that are capable of removing a least 50% nitrate-nitrogen from the sewage effluent; and

- the on-site sewage system be designed and constructed by a licensed septic system installer per the *Ontario Building Code* and in respect to the required setbacks from applicable features, including neighbouring lots.

Yours truly,

GM BLUEPLAN ENGINEERING LIMITED

Per:

Cuirin Cantwell, M.Eng., E.I.T.

Per:

Matthew Nelson, P.Eng., P.Geo

Enclosures:

Figure 1 – Site Location
Figure 2 – Site Layout
Enclosure A: Well Records Information Summary
Enclosure B: Test Hole Logs
Enclosure C: Grain-Size Distribution

REFERENCES

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FIGURE 1:
SITE LOCATION

Hydrogeological Feasibility D-5-4 Study

440 Princess Street, Shallow Lake
Township of Georgian Bluffs
Grey County, ON

LEGEND

Approximate Property Boundary

Figure 1

Site Location

BluePlan ENGINEERING

July, 2023
Project No. 223084
Projection EPSG:3857

Document Path: W:\OwenSound\Owen Sound\223-2023\223084 Conceptual Site Plan & D-5-4 Study - 440 Princess St., Shallow Lake\GIS\223084 Study.qgz

FIGURE 2:
SITE LAYOUT

Hydrogeological Feasibility D-5-4 Study

440 Princess Street, Shallow Lake
Township of Georgian Bluffs
Grey County, ON

LEGEND

- Retained Lot
- Proposed Lot
- TH Locations

Note:
Indicated boundaries and test hole locations have been approximated.

Figure 2

Site Layout

BluePlan ENGINEERING

September, 2023
Project No. 223084
Projection EPSG:3857

ENCLOSURE A:
WELL RECORDS INFORMATION SUMMARY

Enclosure A - Well Information Summary

WELL ID	LOT	CON	GEO. TOWNSHIP	EASTING	NORTHING	USAGE	WELL TYPE	STATIC WATER LEVEL	TOTAL DEPTH	DEPTH TO BEDROCK
								(mbgs)	(mbgs)	(mbgs)
2501539	-	-	SHALLOW LAKE VILLAGE	492664.8	4940488	Domestic (Water Supply)	Bedrock	11.0	33.5	2.4
2502216	-	-	SHALLOW LAKE VILLAGE	492964.8	4940208	Domestic (Water Supply)	Bedrock	4.9	13.7	4.6
2502222	-	-	SHALLOW LAKE VILLAGE	492954.8	4940223	Domestic (Water Supply)	Bedrock	4.6	12.5	4.9
2502228	-	-	SHALLOW LAKE VILLAGE	492924.8	4940398	Domestic (Water Supply)	Bedrock	12.2	25.9	0.6
2502233	-	-	SHALLOW LAKE VILLAGE	492954.8	4940373	Domestic (Water Supply)	Bedrock	6.1	16.8	4.6
2502237	-	-	SHALLOW LAKE VILLAGE	492794.8	4940423	Domestic (Water Supply)	Bedrock	15.2	36.6	0
2502240	-	-	SHALLOW LAKE VILLAGE	492884.8	4940438	Public (Water Supply)	Bedrock	6.7	13.7	7.6
2502241	-	-	SHALLOW LAKE VILLAGE	492914.8	4940323	Domestic (Water Supply)	Bedrock	5.8	15.2	4.3
2502604	-	-	SHALLOW LAKE VILLAGE	492664.8	4940443	Domestic (Water Supply)	Bedrock	18.3	43.6	0.0
2502620	-	-	SHALLOW LAKE VILLAGE	493064.8	4940358	Domestic (Water Supply)	Bedrock	3.7	11.9	1.8
2503188	-	-	SHALLOW LAKE VILLAGE	493064.8	4940373	Domestic (Water Supply)	Bedrock	2.7	16.8	3.0
2503194	-	-	SHALLOW LAKE VILLAGE	493014.8	4940573	Domestic (Water Supply)	Bedrock	6.4	24.4	4.9
2504277	-	-	SHALLOW LAKE VILLAGE	492991.8	4940328	Livestock (Water Supply)	Bedrock	13.1	30.8	0
2505251	-	-	SHALLOW LAKE VILLAGE	493066.8	4940544	Domestic (Water Supply)	Bedrock	4.9	24.4	3.7
2505286	-	-	SHALLOW LAKE VILLAGE	492995.8	4940476	Domestic (Water Supply)	Bedrock	7.6	36.6	0.0
2505291	-	-	SHALLOW LAKE VILLAGE	492999.8	4940541	Domestic (Water Supply)	Bedrock	1.5	25.0	1.5
2505523	22	OR S 2	KEPPEL	492909.8	4940561	Domestic (Water Supply)	Bedrock	3.7	27.4	3.7
2505592	-	-	SHALLOW LAKE VILLAGE	492814.8	4940523	Commercial (Water Supply)	Bedrock	11.0	32.6	0.9
2505620	-	-	SHALLOW LAKE VILLAGE	492864.8	4940573	Domestic (Water Supply)	Bedrock	4.9	29.6	3.7
2506010	-	-	SHALLOW LAKE VILLAGE	492614.8	4940423	Domestic (Water Supply)	Bedrock	21.3	46.9	0.6
2506376	8	8	SHALLOW LAKE VILLAGE	492764.8	4940423	Domestic (Water Supply)	Bedrock	18.9	73.2	2.4
2506377	8	8	SHALLOW LAKE VILLAGE	492814.8	4940423	Domestic (Water Supply)	Bedrock	19.5	45.7	0.9
2507162	-	-	SHALLOW LAKE VILLAGE	492714.8	4940573	Domestic (Water Supply)	Bedrock	18.0	74.7	1.8
2508293	-	-	SHALLOW LAKE VILLAGE	492714.8	4940323	Domestic (Water Supply)	Bedrock	9.1	43.3	0.9
2508535	69	-	SHALLOW LAKE VILLAGE	493064.8	4940423	Domestic (Water Supply)	Bedrock	6.1	45.7	4.6
2508826	-	-	SHALLOW LAKE VILLAGE	492864.8	4940323	Domestic (Water Supply)	Bedrock	10.7	33.5	0.9
2508829	-	-	SHALLOW LAKE VILLAGE	492964.8	4940223	Domestic (Water Supply)	Bedrock	6.1	42.7	5.5
2516500	-	-	SHALLOW LAKE VILLAGE	492886.0	4940604	Domestic (Water Supply)	Bedrock	5.5	36.6	1.8

ENCLOSURE B:
TEST HOLE LOGS

Testhole ID: TH-1

CLIENT Matt Brown
PROJECT NAME Hydrogeological Investigation - 440 Princess Street
PROJECT NUMBER 223084
PROJECT LOCATION Shallow Lake, ON
DATE COMPLETED 26-May-2023
CONTRACTOR E.C. King
LOGGED BY CC
METHOD Excavator
WELL CONSTRUCTION
NOTES

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG		MATERIAL DESCRIPTION
					Ground Surface	
					0.00	TOPSOIL
	0.5					
	1.0				0.30	SILT with CLAY and SAND - brown colour
0.5	1.5					
	2.0				0.60	SAND with some SILT - light brown colour
	2.5					
	3.0		TH-1			
1.0	3.5					
	4.0					
	4.5					
1.5	5.0					
	5.5					
	6.0					

Testhole Terminated at 1.90 m.

Testhole ID: TH-2

CLIENT Matt Brown
PROJECT NAME Hydrogeological Investigation - 440 Princess Street
PROJECT NUMBER 223084
PROJECT LOCATION Shallow Lake, ON
DATE COMPLETED 26-May-2023
CONTRACTOR E.C. King
LOGGED BY CC
METHOD Excavator
WELL CONSTRUCTION
NOTES

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG		MATERIAL DESCRIPTION
						Ground Surface
					0.00	TOPSOIL
	0.5					
	1.0				0.30	SILT
	1.5					
0.5					0.50	SAND
	2.0					Abundant Cobbles and Boulders. Advanced to probable top of Bedrock
	2.5					
	3.0					
1.0						
	3.5					

Testhole Terminated at 1.10 m.

Testhole ID: TH-3

CLIENT Matt Brown
PROJECT NAME Hydrogeological Investigation - 440 Princess Street
PROJECT NUMBER 223084
PROJECT LOCATION Shallow Lake, ON
DATE COMPLETED 26-May-2023
CONTRACTOR E.C. King
LOGGED BY CC
METHOD Excavator
WELL CONSTRUCTION
NOTES

DEPTH (m)	DEPTH (ft)	ELEVATION (m)	SAMPLE TYPE NUMBER	GRAPHIC LOG		MATERIAL DESCRIPTION
					Ground Surface	
					0.00	TOPSOIL with vegetation
	0.5					
	1.0					
	1.5					
0.5			TH-3		0.50	BOULDERS and COBBLES with some FILL
	2.0					
	2.5					
	3.0					
1.0						
	3.5					
	4.0					
	4.5					
1.5						

Testhole Terminated at 1.50 m.

ENCLOSURE C:
GRAIN SIZE DISTRIBUTION

GM BluePlan Engineering Limited

Guelph, Owen Sound, Listowel, Kitchener, London, Hamilton, GTA

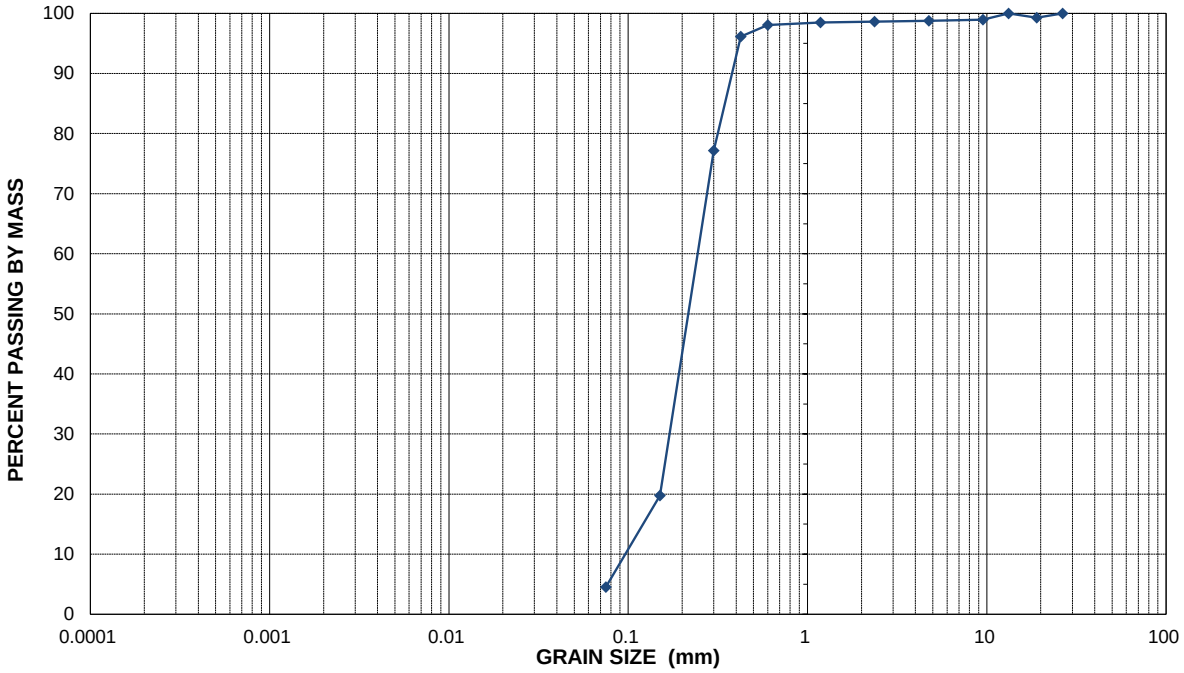
1260 - 2nd Avenue E., Unit 1 Owen Sound, ON N4K 2J3

Phone 519-376-1805 Fax 519-376-8977 www.GMBluePlan.ca

PARTICLE SIZE ANALYSIS

PROJECT:	M.T- Conceptual Site Plan & D-5-4 Study	FILE NO.:	223084
LOCATION:	440 Princess Street, Shallow Lake ON	LAB SAMPLE NO.:	S-5024
CLIENT :	Matt Brown	SAMPLE DATE:	May 26, 2023
SOIL TYPE:	Fine Sand with a trace amount of Silt	SAMPLED BY:	M.N.
		SOURCE:	TH @ 1m bgs

PARTICLE SIZE DISTRIBUTION



←		FINE	MEDIUM	COARSE	FINE	COARSE
CLAY	SILT	SAND			GRAVEL	

SIEVE SIZE PARTICLE DIA. (mm)	PERCENT PASSING SAMPLE	HYDROMETER PARTICLE DIA. (mm)	PERCENT PASSING SAMPLE
26.5	100.0	0.0600	
19	99.3	0.0400	
13.2	100.0	0.0300	
9.5	99.0	0.0250	
4.75	98.7	0.0200	
2.36	98.6	0.0120	
1.180	98.5	0.0090	
0.600	98.1	0.0060	
0.425	96.2	0.0045	
0.300	77.2	0.0032	
0.150	19.7	0.0023	
0.075	4.5	0.0013	

D_{10} : 0.1 mm **D_{60} : 0.3 mm** **Cu : 3**

Coefficient of Permeability: 1 x 10^{-2} cm/sec **"T" Time : 4-6 mins/cm**

Comments:

GM BluePlan Engineering Limited

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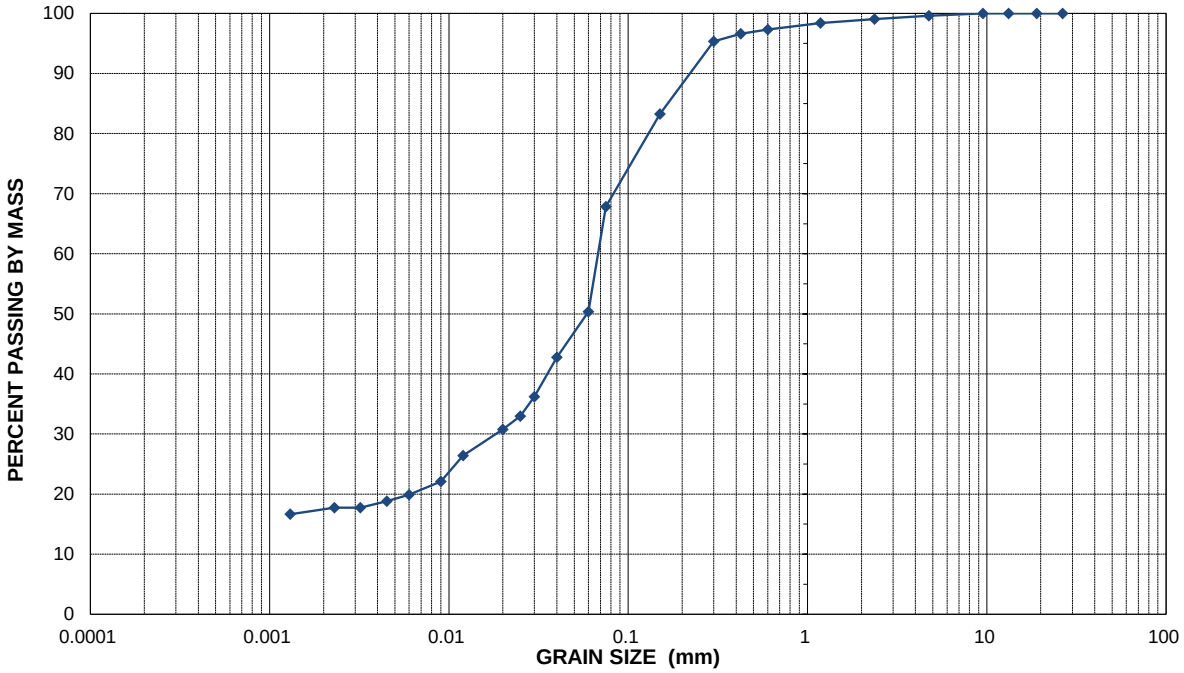
PARTICLE SIZE ANALYSIS

PROJECT:	M.T- Conceptual Site Plan & D-5-4 Study	FILE NO.:	223084
LOCATION:	440 Princess Street, Shallow Lake ON	LAB SAMPLE NO.:	S-5025
CLIENT :	Matt Brown	SAMPLE DATE:	May 26, 2023
SOIL TYPE:	Silt with Sand and some Clay	SAMPLED BY:	M.N.
		SOURCE:	TH @ 0.5m bgs

PARTICLE SIZE DISTRIBUTION



←		FINE	MEDIUM	COARSE	FINE	COARSE
CLAY	SILT	SAND			GRAVEL	

SIEVE SIZE PARTICLE DIA. (mm)	PERCENT PASSING SAMPLE	HYDROMETER PARTICLE DIA. (mm)	PERCENT PASSING SAMPLE
26.5	100.0	0.0600	50.4
19	100.0	0.0400	42.7
13.2	100.0	0.0300	36.2
9.5	100.0	0.0250	33.0
4.75	99.6	0.0200	30.8
2.36	99.1	0.0120	26.4
1.180	98.4	0.0090	22.1
0.600	97.3	0.0060	19.9
0.425	96.6	0.0045	18.8
0.300	95.3	0.0032	17.7
0.150	83.2	0.0023	17.7
0.075	67.8	0.0013	16.6

D_{10} : 0.0001 mm **D_{60} : 0.07 mm** **Cu : 700**

Coefficient of Permeability: 1 x 10^{-8} cm/sec **"T" Time : 50+ mins/cm**

Comments: D10 value extrapolated