CHUNG & VANDER DOELEN
ENGINEERING LTD.

PRELIMINARY GEOTECHNICAL CHARACTERIZATION
PROPOSED INDUSTRIAL SUBDIVISION
6739 WELLINGTON ROAD 109
TEVIOTDALE, ONTARIO

Submitted to:
Frontiers Design Build Inc.
PO Box 27021 RPO Clair
Guelph, Ontario
N1L 0C1

Attention:
Mr. Doug Taylor

FILE NO / 1207 / June 26, 2024

CHUNG & VANDER DOELEN
ENGINEERING LTD.

311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1
519-742-8979

June 26, 2024
File No.: 1207

Frontiers Design Build Inc.
PO Box 27021 RPO Clair
Guelph, Ontario
N1L 0C1

Attention:
Mr. Doug Taylor

Re: **PRELIMINARY GEOTECHNICAL CHARACTERIZATION**
PROPOSED INDUSTRIAL SUBDIVISION
6739 WELLINGTON ROAD 10931
TEVIOTDALE, ONTARIO

We take pleasure in enclosing one (1) copy of our Geotechnical Investigation Report conducted at the above-mentioned location and we will be glad to discuss any questions arising from this work.

We thank you for giving us this opportunity to be of service to you.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

Robert Vander Doelen, P. Eng.
Senior Engineer

GEOTECHNICAL / CONSTRUCTION INSPECTION **/ MATERIALS** TESTING
ENVIRONMENTAL SERVICES **/ WASTEWATER** ENGINEERING **/ HYDROGEOLOGY**

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1.0 INTRODUCTION

CHUNG & VANDER DOELEN ENGINEERING LTD. has been retained by Frontiers Design Build Inc. to conduct a preliminary geotechnical characterization investigation for a proposed industrial subdivision proposed to be developed on a 8.2± hectare property located at 6739 Wellington Road 109 in Teviotdale, Ontario.

The industrial subdivision is proposed to include:

- A 380± m long internal roadway connected to Wellington Road 109
- Twelve (12) lots varying in size between 0.4± and 0.81± hectares and a 0.68± hectare storm water management block
- The subdivision will be serviced with private onsite wastewater treatments systems and private wells
- Open ditching and culverts are proposed to convey storm water to the stormwater management block in the northwest area of the site

No grading plan was available at the time of reporting, however, cut and fill grading procedures would be anticipated with the development of a future subdivision.

The purpose of this investigation has been to determine the subsurface conditions and relevant soil properties at the subject site in order to provide preliminary geotechnical recommendations for the design and construction of site grading operations and the paved roadway. Preliminary soil bearing capacities and estimated percolation T-times of the encountered soils will also be provided.

2.0 FIELD WORK

Ten (10) test pits were excavated to depths ranging between 3.05 and 3.8 m below existing grade in order to investigate the subsurface conditions across the site. The locations of the test pits are illustrated on Drawing No. 1.

The field work for this investigation was conducted on April 8, 2024 under the supervision of CVD's Field Engineer who directed the excavation procedures, logged the subsurface conditions, effected the subsurface sampling and monitored the groundwater conditions.

The test pits were excavated to their investigated depths using a track-mounted excavator supplied by the client. The compactness condition or consistency of the soil strata has been inferred from the encountered digging resistance and manual inspection of the excavations. The groundwater conditions were monitored during the advancement of the test pit excavations.

Soil samples obtained from the test pits were logged in the field and subsequently taken to our laboratory for detailed description and laboratory testing. Five (5) grain size distribution analyses were conducted on representative samples in order to confirm field classification and to assist provide estimates of hydraulic conductivity and percolation T-times of the encountered soil deposits.

The location and ground surface elevation of the test pits were surveyed by CVD with reference to a local temporary benchmark (TBM). The temporary benchmark elevation and ground surface elevations at the boreholes were surveyed by CVD for the purpose of this report using a Network RTK Global Navigation Satellite System (GNSS) Receiver. The survey data was collected using the UTM Zone 17N Projection, NAD83(CSRS)v7-2010 datum and Canada Geoid Model HT2_2010v70 (CGVD28).

TBM:	Top of concrete pad under northernmost Bell box at southeast corner of site , as shown on Drawing No. 1
Elevation:	420.06 m (Geodetic)

3.0 SITE CONDITION

The proposed development site currently exists as agricultural cropland. It is generally bounded by other agricultural lands with a residential lot to the northeast, an industrial property to the south and Wellington Road 109 to the east.

Review of elevation contours indicates the site is topographically high along parts of the southern boundary at elevations between 420± m and 419.5±m and slopes gently downwards in northerly and westerly directions. Ground surface elevations at the test pits ranged between 418.84 and 417.67 m

4.0 SUBSURFACE CONDITION

The subsurface conditions encountered in the test pits are detailed on the Test Pit Log Sheets, Enclosures 1 to 10 inclusive. The following notes are intended to amplify and comment on the subsurface data obtained.

Topsoil measuring between 200 and 350 mm thick was contacted at the ground surface of the thirteen (13) test pits. Brick fragments were noted in the topsoil at Test Pit 1.

The topsoil at Test Pits 7 and 9 was underlain by brown silt or sand and silt which extended to depths of 0.65 and 0.6 m below existing grade, respectively. These deposits exhibited a loose compactness condition and a moist to wet moisture condition.

The topsoil at Test Pits 1 to 6, 8 and 10 and the silt to sand and silt at Test Pits 7 and 9 were underlain by brown to grey till deposits varying in gradation from sandy silt till to clayey silt till. Varying percentages of gravel, sand, clay, cobbles and boulders were observed within the till deposits. The till at Test Pits 2, 4, 9 and 10 extended to depths between 2.9 and 3.35 m below existing grade while the till at Test Pits 1, 3, and 5 to 8 extended to at least the test pit termination depths between 3.05 and 3.8 m below existing grade. The till deposits exhibited a variable soft to very stiff consistency and a moist to wet moisture condition. Four (4) grain size distribution analyses of the till deposits collected from Test Pits 1, 8 , 9 and 10 are graphically presented on Enclosures 11 to 14.

The till at Test Pits 2, 4, 8 and 9 were underlain by brown deposits of silt with trace to some sand, fine to medium sand and/or sand and silt with varying percentages of gravel and clay with extended to at least the test pit termination depths between 3.65 and 3.8 m below existing grade. These lower deposits exhibited a compact compactness condition and a typically saturated moisture condition. One (1) grain size distribution analysis of the sand and silt deposit collected at Test Pit 10 is graphically presented on Enclosure 15.

The groundwater conditions were monitored during and at completion of the individual test pit excavations. Trace to heavy seepage was measured at depths between 1.2 and 3.5 m below existing grade at seven (7) of the ten (10) test pit locations during advancement of the test pit excavations. Three (3) test pits remained dry at completion of the their investigated depths. Stabilized groundwater levels were not able to be measured during the investigation. It is noted that the groundwater table will fluctuate seasonally and in response to major weather events.

5.0 DISCUSSION AND RECOMMENDATIONS

The industrial subdivision is proposed to include:

- A 380± m long internal roadway connected to Wellington Road 109
- Twelve (12) lots varying in size between 0.4± and 0.81± hectares and a 0.68± hectare storm water management block

- The subdivision will be serviced with private onsite wastewater treatments systems and private wells
- Open ditching and culverts are proposed to convey storm water to the stormwater management block in the northwest area of the site

No grading plan was available at the time of reporting, however, cut and fill grading procedures would be anticipated with the development of a future subdivision.

Native soil conditions capable of supporting a future industrial subdivision development were encountered at the site. Groundwater conditions were observed to vary across the site at the time of investigation. Strategic installation of monitoring wells across the site along with a seasonal groundwater monitoring program is recommended and would allow the groundwater conditions to be properly determined and assessed for future development purposes.

The following sections are based upon the preliminary geotechnical characterization performed during the test pit investigation. Additional geotechnical investigation and assessment may be required when design details become available. CVD would be pleased to assist at that time.

5.1 General Site Grading

No grading plan was available at the time of reporting, however, cut and fill grading procedures would be anticipated with the development of a future subdivision. Materials to be used as fill during site grading operations should be suitably handled and placed according to their final use needs. **Earth fill to support future building structures, private pavements, and roadways is to be constructed significantly different than earth fill to be used to raise grade in wastewater treatment leaching bed envelopes.**

It should be noted that the thickness of the organic soil layer could vary drastically across the site from those reported at the test pit locations. Topsoil stripping operations should be conducted when the ground is not wet and can support construction equipment. Over-stripping can result when the ground conditions are wet and unstable.

5.1.1 Site Grading for Engineered Fill Construction

Inorganic onsite native soil deposits from potential “cut” areas may potentially be reused to construct engineered fill capable of supporting future building structures, private pavements, and roadways. The natural moisture content of the “cut” soils to be used as engineered fill should be within 3% below their optimum moisture contents to achieve the specified degree of compaction.

Any shortfall of fill material required for engineered fill operations may be made with similarly graded imported soils. It is recommended that any proposed borrow source materials be tested prior to importing in order to ensure that the environmental quality of the imported fill meets all environmental approval criteria and to ensure that the natural moisture content of the fill is suitable for compaction. Should similarly graded granular soils not be able to meet the requirements for use as engineered fill, imported Granular B may be used for such purposes.

It is recommended that engineered fill construction be conducted during the summer and early fall months when drier warmer weather conditions typically exist as the onsite soils are sensitive to moisture and will become difficult to handle and compact to the specified degree of compaction when wet.

The onsite soils are generally considered to be frost-susceptible. Constructing engineered fill, backfilling footings, foundation walls and service trenches using the fine grained soils during the winter months is not advisable, unless suitable weather conditions prevail, the soils are at suitable moisture content, and strict procedures are followed and monitored on a full-time basis by the geotechnical engineer.

The onsite soils are susceptible to softening and deformation when exposed to excessive moisture and construction traffic. As a result, it is imperative that the grading/filling operations are planned and maintained to direct surface water run-off to low points and then be positively drained by suitable means. Construction traffic should be directed along the designated construction routes so as not to disturb and rut the exposed subgrade soil during periods of wet weather. Temporary construction roads consisting of clear crushed material (such as crushed stone or recycled concrete) may be required during poor weather conditions such as wet Spring or Fall.

The following procedures are recommended for the construction of engineered fill to specifically support future building structures, private pavements, and roadways. Specific recommendations for site grading procedures within the wastewater treatment leaching bed envelope will be provided in the following subsequent section.

1. All topsoil and otherwise deleterious materials should be stripped from building envelope and pavement areas. These excavated materials should be placed in non-structural areas and beyond the future wastewater treatment leaching bed envelope;

2. The exposed subgrade surface should be carefully proof-rolled with a heavy vibratory compactor and inspected by a qualified geotechnical inspector. Any loose/soft spots encountered during the process should be excavated to the level of competent soil;

3. The required grades can then be achieved by placing approved soil in maximum 200 to 300 mm thick lifts which should be compacted to at least 98% standard Proctor maximum dry density (SPMDD) in building envelope, private pavement, and roadway areas. The limits of the engineered fill to be placed to support future building structures, roadways and infrastructure servicing should extend horizontally a distance at least equal to the depth of fill to be placed.

4. Inorganic onsite soils maybe considered as suitable engineered fill material provided the natural moisture content of the soil is within 3% below the optimum moisture content in order to achieve the specified degree of compaction. Overly wet and organic materials should be placed in non-structural areas and beyond future wastewater treatment leaching bed envelopes where 90% SPMDD is considered adequate. Wet inorganic soil could be mixed with drier soils to produce a suitable moisture content to allow appropriate compaction to occur.

5. All fill placement and compaction operations must be supervised on a full-time basis by qualified geotechnical personnel to approve fill material and ensure the specified degrees of compaction have been achieved.

Vibration could be generated from various construction equipment, such as compactors and rollers which could be harmful to surrounding structures and buildings during construction. Peak particle velocity (PPV) of ground motion is widely accepted as the best descriptor of potential for vibration damage to structures. The safe vibration limit can be set to 8 to 25 mm/s PPV, depending on the sensitivity of surrounding structures to vibration.

Vibration monitoring can be carried out to measure the PPV of ground motion from vibration generated from typical compaction equipment at the beginning of the project in the potentially critical areas. This will set criteria and establish the type of equipment to be used for this project. It is also recommended that a pre-construction condition survey be conducted to document the condition of the existing structures within the possible zone of influence.

5.1.2 Site Grading for Wastewater Treatment Leaching Bed Envelope

Proper control during site grading procedures will be paramount to ensure that satisfactory soil conditions are maintained and created in the future wastewater treatment leaching bed envelopes. Earth moving equipment such as scrapers, trucks and compactors are not to be allowed into the future leaching bed envelope areas as they will over-compact the soil and will consequently densify the soil to a percolation rate higher than the design percolation “T” time.

The following procedures are recommended during the planning stages and when site grading operations are occurring.

1. Carefully plan out the stages of site grading operations, routes of construction, topsoil stockpile areas and cut and fill areas.

2. Stake out the leaching bed envelopes and restrict all access of unwanted construction traffic from these areas.

3. Topsoil/organic stripping and excavation “cut” procedures can be conducted using a track-mounted excavator within the leaching bed envelopes. The exposed subgrades must be fully scarified once construction equipment is no longer crossing leaching bed envelopes.

4. Leaching bed envelope areas to be raised with inorganic soil fill will require full removal of topsoil by track-mounted equipment and the exposed subgrade should be scarified and inspected to ensure that no unwanted compaction occurs/exists. Any fill used to raise grade within leaching bed envelopes is recommended to consist of similar soil as that exposed at the inorganic subgrade soil level. The soil should be end-dumped at the edge of the leaching bed envelopes and then pushed into place with a track-mounted dozer in 0.5 m thick lifts. No other compaction should be applied. An estimated percolation time of greater than 50 min/cm may be used to preliminarily size the leaching bed envelopes.

5. The filled areas must ultimately be re-assessed to establish the “T” time for the design of the wastewater treatment systems.

6. The finished leaching bed envelope should be fenced off to prevent unwanted traffic. If any areas receive unwanted compaction, they must be reassessed for design purposes.

5.2 Pavement Design and Construction

The earth subgrade soil is generally expected to vary between clayey silt till and sandy silt till with trace to some clay and gravel. Cognizant of the traffic volume and the subgrade soils, the following pavement component thicknesses are considered suitable for industrial roads.

Pavement Component	Component Thickness
HL3 Surface Asphaltic Concrete HL8 Binder Asphaltic Concrete	40 mm 80 mm
Granular "A" Base Course	150 mm
Granular "B" Type II Sub-base Course	450 mm
Granular Base Equivalency (GBE)	690 mm

Note: GBE denotes Granular Base Equivalency which is calculated using factors of 2 for asphaltic concrete, 1 for Granular "A" base and 0.67 for Granular "B" sub-base

The asphaltic concrete should consist of two layers of 40 mm thick HL8 and one top layer of 40 mm thick HL3.

The pavement design considers that road construction will be carried out during the drier time of the year and that the subgrade is stable, not heaving under construction equipment traffic. If the subgrade is wet or unstable, additional granular sub-base may be required.

The exposed earth subgrade should be recompacted from the surface with a minimum 10 tonne vibratory compactor to a density of no less than 98% Standard Proctor Maximum Dry Density (SPMDD) prior to placement of the Granular "B" Type II. Any soft or otherwise incompactible areas detected should be removed and replaced with approved granular materials and should also be compacted to no less than 98% SPMDD.

The Granular "A" and Granular "B" Type II should meet OPSS 1010 requirements and be compacted to 100% SPMDD. The placing and rolling of the asphalt mixture should conform to OPSS.MUNI 310 Table 10 and should be compacted to no less than 92% of the Marshall Density (BRD). Performance Grade Asphalt Cement (PGAC) 58-28 should be utilized in the hot mix asphalt. Frequent in situ density testing by this office should be carried out to verify that the specified degree of compaction on the granular and asphalt is being achieved and maintained.

The surface course of the asphaltic concrete should be placed at least one (1) year after base course is placed to allow minor settlements of the trench backfill to complete. The incomplete pavement structure may not be capable of supporting the anticipated traffic. Consequently, minor repairs of the sub-base, base and asphaltic concrete may be required prior to paving the surface course asphaltic concrete.

“Frost tapers” (OPSD 803.030) should be implemented in the backfilling above and adjacent to culvert structures. Free-draining Granular “B” (similar to OPSS requirements) is recommended at such structures.

Longitudinal sub-drains with positive drainage outlets are recommended to be installed at the subgrade level along the edges of the roadway construction to enhance the performance of the pavement. Systematic drainage of the granular base materials will promote the longevity of the pavement structure.

5.3 Preliminary Soil Bearing Capacity

Conventional shallow footing foundations extending below the **soft to firm** zones of the native deposits and constructed on the **stiff to very stiff** native till deposits and/or **compact** native deposits can be preliminarily designed using a Geotechnical Reaction at SLS of 150 kPa (3000 psf). The Factored Geotechnical Resistance at ULS is 225 kPa (4500 psf).

Additional geotechnical investigation for future building structures will be required at the design stage.

5.4 Hydraulic Conductivity and Percolation T-time

Based on the laboratory gradational results and our past experience, the hydraulic conductivity and percolation T-times of the native soil deposits encountered are estimated and provided in the following table:

Material	Hydraulic Conductivity (K) (cm/sec)	Percolation T-time (minutes/cm)
Sandy Clayey Silt Till to Sandy Silt Till, trace to some clay	$<1x10^{-6}$	>50
Clayey Silt Till	$<1x10^{-6}$	>50

6.0 CLOSURE

The Limitations of Report, as quoted in Appendix "A", is an integral part of this report.

We trust that the information presented in this report is complete within our terms of reference. If there are any further questions concerning this report, please do not hesitate to contact our office.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

LICENSED PROFESSIONAL ENGINEER
RVD
P.R. Vander Doelen
47825609
June 26/24
PROVINCE OF ONTARIO

Robert Vander Doelen, P. Eng.
Senior Engineer

APPENDIX “A”

Limitations of Report

APPENDIX “A”

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes and their respective depths may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The benchmark and elevations mentioned in this report were obtained strictly for use in the geotechnical design of the project and by this office only, and should not be used by any other parties for any other purposes.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. CHUNG & VANDER DOELEN ENGINEERING LIMITED accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

This report does not reflect the environmental issues or concerns unless otherwise stated in the report.

ENCLOSURES

Soil Abbreviations and Terms Used on Record of Borehole Sheets

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TERMINOLOGY DESCRIBING COMMON SOIL TYPES:

Topsoil	-	mixture of soil and humus capable of supporting vegetation
Peat	-	mixture of visible and invisible fragments of decayed organic matter
Till	-	unstratified glacial deposit which may range from clay to boulders
Fill	-	soil materials identified as being placed anthropologically

CLASSIFICATION (UNIFIED SYSTEM)

Clay	<0.002mm		
Silt	0.002 to .075mm		
Sand	0.075 to 4.75mm		
		Fine	0.075 to 0.425 mm
		Medium	0.425 to 2.0 mm
		Coarse	2.0 to 4.75 mm
Gravel	4.75 to 75mm		
		Fine	4.75 to 19 mm
		Coarse	19 to 75 mm
Cobbles	75 to 300mm		
Boulders	>300mm		

TERMINOLOGY

Soil Composition	**% by Weight**
"traces"	<10%
"some"(eg. some silt)	10-20%
Adjective (eg. sandy)	20-35%
"and"(eg. sand and gravel)	35-50%

Standard Penetration Resistance (SPT): Standard Penetration Resistance ('N' Values) refers to the number of blows required to advance a standard (ASTM D1586) 51 mm Ø (2 inch) split-spoon sampler by the use of a free falling, 63.5 Kg (140lbs) hammer. The number of blows from the drop weight is recorded for every 15 cm (6 inches). The hammer is dropped from a distance of 0.76m (30 inches) providing 474.5 Joules per blow. When the sampler is driven a total of 45 cm (18 inches) into the soil, the standard penetration index ('N' Value) is the total number of blows for the last 30 cm (12 inches).

Dynamic Cone Penetration Resistance (DCPT): Dynamic Cone Penetration Resistance is similar to a SPT with the 474.5 Joule/blow impulse provided by the free falling hammer where the split-spoon sampler is replaced by a 51 mm Ø, 60˚ conical point and the number of blows is recorded continuously for every 30 cm (12 inches).

COHESIVE SOILS CONSISTENCY

	(kPa)	**(P.S.F.)**	**Nominal 'N' Value**
Very Soft	<12	<250	0-2
Soft	12-25	250-500	2-4
Firm	25-50	500-1000	4-8
Stiff	50-100	1000-2000	8-15
Very Stiff	100-200	2000-4000	15-30
Hard	>200	>4000	>30

RELATIVE DENSITY OF COHESIONLESS SOIL

	'N' Value
Very Loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

MOISTURE CONDITIONS:

Cohesive Soil	**Cohesionless Soil**
DTPL- Drier than plastic limit	Damp
APL- About plastic limit	Moist
WTPL- Wetter than plastic limit	Wet
MWTPL- Much wetter than plastic limit	Saturated

SAMPLE TYPES AND ADDITIONAL FIELD TESTS

SS	Split Spoon Sample	**GS**	Grab Sample	**PP**	Pocket Penetrometer
	(obtained from SPT)	**BS**	Bulk Sample	**VANE**	Peak & Remolded shear
AS	Auger Sample	**TW**	Thin Wall Sample or Shelby Tube	**DMT**	Flat Plate Dilatometer

LABORATORY TESTS

SG	Specific Gravity	**S**	Sieve Analysis	**W**	Water Content
H	Hydrometer	**P**	Field Permeability	**K**	Lab Permeability
W_p	Plastic Limit	**W_l**	Liquid Limit	**I_p**	Plasticity Index
GSA	Grain Size Analysis	**C**	Consolidation	**UNC**	Unconfined compression

CHUNG & VANDER DOELEN
ENGINEERING LTD.

Enclosure A

Enclosure No.: 1
Sheet 1 of 1

FILE No: 1207 TEST PIT No. 1

Client: **Frontiers Design Build Inc.**

Project: **Proposed Industrial Subdivision**

Location: **6739 Wellington Road 109, Teviotdale, Ontario**

EQUIPMENT DATA

Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Apr 08 24** TO **Apr 08 24**

SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa) FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. ☐ 50 100 150 200 PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80	WATER CONTENT (%) W_P W W_L 10 20 30	WELL DATA	DEPTH (m)	REMARKS
ELEV./ DEPTH (m)	DESCRIPTION Ground Elevation: **418.66 m**	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE					
	325 mm TOPSOIL (contains brick fragments)										
418.34 0.33	firm mottled brown to brown SANDY CLAYEY SILT TILL trace gravel occ. cobbles wet to moist	0.5								0.5	
		1.0		1	BS					1.0	trace seepage observed at 1.2 m depth
	-------- stiff to very stiff	1.5								1.5	
		2.0								2.0	
		2.5		2	BS					2.5	
	-------- occ. boulders	3.0								3.0	
415.31 3.35	End of Test Pit	3.5								3.5	

PROJECT MANAGER: **RVD**

CHUNG & VANDER DOELEN
ENGINEERING LTD.
311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

Enclosure No.: 2
Sheet 1 of 1

FILE No: 1207

TEST PIT No. 2

Client: **Frontiers Design Build Inc.**

Project: **Proposed Industrial Subdivision**

Location: **6739 Wellington Road 109, Teviotdale, Ontario**

EQUIPMENT DATA

Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Apr 08 24** TO **Apr 08 24**

SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa) FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200 / PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80	WATER CONTENT (%) W_P W W_L 10 20 30	WELL DATA	DEPTH (m)	REMARKS
ELEV./ DEPTH (m)	DESCRIPTION Ground Elevation: **418.72 m**	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE					
	275 mm TOPSOIL										
418.45 0.28	firm mottled brown SANDY CLAYEY SILT TILL trace gravel occ. sand and silt layers occ. cobbles and boulders wet to moist	0.5								0.5	
				1	BS						
		1.0								1.0	
											trace seepage observed at 1.2 m depth
	-------- stiff to very stiff	1.5								1.5	
		2.0								2.0	
		2.5		2	BS					2.5	
	-------- grey										
		3.0								3.0	
415.37 3.35	compact, brown SILT trace to some sand wet	3.5		3	BS					3.5	
415.07 3.65	End of Test Pit										

CVD TEST PIT 1207 - TEVIOTDALE.GPJ CVD_ENG.GDT 6-26-24

PROJECT MANAGER: **RVD**

CHUNG & VANDER DOELEN
ENGINEERING LTD.
311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

Enclosure No.: 3
Sheet 1 of 1

FILE No: 1207

TEST PIT No. 3

Client: **Frontiers Design Build Inc.**

Project: **Proposed Industrial Subdivision**

Location: **6739 Wellington Road 109, Teviotdale, Ontario**

EQUIPMENT DATA

Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Apr 08 24** TO **Apr 08 24**

SOIL LITHOLOGY

Ground Elevation: **417.76 m**

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. ☐
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE	WELL DATA	REMARKS
	300 mm TOPSOIL						
417.46 0.30	firm mottled brown SANDY CLAYEY SILT TILL trace gravel wet	0.5					
		1.0	1	BS			
		1.5					trace seepage observed at 1.35 m depth
	-------- stiff moist	2.0					
	-------- very stiff grey	2.5					
		3.0	2	BS			
414.41 3.35	End of Test Pit	3.5					

PROJECT MANAGER: **RVD**

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ENGINEERING LTD.
311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

Enclosure No.: 4
Sheet 1 of 1

FILE No: 1207

TEST PIT No. 4

Client: **Frontiers Design Build Inc.**

Project: **Proposed Industrial Subdivision**

Location: **6739 Wellington Road 109, Teviotdale, Ontario**

EQUIPMENT DATA

Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Apr 08 24** TO **Apr 08 24**

SOIL LITHOLOGY | SAMPLE | SHEAR STRENGTH (kPa): FIELD VANE: Peak ⊗ Rem. ×; LAB TEST: Unc. ■ P.P. □; 50 100 150 200 | PENETRATION RESISTANCE: STANDARD ● DYN. CONE ○; 20 40 60 80 | WATER CONTENT (%): W_P W W_L; 10 20 30 | WELL DATA | REMARKS

Ground Elevation: **417.98 m**

ELEV./ DEPTH (m)	DESCRIPTION	SAMPLE ID	TYPE	N-VALUE	REMARKS
	300 mm TOPSOIL				
417.68 0.30	soft to firm mottled brown SANDY CLAYEY SILT TILL trace gravel occ. silt layers wet to moist				
		1	BS		
					trace seepage observed at 1.2 m depth
	------ stiff to very stiff				test pit side walls collapsed above 1.85 m during excavation
	-------- grey				
414.63 3.35	compact, brown SILT trace to some sand saturated	2	BS		moderate seepage at 3.5 m depth
414.33 3.65	End of Test Pit				

PROJECT MANAGER: **RVD**

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Enclosure No.: 5
Sheet 1 of 1

FILE No: 1207

TEST PIT No. 5

Client: **Frontiers Design Build Inc.**
Project: **Proposed Industrial Subdivision**
Location: **6739 Wellington Road 109, Teviotdale, Ontario**

EQUIPMENT DATA
Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Apr 08 24** TO **Apr 08 24**

SOIL LITHOLOGY

Ground Elevation: **418.48 m**

SHEAR STRENGTH (kPa): FIELD VANE: Peak ⊗ Rem. × ; LAB TEST: Unc. ■ P.P. □ ; 50 100 150 200
PENETRATION RESISTANCE: STANDARD ● DYN. CONE ○ ; 20 40 60 80
WATER CONTENT (%): W_P W W_L ; 10 20 30

ELEV./ DEPTH (m)	DESCRIPTION	SAMPLE ID	TYPE	N-VALUE	WELL DATA	REMARKS
	200 m TOPSOIL					
418.28 0.20	firm to stiff mottled brown SANDY CLAYEY SILT TILL trace gravel wet to moist ------ stiff					
416.38 2.10	compact, brown SAND AND SILT trace gravel saturated	1	BS		∇	moderate to heavy seepage at 2.1 m depth
415.73 2.75	stiff, brown CLAYEY SILT TILL trace to some sand trace gravel moist					
415.13 3.35	End of Test Pit					

PROJECT MANAGER: **RVD**

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Enclosure No.: 6
Sheet 1 of 1

FILE No: 1207

TEST PIT No. 6

Client: **Frontiers Design Build Inc.**

Project: **Proposed Industrial Subdivision**

Location: **6739 Wellington Road 109, Teviotdale, Ontario**

EQUIPMENT DATA

Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Apr 08 24** TO **Apr 08 24**

ELEV./ DEPTH (m)	DESCRIPTION Ground Elevation: **418.84 m**	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE	REMARKS
	250 mm TOPSOIL					
418.59 0.25	stiff brown SANDY CLAYEY SILT TILL trace gravel moist	0.5				
		1.0	1	BS		
	-------- very stiff occ. cobbles	1.5				
		2.0				
		2.5				
		3.0				
		3.5				
415.04 3.80	End of Test Pit					test pit open and dry at completion

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200

PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

PROJECT MANAGER: **RVD**

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ph. (519) 742-8979, fx. (519) 742-7739

Enclosure No.: 7
Sheet 1 of 1

FILE No: 1207

TEST PIT No. 7

Client: **Frontiers Design Build Inc.**

Project: **Proposed Industrial Subdivision**

Location: **6739 Wellington Road 109, Teviotdale, Ontario**

EQUIPMENT DATA

Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Apr 08 24** TO **Apr 08 24**

SHEAR STRENGTH (kPa): FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ — 50, 100, 150, 200
PENETRATION RESISTANCE: STANDARD ● DYN. CONE ○ — 20, 40, 60, 80
WATER CONTENT (%): W_P W W_L — 10, 20, 30

Ground Elevation: **418.49 m**

ELEV./ DEPTH (m)	DESCRIPTION	SAMPLE ID	TYPE	N-VALUE	WELL DATA	REMARKS
418.24 0.25	250 mm TOPSOIL					
417.84 0.65	loose brown mottled SILT wet					
415.44 3.05	stiff to very stiff mottled brown SANDY SILT TILL trace to some clay trace gravel moist	1	BS			test pit open and dry at completion
	End of Test Pit					

PROJECT MANAGER: **RVD**

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ph. (519) 742-8979, fx. (519) 742-7739

CVD TEST PIT 1207 - TEVIOTDALE.GPJ CVD_ENG.GDT 6-26-24

Enclosure No.: 8
Sheet 1 of 1

FILE No: 1207

TEST PIT No. 8

Client: **Frontiers Design Build Inc.**

Project: **Proposed Industrial Subdivision**

Location: **6739 Wellington Road 109, Teviotdale, Ontario**

EQUIPMENT DATA

Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Apr 08 24** TO **Apr 08 24**

SOIL LITHOLOGY | SAMPLE | SHEAR STRENGTH (kPa) FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200 | PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80 | WATER CONTENT (%) W_P W W_L 10 20 30 | WELL DATA

Ground Elevation: **418.38 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	WELL DATA	DEPTH (m)	REMARKS
	350 mm TOPSOIL								
418.03 0.35	firm brown SANDY SILT TILL trace to some clay trace gravel moist -------- occ. cobbles and boulders ------ stiff	0.5						0.5	
				1	BS				
		1.0						1.0	
		1.5						1.5	
		2.0						2.0	
		2.5						2.5	
		3.0						3.0	
				2	BS				
		3.5						3.5	
414.73 3.65	End of Test Pit								test pit open and dry at completion

PROJECT MANAGER: **RVD**

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Enclosure No.: 9
Sheet 1 of 1

FILE No: 1207

TEST PIT No. 9

Client: **Frontiers Design Build Inc.**
Project: **Proposed Industrial Subdivision**
Location: **6739 Wellington Road 109, Teviotdale, Ontario**

EQUIPMENT DATA
Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Apr 08 24** TO **Apr 08 24**

SOIL LITHOLOGY | SAMPLE | SHEAR STRENGTH (kPa): FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200 | PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80 | WATER CONTENT (%) W_P W W_L 10 20 30 | WELL DATA | DEPTH (m) | REMARKS

Ground Elevation: **417.84 m**

ELEV./ DEPTH (m)	DESCRIPTION	SAMPLE ID	TYPE	N-VALUE	WELL DATA	REMARKS
	300 mm TOPSOIL					
417.54 0.30	loose, brown SAND AND SILT moist to wet					
417.24 0.60	firm to stiff mottled brown SANDY SILT TILL trace to some clay trace gravel moist -------- occ. cobbles	1 2	BS BS			
414.94 2.90	compact, brown Fine to Medium SAND trace silt wet to saturated	3	BS		∇	water level at 3.35 m depth at completion of test pit
414.34 3.50	compact, brown SAND AND SILT trace gravel, trace clay wet to saturated	4	BS			
414.04 3.80	End of Test Pit					

Depth scale (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5

PROJECT MANAGER: **RVD**

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Enclosure No.: 10
Sheet 1 of 1

FILE No: 1207

TEST PIT No. 10

Client: **Frontiers Design Build Inc.**

Project: **Proposed Industrial Subdivision**

Location: **6739 Wellington Road 109, Teviotdale, Ontario**

EQUIPMENT DATA

Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Apr 08 24** TO **Apr 08 24**

SOIL LITHOLOGY — Ground Elevation: **417.67 m**

SHEAR STRENGTH (kPa): FIELD VANE: Peak ⊗ Rem. × — LAB TEST: Unc. ■ P.P. □ — 50 100 150 200

PENETRATION RESISTANCE: STANDARD ● DYN. CONE ○ — 20 40 60 80

WATER CONTENT (%): W_P W W_L — 10 20 30

ELEV./ DEPTH (m)	DESCRIPTION	SAMPLE ID	TYPE	N-VALUE	WELL DATA	REMARKS
	250 mm TOPSOIL					
417.42 0.25	firm mottled brown SANDY SILT TILL trace to some clay trace gravel wet					trace seepage observed at 1.35 m depth
	------ stiff	1	BS			
	-------- grey				∇	water level at 2.4 m depth after 2 hours
414.77 2.90	compact brown SAND AND SILT saturated	2	BS			
		3	BS			
414.02 3.65	End of Test Pit					

PROJECT MANAGER: **RVD**

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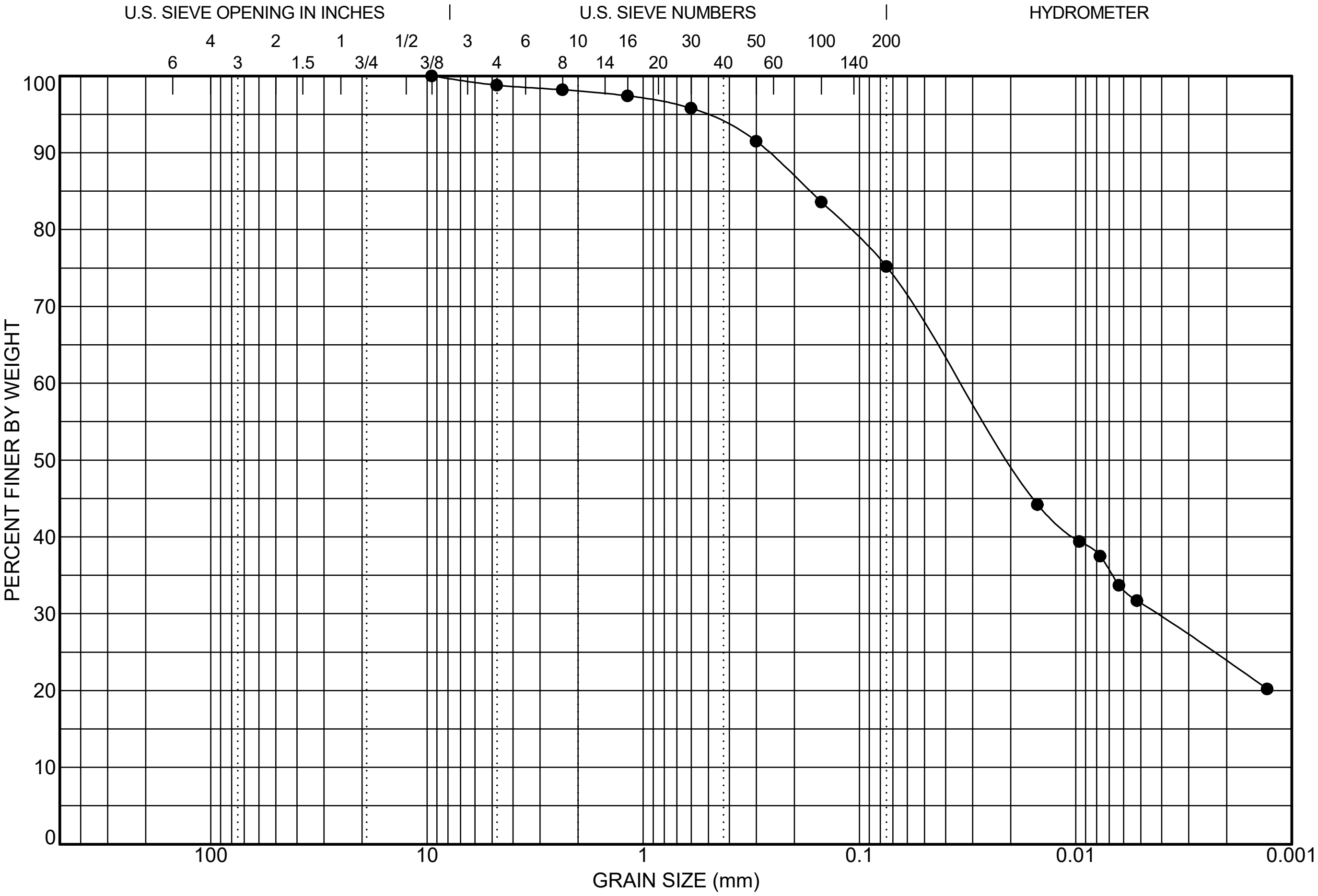


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
					9.5	0.034	0.004		1.2	23.6	75.2	

Date: Jun. 18 - 2024
Client: Frontiers Design Build Inc.
Contractor:
Source:
Sampled From: TP 1, 0.9 to 1.2 m depth
Sample No.: 1
Date Sampled: Apr. 08 - 2024
Sampled By: NZ
Lab No.: 534
Date Tested: Apr. 15 - 2024
Type of Material: Sandy Clayey Silt Till, trace gravel

Sieve Size (mm)	**Percent Passing**	**No Specifications**

CHUNG & VANDER DOELEN
ENGINEERING LTD.
311 Victoria Street North
Kitchener, Ontario N2H 5E1
Telephone: 519-742-8979
Fax: 519-742-7739
e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

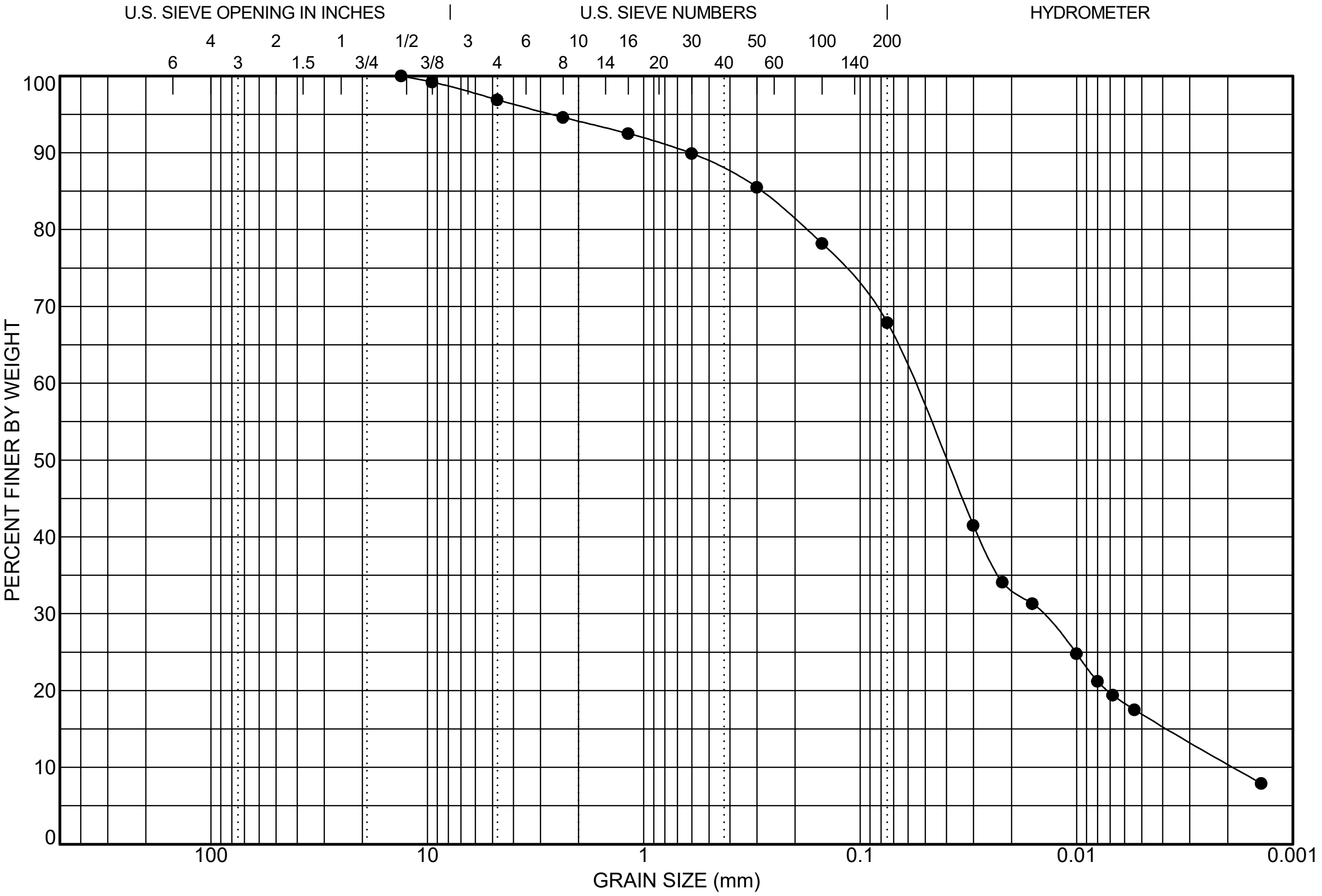
Project: Proposed Industrial Subdivision

Location: 6739 Wellington Road 109, Teviotdale, Ontario

File No.: 1207

Enclosure No.: 11

DM - NO SPECIFICATIONS 1207 - TEVIOTDALE.GPJ LAW LNDN.GDT 6-19-24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.98	30.31	13.2	0.057	0.015	0.002	3.1	29.0	67.9	

Date: Jun. 18 - 2024
Client: Frontiers Design Build Inc.
Contractor:
Source:
Sampled From: TP 8, 0.6 to 0.9 m depth
Sample No.: 1
Date Sampled: Apr. 08 - 2024
Sampled By: NZ
Lab No.: 532
Date Tested: Apr. 15 - 2024
Type of Material: Sandy Silt Till, some clay, trace gravel

Sieve Size (mm)	Percent Passing	No Specifications

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ENGINEERING LTD.
311 Victoria Street North
Kitchener, Ontario N2H 5E1
Telephone: 519-742-8979
Fax: 519-742-7739
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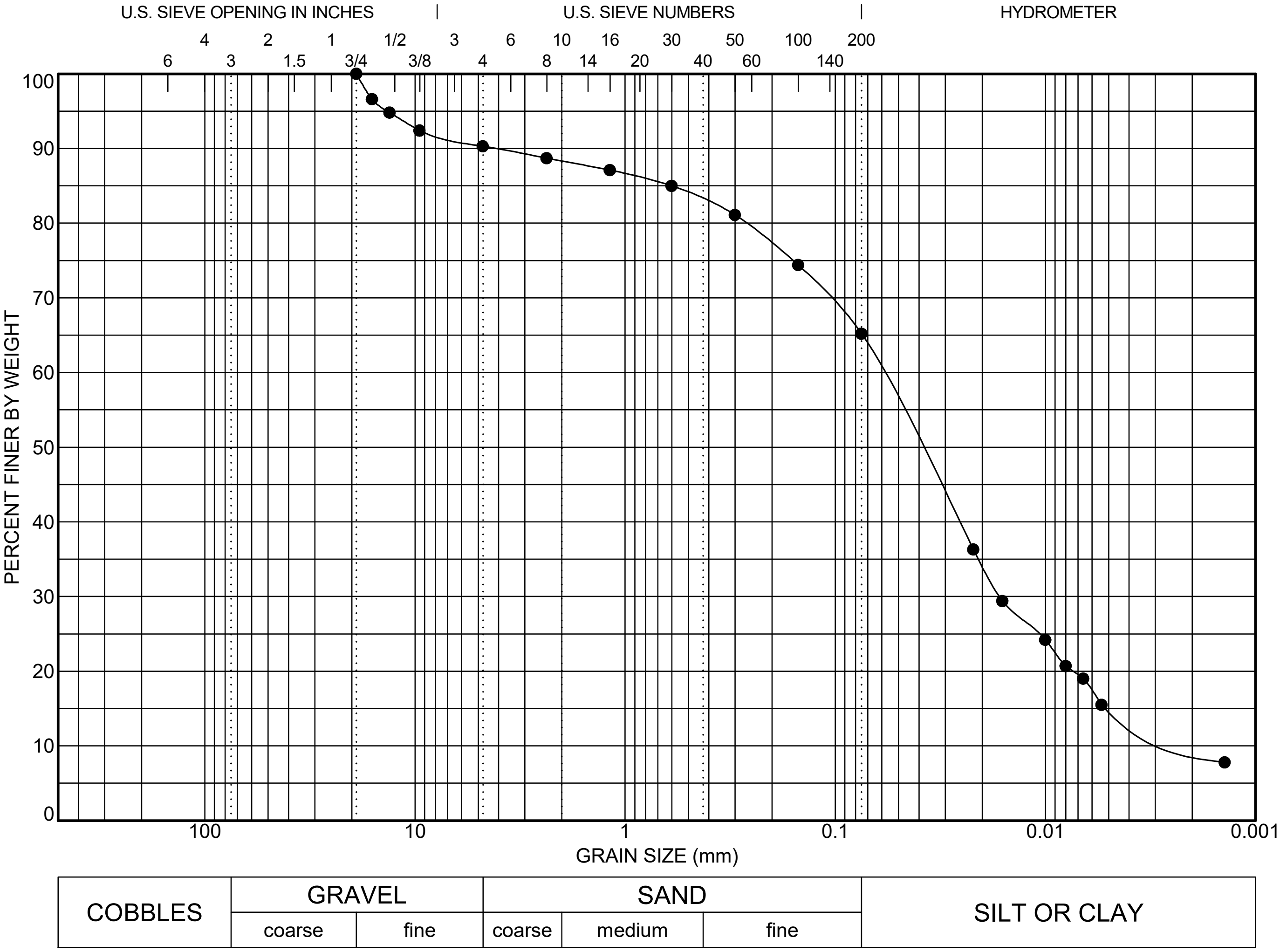
GRAIN SIZE DISTRIBUTION

Project: Proposed Industrial Subdivision

Location: 6739 Wellington Road 109, Teviotdale, Ontario

File No.: 1207

Enclosure No.: 12



LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			2.18	29.21	19	0.06	0.016	0.002	9.7	25.1	65.2	

Date: Jun. 18 - 2024
Client: Frontiers Design Build Inc.
Contractor:
Source:
Sampled From: TP 9, 1.05 to 1.35 m depth
Sample No.: 2
Date Sampled: Apr. 08 - 2024
Sampled By: NZ
Lab No.: 531
Date Tested: Apr. 15 - 2024
Type of Material: Sandy Silt Till, trace clay and gravel

Sieve Size (mm)	Percent Passing	No Specifications

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ENGINEERING LTD.
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Fax: 519-742-7739
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GRAIN SIZE DISTRIBUTION

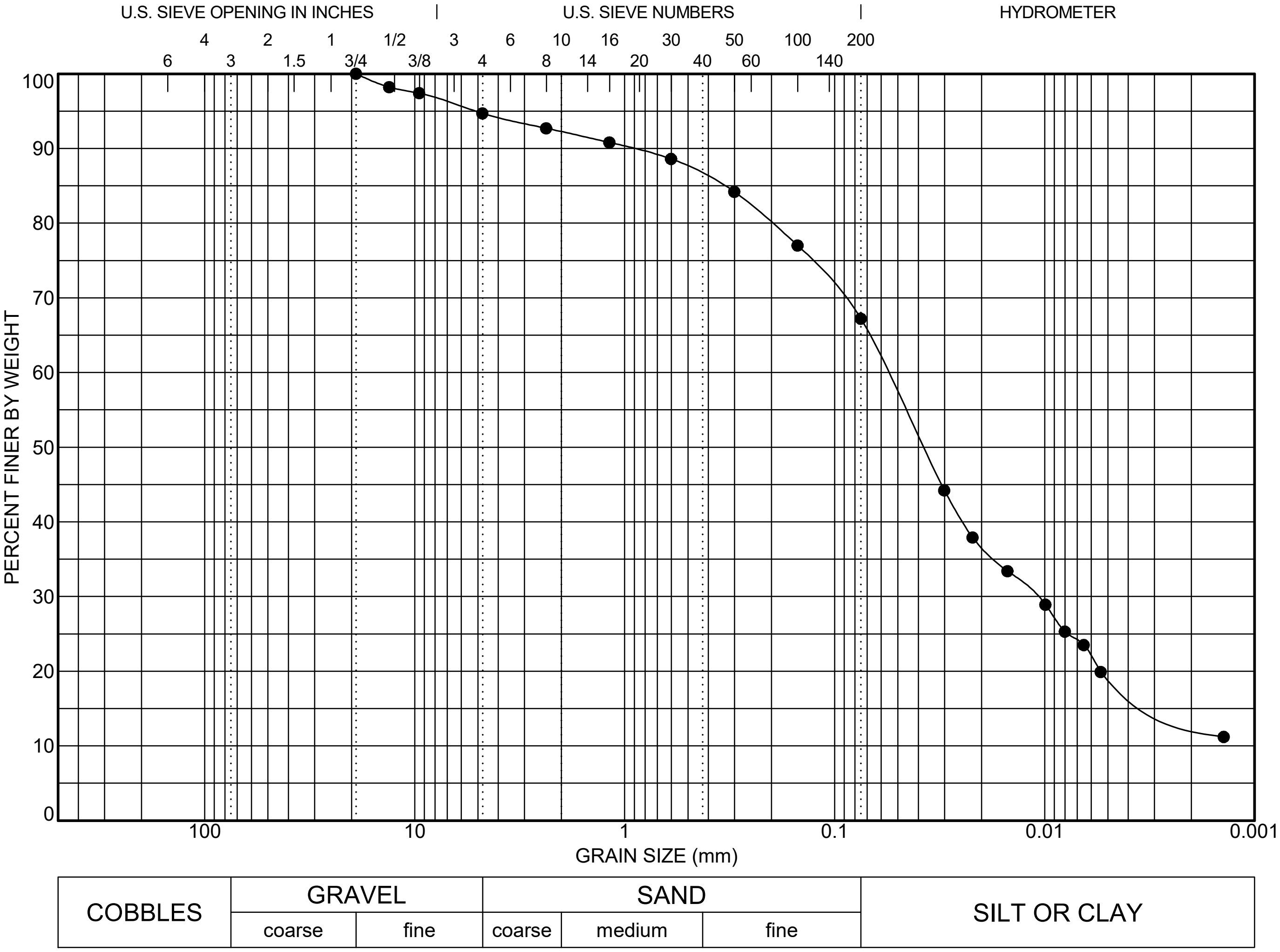
Project: Proposed Industrial Subdivision

Location: 6739 Wellington Road 109, Teviotdale, Ontario

File No.: 1207

Enclosure No.: 13

DM - NO SPECIFICATIONS 1207 - TEVIOTDALE.GPJ LAW LNDN.GDT 6-19-24



LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
					19	0.056	0.011		5.3	27.5	67.2	

Date:	Jun. 18 - 2024
Client:	Frontiers Design Build Inc.
Contractor:	
Source:	
Sampled From:	TP 10, 1.5 to 1.8 m depth
Sample No.:	1
Date Sampled:	Apr. 08 - 2024
Sampled By:	NZ
Lab No.:	529
Date Tested:	Apr. 15 - 2024
Type of Material:	Sandy Silt Till, some clay, trace gravel

Sieve Size (mm)	Percent Passing	No Specifications

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ENGINEERING LTD.
311 Victoria Street North
Kitchener, Ontario N2H 5E1
Telephone: 519-742-8979
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GRAIN SIZE DISTRIBUTION

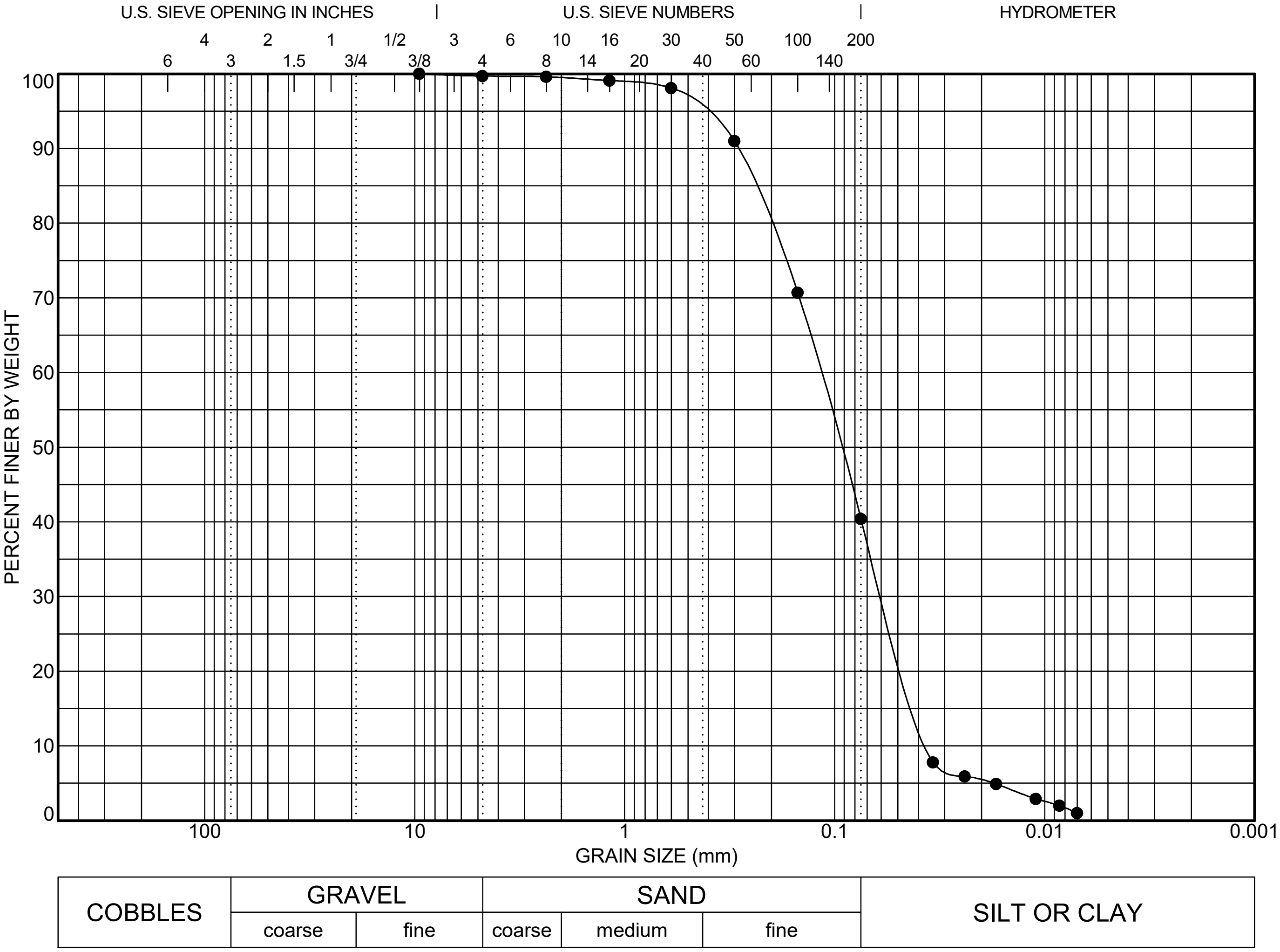
Project: Proposed Industrial Subdivision

Location: 6739 Wellington Road 109, Teviotdale, Ontario

File No.: 1207

Enclosure No.: 14

DM - NO SPECIFICATIONS 1207 - TEVIOTDALE.GPJ LAW LNDN.GDT 6-19-24



LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			0.81	3.27	9.5	0.117	0.058	0.036	0.3	59.3	40.4	

Date: Jun. 18 - 2024
Client: Frontiers Design Build Inc.
Contractor:
Source:
Sampled From: TP 10, 3.35 to 3.65 m depth
Sample No.: 3
Date Sampled: Apr. 08 - 2024
Sampled By: NZ
Lab No.: 533
Date Tested: Apr. 15 - 2024
Type of Material: Sand and Silt

Sieve Size (mm)	Percent Passing	No Specifications

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ENGINEERING LTD.
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Telephone: 519-742-8979
Fax: 519-742-7739
e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Industrial Subdivision

Location: 6739 Wellington Road 109, Teviotdale, Ontario

File No.: 1207

Enclosure No.: 15

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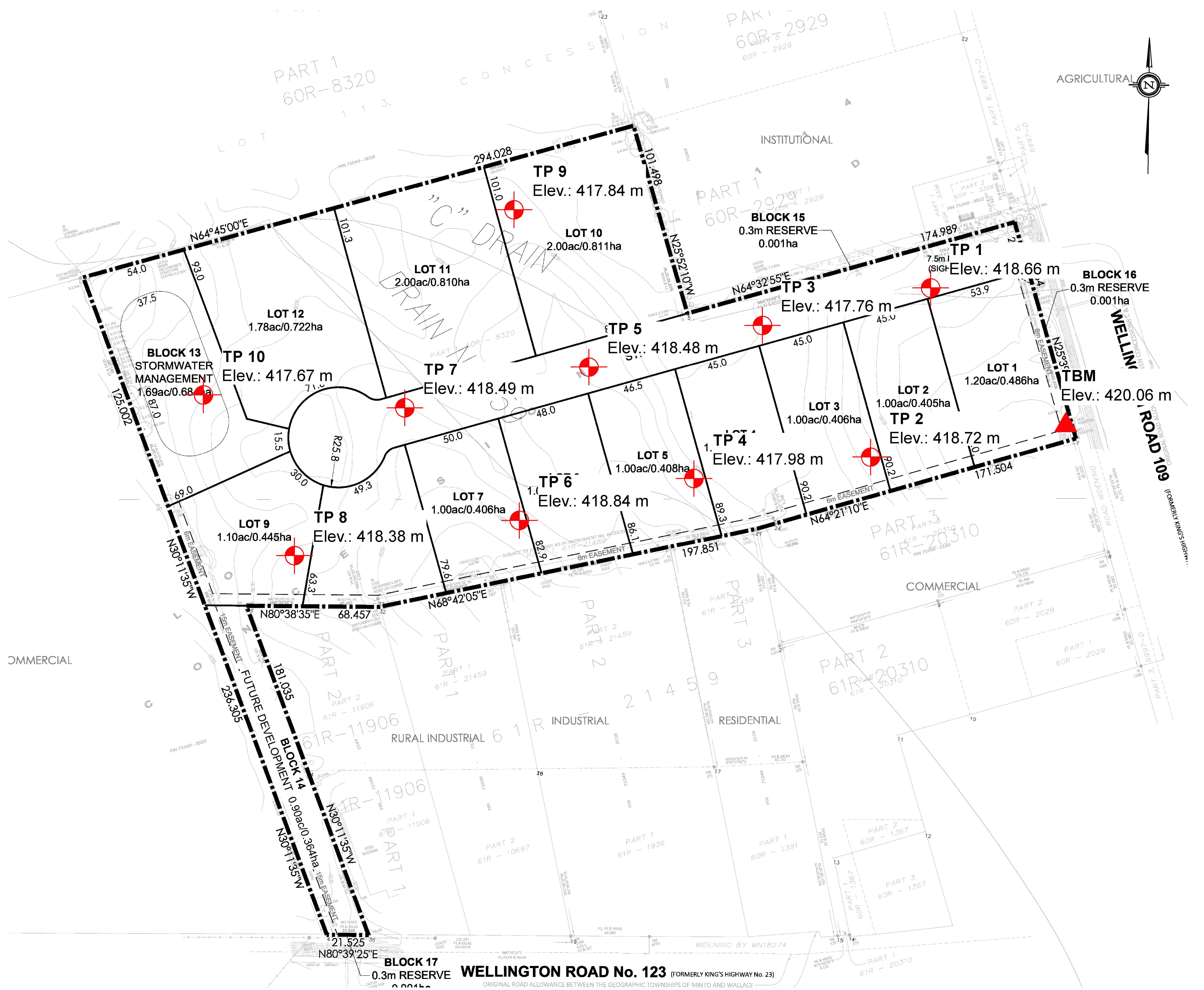

KEY PLAN **SOURCE:** GOOGLE EARTH

LEGEND

▲	**TBM: Top of concrete pad under northernmost Bell box at South-East corner of site Elev.:420.06 m (geodetic)**
⌖	**Test Pit Location**

Elev. Ref.: *The borehole locations and associated ground surface elevations were surveyed using a Network RTK Global Navigation Satellite System (GNSS) Receiver. The survey data was collected using UTM Zone 17N Projection, NAD83(CSRS)v7-2010 datum and Canada Geoid Model HT2_2010v70 (CGVD28).*

DWG Ref.: MHBC; "Draft Plan of Subdivision"; *Project No.: 22343A; Date: 2023-04-20*

TEST PIT LOCATION PLAN

Proposed Industrial Subdivision

6739 Wellington Road 109
Teviotdale, Ontario

CHUNG & VANDER DOELEN
ENGINEERING LTD.

311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1 / 519-742-8979

Drawn By: JR	Date: April 2024	File No.: 1207
Checked By: NZ	Scale: 1:2000	Drawing No.: 1