

"REVISED"

GEOTECHNICAL INVESTIGATION

**WITMER ROAD FROM THE SW CORNER OF #1894
TO 1 KM EAST
TOWNSHIP OF WILMOT, ONTARIO**

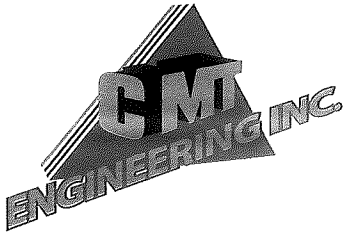
CMT Project 19-018.R02

Prepared For:

IBI Group

**Revised Report Date: September 10, 2019
Original Issue Date: May 7, 2019**





CMT Engineering Inc.

CONSULTING ENGINEERS

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September 10, 2019

19-018.R02 (REVISED)
Original Issue Date: May 7, 2019

IBI Group
410 Albert Street, Suite 101
Waterloo, Ontario
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Attention: Alfiya Kakal

Dear Alfiya:

**Re: Geotechnical Investigation
Witmer Road from the SW Corner of #1894 to 1 km East
Township of Wilmot, Ontario**

As requested, CMT Engineering Inc. conducted a geotechnical investigation at the above-referenced site, and we are pleased to present the enclosed report.

We trust that this information meets your present requirements and we thank you for allowing us to undertake this project. Should you have any questions, please do not hesitate to contact our office.

Yours very truly,

A handwritten signature in black ink, appearing to read 'Shawn Wheatley', is written over a series of horizontal lines.

Shawn Wheatley, M. Eng.

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1.0 INTRODUCTION

The services of CMT Engineering Inc. (CMT Inc.) were retained by Ms. Alfiya Kakal of IBI Group to conduct a geotechnical investigation for potential improvements to Witmer Road, located in the Township of Wilmot, Ontario.

It is understood that 1894 Witmer Road will be converted into a gravel pit, referred to as the Hallman Pit, which will extract up to 750,000 tonnes per year. It is expected that an increased number of heavy trucks will be using the section of Witmer Road east of the proposed Hallman Pit, and as such, the pavement will require improvements. Steed and Evans has previously improved the road from their pit located at #1755 Witmer Road (east of the project area), east to Queen Street.

The purpose of this investigation is to evaluate the existing road conditions and provide recommendations for improvements to accommodate the additional traffic and loading. Included in the assessment are the soil classification and groundwater observations, as well as comments and recommendations regarding dewatering considerations; recommendations for site servicing, excavations and backfilling; recommendations for pavement design and drainage; and a summary of the laboratory test results.

2.0 EXISTING SITE CONDITIONS

Witmer Road is currently a two-lane road paved with asphaltic concrete or tar and chip surface treatment. The surrounding properties are typically agricultural or wooded areas.

CMT Inc. staff reviewed a previous pavement assessment on Witmer Road from Queen Street to 1500 m west, completed by Naylor Engineering Associates Ltd. (NEA Ltd.) and dated May 2, 2007. This assessment was completed for the existing Witmer Pit and included geotechnical information along this section of roadway as well as recommendations for pavement upgrades of Witmer Road to support added truck traffic from the Witmer Pit to Queen Street. CMT Inc. also reviewed the Transportation Impact Study (draft) for 1894 Witmer Road (Hallman Pit) completed by Paradigm Transportation Solutions Ltd. (PTS Ltd.), dated February 2019. This report reviewed the existing traffic conditions by means of a traffic count analysis and made predictions and suggestions of future traffic conditions with respect to the proposed Hallman Pit.

The geotechnical drilling program for the NEA Ltd. report consisted of fifteen (15) boreholes located along Witmer Road from Queen Street to 1500 m west (1790 Witmer Road). The boreholes generally revealed a 20 mm to 30 mm thick surficial tar and chip treatment above a 100 mm to 580 mm thick mixed granular base. The subgrade soils consisted generally of native sands and silty sands, gravelly sand fill and layers of buried topsoil. An existing average Granular Base Equivalency (GBE) of 160 was calculated for the existing conditions. The report made the recommendation to place a 50 mm overlay of either HL4 or HL8 asphalt on the existing road to achieve a new GBE of 260. In conversations with the Township of Wilmot, no as-built conditions exist for Witmer Road between Sandhills Road and Queen Street. For the

purposes of this report, we will assume that 50 mm of asphalt was overlaid on the existing roadway as recommended by the NEA Ltd. report to achieve an average GBE of 260 along this section of roadway.

A site visit was conducted on March 1, 2019 and the condition of the roadway was inspected from Sandhills Road to Queen Street. New hot-mix asphalt was observed to have been placed from the intersection of Witmer Road and Queen Street to 1790 Witmer Road, and the original tar and chip pavement remained in place from 1790 Witmer Road to the intersection of Witmer Road and Sandhills Road. The entrance to the Witmer Pit is slightly east of 1790 Witmer Road. The section of existing roadway consisting of tar and chip pavement had significant alligator cracking along the edges of the pavement; however, the asphalt remained in place and no crumbling of the edges was observed. There was some minor rutting and minor pothole damage with no transverse cracking observed along this section of tar and chip pavement. The section of roadway consisting of new hot-mix asphalt also showed alligator cracking at the edges with some crumbling of the cracked edges. There was significant lateral cracking through this section (approximately every 15 m) and some rutting observed. Alligator cracking was also observed at the pit entrance, which can be attributed to trucks turning.

3.0 FIELD AND LABORATORY PROCEDURES

Prior to the commencement of the field drilling program, locates were organized by CMT Inc. to ensure that underground utilities would not be damaged.

The drilling field investigation was conducted on April 22, 2019, and comprised the advancement of eleven (11) boreholes (referenced as Boreholes 1 to 11), utilizing a Geoprobe 7822DT drillrig operated by CMT Drilling Inc. The boreholes were spaced at 100 m apart, starting from #1894 and moving east. Odd numbered boreholes were drilled on the north side of the road (west-bound lane), and even numbered boreholes were drilled on the south side of the road (east-bound lane).

Boreholes 1, 5, and 10 were advanced to depths of 2.13 m (7.0 ft) below ground surface utilizing the Standard Penetration Test (SPT) conducted at 0.76 m (2.5 ft) intervals. Boreholes 2 to 4, 6 to 9 and 11, were advanced to depths of ranging from 1.52 m (5.0 ft) to 3.05 m (10.0 ft) utilizing the Macro Core (MC5) system. Technical staff from CMT Inc. observed the drilling operation and collected and logged the recovered soil samples. A small portion of each sample was placed in a sealed, marked jar for moisture content determinations. Representative samples from the following boreholes and depths were submitted to our laboratory for grain size analyses:

- Borehole 2 - depth 1.00 m (3.05 ft)
- Borehole 3 - depth 0.63 m (2.1 ft)
- Borehole 6 - depth 0.33 m (1.1 ft)
- Borehole 10 - depth 0.76 m (2.5 ft)

The borehole logs are provided in Appendix A and the grain size analyses are provided in Appendix B.

4.0 SUBSOIL CONDITIONS

The soils encountered in the boreholes are described briefly below and a more detailed stratigraphic description is provided on the borehole logs in Appendix A.

4.1. Asphaltic Concrete

Tar and chip surface treatment asphalt was observed at the surface in all boreholes. The asphalt was observed to range from approximately 55 mm to 75 mm in thickness at the borehole locations (average 65 mm). Some variance in the asphalt thickness should be expected outside of the sampled areas.

4.2. Granular Fill

Brown sand and gravel fill (granular base) with some silt was encountered underlying the asphaltic concrete in all boreholes. The granular base was observed to range from approximately 325 mm to 585 mm in thickness at the borehole locations (average 453 mm). The granular base was considered to be compact to dense, with SPT N-values ranging from 24 to 34 blows per 0.30 m (average 30 blows per 0.30 m). The granular base was considered to be moist, with moisture contents ranging from 3.1% to 7.1% (average of 4.0%).

4.3. Sandy Silt Fill

Brown to dark brown sandy silt fill with trace gravel and clay, as well as trace to some organic material was encountered underlying the granular fill in Boreholes 1, 2, 4, 5, 6, 8 and 9. The sandy silt fill was considered very loose to loose, with a recorded SPT N-value of 2 blows per 0.30 m. The sandy silt fill was considered moist to wet, with moisture contents ranging from 5.5% to 24.6% (average 15.0%).

4.4. Clayey Silt

Brown to red-brown clayey silt with trace sand was encountered underlying the sandy silt fill in Boreholes 1 and 2. The clayey silt was considered firm, with a recorded SPT N-value of 6. The clayey silt was considered moist to wet, with moisture contents ranging from 17.9% to 27.1% (average 21.6%).

4.5. Silt and Sand

Brown, light brown, or red-brown silt and sand with trace to some gravel, and up to some clay, was encountered underlying the clayey silt in Borehole 1, underlying the granular fill in Boreholes 3, 7, 10 and 11, and underlying the sandy silt fill in Boreholes 4, 5, 6, 8 and 9. The silt and sand was considered loose to compact, with SPT N-values ranging from 10 to 14 blows per 0.30 m (average 12 blows per 0.30 m). The silt and sand were considered moist to saturated, with moisture contents ranging from 2.6% to 22.2% (average 9.8%).

4.6. Groundwater

Accumulated groundwater was not observed upon completion of drilling. Some wet to saturated conditions were encountered within the sandy silt fill, clayey silt, as well as the silt and sand. It should be noted that the relatively impermeable clayey silt as well as silt and sand encountered in the lower portions of the boreholes has the potential to create perched water conditions. Groundwater conditions (particularly perched water) are generally dependent on the amount of precipitation, control of surface water, as well as the time of year, and can fluctuate significantly in elevation and volume. Recommendations with respect to dewatering conditions are provided in Section 5.4 of this report.

5.0 DISCUSSION AND RECOMMENDATIONS

It is understood that 1894 Witmer Road will be converted into a gravel pit, which will extract up to 750,000 tonnes per year. It is expected that an increased number of heavy trucks will be using the section of Witmer Road east of the proposed Hallman Pit, and as such, the pavement will require improvements. Steed and Evans has previously improved the road from their pit located at #1755 Witmer Road (east of the project area), east to Queen Street.

Utilizing the information gathered during the geotechnical investigation and assuming that the borehole information is representative of the subsoil conditions throughout the site, the following comments and recommendations are provided:

5.1. Literature Review

CMT Inc. staff reviewed a previous pavement assessment on Witmer Road from Queen Street to 1500 m west, completed by Naylor Engineering Associates Ltd. (NEA Ltd.) and dated May 2, 2007. CMT Inc. also reviewed the Transportation Impact Study (draft) for 1894 Witmer Road (Hallman Pit) completed by Paradigm Transportation Solutions Ltd. (PTS Ltd.), dated February 2019. This report reviewed the existing traffic conditions by means of a traffic count analysis and made predictions and suggestions of future traffic conditions with respect to the proposed Hallman Pit.

5.2. Existing and Future Traffic

The PTS Ltd. Transportation Impact Study was used to determine the existing and future traffic conditions for this section of roadway, between the proposed Hallman Pit and the existing Witmer Pit. An annual average daily traffic (AADT) of 175 vehicles per day with 22% truck traffic was calculated from the observed traffic conditions during the one-day traffic count. The existing Witmer Pit truck traffic is included in this AADT. Assuming the daily operation from the Witmer Pit is 23 trucks per day, none of which will use the section of road west of the Witmer Pit, the AADT of the section of road in this study would be 149 vpd, with 8.7% truck traffic. Since the vehicle counts were completed between 7 AM and 7 PM (peak hours, daytime), an additional 15% was added to this AADT to estimate the low traffic period of 7 PM to 7 AM (off peak, night-time) for a daily total background AADT of 172 vpd with 8.7% truck traffic.

It is proposed to extract 750,000 tonnes of gravel per year from 1894 Witmer Road (Hallman Pit) and transport the aggregate to market via Witmer Road to Queen Street. Averaging the proposed yearly extraction over 300 operating days per year with a mix of tri-axel and tractor trailer trucks, there will be approximately 73 trucks per day leaving from and returning to the proposed gravel pit. Adding this to the background AADT, a total AADT of 318 vehicles per day with 50.6% truck traffic was calculated for the existing traffic and the proposed gravel pit truck traffic.

The routine method of experience based standard sections is used to assess the roadway with respect to existing conditions and proposed future traffic conditions. Table 3.3.3 of the AASHTO Pavement Design and Rehabilitation Manual (see below) indicates surface type and thickness as well as the base and subbase thickness for secondary highways with various AADT ranges and subgrade types. The table assumes 10% commercial/truck traffic and that the subgrade is competent and not saturated.

As observed in the boreholes, the existing subgrade in this section of roadway consists of primarily native silt and sand underlying sandy silt fill. Native clayey silt was observed in Boreholes 1 and 2 at the western extents of this road section. No significant groundwater was encountered in the boreholes.

Considering the proposed gravel operations with a future AADT of 318 with 50.6% truck traffic, an adjusted future AADT of 1609 with 10% truck/commercial traffic was calculated and utilized for this section of roadway.

Part of Table 3.3.3: Structural Design Guidelines for Flexible Pavements (thickness in mm) Secondary Highways

AADT	Pavement Structure Elements	Subgrade Material				
		Gravels and Sands Suitable as Gran-Borrow	Sands and Silts			Lacustrine Clays
			5-75 μ m <40%	5-75 μ m 40% - 55%	5-75 μ m >55%	
1500 - 2000	Single or Double Surface Treatment (ST)	50	50	50	50	50
	Granular 'A' Base Thickness (B)	150	150	150	150	150
	Granular 'B' Subbase Thickness (SB)	--	250	300	450	300
	Granular Base Equivalency (GBE)	250	415	450	550	450
2000 - 3000	Single or Double Surface Treatment (ST)	90	90	90	90	90
	Granular 'A' Base Thickness (B)	150	150	150	150	150
	Granular 'B' Subbase Thickness (SB)	--	300	450	600	450
	Granular Base Equivalency (GBE)	330	530	630	730	630

The subgrade soils generally consist of a silt and subgrade with 44.2% to 54.5% fines. As seen in Table 3.3.3, a minimum GBE of 450 is recommended for this section of roadway, which is greater than the existing average GBE of 260. Native clayey silt with greater than 55% fines comprised the subgrade in Boreholes 1 and 2 at the western extents of this road section. If the driveway to the proposed pit is located at the western edge of the property, then based on Table 3.3.3, a minimum GBE of 450 would be recommended. It should also be noted that the traffic exiting the proposed gravel pit will be primarily heavy truck traffic (fully loaded tractor trailers), exerting high instantaneous loads to the roadway. As such, it is recommended to account for the increased loading by using a higher GBE of 630 for construction purposes.

Although the existing roadway was constructed to an average thickness of approximately 500 mm, the pavement structure is now over 10 years old. The existing granular base material has an excess proportion of fines and does not conform to OPSS 1010 specifications for Granular base material; therefore, a reduced GBE was calculated for the existing granular material. As a result, the existing GBE in the borehole locations ranged from 284 to 447, with an average of 355. It should also be noted that organic material existed within the fill in some sections of the existing roadway, which can lead to future settlement issues if not removed. As such, it is recommended to excavate the existing roadway down to a competent subgrade material, free of topsoil and organics and replace with a pavement structure having a GBE of 630.

5.3. Excavations

Any excavations must be carried out in accordance with Ontario Regulation 213/91 (Reg 213/91) of the Occupational Health and Safety Act and Regulations for Construction Projects.

Type 3 Soils – In general, the existing fill soils, as well as the clayey silt and the silt and sand soils encountered in the boreholes in a drained state would be classified as Type 3 soils under Reg 213/91. Type 3 soils must be sloped from the bottom of the excavation at a minimum gradient of 1 horizontal to 1 vertical. Soils in a saturated condition must be treated as Type 4 soils, addressed below.

Type 4 Soils - In general, any saturated soils encountered in the boreholes, would be classified as Type 4 soils under Reg 213/91. Type 4 soils must be sloped from the bottom of the excavation at a minimum gradient of 3 horizontal to 1 vertical.

If it is not practical to excavate according to the above requirements, then a trench support system (designed in accordance with the Ontario Health and Safety Act Regulations) may be utilized.

5.4. Dewatering Considerations

Accumulated groundwater was not observed upon completion, however wet to saturated soil conditions were encountered in the sandy silt fill, the native clayey silt, as well as the native silt and sand soils. It should be noted that the relatively fine-grained sand and silt soils, as well as the clayey silt soils may have the potential to create perched water conditions. Groundwater conditions (particularly perched water) are generally dependent on the amount of precipitation, control of surface water, as well as the time of year, and can fluctuate significantly in elevation and volume.

Seasonal variations in the groundwater should be expected, with higher levels generally occurring during the wet weather seasons in the spring and fall, and lower levels occurring during dry weather conditions. Therefore, in order to minimize the amount of water encountered during construction, it is recommended that the construction be performed during the drier summer months.

Sloughing of the excavation walls should be expected in the excavations that extend into the wet sandy silt encountered in the boreholes.

Dewatering works should be designed and constructed in accordance with requirements of regulatory agencies such as the Ministry of Transportation, Ministry of Natural Resources and Fisheries and the Ministry of the Environment. Dewatering must be in accordance with OPSS 517 and the control of water must be in accordance with OPSS 518.

5.5. Soil Design Parameters

The following parameters should be utilized in lateral earth pressure calculations:

Soil Type	Soil Density (kg/m ³)	Friction Angle (Degree)	Coefficient of Active Pressure (K _a)	Coefficient of Passive Pressure (K _p)	Coefficient of At-Rest Pressure (K ₀)	Coefficient of Friction (μ)
Sandy Silt Fill	1,800	32°	0.31	3.25	0.47	0.41
Clayey Silt	1,850	30°	0.33	3.00	0.50	0.38
Silt and Sand	1,900	33°	0.29	3.39	0.46	0.43
Imported Granular 'A'/ Granular 'B' (OPSS 1010)	2,100	34°	0.28	3.54	0.44	0.45

5.6. Subgrade Preparation and Pavement Design

It is understood that the roadway on Witmer Road between the proposed Hallman Pit and the existing Steed and Evans Pit may need improvements to handle the increased loads from truck traffic. The following recommendations for the pavement design have been provided for areas where the pavement may need to be replaced.

It should be noted that sandy silt fill with organic material was observed in Boreholes 1, 2, 4, 5, 6 and 9. Organic material tends to decompose over time which can cause differential settlement to occur. Differential settlement can result in cracking and rutting of the asphalt road surface. The organic fill observed in the boreholes is highly susceptible to frost heaving and can lead to frost boils during rapid thawing and subsequent failure of the pavement structure. In order to mitigate differential frost heaving along with potential frost boils and subsequent premature failure of the pavement structure, it is recommended that all existing organic fill be subexcavated from within the road allowance.

In cases where subexcavation is required, the subgrade should be proof-rolled and any soft or unstable areas should be subexcavated and replaced with suitable drier materials, compacted to a minimum of 95% standard Proctor maximum dry density (SPMDD) prior to the replacement of the granular subbase. It is recommended that any areas subexcavated to remove poor quality fill, as well as areas subexcavated due to soft or unstable conditions, be backfilled with mineral soils of similar composition to those of the surrounding soils to eliminate the potential to create perched water conditions as well as differential frost heave.

The subgrade should be graded smooth (free of depressions) and properly crowned to ensure positive drainage, with a minimum grade of 3% towards the edge of road. Rapid drainage of the pavement structure is critical to ensure long-term performance.

The native subgrade soils are sensitive to change in moisture content and can become loose or soft if the soils are subject to inclement weather and seepage or severe drying. Furthermore, the subgrade soils could be easily disturbed if traveled on during construction. As such, where this material will be exposed, it is recommended that the granular subbase be placed immediately upon completion of the subgrade preparation to protect the integrity of the subgrade soils.

Should wet conditions be encountered during construction, site assessments may be required to determine what options can be undertaken to construct a modified pavement base. These options may include subexcavation of wet soils and increasing the thickness of the granular base, the use of reinforcing geotextiles and/or geogrid, or a combination of all.

Based on the above assessment of a GBE of 630, the following pavement design is recommended for the proposed road reconstruction:

Material	Recommended Thickness for New Pavement
Asphaltic Concrete	HL3 or HL4- 50mm (2.0") surface HL8 – 50 mm (2.0") binder
Granular 'A' Base (OPSS 1010)	150 mm (6.0")
Granular 'B' Subbase (OPSS 1010 Type I or Type III)	450 mm (18.0")

The granular subbase material should be compacted to 100% SPMDD. Asphaltic concrete should be supplied, placed and compacted to a minimum 92.0% Marshall maximum relative density in accordance with OPSS 1150 and OPSS 310.

Construction joints in the surface asphalt must be offset a minimum of 150 mm to 300 mm (6" to 12") from construction joints in the binder asphalt so that longitudinal joints do not coincide. The pavement should be designed to ensure that water will not pond on the pavement surface.

In areas where new asphalt will abut the existing asphalt, it is recommended that any joints in the existing asphalt be sawcut in a straight line prior to being milled to a depth of 40 mm and a width of 150 mm as per OPSD 509.010. It is recommended that a tack-coat in conformance with OPSS 308 be applied to the edge and surface of all milled asphalt prior to placement of new asphalt.

Assuming all conditions above can be sufficiently achieved, a 20-year life span can be expected for the designed pavement structure. Historically, the bitumen in asphalt tended to be less refined which can attribute to the longevity of previous driving surfaces. It is becoming apparent that the bitumen produced today is much more refined, and we are seeing a trend to asphalt that has a shorter service life before maintenance and repairs are required.

5.7. Alternative Options

Although it is recommended to reconstruct the existing roadway to achieve a properly constructed and well-founded pavement structure, alternative options exist to achieve a GBE of 630 as specified.

The options are, but not limited to:

- 1) Remove existing asphalt, add 225 mm of Granular 'A' on top of existing road base and place 100 mm of hot mix asphalt. (Total GBE of 648)
- 2) Leave existing pavement structure, add 100 mm of Granular 'A' on top of existing asphalt, and place 100 mm of hot mix asphalt. (Total GBE of 655)
- 3) Leave existing pavement structure, add 150 mm of hot mix asphalt on top of the existing asphalt. (Total GBE of 655)

These options would be considered more feasible from a cost perspective, however, do carry assumptions from a design perspective and inherent risks from existing conditions. These options all achieve the required Granular Base Equivalency; however, these options are based on the existing roadway having an average GBE of 355, and as such, some areas may have less than the required GBE of 630, which may cause premature pavement failures in these areas. Also, these options do not address the removal of buried organic material, or issues related to loose and/or wet soils, and as such, settlement and/or frost heave may occur. These options, if selected, may reduce the service life of the pavement, and may require more ongoing repairs and maintenance throughout the service life.

6.0 LIMITATIONS OF THE INVESTIGATION

This report is intended for the Client named herein and for their Client. The report should be read in its entirety, and no portion of this report may be used as a separate entity. 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.

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete, or if the proposed construction should differ from that mentioned in this report.

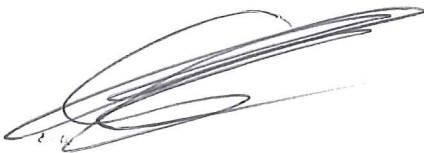
It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments are based on the results obtained at the test locations only. It is therefore assumed that these results are representative of the subsoil conditions across the site. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

It should be noted that this report specifically addresses geotechnical aspects of the project and does not include detailed investigations or assessments relating to potential subsurface contamination. As such, there should be no assumptions or conclusions derived from this report with respect to potential soil or water contamination. Soil or water contamination is generally caused by the presence of xenobiotic (human-made) chemicals or other alteration processes in the natural soil and groundwater environment. If necessary, the investigation, assessment and rehabilitation of soil and water contaminants should be undertaken by qualified environmental specialists.

The samples obtained during the geotechnical investigation will be stored for a period of three months, after which time they will be disposed of unless alternative arrangements are made.

We trust that this report meets with your present requirements. Should you have any questions, please do not hesitate to contact our office.

Prepared by:



Shawn Wheatley, M. Eng.

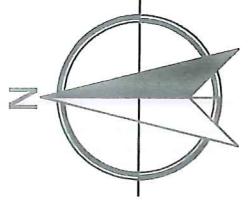
Reviewed by:



Robert Koopmans, P.Eng.
Consulting Engineer

NOTES:

Base map provided by Google Earth.



NO.	DESCRIPTION	DATE

REVISIONS

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 Fax: 519-899-4664
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PROJECT:

PAVEMENT ASSESSMENT
 Wilmot Road
 Township of Wilmot, Ontario

DRAWING TITLE:

SITE LOCATION MAP

PROJECT NO.:

19-018

DATE:

May 3, 2019

SCALE:

N.T.S.

DRAWING NO.:

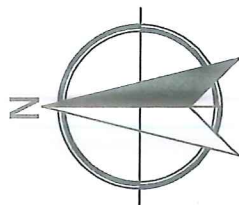
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NOTES:

Base map provided by Google Maps



NO.	DESCRIPTION	DATE

REVISIONS

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PROJECT:

PAVEMENT ASSESSMENT
Wittmer Road
Township of Wilmot, Ontario

DRAWING TITLE:

SITE PLAN SHOWING
BOREHOLE LOCATIONS

PROJECT NO.:

19-018

DATE:

May 3, 2019

SCALE:

N.T.S.

DRAWING NO.:

1

APPENDIX A
BOREHOLE LOGS

BOREHOLE 1

Page 1 of 1

Date Drilled: April 22, 2019
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 0
Logged by: SW

Project No.: 19-018
Project: Geotech - Wilmer Road
Location: Wilmot, Ontario

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wl 10 20 30 40 50	Pocket Penetrometer kPa 100 200 300 400 SPT (N) Blows/0.3 m 20 40 60 80
0					Ground Surface (m) 0.00			
0					ASPHALT Asphaltic concrete (65mm) GBE = 81mm			
1	SS		1		GRANULAR BASE Dense, light brown sand and gravel granular base, some silt, moist (360mm) GBE = 225mm		3.9	33
2					FILL Loose, dark brown sandy silt fill, trace gravel and clay, trace organics, moist			
3					CLAYEY SILT Firm, brown clayey silt, trace sand, moist		17.9	
4	SS		2		Becoming wet		27.1	6
5								
6	SS		3		SILT AND SAND Compact, light brown silt and sand, trace clay and gravel, moist		3.5	11
7					End of Borehole			
8								

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BOREHOLE 3

Page 1 of 1

Date Drilled: April 22, 2019
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 0
Logged by: SW

Project No.: 19-018
Project: Geotech - Wilmer Road
Location: Wilmot, Ontario

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wl 10 20 30 40 50	Pocket Penetrometer kPa 100 200 300 400 SPT (N) Blows/0.3 m 20 40 60 80
0					Ground Surface (m) 0.00			
0					ASPHALT Asphaltic concrete (55mm) GBE = 69mm			
1					GRANULAR BASE Dense, light brown sand and gravel granular base, some silt, moist (580mm) GBE = 362mm		3.8	
2					-0.63 SILT AND SAND Loose, red-brown silt and sand, trace clay and gravel, moist			
2					0.63			
3								
4								
4								16.3
5					-1.52 End of Borehole			
5					1.52			
6								

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BOREHOLE 4

Page 1 of 1

Date Drilled: April 22, 2019
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 0
Logged by: SW

Project No.: 19-018
Project: Geotech - Wilmer Road
Location: Wilmot, Ontario

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [----X----] Wl 10 20 30 40 50	Pocket Penetrometer kPa 100 200 300 400 SPT (N) Blows/0.3 m 20 40 60 80
0					Ground Surface (m) 0.00			
0					ASPHALT Asphaltic concrete (70mm) GBE = 88mm			
1					GRANULAR BASE Dense, light brown sand and gravel granular base, some silt, moist (560mm) GBE = 350mm		3.6	
2								
2					FILL Loose, dark brown silty sand fill, trace gravel and clay, trace organics, moist			
3								
3								21.5
4								
4					SILT AND SAND Compact, brown silt and sand, trace clay and gravel, moist			
5								2.6
5					End of Borehole			
6								

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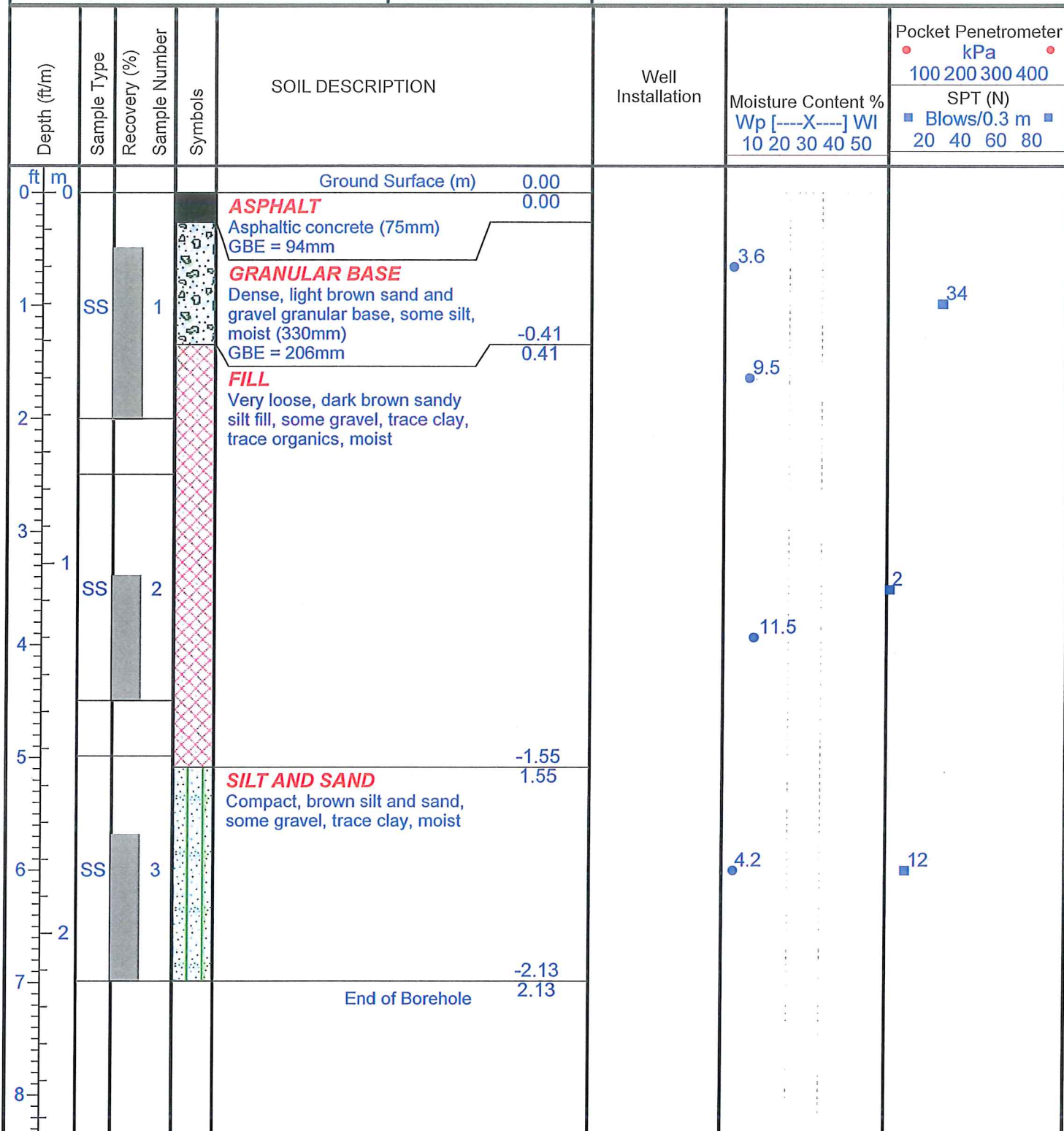
BOREHOLE 5

Page 1 of 1

Date Drilled: April 22, 2019
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 0
Logged by: SW

Project No.: 19-018
Project: Geotech - Witmer Road
Location: Wilmot, Ontario



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BOREHOLE 6

Page 1 of 1

Date Drilled: April 22, 2019
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 0
Logged by: SW

Project No.: 19-018
Project: Geotech - Witmer Road
Location: Wilmot, Ontario

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wl 10 20 30 40 50	Pocket Penetrometer kPa 100 200 300 400 SPT (N) Blows/0.3 m 20 40 60 80
0					Ground Surface (m) 0.00			
0					ASPHALT Asphaltic concrete (65mm) GBE = 81mm			
1					GRANULAR BASE Dense, light brown sand and gravel granular base, some silt, moist (325mm) GBE = 203mm		4.3	
2					FILL Loose, dark brown silty sand fill, trace gravel and clay, trace organics, moist		24.6	
3					SILT AND SAND Compact, red-brown silt and sand, trace gravel and clay, moist		10.4	
4					Light brown, no clay		6.4	
5					End of Borehole			

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BOREHOLE 7

Page 1 of 1

Date Drilled: April 22, 2019
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 0
Logged by: SW

Project No.: 19-018
Project: Geotech - Witmer Road
Location: Wilmot, Ontario

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wl 10 20 30 40 50	Pocket Penetrometer kPa 100 200 300 400 SPT (N) Blows/0.3 m 20 40 60 80
0					Ground Surface (m) 0.00			
0					ASPHALT Asphaltic concrete (70mm) GBE = 88mm			
1					GRANULAR BASE Dense, light brown sand and gravel granular base, some silt, moist (490mm) GBE = 306mm		7.1	
2					-0.66			
2					SILT AND SAND Compact, brown silt and sand, some gravel, trace clay, moist			
3					0.66			
4							4.7	
5					-1.52			
5					End of Borehole 1.52			
6								

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BOREHOLE 8

Page 1 of 1

Date Drilled: April 22, 2019
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 0
Logged by: SW

Project No.: 19-018
Project: Geotech - Witmer Road

Location: Wilmot, Ontario

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wl	Pocket Penetrometer kPa 100 200 300 400
							10 20 30 40 50	SPT (N) Blows/0.3 m 20 40 60 80
0					Ground Surface (m) 0.00			
					ASPHALT Asphaltic concrete (65mm) GBE = 81mm			
					GRANULAR BASE Dense, light brown sand and gravel granular base, some silt, moist (380mm) GBE = 237mm			
					-0.43			
					FILL Loose, dark brown sandy silt fill, trace clay and gravel, trace organics, very moist			
					0.43			
					-0.89			
					SILT AND SAND Compact, red-brown silt and sand, trace clay and gravel, very moist			
					0.89			
					-1.52			
					End of Borehole 1.52			

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BOREHOLE 10

Page 1 of 1

Date Drilled: April 22, 2019
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 0
Logged by: SW

Project No.: 19-018
Project: Geotech - Wilmer Road
Location: Wilmot, Ontario

Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wl 10 20 30 40 50	Pocket Penetrometer kPa 100 200 300 400 SPT (N) Blows/0.3 m 20 40 60 80
0					Ground Surface (m) 0.00			
0					ASPHALT Asphaltic concrete (70mm) GBE = 88mm			
1	SS		1		GRANULAR BASE Dense, light brown sand and gravel granular base, some silt, moist (360mm) GBE = 225mm		3.2	24
2					SILT AND SAND Compact, light brown silt and sand, trace clay and gravel, moist			
3								
4								
5								
6	SS		3		Becoming wet, some clay		9.0	10
7							15.0	14
8							22.2	
					End of Borehole			

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BOREHOLE 11

Page 1 of 1

Date Drilled: April 22, 2019
Rig: Geoprobe 7822DT
Contractor: CMT Drilling Inc.
Drilling Method: SPT

Elevation: 0
Logged by: SW

Project No.: 19-018
Project: Geotech - Wilmer Road
Location: Wilmot, Ontario

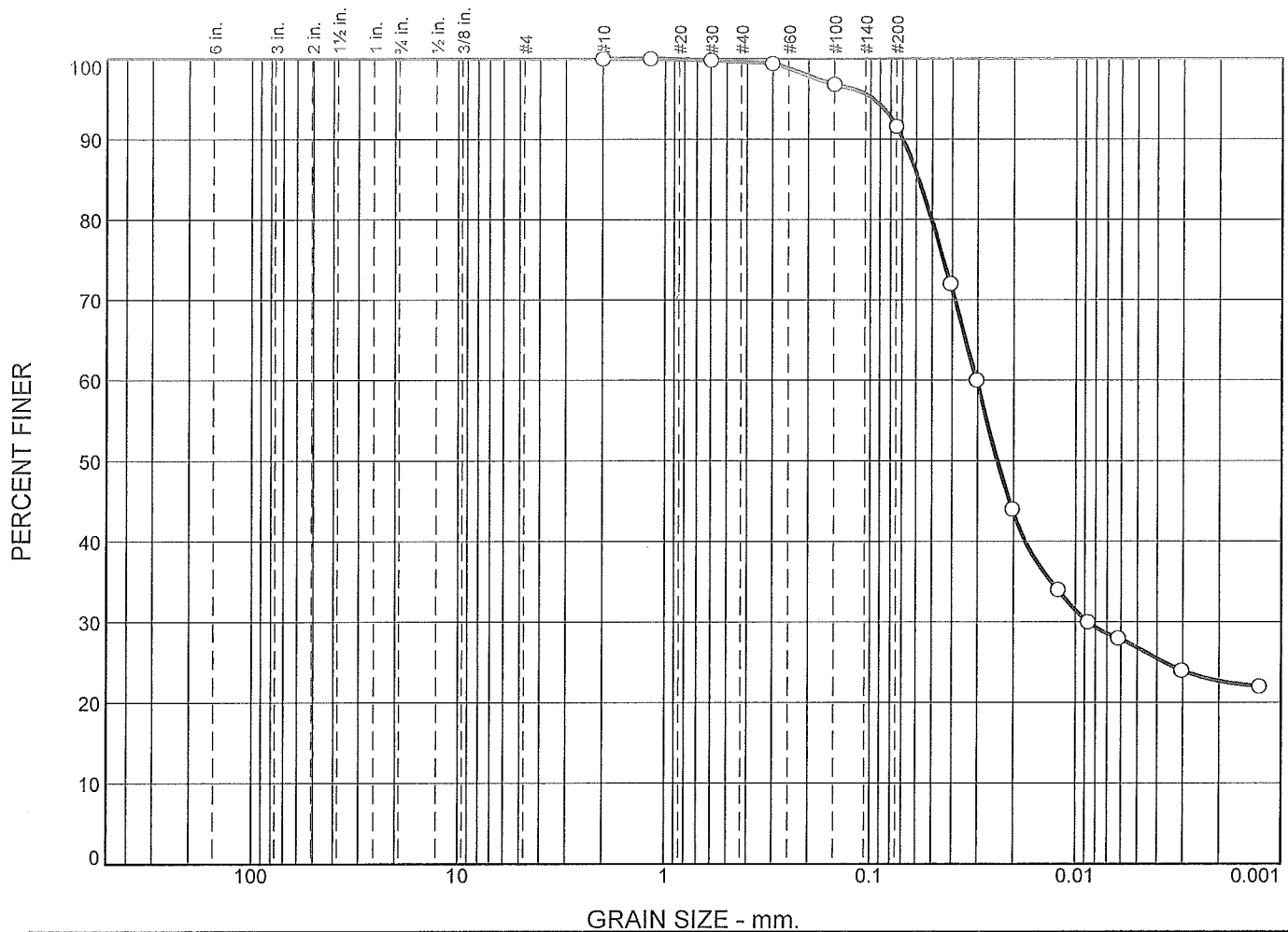
Depth (ft/m)	Sample Type	Recovery (%)	Sample Number	Symbols	SOIL DESCRIPTION	Well Installation	Moisture Content % Wp [---X---] Wl 10 20 30 40 50	Pocket Penetrometer kPa 100 200 300 400 SPT (N) Blows/0.3 m 20 40 60 80
0					Ground Surface (m) 0.00			
0					ASPHALT Asphaltic concrete (65mm) GBE = 81mm			
1					GRANULAR BASE Dense, light brown sand and gravel granular base, some silt, moist (470mm) GBE = 294mm		4.7	
2					-0.54 0.54			
2					SILT AND SAND Compact, brown silt and sand some gravel, trace clay, moist			
3								
4								
5					-1.52 1.52		8.4	
6					End of Borehole			

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APPENDIX B
GRAIN SIZE ANALYSES

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.4	8.0	68.9	22.7

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH2	3	1.0m	clayey silt, trace sand	ML
				Tested by MS of CMT Engineering Inc., April 23, 2019	

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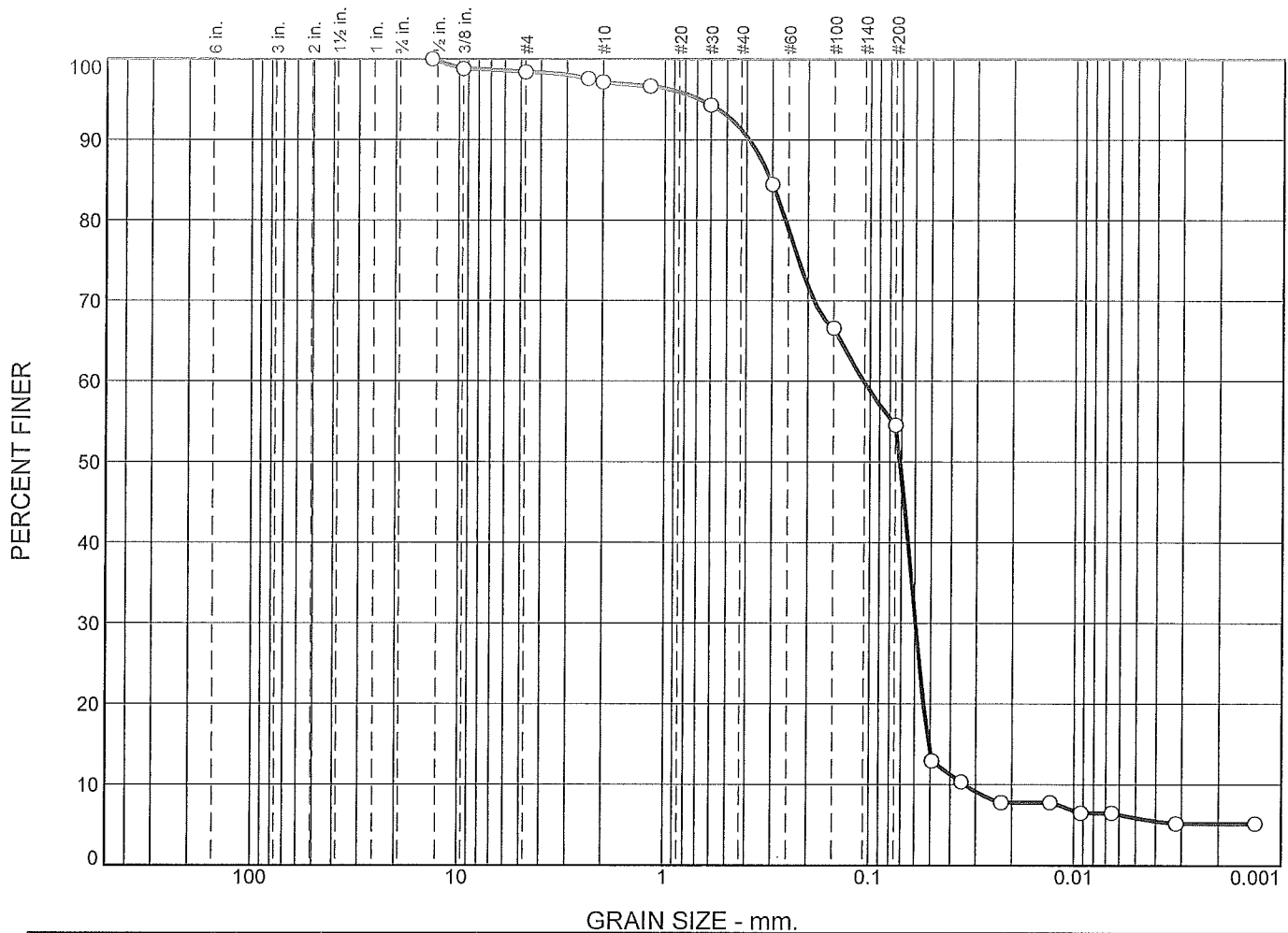
Client: IBI Group

Project: Pavement Assessment for Gravel Pit Operation
Witmer Road, Wilmot Twp, Ontario

Project No.: 19-018

Figure 1

Particle Size Distribution Report



GRAIN SIZE - mm.								
	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.6	1.2	5.9	36.8	49.3	5.2

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH3	2	0.63m	silt and sand, trace clay and gravel	ML
				Tested by MS of CMT Engineering Inc., April 23, 2019	

CMT Engineering Inc.

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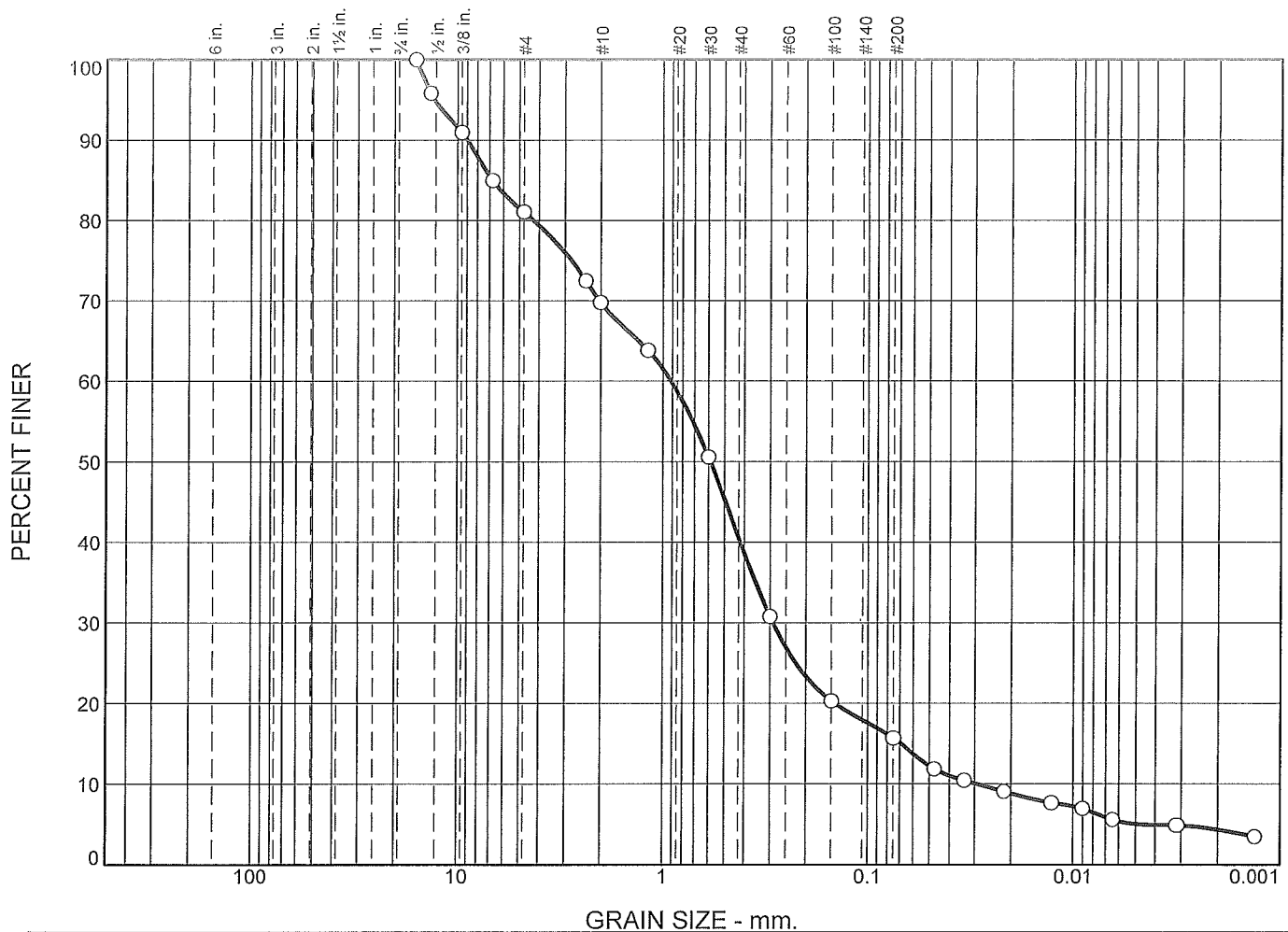
Client: IBI Group

Project: Pavement Assessment for Gravel Pit Operation
Witmer Road, Wilmot Twp, Ontario

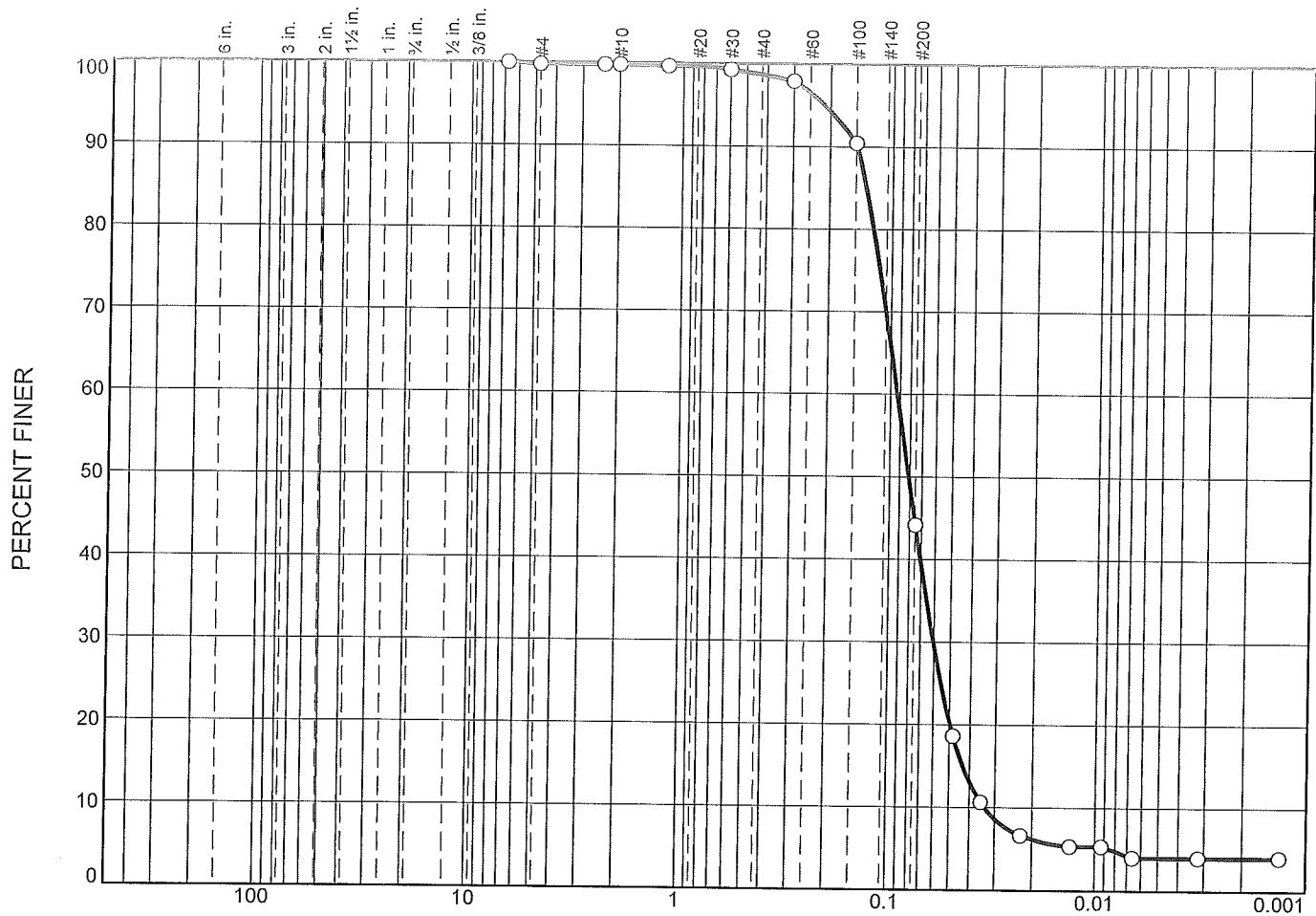
Project No.: 19-018

Figure 2

Particle Size Distribution Report



Particle Size Distribution Report



GRAIN SIZE - mm.

	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.2	0.0	1.1	54.5	40.2	4.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH10	2	0.760m	sand and silt, trace clay and gravel	SM
				Tested by MS of CMT Engineering Inc., April 23, 2019	

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Client: IBI Group

Project: Pavement Assessment for Gravel Pit Operation
Witmer Road, Wilmot Twp, Ontario

Project No.: 19-018

Figure 4