GEOTECHNICAL INVESTIGATION
PROPOSED RECONSTRUCTION OF SIDEROAD 26/27 NOTTAWASAGA FROM OSPREY-CLEARVIEW TOWNLINE TO CONCESSION ROAD 10 NORTH TOWNSHIP OF CLEARVIEW, ONTARIO

for

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PML Ref.: 14BF029
Report: 3
March 2015

Peto MacCallum Ltd.
CONSULTING ENGINEERS

March 9, 2015

PML Ref.: 14BF029
Report: 3

Mr. Paul Hausler
R.J. Burnside & Associates Limited
Georgian Bay Office
3 Ronell Crescent
Collingwood, Ontario
L9Y 4J6

Dear Mr. Hausler

Geotechnical Investigation
Proposed Reconstruction of
Sideroad 26/27 Nottawasaga
From Osprey-Clearview Townline to
Concession Road 10 North
Township of Clearview, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation completed at the above noted project site. Authorization for the project was provided by Mr. P. Hausler in the email of May 2, 2014.

The Walker Quarry in the southeast corner of Duntroon Sideroad (formerly Simcoe County Road 91) and Osprey/Clearview Townline (Townline) is slated for expansion. As a result of the quarry expansion, the Township of Clearview will be closing a section of Duntroon Sideroad between Concession 10 North Nottawasaga Road (Concession 10) and Townline, and traffic will be re-routed along sections of Sideroad 26/27 Nottawasaga (Sideroad 26/27), Concession 10 and Duntroon Sideroad. In this regard, the Township of Clearview will be reconstructing sections of these roads to accommodate the increased traffic loading. The location of the Quarry and subject roads are shown on the Site Plan in Drawing 3-1.

As requested, four separate reports were prepared for this project as follows:

- Report 1 (under separate cover) provides investigation details and recommendations for the replacement of the culverts at Station 8+780 and Station 9+135 on Duntroon Sideroad;
- Report 2 (under separate cover) provides investigation details and recommendations for the reconstruction of Duntroon Sideroad from Concession 10 to the west limits of Duntroon, about 2.4 km;
- This Report 3 presents investigation details and recommendations for the reconstruction of Sideroad 26/27 from Townline to Concession 10, about 2.7 km;

- Report 4 (under separate cover) provides investigation details and recommendations for the reconstruction of Concession 10 from Duntroon Sideroad to Sideroad 30/31, about 3.2 km.

The following improvements are planned for Sideroad 26/27:

- The existing road is a single lane gravel road (no shoulders). Reconstruction of the entire section of the road to a two lane paved road with gravel shoulders and a rural cross section (ditching), is planned. The proposed road profile will require predominately fills up to 2.0 m depth, with local cuts as much as 2.0 m.
- The existing CSP culvert at Station 6+500, in the low lying east part of the site, will be replaced with a 750 mm diameter concrete culvert.

The purpose of the geotechnical investigation was to assess the subsurface conditions along the alignment, and based on this information, provide comments and geotechnical engineering recommendations for road reconstruction, including culvert replacement. Geoenvironmental assessment of the site was not within the terms of reference, and no work has been carried out in this regard.

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

INVESTIGATION PROCEDURES

The field work for the investigation was carried out on May 29, 2014 and consisted of 8 boreholes drilled to 2.1 to 3.5 m depth along the road alignment. Borehole locations are shown on the Borehole Location Plan, Drawing 3-2, and on the Profiles, Drawings 3-3 to 3-10.

Co-ordination of clearances of underground utilities was provided by PML.

Boreholes were advanced using continuous flight solid stem augers, powered by a truck mounted CME-75 drill rig, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member PML's engineering staff.

Road granular thicknesses were measured and samples collected. Representative samples of the underlying subgrade soils were recovered at frequent depth intervals for identification purposes using a conventional split spoon sampler. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the subsoil. Ground water conditions were closely monitored during the course of the field work.

The location of each borehole was established in the field by PML, cognizant of underground utility locates. Borehole elevations were interpreted from profiles provided by the Client.

Traffic control was provided by PML in accordance with the Ontario Traffic Manual, Book 7.

All recovered samples were returned to our laboratory for moisture content determination and detailed examination to confirm field classification. One sample of the existing road base granular material was submitted for gradation analysis. Two samples of the soil units were tested for gradation analysis. Atterberg Limits testing was conducted on one sample. The results are provided on the Particle Size Distribution Charts, Figures 3-1 to 3-3, appended.

SITE DESCRIPTION

The existing road is a single lane gravel road (no shoulders) that is more or less level with the adjacent land. There is limited to no ditching. The existing road profile is gently rolling with relief of about 110 m, sloping down the Niagara escarpment from west to east. The road grade is fairly steep in the centred section, and more gentle in the west and east parts of the alignment. The proposed vertical profile will be established predominately with fills up to 2.0 m, and with local cuts as much as 2.0 m.

SUMMARIZED SUBSURFACE CONDITIONS

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions, including road granular thicknesses, soil classifications, inferred stratigraphy, Standard Penetration 'N' values, ground water observations and the results of laboratory water content determinations.

Due to the soil sampling procedures and limited sample size, the depth demarcations on the borehole logs must be viewed as "transitional" zones between layers, and cannot be construed as exact geologic boundaries between layers.

The boreholes contacted road granular which is supported on fill, underlain by a native till and/or silt unit, with a discontinuous clayey silt layer noted. A general description of the distribution of the various soil units is provided below.

Road Granular

All boreholes were drilled through the road granular and the table below summarizes the thicknesses encountered.

BOREHOLE	GRANULAR BASE (mm)	GRANULAR SUBBASE (mm)	TOTAL THICKNESS (mm)
1	190	*	190
2	190	*	190
3	120	*	120
4	80	*	80
5	30	*	30
6	350	*	350
7	380	*	380
8	160	*	160

Note * - No distinguishable granular subbase noted.

A grain size analysis was conducted on a sample of the granular base material from Borehole 6 and the results are presented in Figure 3-1, appended. The sample does not conform to the gradation requirements for OPSS Granular A and Granular B Type I, as it is very silty (40% vs 8% standard).

Fill

Below the road granular, fill was encountered in all boreholes. The fill extended to 0.7 to 2.1 m depth (elevation 406.1 to 510.6). The fill was variable comprising silt/sandy silt/silty clay, with varying sand and gravel content, and trace organics noted in several boreholes. The fill was typically moist in the higher ground in the west and typically wet in the lower ground in the east, with moisture contents ranging from 7 to 38%.

Clayey Silt

Locally a clayey silt unit was encountered below the fill in Borehole 3 extending to the 3.5 m depth of exploration. A sample was submitted for grain size analysis and the results are presented on Figure 3-2, appended. The unit was firm to hard and very moist with contents between 19 and 22%.

Silt

A silt unit was encountered below the fill in Boreholes 4 to 6, extending to 2.1 m (elevation 481.9) in Borehole 4 and to the 3.5 m depth of exploration in Boreholes 5 and 6. The unit contained trace gravel, trace sand and trace clay. The silt unit was typically compact, locally very dense at the base of Borehole 5, and typically wet becoming moist with depth, with moisture contents ranging from 10 to 24%.

Till

A till deposit was encountered below the fill in Boreholes 1, 2, 7 and 8, and under the silt in Borehole 4, extending to the 2.1 to 3.5 m depth of exploration. The deposit comprised silty sand or sandy silt in the higher ground in the west (Boreholes 1 and 2) and silt to silty clay in the central

section and lower ground in the east (Boreholes 4, 7 and 8). A sample of the till from Borehole 7 was submitted for grain size analysis and Atterberg Limits tests and the results are presented on Figure 3-3, appended. The presence of cobbles and boulders were noted throughout. The till was moist with moisture contents of 7 to 14%.

Ground Water

Upon completion of augering, water was only observed in Boreholes 1, 4 and 6 at 2.4 m, 1.5 m and 1.2 m depth below the road grade, respectively.

In conjunction with the moisture content profile, the observations are believed to reflect perched water in the fill above the less pervious native soils. The water was more pronounced in the lower lying centred and east parts of the site, and appears to be localized in the elevated west part of the site. Along the more steeply sloping central part of the site, seepage was noted, with water in the limited ditching along the side of the road. In the east part of the site, there were wet areas with cattails near the culvert at Station 6+500.

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

GEOTECHNICAL ENGINEERING CONSIDERATIONS

The Township of Clearview is proposing to reconstruct Sideroad 26/27 from the Townline to Concession 10, an approximate 2.7 km section.

The following improvements are planned for Sideroad 26/27:

- The existing road is a single lane gravel road to be reconstructed to a two lane paved road with gravel shoulders and a rural cross section (ditching). The proposed road profile will require predominately fills up to 2.0 m depth, with local cuts as much as 2.0 m.
- The existing CSP culvert at Station 6+500, in the low lying east part of the site, will be replaced with a 750 mm diameter concrete culvert.

Surface fill with underlying sandy to clayey till and localized clayey silt or silt are anticipated along the alignment. Locally perched water can be expected in the west elevated part of the site, but water at or close to surface prevails in the central and low lying parts of the site.

Embankment Construction

General requirements for embankment construction are found in OPSS.MUNI 206.

Beneath the new road platform, topsoil/organics or other obvious deleterious material should be removed from the edge of the existing gravel road to the new proposed toe of slope. It is recommended that the test holes be carried out at the time of the new road embankment to determine the thickness of topsoil to be removed.

Following stripping, the exposed subgrade should be compacted with a heavy roller under geotechnical review. On-site soils should be used as much as possible to match the existing subgrade conditions, however, imported earth borrow (OPSS 212) will be required. The embankment fill should be placed in maximum 300 mm thick layers and compacted to minimum 95% Standard Proctor maximum dry density, under geotechnical review by PML.

Wet conditions were noted in the steeply sloping central and lower lying east part of the site. In this regard, for stability purposes, it is recommended that the initial lift of fill should comprise 50 mm crusher run (Granular B Type II). The required thickness can be assessed during construction.

Embankments should be sloped at three horizontal to one vertical (3H:1V) or flatter, and should be topsoiled, seeded and covered with erosion control blankets as soon as possible.

Cut Slopes

Local cut sections are planned. Perched water can be expected locally in the elevated west pad of the site, with more significant seepage in the central and low lying east section of the alignment.

Where seepage zones are encountered, R-10 Rip Rap as per OPSS.PROV 1004 should be placed over the cut slope and also to line the ditch. Below the rip rap a Class II non-woven geotextile with a Filtration Opening Size (FOS) of 75 to 150 um is required. Specific limits can be assessed during construction.

Culvert Replacement

The existing CSP culvert at Station 6+500 will be replaced with a 750 mm diameter concrete culvert. The existing culvert invert is, at most, 0.5 m below the road grade and there was only about 50 mm of water flowing through the culvert, from south to north, at the time of our investigation. The proposed road profile will be raised up to about 2.0 m, and the replacement culvert invert will be about the same level as the existing culvert. Also, it is noted that the existing culvert is on a slight skew and about 10 m long. The proposed culvert is on a greater skew and will be about 31 m long.

Borehole 6 encountered road granular, over fill to 2.1 m depth over compact native silt. Ground water close to existing grade is anticipated.

Existing fill subgrade can be expected at the borehole location, however, variable conditions may exist along the proposed 31 m long culvert. Geotechnical review of the subgrade will be required at the time of construction. Provision for an increase in granular bedding for the culvert is recommended.

Site soils are considered Type 3 soil requiring excavation sidewalls to be constructed at no steeper than 1H:1V from the base of the excavation in accordance with the Occupational Health and Safety Act. However, it is envisioned that excavation will be no more than 1 m below existing grade.

Ground water control will likely require temporary diversion of the water course in conjunction with sump pumping.

Refer to OPSD 802.034 for culvert bedding, cover and backfill requirements and refer to OPSD 803.30 or 803.31 for frost treatment.

Pavement Design and Construction

Based on the proposed finished road profile provided by the Client and the borehole information, the following table outlines the expected subgrade along the alignment;

STATION RANGE	CUT/FILL	ANTICIPATED SUBGRADE
4+260 to 4+655	Fill up to 2.0 m	New Embankment Material
4+655 to 4+675	No grade change	Existing Granular Material over Sandy Silt Fill, Sandy Silt Till
4+675 to 4+780	Fill up to 1.0 m	New Embankment Material
4+780 to 4+815	Cut up to 0.3 m	Existing Granular Material over Sandy Silt Fill, Sandy Silt Till
4+815 to 5+080	Fill up to 1.5 m	New Embankment Material
5+080 to 5+230	No grade change	Existing Granular Material over Sandy Silt Fill, Clayey Silt
5+230 to 5+450	Cut up to 2.0 m	Existing Granular Material over Sandy Silt Fill Clayey Silt
5+450 to 6+830	Fill up to 2.0 m	New Embankment Material
6+830 to 6+900	No grade change	Existing Granular Material over Sandy Silt Fill, Silt Till
6+890 to 6+990	Fill up to 0.3 m	Existing Granular Material over Sandy Silt Fill, Silt Till

New embankment material is anticipated to comprise select excavated site soils or imported earth borrow (OPSS 212).

The Client has estimated the traffic volume for the road to be 1,000 AADT with 5% commercial traffic. Based on the moderate to high frost susceptible subgrade soils on the site, the following pavement structure thicknesses are recommended for a service life of 18 years:

	THICKNESS (mm)
Asphalt	90
Granular A Base Course	150
Granular B Subbase Course	400
Total Thickness	600

New embankment material must be placed in maximum 300 mm thick lifts compacted to at least 95% Standard Proctor maximum dry density. Following rough grading in cut areas, subgrade preparation should include proofrolling and compacting the exposed subgrade with a heavy vibratory compactor to 95% Standard Proctor maximum dry density, under geotechnical review.

Wet subgrade conditions can be expected, particularly in the lower lying central and east parts of the site, and locally in the west. It is likely that sub-excavation and provision of a layer of 50 mm crusher run (Granular B Type II) will be needed for stability purposes. The thickness and extent can be best assessed during construction. Further, construction of ditches ahead of road construction would help drain the subgrade.

Existing road granular is not suitable for reuse as new pavement granular and may be used for general bulk fill.

Imported material for the granular base and subbase should conform to OPSS gradation specifications for Granular A and Granular B, and should be compacted to 100% Standard Proctor maximum dry density. Asphalt should be compacted in accordance with OPSS 310.

For the pavement to function properly, it is essential that provisions be made for water to drain and not collect in the base material. For the rural road cross sections, road granular should day light in the ditches and ditching should be constructed as per OPSS in conjunction with crowning of the subgrade and final surface to promote drainage away from the pavement structure.

Ditching

Ditching should be provided prior to the construction of the road, particularly in the central and east parts of the site, and other wet areas. This should provide drainage of surface or near surface ground water and generally improve conditions for road construction.

As a minimum, provide the following within earth ditches:

DITCH INVERT GRADIENT	TREATMENT
< 3%	Seed and cover
3 - 5%	Erosion control blankets
> 5%	Rip rap

R-10 Rip Rap as per OPSS.PROV 1004 should also be placed at culvert inlets and outlets, sharp bends in ditch alignments, other critical areas of high volume / velocity flow, within the ditches where earth slopes are cut within seepage areas and in seepage areas in general. Below the rip rap, a Class II non-woven geotextile with a Filtration Opening Size (FOS) of 75 to 150 µm is required.

GEOTECHNICAL REVIEW AND CONSTRUCTION, INSPECTION AND TESTING

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

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

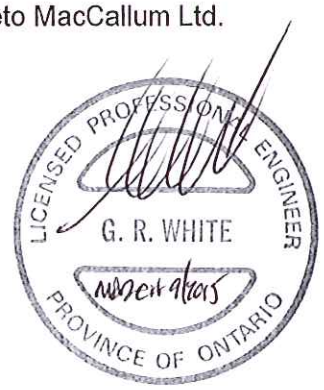
The comments and recommendations provided in the report are based on information revealed in the boreholes. Conditions away from and between boreholes may vary, particularly where foundation and/or service trenches exist. Geotechnical review during construction should be ongoing to confirm the subsurface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

CLOSURE

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

Sincerely

Peto MacCallum Ltd.



Geoffrey R. White, P.Eng.
Associate
Manager, Geotechnical and Geoenvironmental Services

Turney Lee-Bun, P.Eng.
President

GRW/TLB:jlb

Enclosures:
Figures 3-1 to 3-3 - Particle Size Distribution Charts
List of Abbreviations
Log of Borehole Nos. 1 to 8
Drawing 3-1 - Site Plan
Drawing 3-2 - Borehole Location Plan
Drawings 3-3 to 3-10 - Profiles

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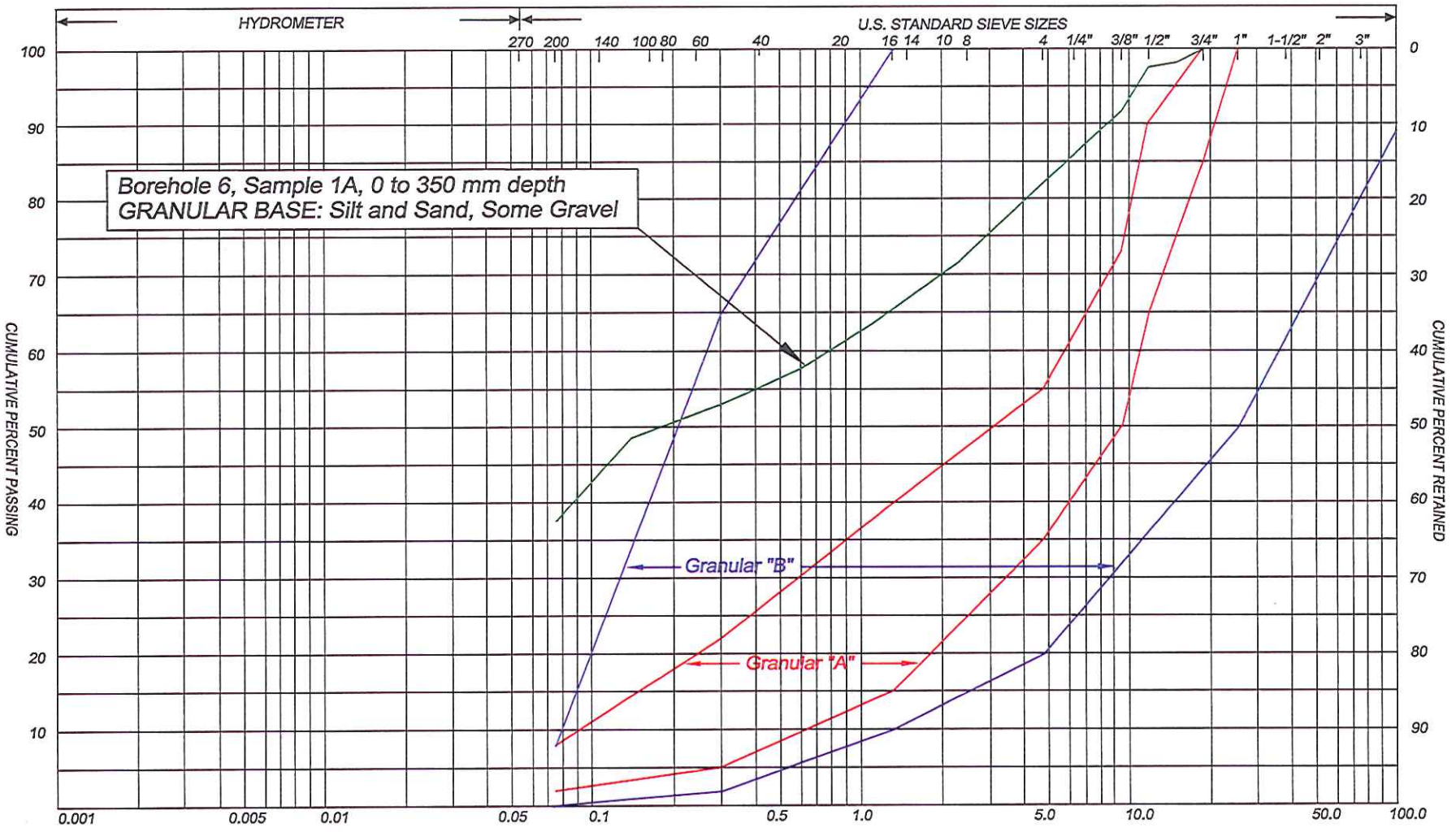
PARTICLE SIZE DISTRIBUTION CHART

PML Ref.: 14BF029
Lab No.: 21782
Figure No.: 3-1



SILT & CLAY				FINE	MEDIUM	COARSE	GRAVEL		COB BLES	UNIFIED
				SAND						
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL		COBBLES	M.I.T.
	SILT			SAND						
CLAY	SILT			V. FINE	FINE	MED	COARSE	GRAVEL		U.S. BUREAU
				SAND						

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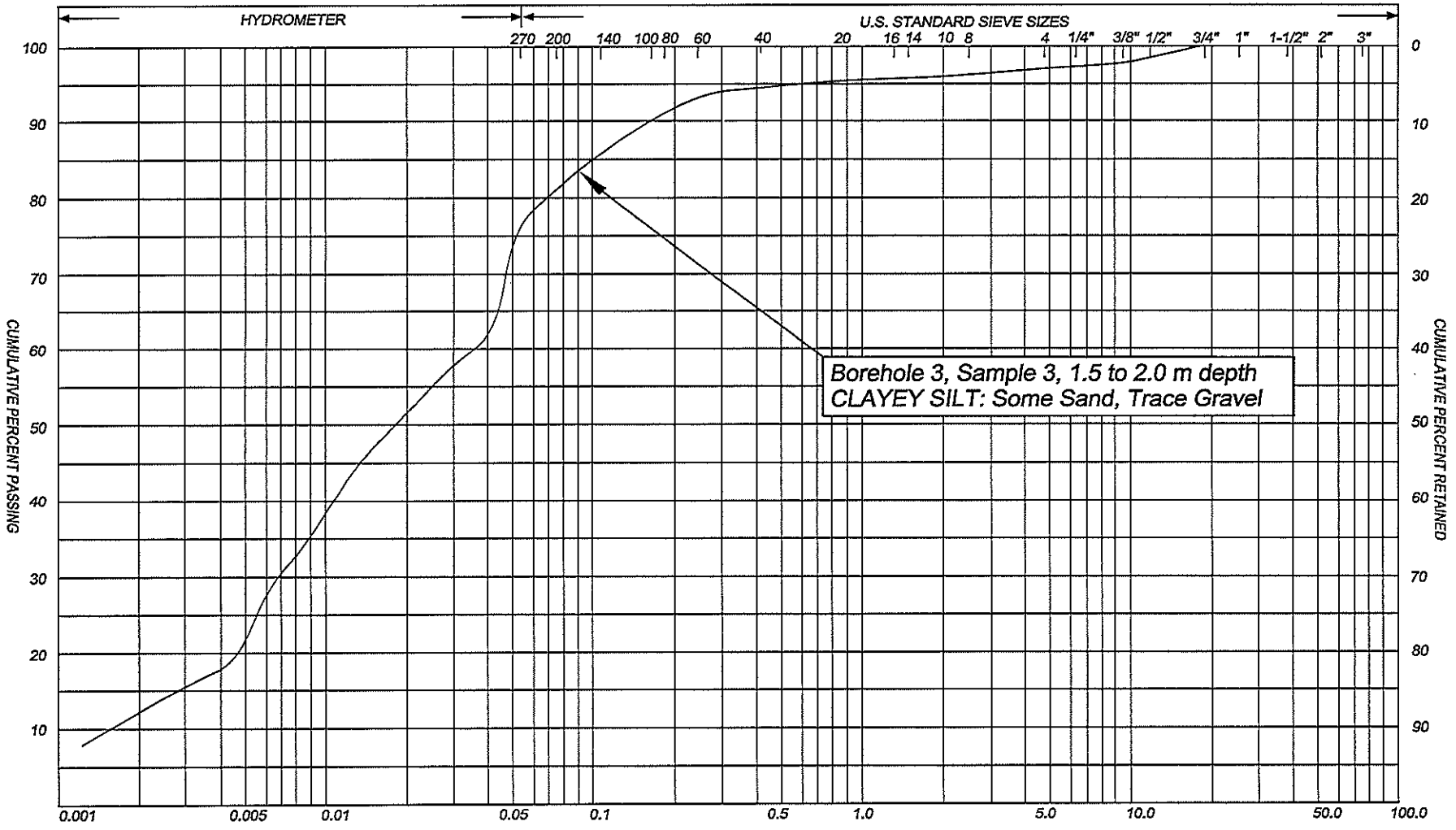
PARTICLE SIZE DISTRIBUTION CHART

PML Ref.: 14BF029
Lab No.: 21780
Figure No.: 3-2



SILT & CLAY				FINE	MEDIUM	COARSE	GRAVEL			COB BLES	UNIFIED
				SAND							
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL			COBBLES	M.I.T.
	SILT			SAND							
CLAY	SILT			V. FINE	FINE	MED	COARSE	GRAVEL			U.S. BUREAU
				SAND							

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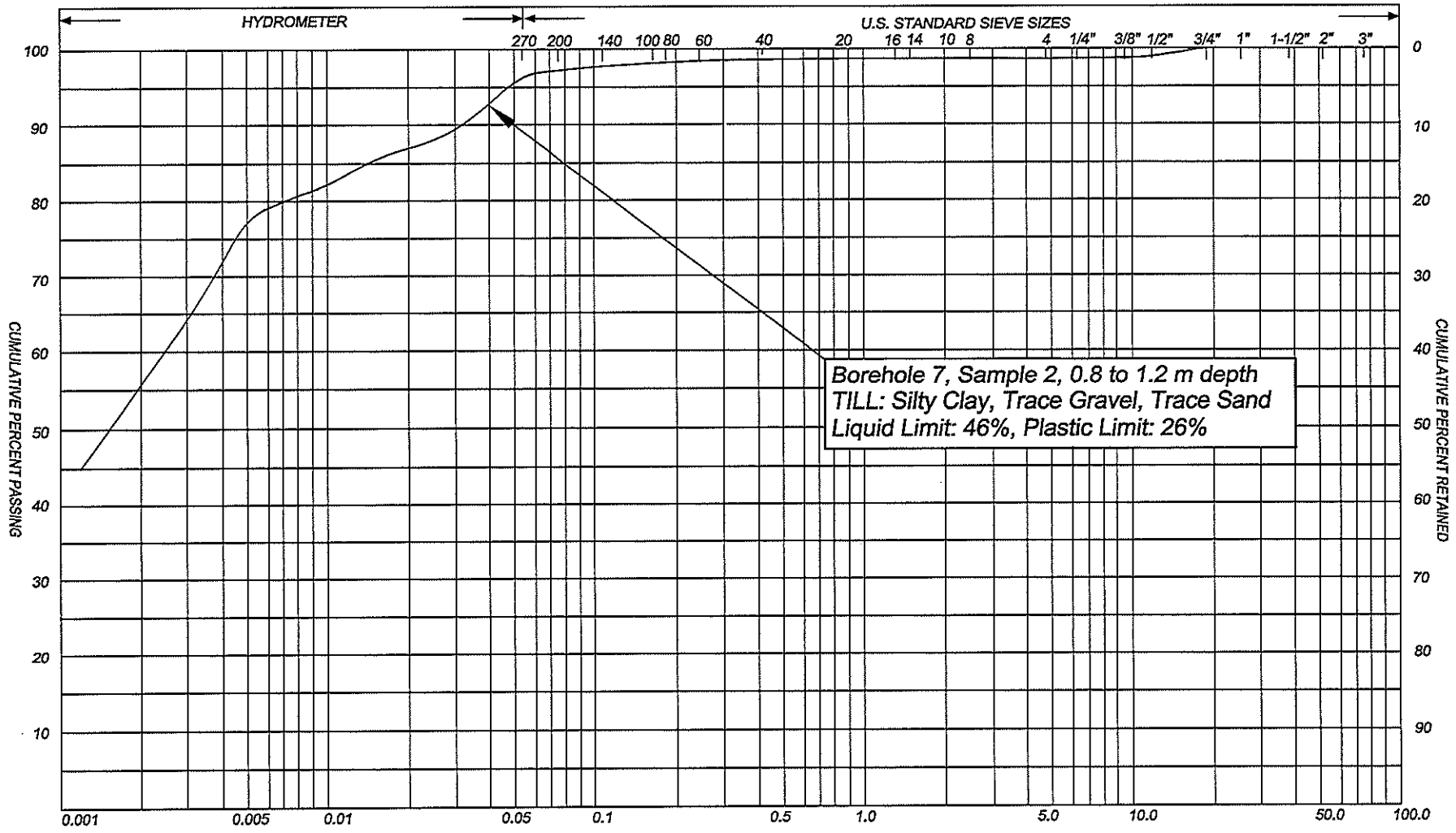
PARTICLE SIZE DISTRIBUTION CHART

PML Ref.: 14BF029
Lab No.: 21781
Figure No.: 3-3



SILT & CLAY				FINE	MEDIUM	COARSE	GRAVEL		COB BLES	UNIFIED
				SAND						
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL		COBBLES	M.I.T.
	SILT			SAND						
CLAY	SILT			V. FINE	FINE	MED	COARSE	GRAVEL		U.S. BUREAU
				SAND						

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	TW	Thinwall Open
WS	Washed Sample	TP	Thinwall Piston
SB	Scraper Bucket Sample	OS	Oesterberg Sample
AS	Auger Sample	FS	Foil Sample
CS	Chunk Sample	RC	Rock Core
ST	Slotted Tube Sample		

- PH Sample Advanced Hydraulically
- PM Sample Advanced Manually

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

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LOG OF BOREHOLE NO. 1

PROJECT Proposed Road Reconstruction of Sideroad 26/27 Nottawasaga
OUR PROJECT NO. 14BF029
LOCATION Township of Clearview, Ontario
BORING DATE: May 29, 2014
ENGINEER GRW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH In METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	GROUND WATER OBSERVATIONS AND REMARKS
	GROUND ELEVATION 509.50							
509.31 0.19	ROAD GRANULAR: 190 mm granular base, moist		1A	GS	-			Proposed Road Profile 1.0 m Fill
			1B	GS	-	509		
	FILL: Dark brown, silt, some gravel, trace sand, organic pockets, very moist		2	SS	19			
508.1 1.4	TILL: Compact, brown, silty sand, trace gravel, trace clay, cobbles and boulders, moist		3	SS	24	508		
507.4 2.1	BOREHOLE TERMINATED AT 2.1 m							Upon completion of augering Water at 1.2 m (elevation 508.3) No cave

SHEAR STRENGTH C_u (kPa) 20 40 60 80
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ____ W
W_P W W_L
WATER CONTENT % 10 20 30

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0

NOTES:

SENSITIVITY
UNDISTURBED FIELD VANE
REMOLDED FIELD VANE
LAB SHEAR TEST
POCKET PENETROMETER

CHECKED BY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 2

PROJECT Proposed Road Reconstruction of Sideroad 26/27 Nottawasaga
OUR PROJECT NO. 14BF029
LOCATION Township of Clearview, Ontario
BORING DATE: May 29, 2014
ENGINEER GRW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH In METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE
	GROUND ELEVATION 512.00					
511.81 / 0.19	ROAD GRANULAR: 190 mm granular base, moist		1A	GS	-	
	FILL: Dark brown, silt to sandy silt, trace gravel, moist		1B	GS	-	
			2	SS	6	511
510.6 / 1.4	TILL: Loose, brown, sandy silt, trace gravel, trace clay, cobbles and boulders, moist		3	SS	7	
509.9 / 2.1	BOREHOLE TERMINATED AT 2.1 m					510

SHEAR STRENGTH C_u (kPa) 20 40 60 80
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80
LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ____ W
W_P W W_L
WATER CONTENT % 10 20 30
UNIT WEIGHT γ kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Proposed Road Profile
2.0 m Fill

Upon completion of augering
No water
No cave

NOTES:

+² SENSITIVITY
+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊗ LAB SHEAR TEST
▲ POCKET PENETROMETER

CHECKED BY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 3

PROJECT Proposed Road Reconstruction of Sideroad 26/27 Nottawasaga
OUR PROJECT NO. 14BF029
LOCATION Township of Clearview, Ontario
BORING DATE: May 29, 2014
ENGINEER GRW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH In METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE
	GROUND ELEVATION 507.60					
0.0						
507.48 0.12	ROAD GRANULAR: 120 mm granular base, moist		1A	GS	-	
			1B	GS	-	
506.90 0.70	FILL: Dark brown, sandy silt, trace gravel, moist					507
1.0	CLAYEY SILT: Firm to hard, brown, clayey silt, trace gravel, trace sand, very moist		2	SS	7	
			3	SS	16	506
2.0						
			4	SS	20	505
3.0						
504.1 3.5	BOREHOLE TERMINATED AT 3.5 m		5	SS	31	
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						

SHEAR STRENGTH C_u (kPa) 20 40 60 80
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ___ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Proposed Road Profile
1.5 m Cut

Upon completion of augering
No water
No cave

NOTES:

SENSITIVITY
UNDISTURBED FIELD VANE
REMOLDED FIELD VANE
LAB SHEAR TEST
POCKET PENETROMETER

CHECKED BY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 4

PROJECT Proposed Road Reconstruction of Sideroad 26/27 Nottawasaga
LOCATION Township of Clearview, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE: May 29, 2014
OUR PROJECT NO. 14BF029
ENGINEER GRW
TECHNICIAN AT

DEPTH In METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE	GROUND WATER OBSERVATIONS AND REMARKS
	GROUND ELEVATION 484.00						
483.92 0.0	ROAD GRANULAR: 80 mm granular base, moist		1A	GS	-		Proposed Road Profile 1.8 m Fill
			1B	GS	-		
483.30 0.70	FILL: Dark brown, sandy silt, trace gravel, wet						
	SILT: Compact, brown, silt, trace sand, trace clay, trace gravel, silty sand layer, very moist		2	SS	23	483	
			3	SS	25		
481.9 2.1	TILL: Very dense, brown, silt, trace gravel, trace sand, trace clay, cobbles and boulders, moist		4	SS	66	482	
481.1 2.9	Becoming silty clay, trace gravel, trace sand		5	SS	64	481	
480.5 3.5	BOREHOLE TERMINATED AT 3.5 m						Upon completion of augering Water at 1.5 m (elevation 482.5) Cave at 2.7 m

SHEAR STRENGTH C_u (kPa) 20 40 60 80
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ___ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0

NOTES:

+² SENSITIVITY
+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊗ LAB SHEAR TEST
▲ POCKET PENETROMETER
CHECKED BY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 5

PROJECT Proposed Road Reconstruction of Sideroad 26/27 Nottawasaga
LOCATION Township of Clearview, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE: May 29, 2014
OUR PROJECT NO. 14BF029
ENGINEER GRW
TECHNICIAN AT

DEPTH in METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE
	GROUND ELEVATION 422.00					
421.97 / 0.03	ROAD GRANULAR: 30 mm granular base, moist		1A	GS	-	
			1B	GS	-	
	FILL: Dark brown, sandy silt, trace gravel, trace clay, trace organics, topsoil layers, wet		2	SS	4	421
420.6 / 1.4	SILT: Compact to very dense, red/brown, silt, trace gravel, trace sand, trace clay, wet to moist		3	SS	14	420
			4	SS	46	
			5	SS	52	419
418.5 / 3.5	BOREHOLE TERMINATED AT 3.5 m					

SHEAR STRENGTH C_u (kPa) 20 40 60 80
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ____ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

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

Proposed Road Profile
2.0 m Fill

Upon completion of augering
No water
No cave

NOTES:

+ SENSITIVITY
+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊘ LAB SHEAR TEST
▲ POCKET PENETROMETER

CHECKED BY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 6

PROJECT Proposed Road Reconstruction of Sideroad 26/27 Nottawasaga
LOCATION Township of Clearview, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE: May 29, 2014
OUR PROJECT NO. 14BF029
ENGINEER GRW
TECHNICIAN AT

DEPTH In METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE	GROUND WATER OBSERVATIONS AND REMARKS
	GROUND ELEVATION 416.00						
0.0							
415.65 / 0.35	ROAD GRANULAR: 350 mm granular base, moist		1A	GS	-		Proposed Road Profile 1.5 m Fill
			1B	GS	-		
	FILL: Dark brown, silt, trace gravel, trace, sand, trace organics, moist to wet		2	SS	16	415	Proposed Culvert Invert 0.5 m depth
1.0							
			3	SS	6		
413.9 / 2.1						414	
2.0	SILT: Compact, red/brown, silt, trace gravel, trace sand, trace clay, wet to moist		4	SS	10		
						413	
3.0			5	SS	23		
412.5 / 3.5	BOREHOLE TERMINATED AT 3.5 m						Upon completion of augering Water at 2.4 m (elevation 413.6) No cave
4.0							
5.0							
6.0							
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							
13.0							
14.0							
15.0							

SHEAR STRENGTH C_u (kPa) 20 40 60 80
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ____ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

NOTES:

+ SENSITIVITY
+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊗ LAB SHEAR TEST
▲ POCKET PENETROMETER

CHECKED BY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 7

PROJECT Proposed Road Reconstruction of Sideroad 26/27 Nottawasaga
LOCATION Township of Clearview, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE: May 29, 2014
OUR PROJECT NO. 14BF029
ENGINEER GRW
TECHNICIAN AT

GROUND ELEVATION 412.00

DEPTH in METRES	DESCRIPTION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE
411.62	ROAD GRANULAR: 380 mm granular base, moist	1A	GS	-	
0.38		1B	GS	-	
411.30	FILL: Brown, silty clay, trace gravel, trace sand, trace organics, wet				
0.70	TILL: Stiff to hard, red/brown, silty clay, trace gravel, trace sand, cobbles and boulders, moist	2	SS	14	411
		3	SS	20	410
		4	SS	56	
					409
408.7		5	SS	82/290 mm	
3.3	BOREHOLE TERMINATED AT 3.3 m				

SHEAR STRENGTH C_u (kPa) 20 40 60 80
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ____ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³: 46

GROUND WATER OBSERVATIONS AND REMARKS
Proposed Road Profile
1.1 m Fill

Upon completion of augering
No water
Cave at 2.9 m

GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

NOTES:

$+^2$ SENSITIVITY
$+$ UNDISTURBED FIELD VANE
$\oplus$ REMOLDED FIELD VANE
$\circledast$ LAB SHEAR TEST
▲ POCKET PENETROMETER

CHECKED BY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 8

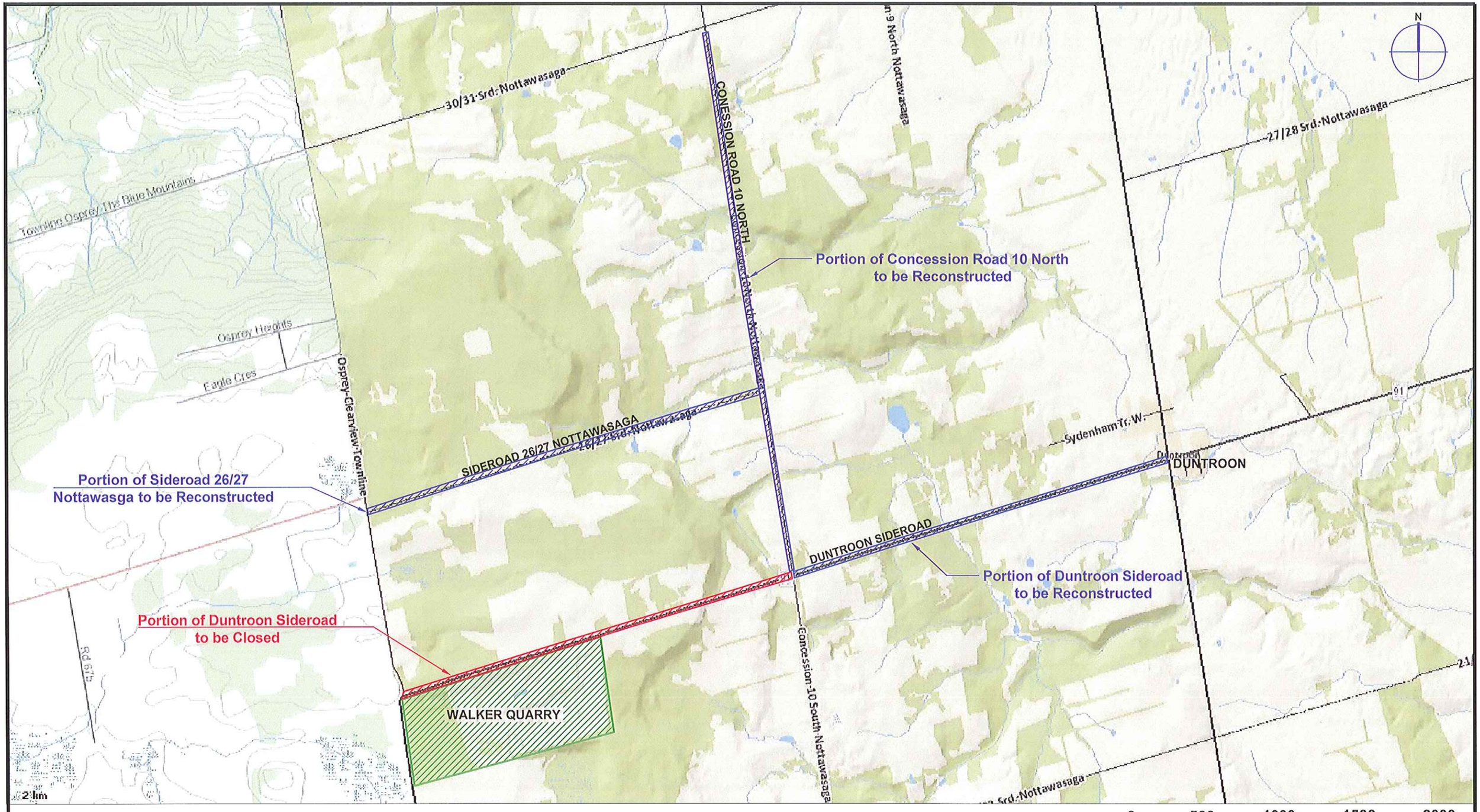
PROJECT Proposed Road Reconstruction of Sideroad 26/27 Nottawasaga
OUR PROJECT NO. 14BF029
LOCATION Township of Clearview, Ontario
BORING DATE: May 29, 2014
ENGINEER GRW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH in METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE	SHEAR STRENGTH C_u (kPa) 20 40 60 80; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; BLOWS/0.3M 20 40 60 80	LIQUID LIMIT ____ W_L; PLASTIC LIMIT ____ W_P; WATER CONTENT ____ W; W_P W W_L; WATER CONTENT % 10 20 30	UNIT WEIGHT γ kN/m³	GROUND WATER OBSERVATIONS AND REMARKS; GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	GROUND ELEVATION 407.50									
0.0	407.34 0.16 ROAD GRANULAR: 160 mm granular base, moist		1A	GS	-					Proposed Road Profile
			1B	GS	-	407				0.2 m Fill
	FILL: Dark brown, sandy silt, trace gravel, very moist									
1.0			2	SS	5					
	406.1 1.4 TILL: Compact, brown, silt, trace gravel, trace sand, trace clay, cobbles and boulders, moist					406				
2.0			3	SS	13					
	405.4 2.1 BOREHOLE TERMINATED AT 2.1 m									Upon completion of augering No water No cave
3.0										
4.0										
5.0										
6.0										
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										

NOTES:

SENSITIVITY
+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊗ LAB SHEAR TEST
▲ POCKET PENETROMETER

CHECKED BY

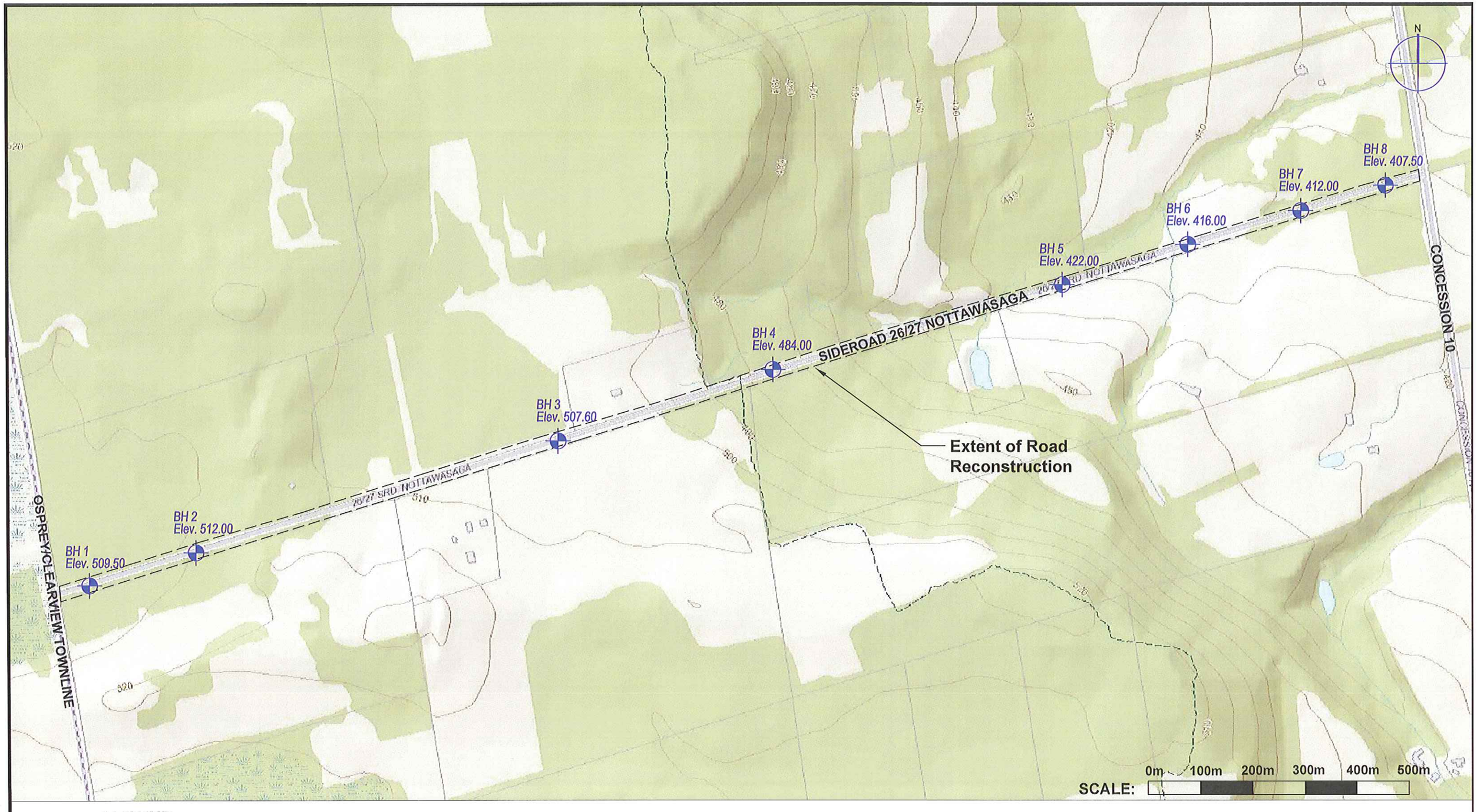


SITE LOCATION PLAN

PROPOSED ROAD RECONSTRUCTION OF
SIDEROAD 26/27 NOTTAWASAGA
TOWNSHIP OF CLEARVIEW, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2015	AS SHOWN	14BF029	3-1



LEGEND

BH 1
Elev. 509.50

Borehole 1
Ground Surface Elevation

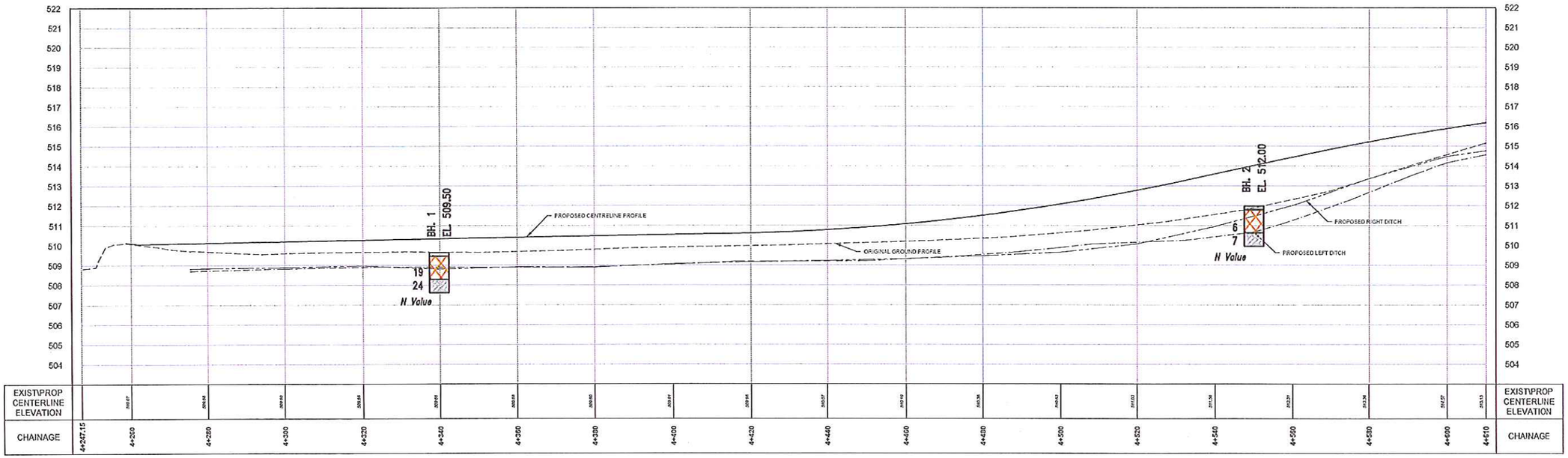
Ground Surface Elevations approximated based on profile plans provided by Client

BOREHOLE LOCATION PLAN

PROPOSED RECONSTRUCTION OF
SIDEROAD 26/27 NOTTAWASAGA
TOWNSHIP OF CLEARVIEW, ONTARIO

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2015	AS SHOWN	14BF029	3-2



LEGEND

- GRANULAR
- FILL
- SILT
- CLAYEY SILT
- Glacial Till

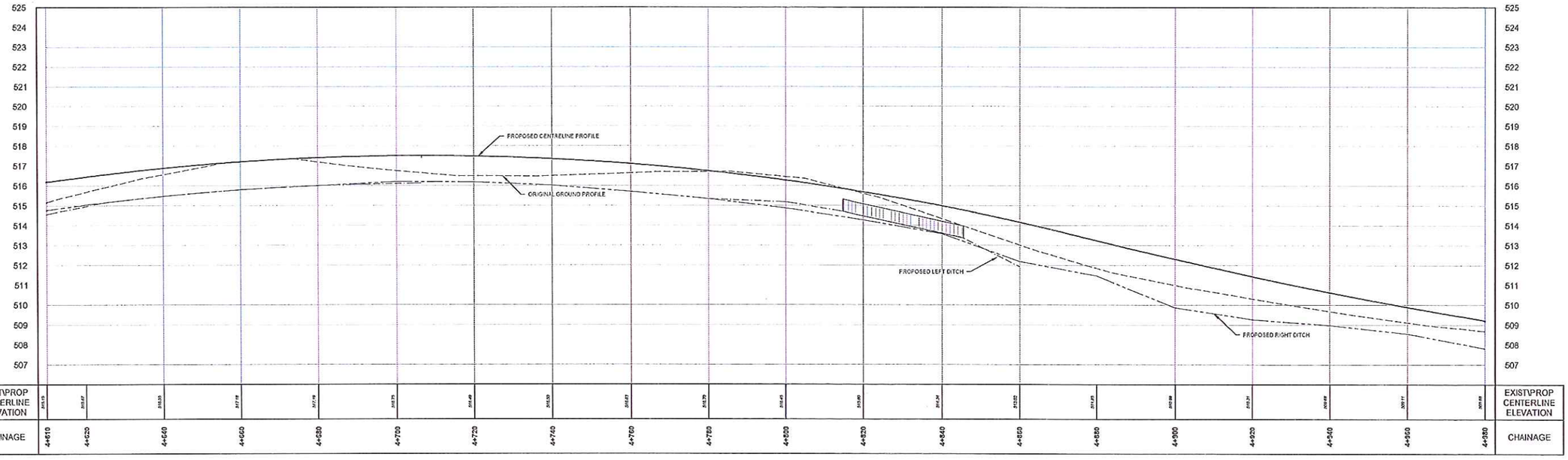
NOTE: Base drawing was provided by R.J. Burnside & Associates Limited

PROFILES

PROPOSED RECONSTRUCTION OF
SIDEROAD 26/27 NOTTAWASAGA
TOWNSHIP OF CLEARVIEW, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2015	NTS	14BF029	3-3



LEGEND

- GRANULAR
- FILL
- SILT
- CLAYEY SILT
- Glacial Till

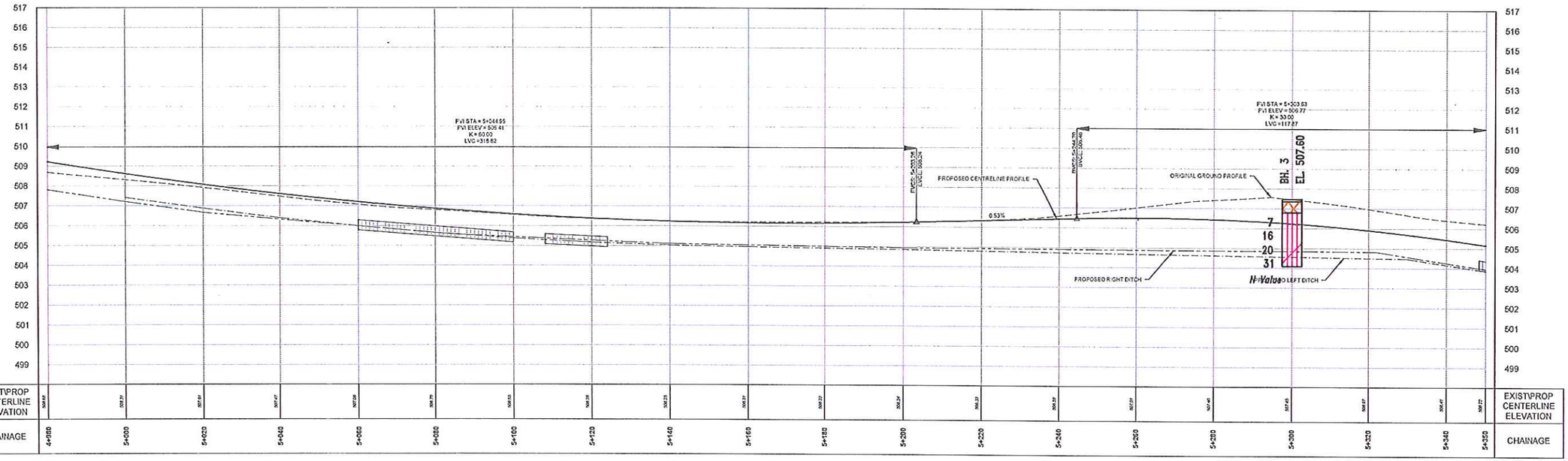
NOTE: Base drawing was provided by R.J. Burnside & Associates Limited

PROFILES

PROPOSED RECONSTRUCTION OF
SIDEROAD 26/27 NOTTAWASAGA
TOWNSHIP OF CLEARVIEW, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2015	NTS	14BF029	3-4



LEGEND

- GRANULAR
- FILL
- SILT
- CLAYEY SILT
- Glacial Till

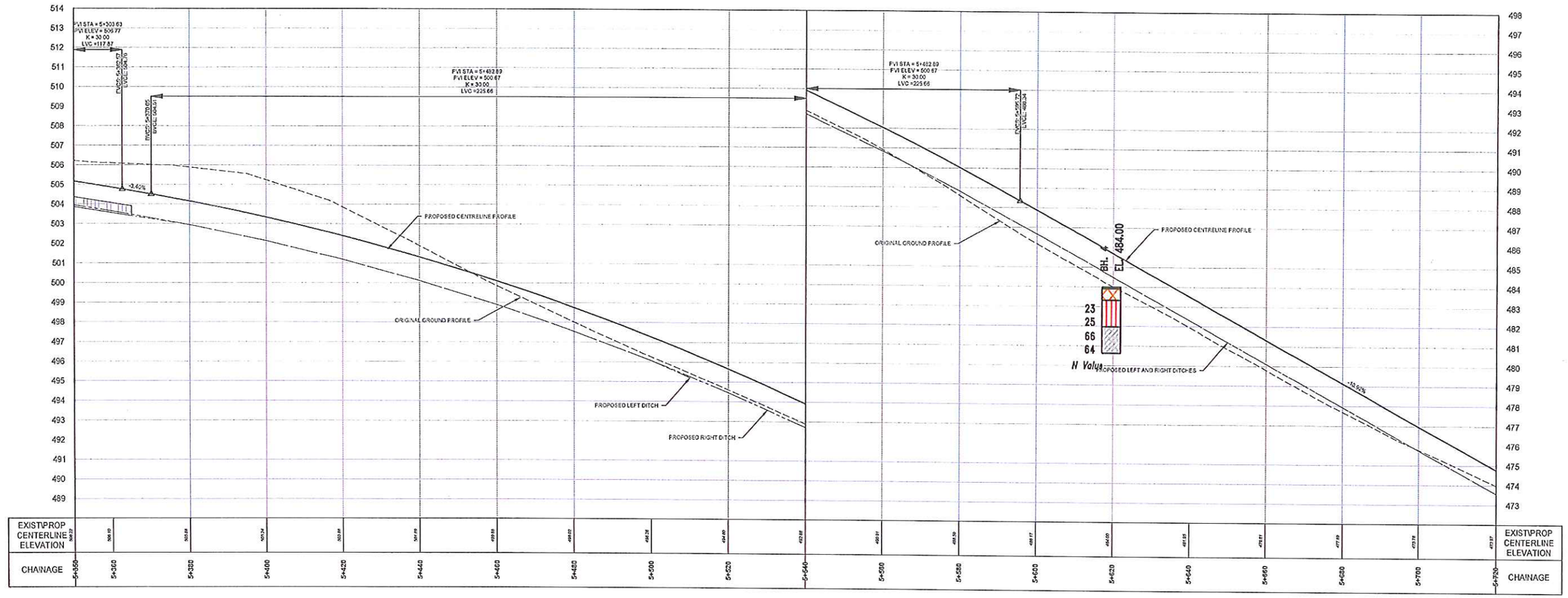
NOTE: Base drawing was provided by R.J. Burnside & Associates Limited

PROFILES

PROPOSED RECONSTRUCTION OF
SIDEROAD 26/27 NOTTAWASAGA
TOWNSHIP OF CLEARVIEW, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2015	NTS	14BF029	3-5



LEGEND

- GRANULAR
- FILL
- SILT
- CLAYEY SILT
- Glacial Till

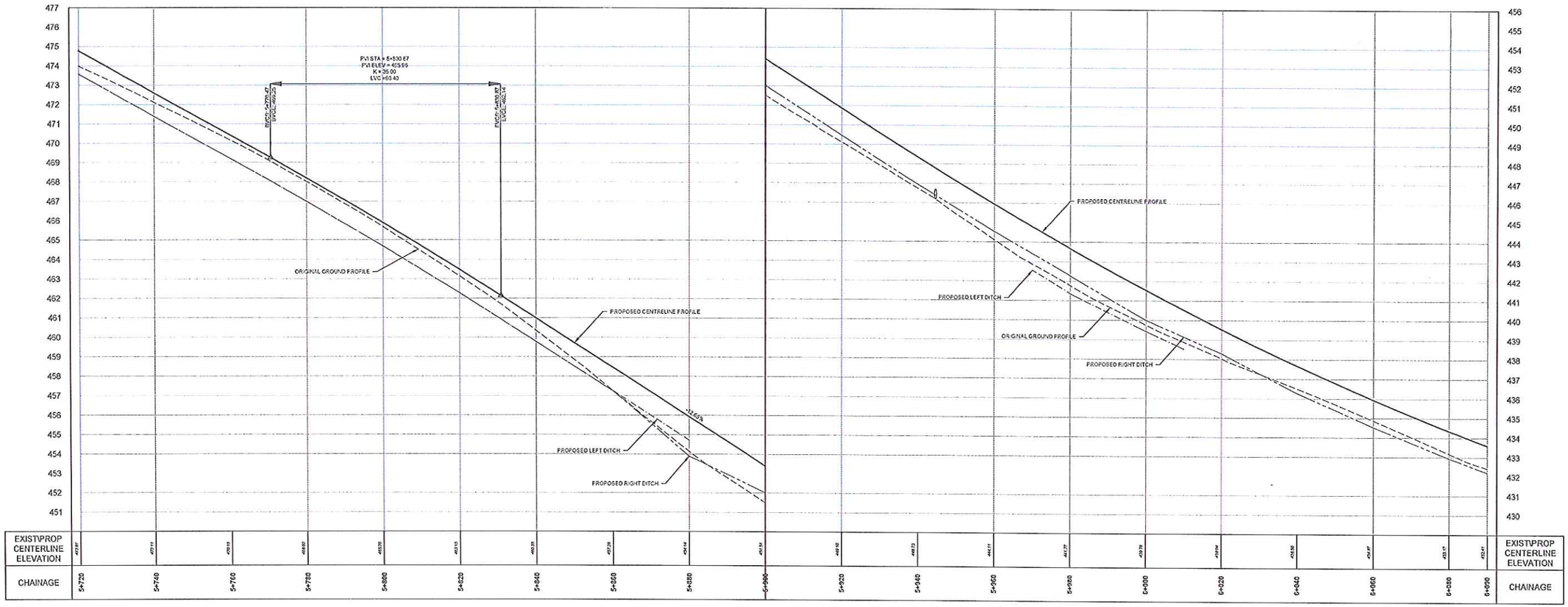
NOTE: Base drawing was provided by R.J. Burnside & Associates Limited

PROFILES

PROPOSED RECONSTRUCTION OF
SIDEROAD 26/27 NOTTAWASAGA
TOWNSHIP OF CLEARVIEW, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2015	NTS	14BF029	3-6



LEGEND

- GRANULAR
- FILL
- SILT
- CLAYEY SILT
- Glacial Till

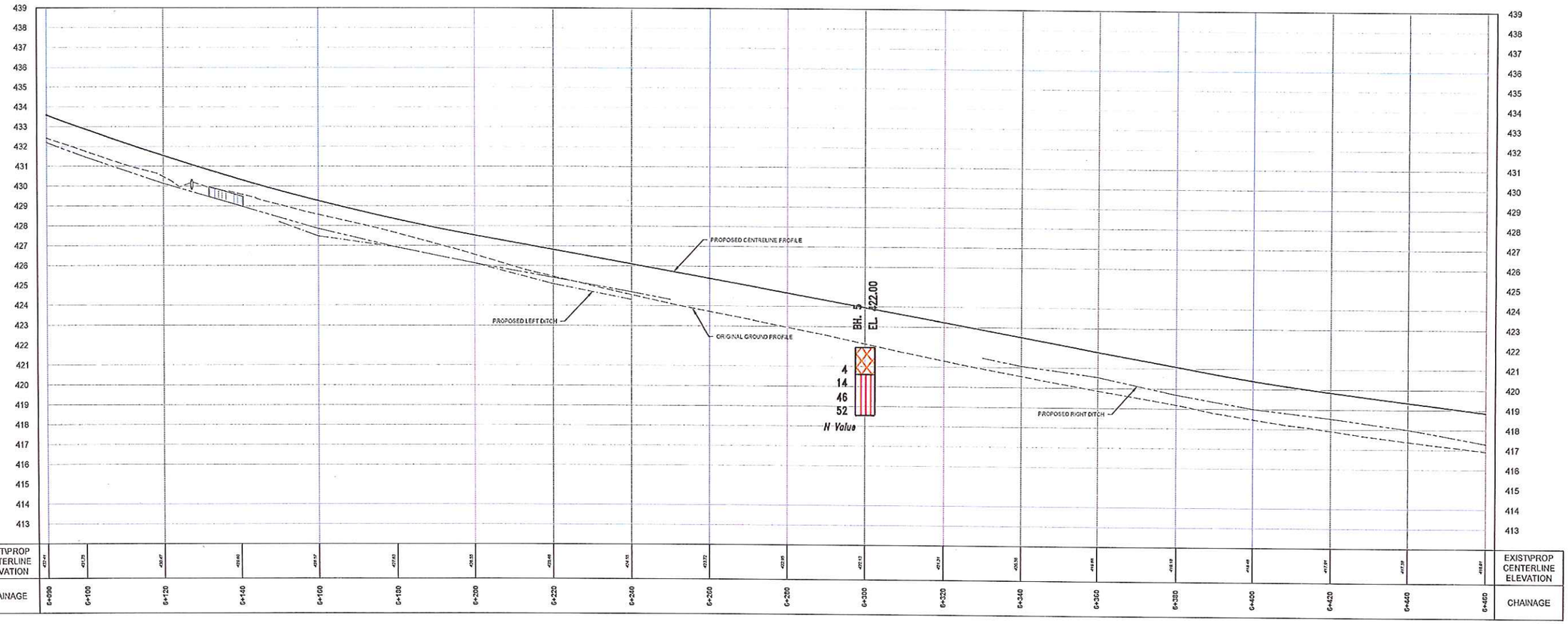
NOTE: Base drawing was provided by R.J. Burnside & Associates Limited

PROFILES

PROPOSED RECONSTRUCTION OF
SIDEROAD 26/27 NOTTAWASAGA
TOWNSHIP OF CLEARVIEW, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2015	NTS	14BF029	3-7



LEGEND

- GRANULAR
- FILL
- SILT
- CLAYEY SILT
- Glacial Till

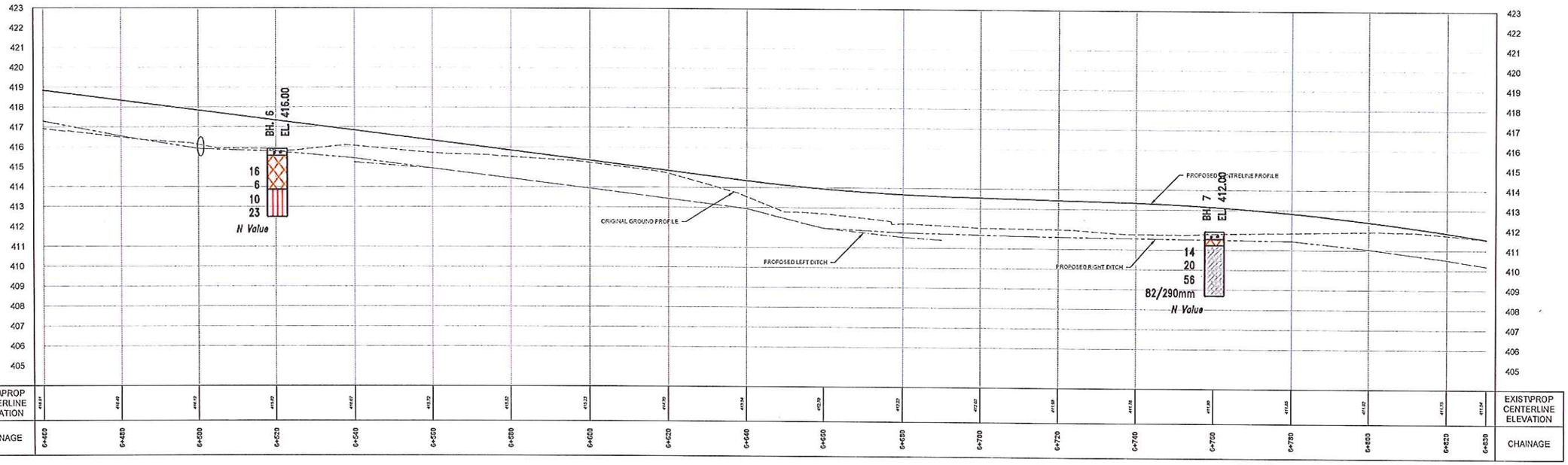
NOTE: Base drawing was provided by R.J. Burnside & Associates Limited

PROFILES

PROPOSED RECONSTRUCTION OF
SIDEROAD 26/27 NOTTAWASAGA
TOWNSHIP OF CLEARVIEW, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2015	NTS	14BF029	3-8



LEGEND

- GRANULAR
- FILL
- SILT
- CLAYEY SILT
- Glacial Till

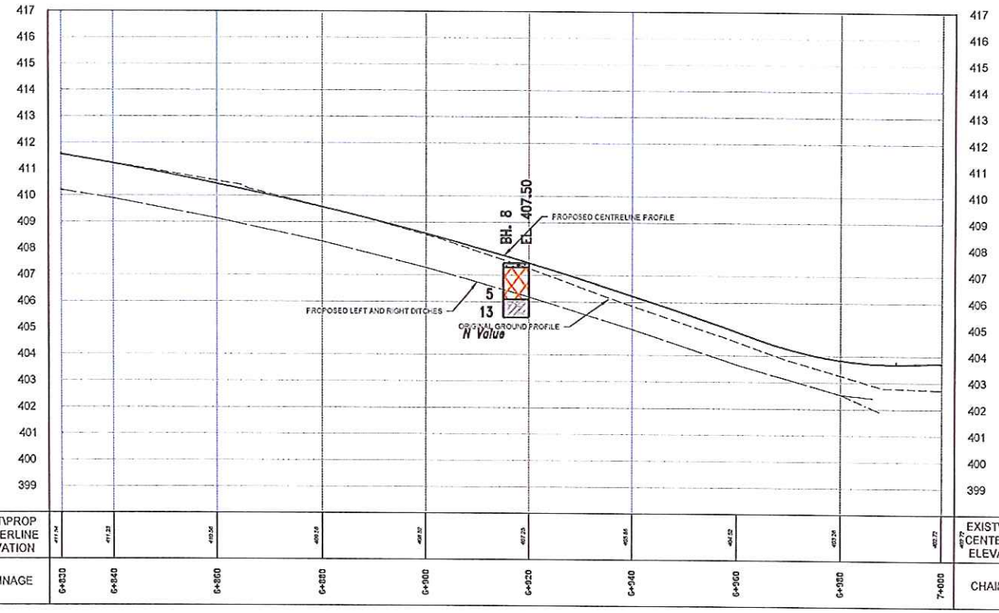
NOTE: Base drawing was provided by R.J. Burnside & Associates Limited

PROFILES

PROPOSED RECONSTRUCTION OF
SIDEROAD 26/27 NOTTAWASAGA
TOWNSHIP OF CLEARVIEW, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2015	NTS	14BF029	3-9



LEGEND

- GRANULAR
- FILL
- SILT
- CLAYEY SILT
- Glacial Till

NOTE: Base drawing was provided by R.J. Burnside & Associates Limited

PROFILES

PROPOSED RECONSTRUCTION OF
SIDEROAD 26/27 NOTTAWASAGA
TOWNSHIP OF CLEARVIEW, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2015	NTS	14BF029	3-10