EXP Services Inc.

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Technical Memorandum No. 1 – Preliminary Geotechnical Information

Exp Project No:	OTT-21003218-A0
Project Name:	Proposed New Borrisokane Catholic Elementary School 3387 Borrisokane Road, Ottawa, ON.
Date	June 16, 2021
Attention:	Donald Wood; donald.wood@ocsb.ca

Prepared by: Susan Potyondy, P.Eng. **Reviewed by:** Ismail Taki, P.Eng.

EXP Services Inc, (EXP) is pleased to present preliminary geotechnical comments and recommendations for the proposed new Borrisokane Catholic elementary school to be located at 3387 Borrisokane Road, Ottawa, Ontario (Figure 1). EXP was retained to conduct a geotechnical investigation for the proposed school with authorization to proceed with the investigation provided by the Ottawa Catholic School Board. Since certain areas of the site could not be accessed by the drill rig, only five (5) of the originally programmed planned testholes in the accessible areas of the site have been completed to date. The purpose of this technical memorandum is to provide preliminary geotechnical comments and recommendations based on the recently completed five (5) boreholes.

Site Description and Background Information

Currently, the site is occupied by three (3) fill piles. A portion of the fill pile from the adjacent property to the north encroaches onto the school property in the northeast part of the site. A portion of a second fill pile from the adjacent property west of the school site encroaches onto the school property and the proposed school building along the west side of the site. The two (2) fill piles are part of the surcharge loading program undertaken at the site of the new subdivision adjacent to the school site and referenced in the geotechnical report titled, *Geotechnical Investigation, Proposed Residential Subdivision, 3387 Borrisokane Road, Ottawa, Ontario* dated May 1, 2017 and prepared by Paterson Group Inc. (Report:PG3621-1 Revision 5). The 2017 geotechnical investigation is based on boreholes undertaken in 2011 and test pits undertaken in 2015. The elevation of the top of the two (2) piles is approximately Elevation 95.3 m to Elevation 96.0 m. A third fill pile is located in the central east portion of the site and was recently placed for the construction of a temporary access roadway and lay-down area that runs in a north-south direction across the site. The elevation of the top of this pile is approximately Elevation 92.9 m to Elevation 94.0 m. Between the west fill pile and the roadway fill pile there is a low-lying area where a shallow drainage ditch runs in a north-south direction through the site. The elevation of the top of the banks of the ditch and the bottom of the ditch are approximately at Elevation 91.7 m to Elevation 92.0 m. The current conditions of the site and the location of the proposed school building are shown in Figure 2. A review of Figure 2 indicates a portion of the west surcharge fill pile and the east roadway fill pile are located within the footprint of the proposed school building along with the drainage ditch that runs through the central portion of the school building.

Subsurface Soil Conditions (Borehole Nos. 2, 4, 12, 14 and 15)

Borehole Nos. 2, 4, 12, 14 and 15 drilled by EXP on March 30 and 31, 2021 were advanced to termination and cone refusal depths of 4.9m to 29.1 m (Elevation 88.3 m to Elevation 64.2 m). The locations of the boreholes are shown in Figure 2 and the borehole logs are shown in Figures 3 to 7.

The subsurface soil conditions consist of existing surficial fill which extends to depths ranging from 1.8 m to 2.2 m (Elevation 91.5 m to Elevation 91.2 m) overlying a native loose to compact sandy silt to silty sand that extends to depths of 2.9 m to 3.3 m (Elevation 90.3 m to Elevation 90.1 m). The native sandy silt to silty sand is underlain by a deep silty clay deposit that extends to an approximate 25.5 m depth below existing grade (Elevation 67.8 m). The silty clay has a firm consistency with a localized soft consistency in Borehole Nos. 4 and 14 at a 7.0 m depth (Elevation 86.5 m and Elevation 86.2 m). The groundwater level is at 2.5 m depth (Elevation 90.7 m).

A summary of the site topography and findings from the boreholes drilled by EXP is as follows:

- The topography of the site is variable due to the past activities completed by the developer as part of their current work (such as fill piles placed for pre-loading purposes, low lying area where trees have been cut and the drainage ditch that is yet to be re-routed, temporary access roadway and lay-down area).

- The upper sandy silt/silty sand is generally loose to compact with a natural moisture content ranging between 17 percent and 25 percent.

- The silty clay deposit beneath the sandy silt/silty sand has a firm consistency with localized soft consistency as indicated by undrained shear strength values ranging between 14 kPa and 48 kPa. The natural moisture content of the silty clay ranges between 21 percent and 53 percent and the natural unit weigh of the silty clay is 17.4 kN/m^3. Based on the results from a one-dimensional consolidation test conducted on one (1) sample of the silty clay from a 4.3 m depth (Elevation 89.0 m) in Borehole No. 2, the silty clay was found to be over-consolidated by approximately 75 kPa. The over-consolidation value is higher than the over-consolidation values reported by Paterson from the 2011 boreholes. This is likely a result of Borehole No. 2 being located within the footprint of the fill pile for the temporary roadway and lay-down area placed subsequent to the completion of the 2011 boreholes. As such, the silty clay in Borehole No. 2 is undergoing consolidation as a result of the surcharge load imposed on it by the fill pile.

Geotechnical Comments and Recommendations

Similar subsurface conditions consisting of a compressible silty clay were encountered in the 2017 geotechnical investigation by Paterson for the entire subdivision. The preliminary grading plan prepared by David Schaeffer Engineering Ltd. (DSEL) date April 23, 2012 (First Submission) indicates the final design grades at the school site will be in the order of Elevation 93.3 m to Elevation 92.8 m. This will result in the grades at the site being raised by approximately 1.1 m to 1.7 m which exceeds the permissible grade raise of 1.0 m to 1.2 m for the school site as indicated in the 2017 Paterson report. The results from the consolidation test completed as part of this geotechnical investigation and consolidation test results from the 2017 Paterson report indicate the silty clay is slightly over-consolidated. Therefore, the silty clay is prone to large settlements on application of any additional loads. At the time of the 2017 geotechnical investigation, a surcharge loading program was initiated for the new subdivision surrounding the school site. The purpose of the program was to consolidate the silty clay so that future settlements of the silty clay from loads imposed by the fill placed to raise the grades at the site to the design elevation and loads imposed by footing foundations would be within normally tolerable limits.

As with the subdivision site, the site grade raise proposed at the school site will result in consolidation settlement of the silty clay that will be higher than the normally tolerable limits. With the current site conditions and the design elevation of the grade raise at the site, several options are available for the proposed school development to reduce the consolidation settlement to within tolerable limits or minimize the impact of the high consolidation settlement on the proposed development. The options currently being considered are as follows:

Option No. 1 – Pre-Loading/Surcharging Program of the School Site

The school site may be pre-loaded/surcharged by placing a specified height of fill (pre-load and surcharge) on the entire school site including on the entire footprint of the proposed school building for a specified period of time until the completion of the consolidation settlement of the silty clay. The load exerted by the fill pile should greater than the maximum pressure applied by the design grade raise fill and by the shallow strip and spread footings of the new school building. This option may be considered provided the construction schedule for the school development can accommodate the delay in the construction of the school building due to the time required for the completion of the pre-loading/surcharging program.

The pre-loading/surcharge program will have to be initiated following the re-routing of the existing drainage ditch.

As part of the construction of the pre-loading/surcharge program, the existing northeast, east and west fill piles will have to be excavated and removed down to the original grade of the site estimated to be similar to the ground surface elevation in the low-lying ditch area (Elevation 91.7 m). The preload fill may be placed to the design elevation of the final grade for the site by the controlled placement of an engineered fill pad constructed in accordance engineered fill placement procedure. This preload fill will remain in place after the preloading/surcharge program has been completed and will also become part of the engineered fill pad that will support the foundations and ground floor of the school building and will become the subgrade for the parking lot, access roads, sports fields and play structures in the remaining areas of the school property. A surcharge fill should be placed on the pre-load engineered fill to the specified height required to further consolidate the silty clay. The surcharge fill will be removed on completion of the preload/surcharge program and as such, may consist of select subgrade material or approved on-site material nominally compacted in place.

A settlement monitoring program of the preload/surcharge fill pile should be employed to confirm that the required settlements have been achieved across the school site. The settlement monitoring program should consist of the installation of a sufficient number of settlement plates to monitor the progress of the settlement and to confirm that sufficient degree of consolidation has occurred prior to the construction of the footings and floor slab for the school building. A sufficient number of settlement plates should be installed across the site, since the site and the underlying silty clay have been exposed to varying loads from soil fill piles of different heights placed on site over different periods of time.

Option No. 2 – Pile Foundations and Structural Slab

With this option, there is no delay in start of construction of the proposed school building however, this option may be more costly than the remaining options. The proposed school building may be founded on piles driven to bedrock anticipated at approximately a 29.1 m depth (Elevation 64.2 m). The floor slab may be designed as a structural slab also supported by piles. The estimated consolidation settlement of the silty clay due to the site grade raise beyond the school building footprint will have to be estimated and compared with the permissible total settlement of underground service connections to confirm if the consolidation settlement is within tolerable limits or exceeds the tolerable limits of the underground services.

Option No. 3 – Pile Foundations and Slab-on-Grade Construction

With this option, there is also no delay in the start of the construction of the proposed building however, this option may be costly but anticipated to be less costly than Option No. 2. For this option, the school building is supported by pile foundation and the ground floor is designed as a slab-on-grade supported by either light-weight fill (LWF) or a combination of engineered fill placed to the permissible grade raise level and LWF. The anticipated consolidation

settlement of the silty clay will have to be compared with the tolerable settlements of the underground services as in Option No. 2.

Additional Comments

More detailed geotechnical comments and recommendations regarding the options will be provided in a geotechnical engineering report for the proposed school development once the remaining boreholes and test pits from the current geotechnical investigation and additional laboratory testing have been completed.

As noted above, a surcharge loading program is currently being undertaken at the subdivision site by Paterson. Portions of the fill piles that are part of the surcharge loading program are currently encroaching onto the school site and onto the footprint of the proposed school building. It is our understanding that a report about the surcharge loading program is currently being prepared by Paterson. The surcharge loading report should be provided to EXP so that a strategy may be developed for the pre-loading/surcharge program of the school site and the proposed school building.

We trust the information contained in this technical memorandum will be satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Susan M. Potyondy, P.Eng.
Senior Project Manager
Earth and Environment

Ismail M. Taki, M.Eng., P.Eng.
Senior Manager, Eastern Region
Earth and Environment

Attachments:
Figure 1: Site Location Plan
Figure 2: Test Hole Location Plan and Topographic Survey
Figures 3 to 7: Borehole Logs

Figures

0 150m 300m 600m
HORIZONTAL 1:15,000

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DATE: MARCH 2021	CLIENT: OTTAWA CATHOLIC SCHOOL BOARD	project no.: OTT-21003218-A0
DESIGN: L.W. / CHECKED: L.W.		scale: ~1:15,000
DRAWN BY: T.M.	TITLE: SITE LOCATION PLAN 3387 BORRISOKANE ROAD, OTTAWA, ONTARIO	FIG 1

Filename: E:\OTT\OTT-21003218-A0\60 Execution\65 Drawings\phase i\21003218-a0 ph1.dwg
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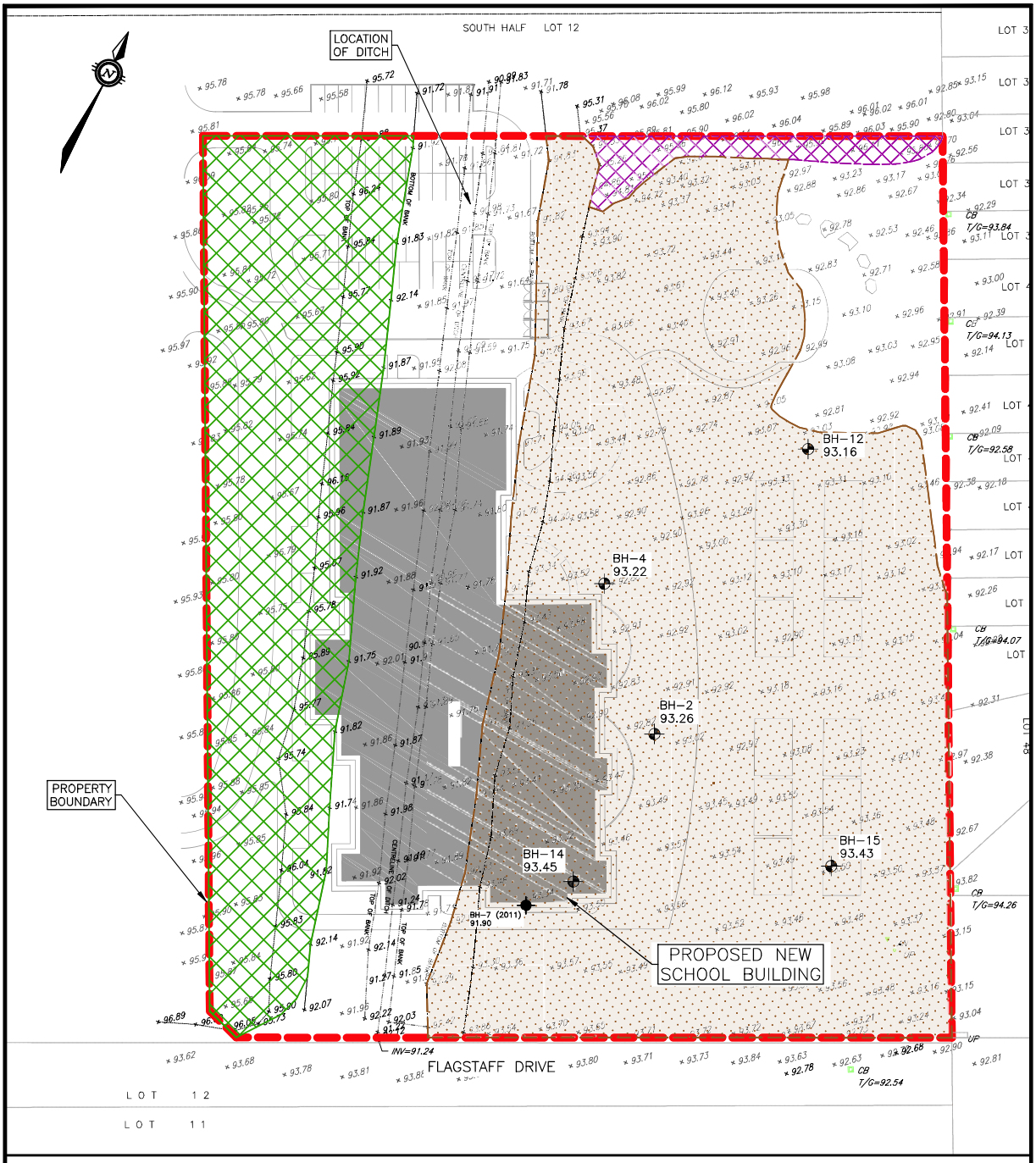

LEGEND:

- BH–1 91.99 — BOREHOLE LOCATION, NUMBER AND GROUND SURFACE ELEVATION
- BH–7 (2011) 91.90 — BOREHOLE LOCATION, NUMBER AND GROUND SURFACE ELEVATION (2011 BOREHOLE FROM PATERSON)
- APPROXIMATE LOCATION OF NORTH FILL PILE (SURCHARGE LOADING PROGRAM, PATERSON)
- APPROXIMATE LOCATION OF WEST FILL PILE (SURCHARGE LOADING PROGRAM, PATERSON)
- APPROXIMATE LOCATION OF EAST FILL PILE (TEMPORARY ROADWAY AND LAY–DOWN AREA)

NOTES:

1. THE BOUNDARIES AND THE SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL SAMPLES WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. BOREHOLE ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
4. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.
5. BASE PLAN OBTAINED FROM TOPOGRAPHIC SURVEY RECEIVED JUNE 08, 2021 AND PREPARED BY STANTEC GEOMATICS INC., DWG. NO. 161614393–111–D2–C3D

REFERENCES:

1. SURCHARGE LOADING PROGRAM INFORMATION OBTAINED FROM REPORT TITLED "GEOTECHNICAL INVESTIGATION, PROPOSED RESIDENTIAL DEVELOPMENT, 3387 BORRISOKANE ROAD, OTTAWA" DATED MAY 01, 2017 AND PREPARED BY PATERSON GROUP INC., REPORT NO. PG3621–1 REV. 5
2. SPOT ELEVATIONS OBTAINED FROM TOPOGRAPHIC SURVEY RECEIVED JUNE 08, 2021 AND PREPARED BY STANTEC GEOMATICS INC., DWG. NO. 161614393–111–D2–C3D

0 5m 10m 30m
HORIZONTAL 1:750

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DESIGN	S.P.
DRAWN	G.C.
DATE	JUNE 2021
FILE NO	OTT–21003218–A0

GEOTECHNICAL INVESTIGATION – PROPOSED NEW BORRISOKANE CATHOLIC ELEMENTARY SCHOOL
3387 BORRISOKANE ROAD, OTTAWA, ONTARIO

TEST HOLE LOCATION PLAN AND TOPOGRAPHIC SURVEY

SCALE 1:750
SKETCH NO FIG 2

Filename: E:\OTT\OTT-21003218-A0\60 Execution\65 Drawings\21003218 FIG_2.dwg
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Log of Borehole BH02

Project No: OTT-21003218-A0

Project: Proposed New Borrisokane Catholic Elementary School

Location: 3387 Borrisokane Road, Ottawa, ON

Figure No. 3

Page. 1 of 3

Date Drilled: 'March 31, 2021

Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: AN Checked by: SMP

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		GRANULAR FILL Granular A type crushed granular material, grey Over	93.26	0			AS1	
		BLAST-ROCK FILL Cobble and boulder sizes, grey	92.5					
		FILL Silty sand and gravel with cobbles and boulders, brown, moist, (dense) difficult augering from 0.8 m to 1.5 m depths	91.5	1	48		SS2	23.8
		SANDY SILT Brown, moist to wet, (compact)		2	23		SS3	
					15		SS4	
		SILTY CLAY With sand, low plasticity, sensitive, dark grey, wet, (firm)	90.3	3	Hammer Weight		SS5	
				4	38 kPa, s=8.0		ST6	
		SILTY CLAY Low plasticity, sensitive, dark grey, wet, (firm)	88.8	5	34 kPa, s=7.0			
					Hammer Weight		SS7	
		with black bands from 6.1 m to 8.2 m depths		6			ST8	
				7	29 kPa			
					Hammer Weight		SS9	
			84.8	8	43 kPa			
		Dynamic Cone Penetration Test (DCPT) conducted from 8.5 m to 29.1 m depths.		9				
				10				

Continued Next Page

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21003218-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
Completion	4.6	7.6

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS - 21003218.GPJ TROW OTTAWA.GDT 6/11/21

Log of Borehole BH02

Project No: OTT-21003218-A0

Project: Proposed New Borrisokane Catholic Elementary School

Figure No. 3

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		Dynamic Cone Penetration Test (DCPT) conducted from 8.5 m to 29.1 m depths. *(continued)*	83.26	10	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
				11				
				12				
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				
				21				
				22				

Continued Next Page

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21003218-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	4.6	7.6

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS - 21003218.GPJ TROW OTTAWA.GDT 6/11/21

Log of Borehole BH02

Project No: OTT-21003218-A0

Project: Proposed New Borrisokane Catholic Elementary School

Figure No. 3

Page. 3 of 3

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		Dynamic Cone Penetration Test (DCPT) conducted from 8.5 m to 29.1 m depths. *(continued)*	71.26	22				
				23				
				24				
				25				
				26				
				27				
				28				
			64.2	29				
		Cone Refusal at 29.1 m Depth						

LOG OF BOREHOLE BH LOGS - 21003218.GPJ TROW OTTAWA.GDT 6/11/21

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21003218-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
Completion	4.6	7.6

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH04

Project No: OTT-21003218-A0

Project: Proposed New Borrisokane Catholic Elementary School

Location: 3387 Borrisokane Road, Ottawa, ON

Figure No. 4

Page. 1 of 1

Date Drilled: 'March 30, 2021

Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: AN Checked by: SMP

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		GRANULAR FILL Granular A type crushed granular material, grey Over **BLAST-ROCK FILL** Cobble and boulder sizes, grey	93.22 92.3	0			AS1	
		FILL Silty sand and gravel with cobbles and boulders, brown, moist, (compact to dense) ~ 200 mm thick organic layer with decayed wood chips at 1.5 m depth	91.2	1	44		SS2	23.2
		SILTY SAND Grey, wet, (loose)	90.72	2	17 5		SS3 SS4	20.5
		SILTY CLAY With sand, shell fragments, black bands, medium sensitivity, dark grey, wet, (soft to firm)	90.2	3	2 38 kPa s=4.0 Hammer Weight 29 kPa s=3.0 Hammer Weight		SS5 SS6	
				5	Hammer Weight 29 kPa		SS7	
				6	Hammer Weight		SS8	
				7	14 kPa 19 kPa			
				8	Hammer Weight 24 kPa		SS9	
		Borehole Terminated at 8.5 m Depth	84.7					

LOG OF BOREHOLE BH LOGS - 21003218.GPJ TROW OTTAWA.GDT 6/11/21

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 19 mm diameter standpipe installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21003218-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	4.6	N/A
June 3, 2021	2.5	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH12

Project No: OTT-21003218-A0

Project: Proposed New Borrisokane Catholic Elementary School

Location: 3387 Borrisokane Road, Ottawa, ON

Figure No. 5

Page. 1 of 1

Date Drilled: 'March 30, 2021

Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: AN Checked by: SMP

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		GRANULAR FILL Granular A type crushed granular material, grey	93.16	0			AS1	
			92.4					
		FILL Silty sand and gravel, brown to grey, moist, (compact)		1	16		SS2	22.6
			91.3		14		SS3	21.2
		SILTY SAND Brown, wet, (loose)		2	6		SS4	
			90.3		48 kPa s=5.0			
		SILTY CLAY With sand, medium sensitivity to sensitive, dark grey, wet, (firm)		3	5		SS5	
					38 kPa s=5.3			
				4	Hammer Weight		SS6	
			88.3		38 kPa s=2.7			
		Borehole Terminated at 4.9 m Depth						

LOG OF BOREHOLE BH LOGS - 21003218.GPJ TROW OTTAWA.GDT 6/11/21

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21003218-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
Completion	4.3	4.6

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH14

Project No: OTT-21003218-A0

Project: Proposed New Borrisokane Catholic Elementary School

Location: 3387 Borrisokane Road, Ottawa, ON

Figure No. 6

Page. 1 of 1

Date Drilled: 'March 30, 2021

Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: AN Checked by: SMP

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test + S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		GRANULAR FILL Granualr A type crushed granular fill, grey	93.45	0			AS1	
		Over **BLAST-ROCK FILL** Cobble and boulder sizes, grey, moist	92.7					
		FILL Silty sand and gravel, cobbles and boulders, brown, moist, (dense)		1	38		SS2	21.6
					49		SS3	
		difficult augering from 1.5 m to 2.3 m depths	91.3	2				
		SILTY SAND Brown, moist, (compact)			14		SS4	22.1
			90.2	3	3		SS5	
		SILTY CLAY With sand and black bands, sensitive, dark grey, wet, (soft to firm)		4	34 kPa 34 kPa s=4.7			
					Hammer Weight		SS6	
				5	29 kPa s=4.0			
				6	Hammer Weight		SS7	
				7	24 kPa			
					Hammer Weight		SS8	
			85.0	8	38 kPa s=4.0			
		Borehole Terminated at 8.5 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21003218-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	4.6	7.6

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS - 21003218.GPJ TROW OTTAWA.GDT 6/11/21

Log of Borehole BH15

Project No: OTT-21003218-A0

Project: Proposed New Borrisokane Catholic Elementary School

Location: 3387 Borrisokane Road, Ottawa, ON

Figure No. 7

Page. 1 of 1

Date Drilled: 'March 31, 2021

Drill Type: CME-55 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: AN Checked by: SMP

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test + S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		GRANULAR FILL Granular A type crushed granular material, grey Over **BLASTED ROCK FILL** Cobbles and boulders, grey	93.43 92.6	0			AS1	
		FILL Silty sand and gravel, brown and grey, moist, (compact)		1	15		SS2	22.0
			91.4	2	11		SS3	20.7
		SILTY SAND Brown, moist to wet, (loose)			4		SS4	
			90.1	3	Hammer Weight		SS5	
		SILTY CLAY With sand, medium sensitivity to sensitive, dark grey, wet, (firm)		4	38 kPa s=3.2 Hammer Weight		SS6	
				5	38 kPa s=5.3			
			87.9					
		Borehole Terminated at 5.5 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21003218-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
Completion	4.3	4.6

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS - 21003218.GPJ TROW OTTAWA.GDT 6/11/21

Technical Memorandum No. 2
Preliminary Settlement Analysis and Preloading Requirements

Exp Project No:	OTT-21003218-A0
Project Name:	Proposed New Borrisokane Catholic Elementary School Site 3387 Borrisokane Road, Ottawa, ON.
Date:	November 23, 2021
Attention:	Donald Wood; donald.wood@ocsb.ca

Prepared by: Ismail M. Taki, P.Eng. **Reviewed by:** Susan M. Potyondy, P.Eng.

EXP Services Inc, (EXP) is pleased to present the preliminary settlement analysis and preloading requirements for the proposed new Borrisokane Catholic elementary school to be located at 3387 Borrisokane Road, Ottawa, Ontario This technical memorandum is a follow-up to our Technical Memorandum No. 1 dated June 16, 2021 where options are provided to reduce the consolidation settlement of the underlying native silty clay to within tolerable limits and options are provided to minimize the impact of the high consolidation settlement on the proposed school development. This memorandum discusses the option of pre-loading/surcharging the site for the proposed school development.

This memorandum supersedes the Technical Memorandum No. 2 dated July 30, 2021. This memorandum should be read in conjunction with our Technical Memorandum No. 1 dated June 16, 2021, which provides background information regarding the previous geotechnical investigation by others, the previous pre-loading activities at the school site and geotechnical information from the boreholes completed on site in March 2021 by EXP.

In October 2021, preparation of the site for the engineered fill pad construction and pre-loading construction was started. Once the engineered fill pad and pre-loading construction have been completed and the pre-loading process has been initiated, settlement monitoring of the engineered fill pad and pre-load will be conducted to determine when the required settlement has been achieved. At that time, a more detailed geotechnical investigation will be conducted to confirm 'as-built' conditions of the site in preparation for the design and construction of the proposed new Borrisokane Catholic Elementary School building.

Proposed Design Information

It is our understanding that the proposed design elevation of the ground floor for the proposed school building will be Elevation 94.5 m. The elevation of the original ground surface of the site prior to any pre-loading activities (placement of fill on the site) was Elevation 91.5 m. Therefore, the proposed site grade raise will be 3.0 m. The footings for the proposed school building will be set at Elevation 93.0 m (1.5 m below the floor slab) and designed for a bearing pressure at serviceability limit state (SLS) of 75 kPa. Removal of organic on site is expected to extend to Elevation 91.0 m.

Available Information

Following the issuance of our June 16,2021 Technical Memorandum, we were provided with the settlement surcharge monitoring program memorandum dated June 24,2021 and prepared by Paterson Group Inc. This memorandum summarizes the settlement surcharge monitoring program for the portion of the proposed school

property that is currently pre-loaded/surcharged by a 4.4 m high fill pile located in the west portion of the school property; identified as 'Area H' in the Paterson memorandum.

Two (2) settlement monitoring plates SP29 and SP30 are located in Area H, along the west side of the school property. Based on a review of the settlement (mm) versus time (date) graph shown in Figure 1 of the memorandum, the monitoring of the settlement of the underlying silty clay at SP29 and SP30 was started in September 2020 with subsequent measurements taken in October, November and December 2020 and in May 2021. The last measurement in May 2021 indicates that the settlement that has occurred on the underlying silty clay to May 2021 is approximately 105 mm and 120 mm.

Based on a site review of the fill pile in Area H, we speculate that the fill pile is constructed from a soil fill material that is not Ontario Provincial Standard Specification (OPSS) 1010 Granular B Type II but rather a clayey type of soil; possibly surplus excavated material originating from the nearby subdivision development currently undergoing construction.

Settlement Analysis and Pre-Loading Requirements

Based on the results of the consolidation tests conducted by EXP in 2021 and by Paterson in 2011 and the proposed site grade raise of 3.0 m, the long-term consolidation settlement of the underlying silty clay due to the placement of 3.0 m of engineered fill to raise the site grades to the design elevation of Elevation 94.5 m was estimated to be 240 mm. For the footing foundation, the tolerable total settlement of the footings is taken as 25 mm. Therefore, the total consolidation settlement of the silty clay due to the loads imposed by the 3.0 m grade raise and the footings is estimated to be 265 mm. As the estimated settlement is significantly higher than the typical allowable limits (total settlement of 25 mm and differential settlement of 19 mm), preloading/surcharging the site is considered to be an option to accelerate the consolidation of the silty clay, so that future settlements will be within the tolerable limits.

Pre-loading/surcharging the site should be undertaken prior to the construction of the proposed school building. The pre-loading/surcharging of the site should consist of constructing the 3.0 m high engineered fill pad to the design elevation of Elevation 94.5 m and by placing additional soil fill (pre-load/surcharge material) on top of the 3.0 m high engineered fill pad. The additional fill is left in place for a specified period of time until the estimated consolidation settlement is reached in the silty clay. The time to achieve the required settlement will vary depending on the height of the pre-load material placed on top of the prepared engineered fill pad as well as the type of material used for pre-loading the site. The time required to achieve the required consolidation settlement of the underlying silty clay may be further accelerated by installing wick drains on the site along with pre-loading/surcharging the site. It is noted that the installation of wick drains will add costs to the project.

Two options were considered in the estimate the length of time required to achieve the allowable settlement (i.e. total settlement – 25 mm allowable settlement). Option 1 considers using pre-load fill only of variable thicknesses whereas option 2 consider the use of wick drain in addition to different pre-load fill thicknesses in order to reduce the time required to achieve the target settlement. Table I presents the assumed parameters of the wick drains which needs to be initiated by a specialized contractor, who will be performing the work. Therefore, data provided in Table I regarding type, depth and spacing are for general information only.

Table I: Assumed Parameters of the Wick Drains		
Item		**Wick Drains Parameters**
Drain Cross Section Shape		Strip
Drain Width	(m)	0.1
Drain Thickness	(m)	0.005
Drain Spacing	(m)	3.0
Drain Length	(m)	20.0
Drain Pattern		Triangular
Ratio of Diameter of Smear Zone to Diameter of Drain		3
Ratio of Undisturbed to Smear Zone Permeability		4

A summary of the estimated time in days to achieve the required consolidation settlement of the underlying silty clay for the different heights of pre-load/surcharge material placed on top of the 3 m of engineered fill pad, without and with wick drains, is shown in Tables II and III, respectively. For the settlement analysis, the material used to construct the 3 m high engineered fill pad and to construct the pre-load fill consists of Ontario Provincial Standard Specification (OPSS) 1010 Granular B Type II material.

Table II: Height of Pre-Load Material and Estimated Time to Achieve Required Settlement – WITHOUT Wick Drains				
Maximum Height of Engineered Fill to Remain after Pre-Loading the Site (Maximum Site Grade Raise) (m)	**Height of Pre-Load Material (m)**	**Total Maximum Height of Fill Placed (Site Grade Raise + Pre-Load Height) (m)**	**Total Required Estimated Consolidation Settlement from Maximum Site Grade Raise and Footing Loads (mm)**	**Estimated Time To Achieve Required Consolidation Settlement (Days)**
3.0 m	0.5	3.5	265	600
3.0 m	1.0	4.0	265	350
3.0 m	1.5	4.5	265	250
3.0 m	2.0	5.0	265	185

Table III: Height of Pre-Load Material and Estimated Time to Achieve Required Settlement – WITH Wick Drains				
Maximum Height of Engineered Fill to Remain after Pre-Loading the Site (Maximum Site Grade Raise) (m)	**Height of Pre-Load Material (m)**	**Total Maximum Height of Fill Placed (Site Grade Raise + Pre-Load Height) (m)**	**Total Required Estimated Consolidation Settlement from Maximum Site Grade Raise and Footing Loads (mm)**	**Estimated Time To Achieve Required Consolidation Settlement (Days)**
3.0 m	0.5	3.5	265	140
3.0 m	1.0	4.0	265	80
3.0 m	1.5	4.5	265	60
3.0 m	2.0	5.0	265	45

As indicated in Table II, without wick drains, the required settlement from the 3.0 m thick engineered fill pad and the footing can be achieved in approximately 185 days to 600 days of preloading, depending on the height of preload material. As indicated in Table III, with wick drains, the required settlement can be achieved in approximately 45 days to 140 days of preloading, depending on the height of preload material.

It is noted that a direct comparison of the settlement and time to achieve the required consolidation settlement cannot be made between the Paterson monitoring data and the results from the EXP analysis. Our analysis is based on using a different material for site grade raise and pre-load purposes compared with the speculated fill material used to construct the existing pre-load fill pile in the pre-load area, Area H, currently being monitored by Paterson. The unit weight of the soil material used to construct the existing pre-load fill pile in Area H and the unit weight of the OPSS Granular B Type II material we propose to use for the school development are different and as a result the estimated consolidation settlement of the underlying silty clay and the estimated time to achieve the consolidation settlement will also be different.

Our settlement analysis and estimated days to achieve the required consolidation settlement is based on using OPSS Granular B Type II material for the construction of the engineered fill pad to achieve the design grade raise of 3 m at the proposed building location and for the construction of the pre-load fill to be placed on top of the 3 m thick engineered fill pad. The engineered fill pad will have to be compacted to 100 percent standard Proctor maximum dry density (SPMDD) and the pre-load should be compacted to a minimum 90 percent SPMDD. OPSS Granular B Type II material was selected for the engineered fill pad to minimize double handling of materials. The Granular B Type II is also recommended for the construction of the pre-load fill, since the Granular B Type II material may be utilized in other areas of the site, such as for parking lot and access road construction, once the pre-loading operation has been completed and the pre-load fill has been disassembled.

A settlement monitoring program of the pre-loading operation should be undertaken to confirm the results of the above analysis and determine when the required settlement has been achieved.

Preliminary Settlement Analysis and Pre-Loading Requirements
Proposed New Borrisokane Catholic Elementary School, 3387 Borrisokane Road, Ottawa, ON
Ottawa Catholic School Board
OTT-21003218-A0
November 23, 2021

Site Preparation for Engineered Fill Pad Construction and for Pre-Loading Construction

EXP recommends the following be undertaken to prepare the site for engineered fill pad construction and pre-loading construction:

- Test pits must be excavated in the lay-down area of the site to investigate the type of fill currently in place and to determine if organic material (such as the original topsoil layer) was stripped from the site prior to placement of the fill. If the existing fill is deemed not suitable for the proposed school construction or organic material was left in place, the existing fill and organic material will have to be removed and replaced with engineered fill consisting of OPSS Granular B Type II.

- Within the low-lying central ditch area, all organic material including topsoil layers and any unsuitable material will have to be removed and the area backfilled with engineered fill comprising of OPSS 1010 Granular B Type II to design finished grade, placed in 300 mm thick lifts and each lift compacted to 100 percent SPMDD within the envelope of the proposed school building and to 95 percent SPMDD elsewhere on site. Use of compactible clay material with moisture content within +/- 2 percent clay of optimum value would be acceptable to backfill the ditch up to original grade. Organic is expected to extend to Elevation 91.0 m in this area.

- Any additional fill required for pre-loading can consist of either granular fill (OPSS Granular B Type II) if it can be used elsewhere on-site following the disassembly of the pre-load fill pile or earth borrow fill material that has been designated for removal and disposal off-site. The local developer can be consulted for the availability of such material close to the site and within the adjacent subdivision.

- The existing stockpiles currently present on the site and placed by others, will have to be removed down to the original ground level. As noted above, if organic material was stripped from these areas and suitable material was used in the construction of these stockpiles, it may be possible to leave some of the stockpiles in place and re-engineer any of the stockpiles constructed from unsuitable material for the proposed school development with available approved material.

We trust the information contained in this technical memorandum will be satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Sincerely,

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Senior Manager, Eastern Region
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