CHUNG & VANDER DOELEN
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November 16, 2018
File No.: G18675

Spirit of Pentecost
c/o Mr. Terrell Heard
3029 Clayhill Road, PO Box 20059
Mississauga, Ontario
N0B 1T0

Attention: Terrell Heard

Re: Geotechnical Investigation
Proposed Residential Development
Part of Lot 13, Concession 2, Town of Erin

CHUNG & VANDER DOELEN ENGINEERING LTD. (CVD) has been retained by Spirit of Pentecost to conduct a geotechnical investigation for a proposed thirteen lot subdivision to be developed at Part of Lot 13, Concession 2 in the Town of Erin, Ontario.

It is proposed to develop the 3.62 hectare site with thirteen residential lots serviced with an internal roadway and a storm water management facility. It is understood that each lot will be privately serviced with a drilled well and an onsite wastewater treatment system. Review of site grading drawings indicate that cut and fill procedures (upto 3± m) will be utilized during regrading of the site.

The purpose of this investigation has been to determine the subsurface conditions and relevant soil properties at the subject site in order to provide geotechnical recommendations for the design and construction of site grading operations, the internal roadway, and residential foundations. Estimates of hydraulic conductivity of the insitu soil deposits are also provided.

FIELD WORK

Six boreholes were drilled and sampled to depths between 5.03 and 7.01 m below existing grade across the site in order to investigate the subsurface conditions. The locations of the boreholes are shown on Drawing No. 1, Borehole Location Plan.

The field work for this project was conducted on May 3, 2018 under the supervision of a member of our engineering team, who logged the boreholes in the field, effected the subsurface sampling and monitored the groundwater conditions. Utility locates were completed prior to commencement of the borehole investigation program.

The boreholes were advanced to the sampling depths using a power auger drilling rig equipped with continuous flight hollow stem augers and standard soil sampling equipment. Standard penetration tests (STPs) were carried out at frequent intervals of depth, and the results are shown on the Borehole Logs as Penetration Resistance or "N"-values. The compactness condition or consistency of the soil strata has been inferred from the test results.

50 mm diameter monitoring wells with above grade protective covers were installed at each of the drilled boreholes to enable measurement of groundwater levels over the long term.

Samples obtained from the insitu tests were examined in the field and subsequently taken to our laboratory for detailed description and moisture content determination. Five grain size distribution analyses were conducted on representative samples of the encountered soil deposits.

Ground surface elevations at the borehole locations were surveyed by CVD and are referenced to a temporary benchmark (TBM) which is shown on Drawing No. 1 and described below:

TBM: Top of catchbasin/manhole at edge of pavement to westbound lane of Wellington Road 124, just west of church entrance

Elevation: 414.48 m (as provided to CVD by IBI Group)

EXISTING CONDITION

The site is located at the northwesterly corner of the intersection of Wellington Road 124 and Second Line in the hamlet of Ospringe.

The site primarily exists asa large crop field with multiple residences fronting onto Second Line and Wellington Road 124. The site is topographically high near Elevation 417.5 m in the north west portion of the site and generally slopes easterly and southeasterly down to near Elevation 408 m in the southeast corner of the site.

SUBSURFACE CONDITIONS

The subsurface conditions encountered at the boreholes are detailed on the Borehole Log Sheets, Enclosures 1 to 6, inclusive. The following notes are intended to amplify and comment on the subsurface data obtained.

Stratigraphic boundaries shown on the borehole logs are inferred from non-continuous sampling conducted during advancement of the borehole drilling procedures and, therefore, represent transitions between soil types rather than exact planes of geologic change. The subsurface conditions may vary between and beyond the borehole locations.

Topsoil

Topsoil was contacted at the ground surface of all boreholes with measured thicknesses between 330 and 450 mm.

Sand and Silt to Sandy Silt

The surficial topsoil layer at Boreholes 1 to 4 and 6 was underlain by brown sand and silt to sandy silt with varying percentages of gravel and clay which extended to depths between 1.4 and 2.9 m below existing grade. Four grain size distribution analyses were conducted on representative samples and the results are presented on Enclosures 7 to 10.

Standard penetration testing within these deposits yielded “N”-values between 6 and 32 blows per 300 mm, indicating a variable loose to dense compactness condition. The loose compactness condition was generally confined to within 1.2 m from existing ground level. Natural moisture contents were measured between 11 and 21%, indicating a moist to saturated moisture condition.

Granular Deposits

The sand and silt to sandy silt deposits at Boreholes 1 and 3 were underlain by brown granular deposits which extended to depths of 4.9 and 4.1 m below existing grade, respectively. The granular deposits were comprised of silty sand, fine sand and sand and gravel.

Standard penetration testing within the granular deposits yielded “N”-values between 15 and 36 blows per 300 mm, indicating a compact to dense compactness condition. Natural moisture contents were measured between 11 and 21%, indicating a saturated moisture condition.

Sandy Silt Till

The topsoil at Borehole 5 and the sand and silt at Borehole 2 were underlain by brown to grey sandy silt till with a trace of gravel and clay. The till extended to a depth of 5.5 m below existing grade at Borehole 2. Borehole 5 was terminated within the till at a depth of 7.0 m below existing grade.

Standard penetration testing within the till yielded "N"-values between 14 and greater than 100 blows per 300 mm, indicating a compact to very dense compactness condition. Natural moisture contents were measured between 10 and 16%, indicating a moist to saturated moisture condition.

Silt

The above described deposits at Boreholes 1 to 4 and 6 were underlain by brown to grey silt which extended to at least the borehole termination depths between 5.03 and 6.56 m below existing grade.

Standard penetration testing within the silt yielded "N"-values between 31 and greater than 100 blows per 300 mm, indicating a dense to very dense compactness condition. Natural moisture contents were measured between 16 and 21%, indicating a saturated moisture condition.

Groundwater

50 mm diameter monitoring wells with 3 m screen lengths were installed to depths between 4.57 and 7.01 m below existing grade at the six boreholes to enable measurement of groundwater levels over the long term. The following table provides the water levels measured on May 11 and July 31, 2018.

Borehole Location	Ground Surface Elevation (m)	Water Depth (m)		Water Elevation (m)	
		May 11, 2018	July 31, 2018	May 11, 2018	July 31, 2018
BH 1	410.54	1.02	2.55	409.52	407.99
BH 2	412.09	0.70	3.12	411.39	408.97
BH 3	414.45	0.82	2.10	413.63	412.35
BH 4	415.74	1.25	2.61	414.49	413.13
BH 5	417.47	1.35	3.18	416.13	414.30
BH 6	413.88	0.64	2.54	413.23	411.34

It should be cautioned that the groundwater table will fluctuate in response to major weather events. Seasonal fluctuations of the groundwater table are to be expected.

DISCUSSION AND RECOMMENDATIONS

General

It is proposed to develop the 3.62 hectare site with thirteen residential lots serviced with an internal roadway and a storm water management facility. It is understood that each lot will be privately serviced with a drilled well and an onsite wastewater treatment system. Review of site grading drawings indicate that cut and fill procedures (upto 3± m) will be utilized during regrading of the site.

General Site Grading

Cut and fill procedures (upto 3± m) will be utilized during regrading of the site. Materials to be used as fill during site grading operations are to be suitably handled and placed according to their final use needs. **Earth fill to support future dwelling structures and roadways is to be constructed significantly different than earth fill to be used to raise grade in wastewater treatment leaching bed envelopes.**

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

Site Grading for Engineered Fill Construction

Inorganic onsite native soil deposits from “cut” areas may potentially be reused to construct engineered fill capable of supporting future buildings/foundations, roadways, and municipal infrastructure servicing. The natural moisture content of the “cut” soils to be used as engineered fill should be within 3% below their optimum moisture contents in order to achieve the specified degree of compaction.

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

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

The onsite deposits are generally considered to be frost-susceptible. Constructing engineered fill using the onsite finer grained soils during the winter months is to be avoided.

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

The following procedures are recommended for the construction of engineered fill to specifically support future dwellings, roadways and municipal infrastructure servicing. Specific recommendations for site grading procedures within wastewater treatment leaching bed envelopes will be provided in the following subsequent section.

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

2. The exposed subgrade surface should be thoroughly recompacted with a heavy vibratory compactor and inspected by a qualified geotechnical inspector. Should the subgrade react adversely, the recompaction process should be ceased and the geotechnical engineer is to be contacted to assess the condition. Any soft spots encountered during the recompaction process should be excavated to the level of competent soil

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

4. Inorganic onsite soils maybe considered as suitable engineered fill material provided the natural moisture content of the soil is within 3% below the optimum moisture content in order to

achieve the specified degree of compaction. Overly wet and organic materials are to be placed in non-structural areas and beyond future wastewater treatment leaching bed envelopes where 90% SPMDD is considered adequate. Overly wet inorganic soil may be mixed with drier soils to produce a suitable moisture content to allow appropriate compaction to occur

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

The engineered fill located beneath future building structures should not be constructed upon until a three (3) month waiting period has lapsed to allow any secondary consolidation of the soil fill to occur. Should it be necessary to construct foundations before the three (3) month period has lapsed, structural reinforcement of the footings and foundation walls is recommended.

Vibration could be generated from various construction equipment during construction, such as compactors and rollers, which could be harmful to surrounding structures and buildings. Peak particle velocity (PPV) of ground motion is widely accepted as the best descriptor of potential for vibration damage to structures. The safe vibration limit can be set to 10 to 20 mm/s PPV, depending on the sensitivity of surrounding structures to vibration.

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

Site Grading for Wastewater Treatment Leaching Bed Envelopes

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

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

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

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

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

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

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

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

Pavement Design

The earth subgrade soil is generally expected to consist of sand and silt soil. The following flexible pavement structure is recommended for the local residential roadway based on the results of the gradational analyses, assumed CBR values, groundwater table, frost susceptibility of subgrade soils and anticipated traffic volume.

Pavement Component	Component Thickness
HL3 Surface Asphaltic Concrete HL8 Binder Asphaltic Concrete	40 mm 50 mm
Granular "A" Base Course	150 mm
Granular "B" Type II Sub-base Course	400 mm
Granular Base Equivalency (GBE)	596 mm

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

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

Preparation of the earth subgrade will involve procedures as provided in the Site Grading and Engineered Fill section. Any soft spots encountered during the final preparation process prior to pavement should be removed and replaced with suitable granular soil compacted to at least 95% SPMDD.

The base and sub-base materials should be produced in accordance with the current OPSS specifications, and placed and uniformly compacted to at least 100% SPMDD. The asphaltic concrete should be placed and compacted in accordance with OPSS Form 310 and to a minimum of 92% of the Marshall Density (MRD). Frequent in situ density testing by this office should be carried out to verify that the specified degree of compaction is being achieved and maintained.

It should be noted that even well compacted trench backfill could settle for a period of time after construction. In this regard, the surface course of the asphaltic concrete should be placed at least one (1) year after trench backfill is completed so as to allow any minor settlements to occur within the trench backfill. The incomplete pavement structure may not be capable of supporting construction

traffic. Consequently, minor repairs of the sub-base, base and asphaltic concrete may be required prior to paving with the base course and/or the surface course asphaltic concrete.

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

Building Foundations

Building foundations can be founded on native inorganic compact soil deposits or well-compacted engineered fill. The competent native soils and approved engineered fill constructed as per the procedures in the Site Grading for Engineered Fill Construction section can be used to support footing foundations designed to a net soil bearing pressure of up to 100 kPa (2000 psf).

Footing subgrade inspections are recommended to verify the bearing capacity of the soil prior to placement of the forms and concrete for the building foundations.

Should foundation construction on engineered fill be required to occur prior to the previously discussed three (3) month waiting period (see Site Grading for Engineered Fill Construction section), structural reinforcement of the footings and foundation walls is recommended.

Lateral Earth Pressure

House basement walls and other soil retaining structures should be designed to resist the lateral earth pressure acting against these walls. The following formula may be used for these calculations. The following formula may be used to calculate the unfactored earth pressure distribution. The factored resistance can be calculated by using a factor of 0.8.

$P = K(\gamma H + q)$

where:

P =	lateral earth pressure	kPa
K =	earth pressure coefficient, 0.5 for non-yielding foundation wall	
γ =	unit weight of granular backfill	21 kN/m^3
H =	unbalanced height of wall	m
q =	surcharge load at ground surface	kPa

The soils encountered during the investigation were variable in composition and are generally not considered to be free-draining materials. A drainage core layer should be installed against basement walls in accordance with OBC requirements. The basement walls should be damp-proofed.

A perimeter drainage system is required to ensure hydrostatic pressure does not build up in the backfill against the foundation wall. The perimeter weeping tile system is to be installed at the base of the footing to direct the collected waters to sump pump installations or the storm sewer.

Hydraulic Conductivity of Soils

Grain size distribution analyses were conducted on various samples of the native soil deposits and the results are graphically presented on Enclosures 7 to 11.

Based on our past experience and the results of grain size analyses, the hydraulic conductivity of the encountered inorganic soil types are estimated and provided in the following table:

Material	Hydraulic Conductivity (K) (cm/sec)
Sandy Silt and Sandy Silt Till	5×10^{-6}
Silty Sand	1×10^{-4}
Sand and Silt	1×10^{-5}

CLOSURE

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

We trust this report is sufficient for your immediate requirements. If you have any questions, please do not hesitate to contact the undersigned.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

Robert Vander Doelen, P. Eng.
Senior Engineer

encls

APPENDIX “A”

STATEMENT OF LIMITATIONS

APPENDIX "A"

LIMITATIONS OF REPORT

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

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

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

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

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

ENCLOSURES

Enclosure No.: 1
Sheet 1 of 1

FILE No: H16051

BOREHOLE No. 1

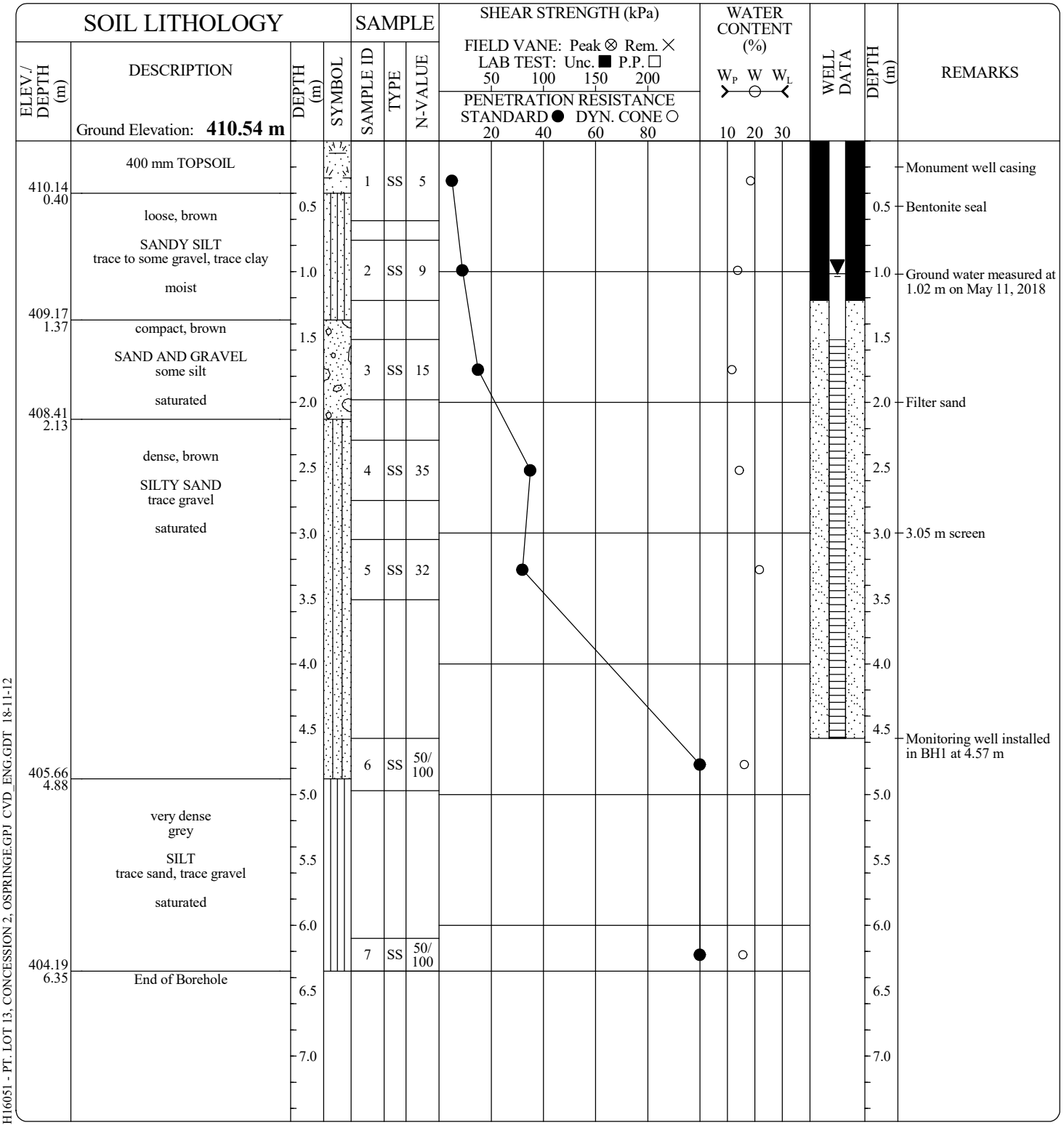
Client: **Spirit of Pentecost**

Project: **Proposed Residential Development**

Location: **Part of Lot 13, Concession 2, Town of Erin (Ospringe)**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm ID**
Date: **May 03 - 18** TO **May 03 - 18**



PROJECT MANAGER: **LC**

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Enclosure No.: 2
Sheet 1 of 1

FILE No: H16051

BOREHOLE No. 2

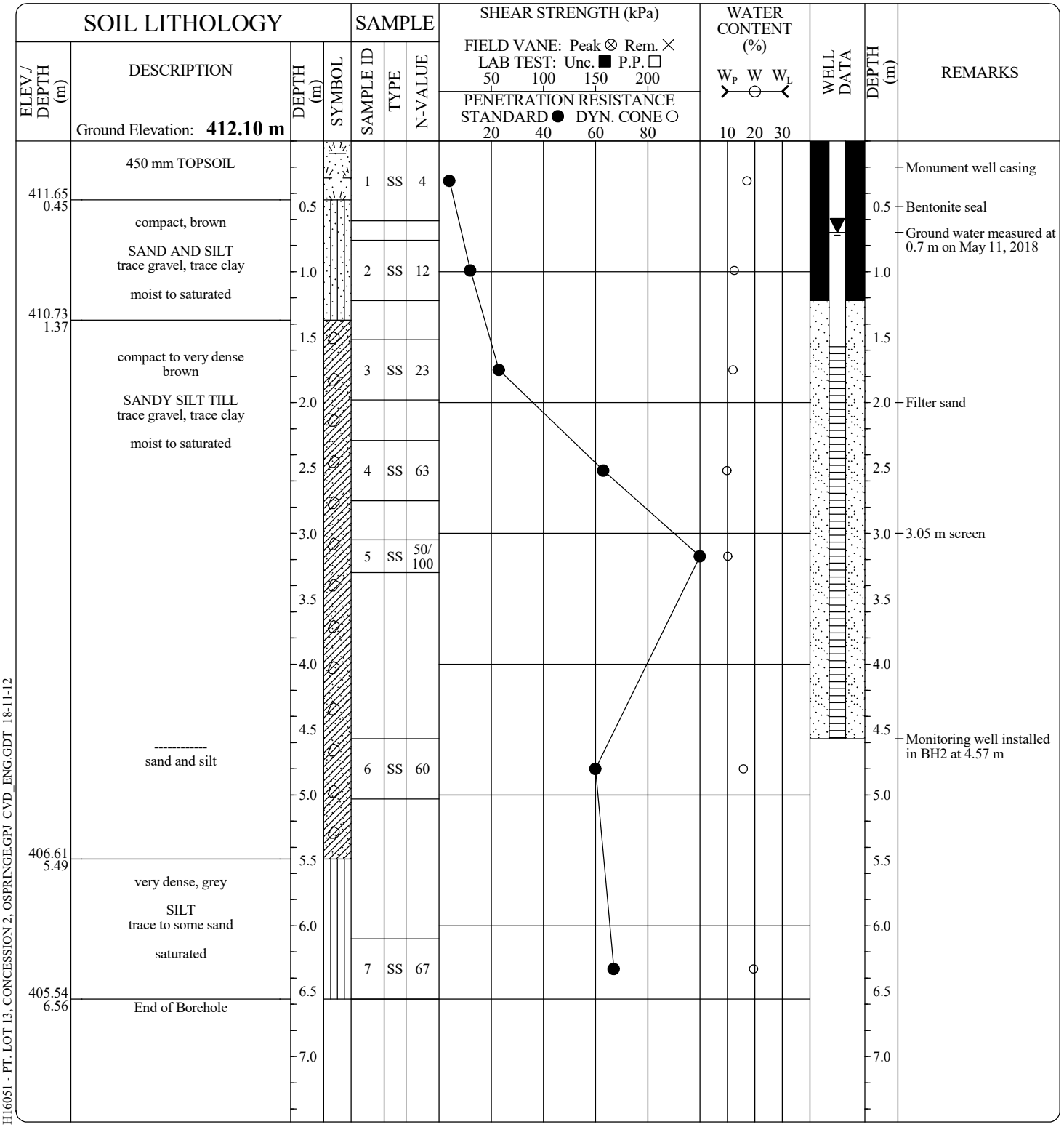
Client: **Spirit of Pentecost**

Project: **Proposed Residential Development**

Location: **Part of Lot 13, Concession 2, Town of Erin (Ospringe)**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm ID**
Date: **May 03 - 18** TO **May 03 - 18**



PROJECT MANAGER: **LC**

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FILE No: H16051

BOREHOLE No. 3

Client: **Spirit of Pentecost**

Project: **Proposed Residential Development**

Location: **Part of Lot 13, Concession 2, Town of Erin (Ospringe)**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm ID**
Date: **May 03 - 18** TO **May 03 - 18**

Ground Elevation: **414.45 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE
414.05	400 mm TOPSOIL	0.0	1	SS	3
0.40	compact to dense brown mottled SAND AND SILT trace gravel, trace clay moist to saturatedf	0.5			
		1.0	2	SS	10
		1.5	3	SS	18
		2.0			
		2.5	4	SS	32
411.55		3.0			
2.90	dense, brown fine SAND trace silt saturated	3.5	5	SS	36
410.34		4.0			
4.11	compact, brown SAND AND SILT saturated	4.5	6	SS	25
		5.0			
408.81		5.5			
5.64	very dense, brown SILT trace sand saturated	6.0	7	SS	50/ 140
407.91		6.5			
6.54	End of Borehole	7.0			

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

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)	REMARKS
0.0	Monument well casing
0.5	Bentonite seal
1.0	Ground water measured at 0.82 m on May 11, 2018
2.0	Filter sand
3.0	3.05 m screen
4.5	Monitoring well installed in BH3 at 4.57 m

PROJECT MANAGER: **LC**

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Enclosure No.: 4
Sheet 1 of 1

FILE No: H16051

BOREHOLE No. 4

Client: **Spirit of Pentecost**

Project: **Proposed Residential Development**

Location: **Part of Lot 13, Concession 2, Town of Erin (Ospringe)**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm ID**
Date: **May 03 - 18** TO **May 03 - 18**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE
	Ground Elevation: **415.74 m**					
415.41	330 mm TOPSOIL			1	SS	3
0.33	loose to compact brown SANDY SILT moist to saturated	0.5				
		1.0		2	SS	6
		1.5		3	SS	12
		2.0				
		2.5		4	SS	25
412.84						
2.90	dense brown to grey SILT trace sand saturated	3.0		5	SS	31
		3.5				
		4.0				
		4.5		6	SS	35
		5.0				
		5.5				
		6.0				
				7	SS	38
409.18		6.5				
6.56	End of Borehole					
		7.0				

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

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

- Monument well casing
- Bentonite seal
- Ground water measured at 1.25 m on May 11, 2018
- Filter sand
- 3.05 m screen
- Monitoring well installed in BH4 at 4.57 m

PROJECT MANAGER: **LC**

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Enclosure No.: 5
Sheet 1 of 1

FILE No: H16051

BOREHOLE No. 5

Client: **Spirit of Pentecost**

Project: **Proposed Residential Development**

Location: **Part of Lot 13, Concession 2, Town of Erin (Ospringe)**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm ID**
Date: **May 03 - 18** TO **May 03 - 18**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	WELL DATA	DEPTH (m)	REMARKS
	Ground Elevation: **417.47 m**								
417.14	330 mm TOPSOIL								Monument well casing
0.33	compact to very dense brown SANDY SILT TILL trace gravel, trace clay moist to saturated	0.5		1	SS	5		0.5	
		1.0		2	SS	14		1.0	
		1.5		3	SS	14		1.5	Ground water measured at 1.35 m on May 11, 2018
		2.0						2.0	Bentonite seal
		2.5		4	SS	63		2.5	
		3.0		5	SS	86		3.0	
		3.5						3.5	
		4.0						4.0	Filter sand
	---------- grey	4.5		6	SS	68		4.5	
		5.0						5.0	
		5.5						5.5	3.05 m screen
		6.0						6.0	
	---------- occ. sand seams	6.5		7	SS	60		6.5	
410.46									
7.01	End of Borehole	7.0						7.0	Monitoring well installed in BH5 at 7.01 m

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

WATER CONTENT (%)
W_P W W_L
10 20 30

PROJECT MANAGER: **LC**

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Enclosure No.: 6
Sheet 1 of 1

FILE No: H16051

BOREHOLE No. 6

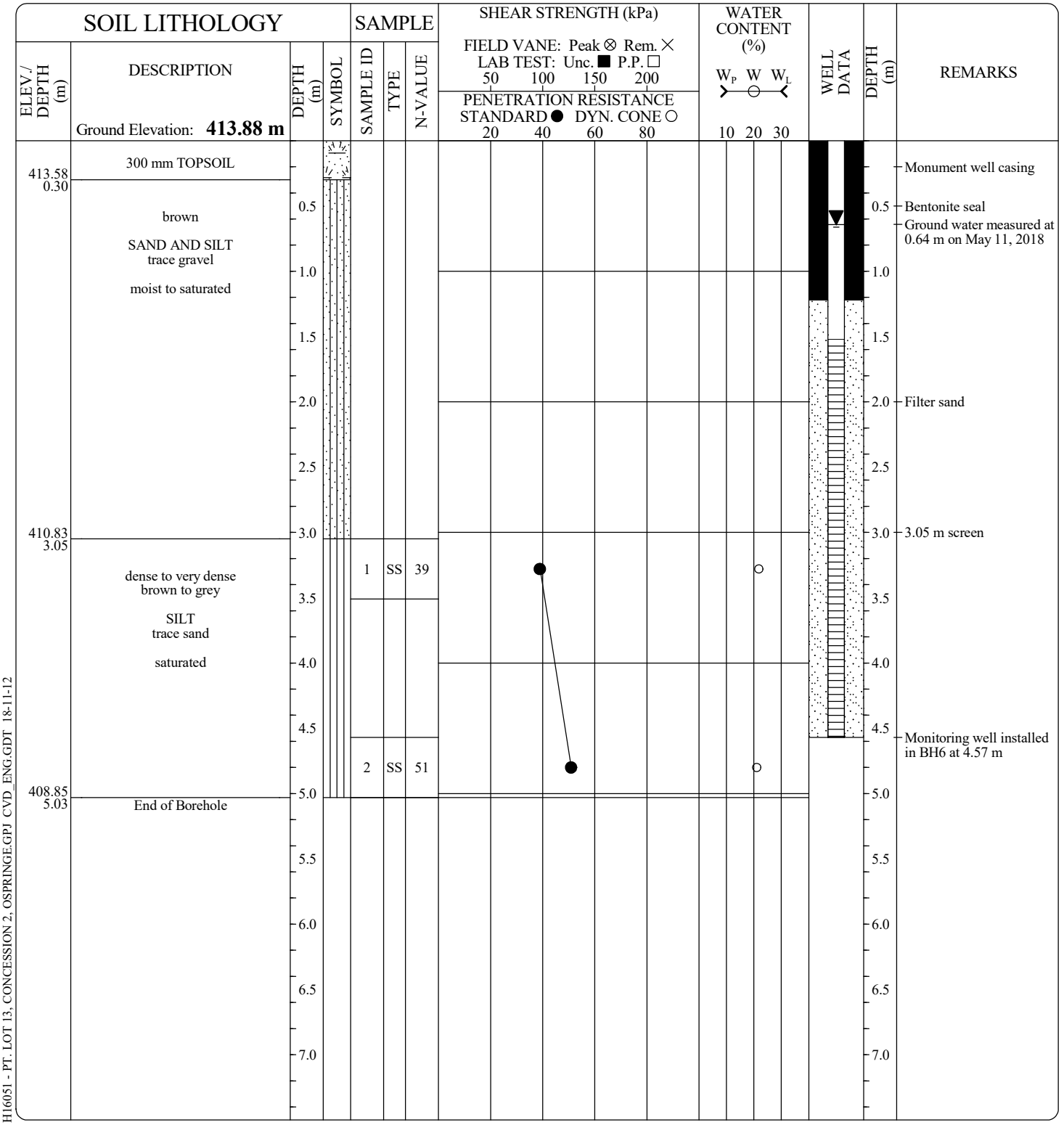
Client: **Spirit of Pentecost**

Project: **Proposed Residential Development**

Location: **Part of Lot 13, Concession 2, Town of Erin (Ospringe)**

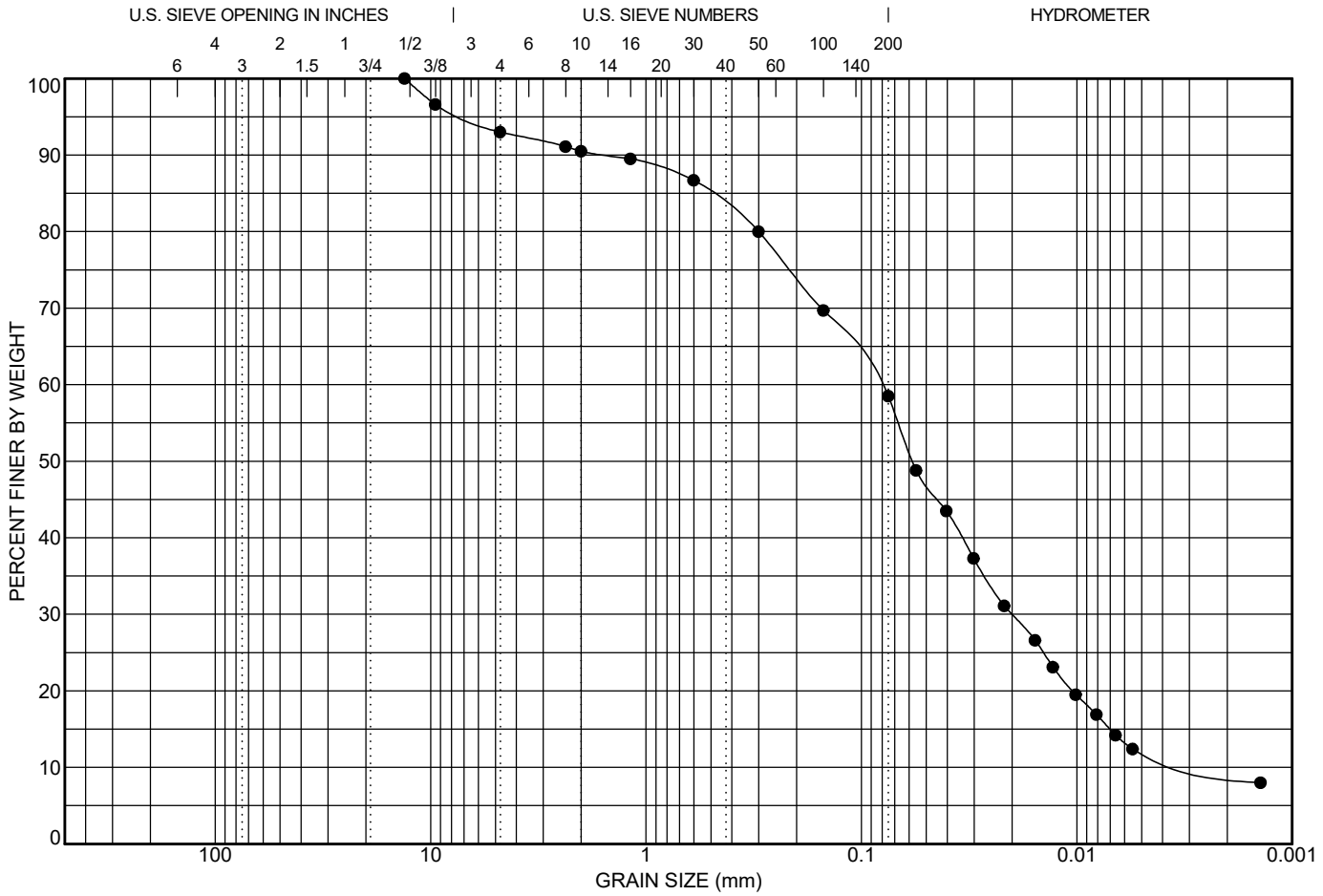
EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm ID**
Date: **May 03 - 18** TO **May 03 - 18**



PROJECT MANAGER: **LC**

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



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.87	31.56	13.2	0.082	0.02	0.003	7.0	34.5	58.5	

Date: Jul. 03 - 2018
Client: Spirit of Pentecost
Contractor:
Source:
Sampled From: BH 2 - SA 2, 0.76 to 1.22 m depth
Sample No.: 2-2
Date Sampled: May. 03 - 2018
Sampled By: LC
Lab No.: 3145
Date Tested: May. 31 - 2018
Type of Material: Sand and Silt, trace gravel, trace clay

Sieve Size (mm)	Percent Passing	No Specifications

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Fax: 519-742-7739
e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

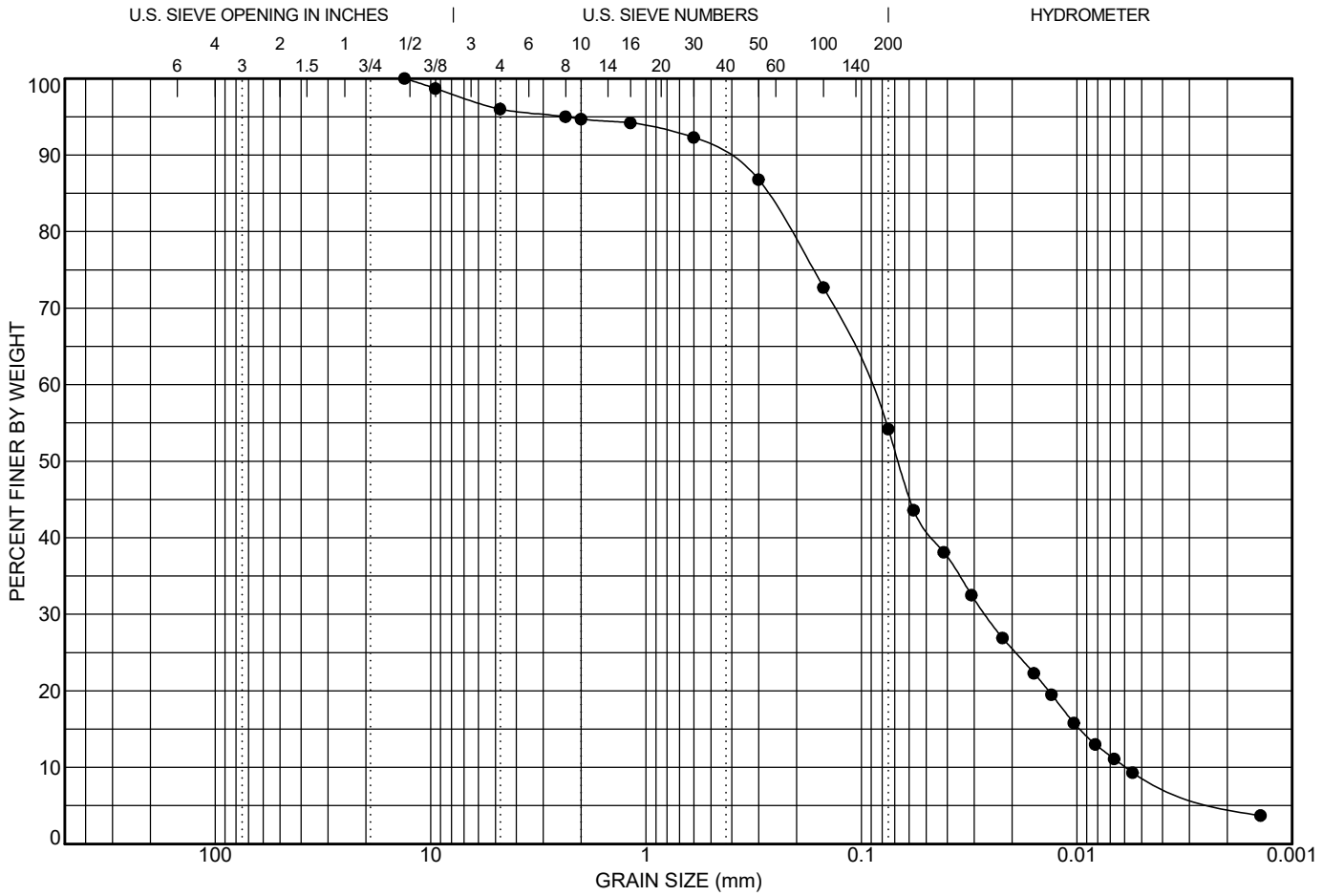
Project: Proposed Residential Development

Location: Part of Lot 13, Concession 2, Town of Erin (Ospringe)

File No.: H16051

Enclosure No.: 7

DM - NO SPECIFICATIONS H16051 - PT. LOT 13, CONCESSION 2, OSPRINGE.GPJ LAW LNDN.GDT 18-11-12



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.27	15.69	13.2	0.093	0.027	0.006	4.0	41.8	54.2	

Date: Jul. 03 - 2018
Client: Spirit of Pentecost
Contractor:
Source:
Sampled From: BH 3 - SA 2, 0.76 to 1.22 m depth
Sample No.: 3-2
Date Sampled: May. 03 - 2018
Sampled By: LC
Lab No.: 3146
Date Tested: May. 31 - 2018
Type of Material: Sand and Silt, trace gravel, trace clay

Sieve Size (mm)	Percent Passing	No Specifications

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e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

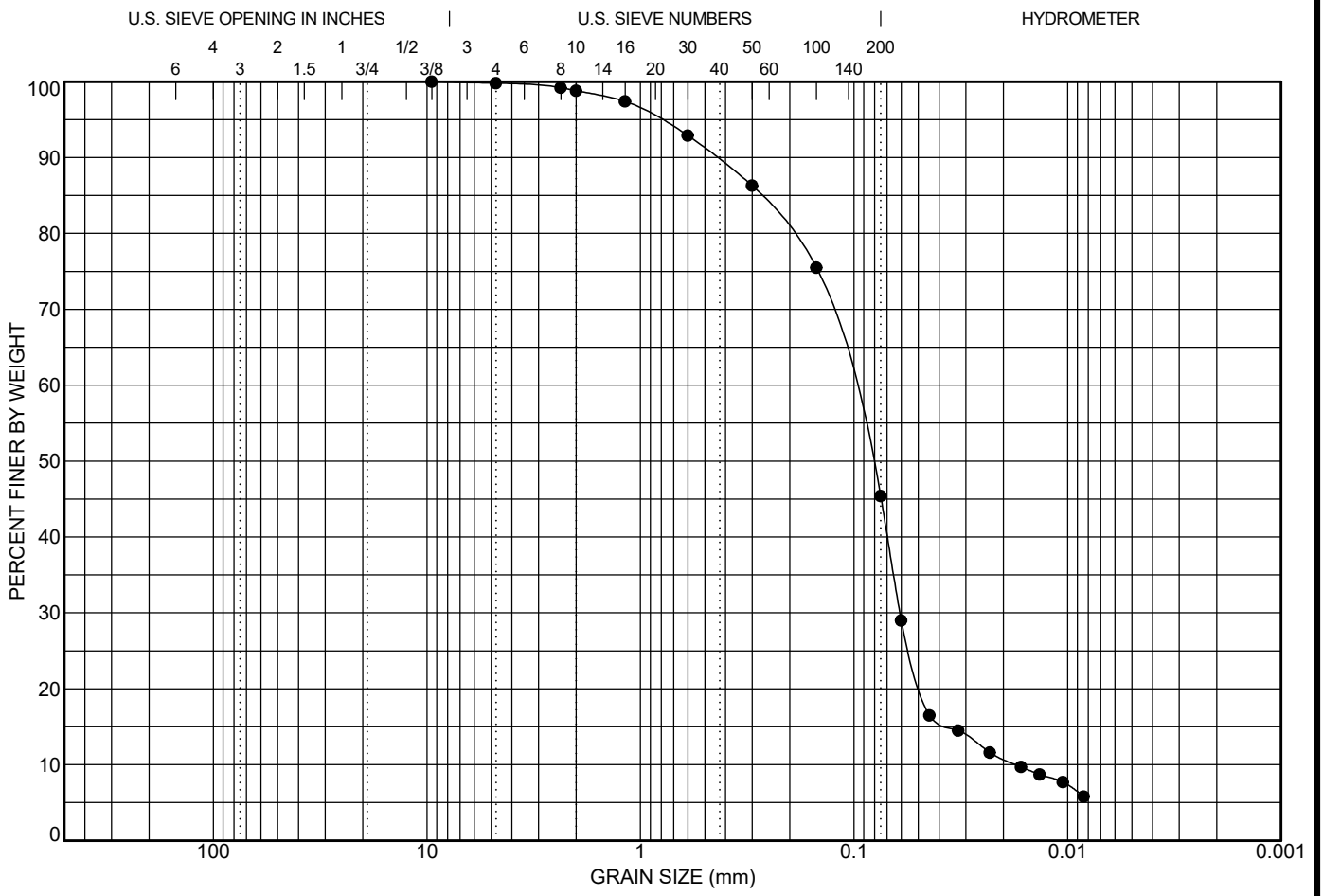
Project: Proposed Residential Development

Location: Part of Lot 13, Concession 2, Town of Erin (Ospringe)

File No.: H16051

Enclosure No.: 8

DM - NO SPECIFICATIONS H16051 - PT. LOT 13, CONCESSION 2, OSPRINGE.GPJ LAW LNDN.GDT 18-11-12



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			2.03	6.03	9.5	0.105	0.061	0.017	0.2	54.4	45.4	

Date: Jul. 03 - 2018
Client: Spirit of Pentecost
Contractor:
Source:
Sampled From: BH 3 - SA 4, 2.29 to 2.74 m depth
Sample No.: 3-4
Date Sampled: May. 03 - 2018
Sampled By: LC
Lab No.: 3147
Date Tested: May. 31 - 2018
Type of Material: Sand and Silt, trace gravel

Sieve Size (mm)	Percent Passing	No Specifications

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e-mail: info@cvdengineering.com

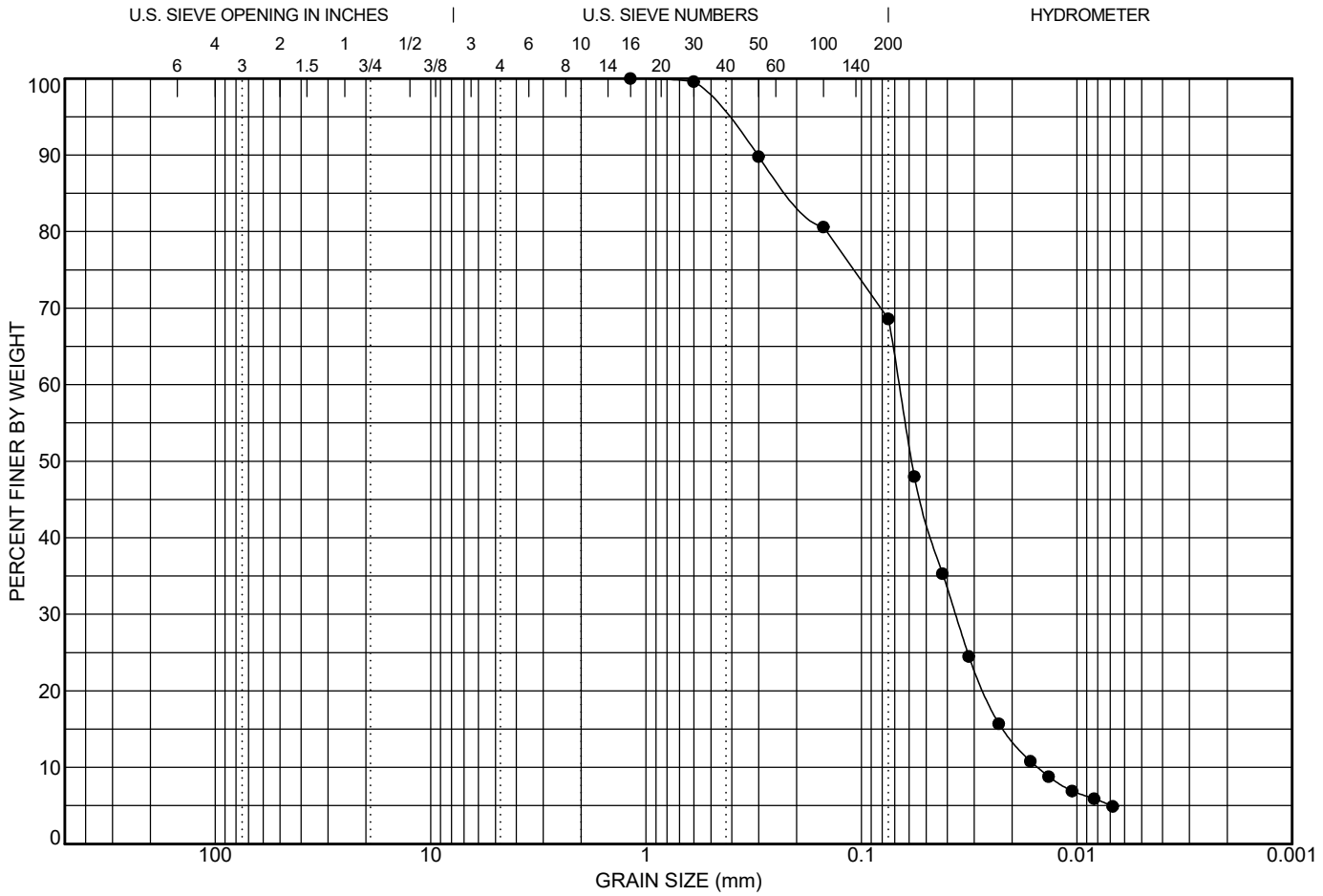
GRAIN SIZE DISTRIBUTION

Project: Proposed Residential Development

Location: Part of Lot 13, Concession 2, Town of Erin (Ospringe)

File No.: H16051

Enclosure No.: 9



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.32	4.40	1.18	0.067	0.037	0.015	0.0	31.4	68.6	

Date: Jul. 03 - 2018
Client: Spirit of Pentecost
Contractor:
Source:
Sampled From: BH 4 - SA 2, 0.76 to 1.22 m depth
Sample No.: 4-2
Date Sampled: May. 03 - 2018
Sampled By: LC
Lab No.: 3148
Date Tested: May. 31 - 2018
Type of Material: Sandy Silt

Sieve Size (mm)	Percent Passing	No Specifications

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e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

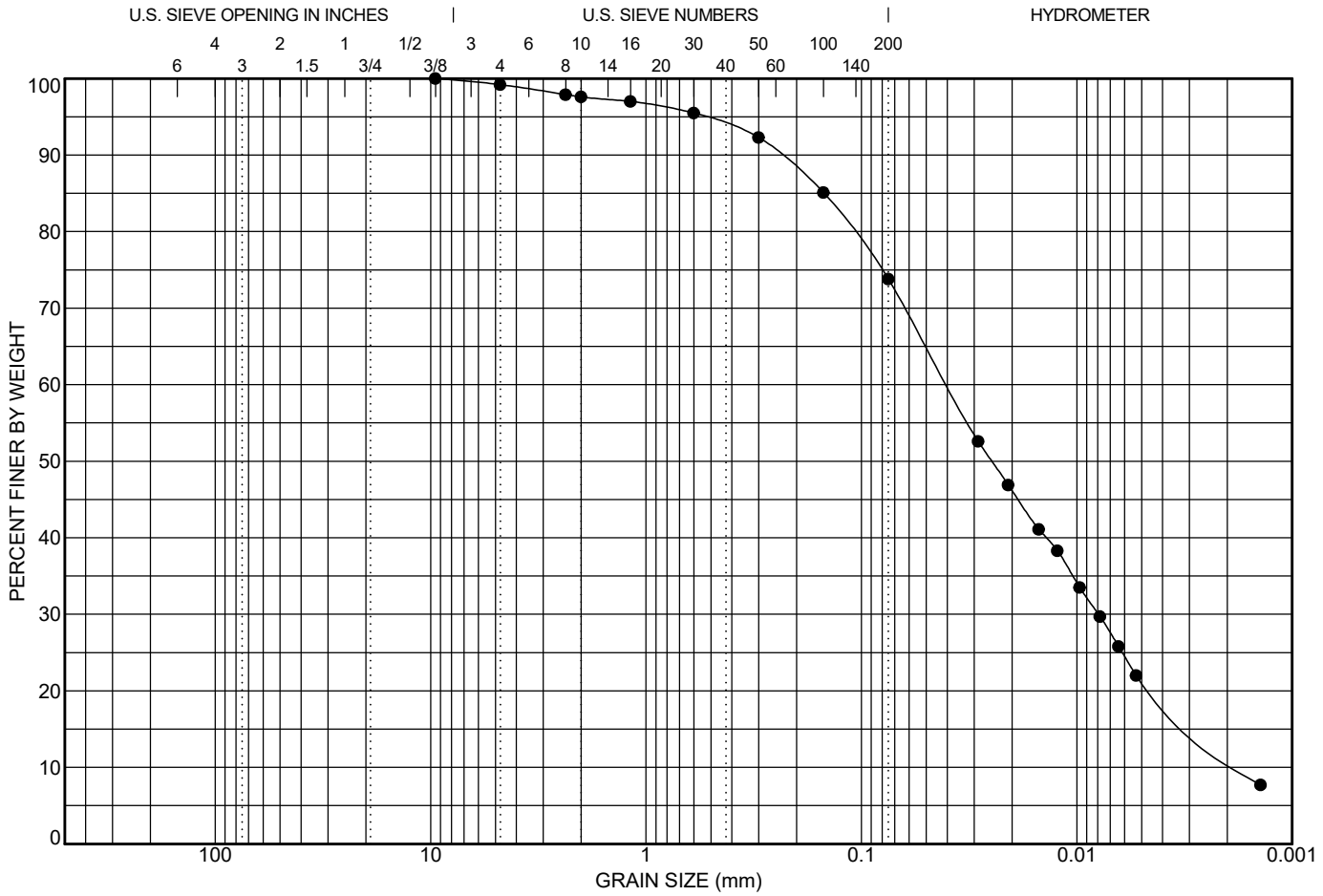
Project: Proposed Residential Development

Location: Part of Lot 13, Concession 2, Town of Erin (Ospringe)

File No.: H16051

Enclosure No.: 10

DM - NO SPECIFICATIONS H16051 - PT. LOT 13, CONCESSION 2, OSPRINGE.GPJ LAW LNDN.GDT 18-11-12



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			0.90	23.14	9.5	0.04	0.008	0.002	0.8	25.4	73.8	

Date: Jul. 03 - 2018
Client: Spirit of Pentecost
Contractor:
Source:
Sampled From: BH 5 - SA 2, 0.76 to 1.22 m depth
Sample No.: 5-2
Date Sampled: May. 03 - 2018
Sampled By: LC
Lab No.: 3149
Date Tested: May. 31 - 2018
Type of Material: Sandy Silt Till, trace gravel, trace clay

Sieve Size (mm)	Percent Passing	No Specifications

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e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

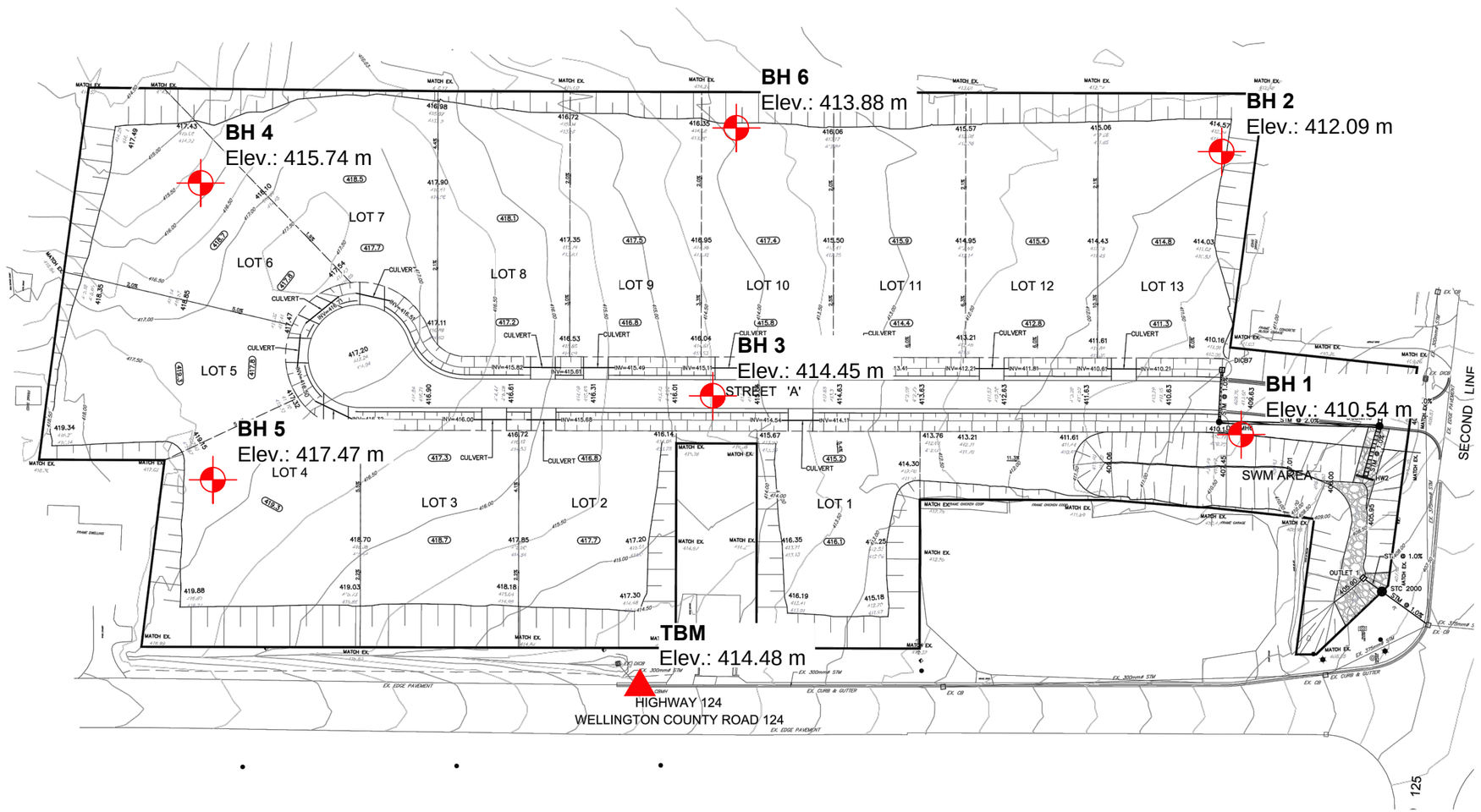
Project: Proposed Residential Development

Location: Part of Lot 13, Concession 2, Town of Erin (Ospringe)

File No.: H16051

Enclosure No.: 11

DM - NO SPECIFICATIONS H16051 - PT. LOT 13, CONCESSION 2, OSPRINGE.GPJ LAW LNDN.GDT 18-11-12



KEY PLAN **SOURCE:** Google Earth

LEGEND

TBM: Top of catchbasin/manhole at edge of pavement to westbound lane of Wellington Road 124, just west of church entrance Elev.: 414.48m (as provided to CVD by IBI Group)

Borehole Location

BOREHOLE LOCATION PLAN

Proposed Residential Development

Part of Lot 13, Concession 2
Town of Erin

CHUNG & VANDER DOELEN ENGINEERING LTD.

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

Drawn By: NZ	Date: November, 2018	File No.: G18675
Checked By: RVD	Scale: NTS	Drawing No.: 1