LVM 1961 2011

SPH Engineering

Proposed Commercial Storage Building
Regional Road 78
Township of North Dumfries, Ontario

Geotechnical Investigation Report

Prepared by:

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Property and Confidentiality

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65 Springbank Avenue North
Woodstock, Ontario N4S 8V8
Attention: Mr. Sean Panjer P.Eng.

REVISION AND PUBLICATION REGISTER		
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INTRODUCTION

LVM inc. (LVM) was retained by SPH Engineering to carry out a geotechnical investigation at the site of the proposed storage facility development in the Township of North Dumfries, Ontario. This work was authorized by Mr Sean Panjer, P.Eng. in an email dated June 17, 2011, following submission of a fee proposal for the geotechnical investigation

The project involves the proposed construction of multiple single story storage buildings, to be built on a parcel of land located in the Township of North Dumfries, at the site shown on the appended Location Plan.

The purpose of the investigation was to explore the subsurface soil and groundwater conditions at the site. Based on that information, we have prepared this engineering report with geotechnical recommendations pertaining to development. Specific considerations include site grading, excavations, building foundations and floor slabs, and stormwater infiltration.

1 INVESTIGATION METHODOLOGY

The fieldwork for this investigation was carried out on July 12, 2011 and involved seven test pits advanced to depths between 2.0 and 2.6 m below existing grade. The test pit locations are shown the appended Site Plan.

The test pits were excavated by CTS Excavating, working under the direction of a member of our engineering staff. LVM established the test pit locations, documented the subsurface soil and groundwater conditions encountered, and processed recovered samples.

Representative samples of the overburden were recovered throughout the depths explored. Soil samples secured during this investigation were returned to our laboratory for further visual examination, as well as moisture content tests. The moisture content test results are plotted on the appended test pit logs. One particle size distribution analysis was also conducted on soil likely to be used for on-site infiltration, and the results are presented on Figure 1.

2 SUMMARIZED FINDINGS

We refer to the appended test pit logs for detailed soil descriptions and stratigraphies; moisture content profiles; and, groundwater observations. In general, the subsurface stratigraphy comprised respective layers of fill, over native sand and silt.

2.1 FILL

Surficial fill was encountered in Test Pits 03-11 to 07-11 to depths between 0.4 to 1.7 m below existing grades. The fill generally comprised 150 to 400 mm of topsoil, underlain by sand. Numerous pieces of wood were encountered in the fill at Test Pit 04-11.

2.2 TOPSOIL AND BURIED PEAT

Surficial topsoil was encountered in Test Pit 02-11, located at the east side of the site. Buried coarse fibrous peat was encountered below the fill, at the west side of the site, in Test Pits 04-11 and 06-11.

2.3 SILT AND SAND

Compact sand and silt soils were encountered below the near surface soils (fill, topsoil, and peat) in all of the test holes. These soils were typically moist above 1.5 m depth and wet below, corresponding to moisture contents between 2 and 20%.

As per the Ontario Building Code, a seismic site Class D may be used for design.

The founding subgrade should be inspected and approved prior to concrete placement. Any soft areas encountered during proof-rolling should be subexcavated and backfilled with structural fill. Lean mix concrete may be used in place of structural fill.

The slabs should be wet-cured to minimize problems associated with shrinkage and curling. The wet-curing procedure typically involves placing water over the slab then covering the slab with burlap or moisture vapour barrier. The wet burlap or moisture vapour barrier should be left-in-place for at least ninety-six hours.

Given the proposed foundation system, the founding soils will not have the minimum 1.2 m of earth necessary for frost protection. At least 50 mm of polystyrene insulation will be required over the founding subgrade to provide to the necessary thermal protection.

3.4 STORMWATER MANAGEMENT

At-source infiltration is being considered. One particle size distribution analysis was conducted on a sample of the surficial fill (from Test Pit 06-11), to determine its infiltration parameters, the results are appended. Based on the results, a percolation rate of 30 mm/hr may be used for design of infiltration systems in the onsite sand fill.

Generally, soak-away pits or can be used when located in areas where the natural groundwater level is below the bottom of the pit and the native soils are relatively free-draining. Soak-away pits generally require a minimum separation between the bottom of the pit to the seasonally high water table of 1 m.

Based on the investigation findings, conventional buried infiltrations systems are generally feasible for buildings constructed on the high ground found at the east side of the site (Test Pits 01-11 and 02-11). At the west side of the site, the infiltration system design must consider the typical 1.5 m depth to groundwater. Moreover, it may not be possible to provide the appropriate separation and earth cover to infiltration pipes in this area. Alternative systems including surface storage and infiltration ponds or ditching may be considered for at-source infiltration.

The soak-away pits must be checked by LVM at the time of construction to confirm satisfactory soil conditions, and to check that the pits are being constructed in accordance with the specifications.

D=14

4 CONSTRUCTION INSPECTION AND TESTING

Geotechnical inspections and insitu density testing should be conducted during site grading in order to verify that all loose fill and organics have been properly stripped and to ensure that all fill materials are being adequately compacted. For footings, the founding subsoils must be field reviewed by LVM to ensure that the founding soil is consistent with the design bearing intended by the geotechnical engineer. During the placement of concrete, testing should be performed to determine the slump and air content of the concrete; and, concrete cylinders should be cast for compressive strength testing.

LVM operates a Canadian Council of Independent Laboratories (CCIL) certified soils and aggregates laboratory in, Brantford, Kitchener, London, and Stratford. LVM is a licensed operator of appropriate nuclear density gauges for on-site compaction testing work. LVM staff also provide quality testing services for building envelope, structural steel, reinforcing steel and roofing.

5 STATEMENT OF LIMITATIONS

The geotechnical recommendations provided 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 at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. We also recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test pits and to ensure that our recommendations are properly understood.

The geotechnical recommendations provided in this report are applicable only to the project described in the text and are intended for the use of the project designer. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect them.

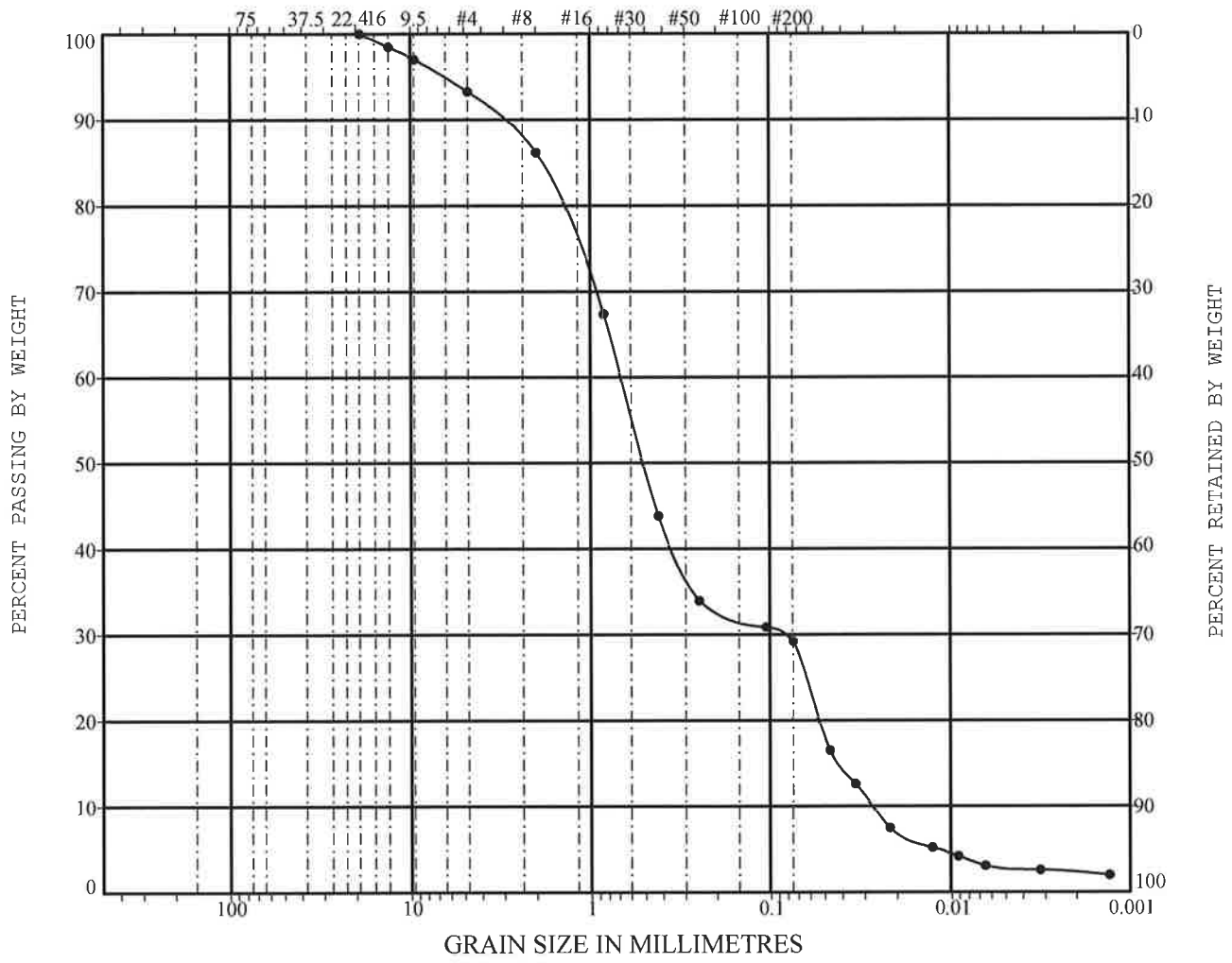
It is important to note that the geotechnical investigation involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered. The subsurface conditions between and beyond the test holes will differ from those encountered at the test holes. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions.

Appendix 1 Figures

Figure 1: Particle Size Distribution Analysis

UNIFIED SOIL CLASSIFICATION

COBBLES	*GRAVEL*		*SAND*			*SILT OR CLAY*
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN MILLIMETRES			U.S. STANDARD SIEVE No.			HYDROMETER



PROJECT Proposed Storage Buildings

LOCATION Sprague Road, Township of North Dumfries, Ontario JOB NO. P041419-100

CURVE ID	BOREHOLE/ TEST PIT	SAMPLE NO.	DEPTH (m)	SOIL DESCRIPTION
●	TP 06-11	Sa1	0.15-1.7	Silty SAND, trace Gravel

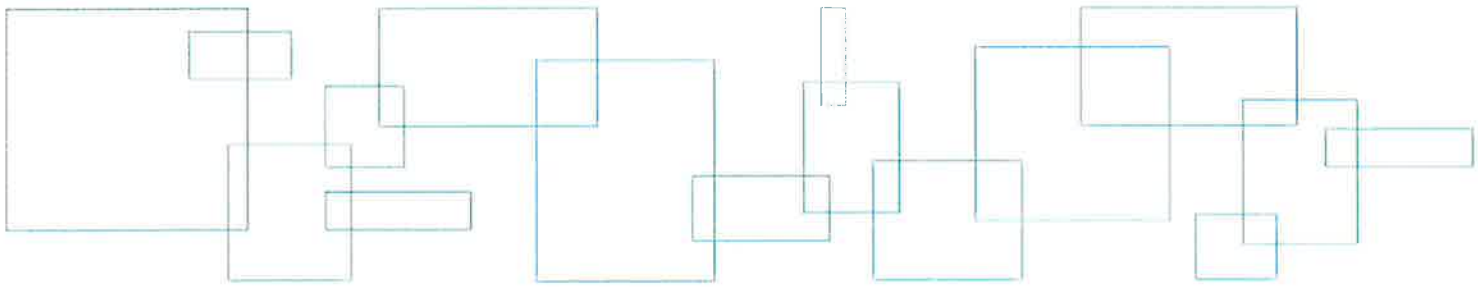
REMARKS

LVM

Figure No. 1

Appendix 2 Test Logs

List of Abbreviations
Test Pits 01-11 to 07-11



LIST OF ABBREVIATIONS

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

Sample Types		Soil Tests and Properties	
AS	auger sample	SPT	Standard Penetration Test
CS	chunk sample	UC	unconfined compression
RC	rock core	FV	field vane test
SS	split spoon	ø	angle of internal friction
TW	thin-walled, open	γ	unit weight
WS	wash sample	w_p	plastic limit
		w	water content
		w_l	liquid limit
		I_L	liquidity index
		I_p	plasticity index
		PP	pocket penetrometer

Penetration Resistances	
Dynamic Penetration Resistance	The number of blows by a 63.5 kg (140 lb.) hammer dropped 0.76 m (30 in.) required to drive a 50 mm (2 in.) diameter 60° cone a distance 0.30 m (12 in.). The cone is attached to 'A' size drill rods and casing is not used.
Standard Penetration Resistance, N (ASTM D1586)	The number of blows by a 63.5 kg. (140 lb.) hammer dropped 0.76 m (30 in.) required to drive a standard split spoon sampler 0.30 m (12 in.)
WH	sampler advanced by static weight of hammer
PH	sampler advanced by hydraulic pressure
PM	sampler advanced by manual pressure

Soil Description		
Cohesionless Soils	**SPT N-Value**	**D_r (%)**
Relative Density (D_r)	(blows per 0.30 m)	
Very Loose	0 to 4	0 to 20
Loose	4 to 10	20 to 40
Compact	10 to 30	40 to 60
Dense	30 to 50	60 to 80
Very Dense	over 50	80 to 100
Cohesive Soils	Undrained Shear Strength (C_u)	
Consistency	**kPa**	**psf**
Very Soft	less than 12	less than 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000
DTPL	Drier than plastic limit	
APL	About plastic limit	
WTPL	Wetter than plastic limit	

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Test Pit Number: 01-11

Ground Elevation: *N/A*

Project: *Proposed Storage Buildings*

Job No.: *P041419-100*

Location: *Just Store It - Spragues Road, Township of North Dumfries, ON*

Excavation Date: *2011-07-11*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	WP — Water Content (%) — WL (10, 20, 30)	Groundwater Observations and Measurements (m)
0,00	Ground Elevation		0,00			
	SAND: loose to compact brown gravelly sand, trace silt, moist		-0,50			
1,00			-1,00			
			-1,50			
2,00			-2,00			
	Test Pit terminated at 2.1 m		-2,50			Upon completion of excavation, test pit sidewalls stable No free groundwater encountered

Reviewed by: *WLoghrin*

Drafted by: *SMeteer*

Field Tech: *WLoghrin*

Sheet: *1 of 1*

Notes:

LVM

Test Pit Number: 02-11

Ground Elevation: *N/A*

Project: *Proposed Storage Buildings*

Job No.: *P041419-100*

Location: *Just Store It - Spragues Road, Township of North Dumfries, ON*

Excavation Date: *2011-07-11*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	WP — Water Content (%) — WL (10, 20, 30)	Groundwater Observations and Measurements (m)
0,00	Ground Elevation		0,00			
	TOPSOIL: dark brown silty sand, moist					
	SAND: compact brown silty sand, moist		-0,50			
	trace to some silt					
1,00			-1,00			
			-1,50			
2,00	Test Pit terminated at 2.0 m		-2,00			Upon completion of excavation, test pit sidewalls stable No free groundwater encountered
			-2,50			

Reviewed by: *WLoghrin*

Drafted by: *SMeteer*

Field Tech: *WLoghrin*

Sheet: *1 of 1*

Notes:

LVM

Test Pit Number: 03-11

Ground Elevation: *N/A*

Project: *Proposed Storage Buildings*

Job No.: *P041419-100*

Location: *Just Store It - Spragues Road, Township of North Dumfries, ON*

Excavation Date: *2011-07-11*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	WP — Water Content (%) — WL (10, 20, 30)	Groundwater Observations and Measurements (m)
0,00	Ground Elevation		0,00			
	FILL: dark brown sand (topsoil), some gravel and silt, moist		-0,50			
	SAND: sand, some silt and gravel, moist					
1,00			-1,00			
	wet		-1,50			Major groundwater seepage encountered at 1.5 m
2,00	Test Pit terminated at 2.0 m		-2,00			Upon completion of excavation, test pit sidewalls unstable with cave at 1.5 m
			-2,50			

Reviewed by: *WLoghrin*

Drafted by: *SMeteer*

Field Tech: *WLoghrin*

Sheet: *1 of 1*

Notes:

LVM

Test Pit Number: 04-11

Ground Elevation: *N/A*

Project: *Proposed Storage Buildings*

Job No.: *P041419-100*

Location: *Just Store It - Spragues Road, Township of North Dumfries, ON*

Excavation Date: *2011-07-11*

Depth (m)	Description	Symbol	Elevation (m)	Sample Number	Water Content (%) WP / WL	Groundwater Observations and Measurements (m)
0,00	Ground Elevation		0,00		WP WL; 10 20 30	
	FILL: dark brown silt (topsoil), moist					
	brown silt, some sand, numerous pieces of wood		-0,50			
1,00	***PEAT:*** dark brown coarse fibrous peat, wet		-1,00	1		
	SAND: grey sand, some silt, wet		-1,50			
2,00			-2,00	2		
	Test Pit terminated at 2.2 m		-2,50			Upon completion of excavation, test pit sidewalls unstable with cave at 1.8 m

Reviewed by: *WLoghrin*

Field Tech: *WLoghrin*

Notes:

Drafted by: *SMeteer*

Sheet: *1 of 1*

LVM

Test Pit Number: 05-11

Ground Elevation: *N/A*

Project: *Proposed Storage Buildings*

Job No.: *P041419-100*

Location: *Just Store It - Spragues Road, Township of North Dumfries, ON*

Excavation Date: *2011-07-11*

Depth (m)	Description	Symbol	Elevation (m)	Sample Number	Water Content (%) (WP / WL; 10, 20, 30)	Groundwater Observations and Measurements (m)
0,00	Ground Elevation		0,00			
	FILL: brown sandy silt, some topsoil					
	SILT: compact brown sandy silt		-0,50			
	SAND: compact brown sand, moist					
1,00			-1,00			
	becoming wet		-1,50			Major groundwater seepage encountered at 1.5 m
2,00	Test Pit terminated at 2.0 m		-2,00			Upon completion of excavation, test pit sidewalls unstable with cave at 1.5 m
			-2,50			

Reviewed by: *WLoghrin*

Drafted by: *SMeteer*

Field Tech: *WLoghrin*

Sheet: *1 of 1*

Notes:

LVM

Test Pit Number: 06-11

Ground Elevation: *N/A*

Project: *Proposed Storage Buildings*

Job No.: *P041419-100*

Location: *Just Store It - Spragues Road, Township of North Dumfries, ON*

Excavation Date: *2011-07-11*

Depth (m)	Description	Symbol	Elevation (m)	Sample Number	Water Content (%) (WP / WL; 10, 20, 30)	Groundwater Observations and Measurements (m)
	Ground Elevation		0,00			
0,00	***FILL:*** brown silt (topsoil)					
	compact sand, some gravel and silt, moist		-0,50			
1,00			-1,00			
	becoming silty, wet		-1,50	1		Major groundwater seepage encountered at 1.5 m
	PEAT: dark brown fibrous peat, wet					
2,00	***SILT:*** grey clayey silt, some sand, APL		-2,00	2		
			-2,50	3		
	Test Pit terminated at 2.6 m					Upon completion of excavation, test pit sidewalls unstable with cave at 2.3 m

Reviewed by: *WLoghrin*

Drafted by: *SMeteer*

Field Tech: *WLoghrin*

Sheet: *1 of 1*

Notes:

LVM

Test Pit Number: 07-11

Ground Elevation: *N/A*

Project: *Proposed Storage Buildings*

Job No.: *P041419-100*

Location: *Just Store It - Sprague Road, Township of North Dumfries, ON*

Excavation Date: *2011-07-11*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	WP — Water Content (%) — WL (10, 20, 30)	Groundwater Observations and Measurements (m)
0,00	Ground Elevation		0,00			
	FILL: dark brown sandy silt (topsoil), damp					
	loose sand, some silt, moist		-0,50			
1,00			-1,00			
	SILT: brown sandy silt, moist			1		
	SAND: brown sand, some silt, wet		-1,50			Major groundwater seepage encountered at 1.5 m
2,00	Test Pit terminated at 2.0 m		-2,00			Upon completion of excavation, test pit sidewalls unstable with cave at 1.4 m
			-2,50			

Reviewed by: *WLoghrin*

Drafted by: *SMeteer*

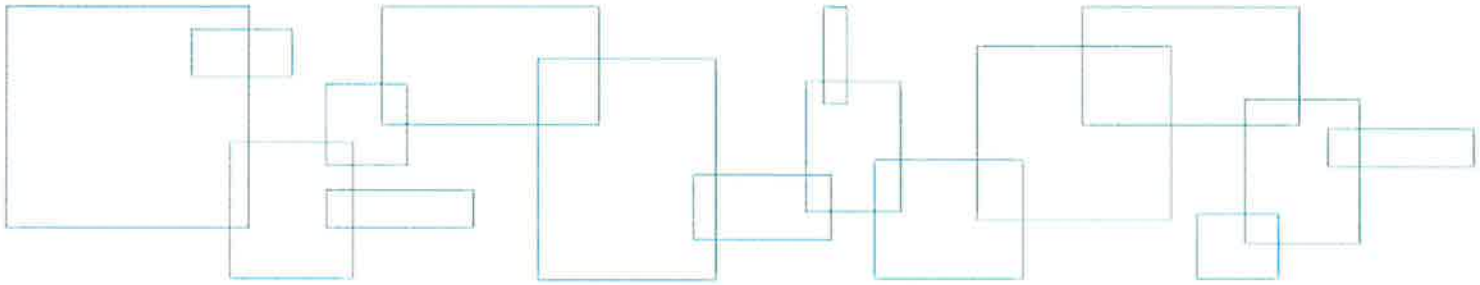
Field Tech: *WLoghrin*

Sheet: *1 of 1*

Notes:

Appendix 3 Drawings

Drawing 1: Location Plan
Drawing 2: Site Plan
Drawing 3: Typical Structural Fill Pad



NOTES :
1-REFERENCES : GRAND RIVER CONSERVATION AUTHORITY, 2006 aerial photography (2011).

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Project

Proposed Storage Buildings

Sprague Road, Township of North Dumfries, Ontario

Title

LOCATION PLAN

LVM inc.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	SMeteer	Discipline	GEOTECHNICAL	Project manager	WLoghrin
Drawn	SMeteer	Scale	1:10000	Sequence no.	01 of 03
Checked	WLoghrin	Date	2011-07-19		

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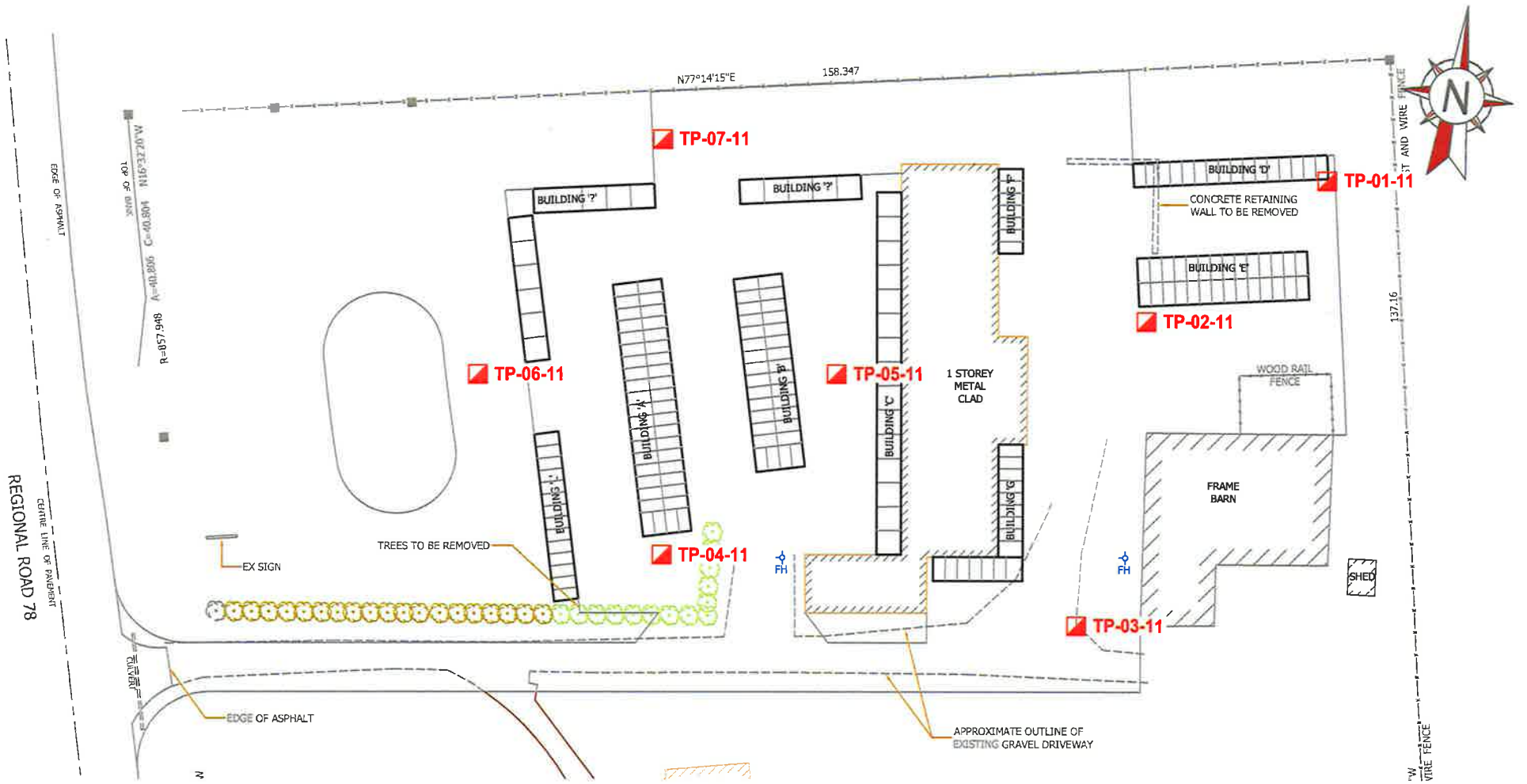

LEGEND :

TEST PIT LOCATION

NOTES :

1-REFERENCES : SPH ENGINEERING INC., Project 11013, Drawing P1, 2011-03-30

Project

Proposed Storage Buildings

Sprague Road, Township of North Dumfries, Ontario

Title

SITE PLAN

LVM inc.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	SMeteer	Discipline	GEOTECHNICAL	Project manager	WLoghrin
Drawn	SMeteer	Scale	1:750	Sequence no.	02 of 03
Checked	WLoghrin	Date	2011-07-19		

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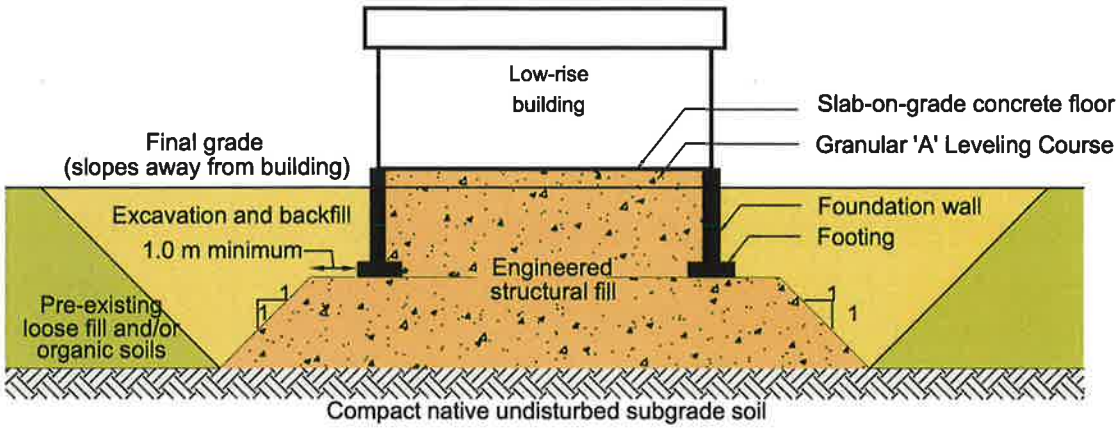


GENERAL REQUIREMENTS FOR ENGINEERED STRUCTURAL FILL

1. The area must be excavated of all pre-existing loose fill, topsoil, and/or organic soil until compact native undisturbed soil is reached.

2. The excavation should allow for the structural fill to extend 1.0 m beyond the outside edge of the building footings and down to the approved subgrade soil at a slope of 1 horizontal to 1 vertical (45 °).

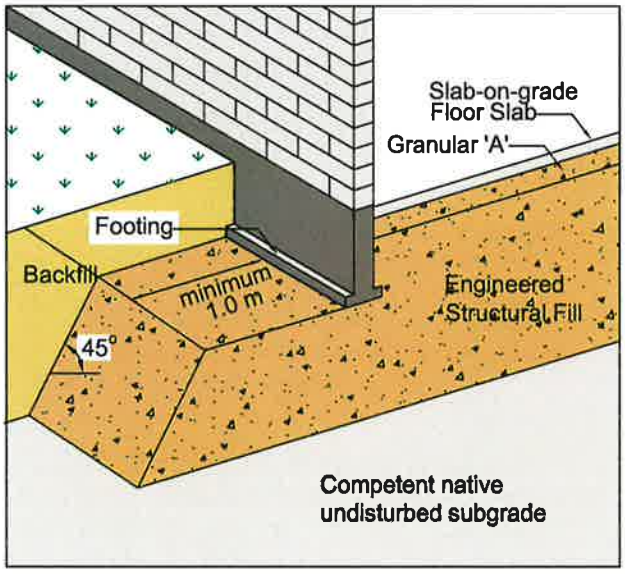
3. The subgrade below the engineered fill should be inspected and approved by a geotechnical engineer prior to fill construction. Fill placement and compaction operations to be carried out under full-time geotechnical supervision.

4. The structural fill should comprise sand and gravel aggregate placed in 300 mm thick lifts and compacted to at least 100% Standard Proctor Maximum Dry Density (SPMDD). The exterior backfill should consist of approved inorganic soil also placed in 300 mm thick lifts and compacted to minimum 95% SPMDD.

5. A minimum 150 mm thick layer of Granular 'A' should be placed directly below the floor slab for leveling and support purposes.

6. Exterior footings should be provided with minimum 1.2 m of soil cover for frost protection, or equivalent insulation

7. All excavations must be carried out in conformance with the current Ontario Occupational Health and Safety Act and Regulations 213/91 for construction projects.



Project

Proposed Storage Buildings

Sprague Road, Township of North Dumfries, Ontario

Title

TYPICAL STRUCTURAL FILL PAD

LVM inc.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	SMeteer	Discipline	GEOTECHNICAL	Project manager	WLoghrin
Drawn	SMeteer	Scale	NTS	Sequence no.	03 of 03
Checked	WLoghrin	Date	2011-07-19		

M. dept.	Project	Work pckg.	Sub-w.p.	Disc.	Drawing no.	Rev.
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