October 6, 2025 CA0059481.3139

Mr. Todd Barber
Forestgreen Creations
25 Pelham Town Square
Fonthill, ON, L0S 1E0

SLOPE STABILITY ASSESSMENT
10165 CEDAR CREST ROAD,
PORT COLBORNE, ONTARIO

Dear Mr. Barber:

WSP Canada Inc. (WSP) completed a slope stability assessment at 10165 Cedar Crest, Port Colborne, Ontario (Site) in proximity to the Lake Erie shoreline. We understand that the property owner plans to construct a new garage on a slope east of the existing dwelling. The property is located on a Lake Erie shoreline dune and as part of the permitting process the NPCA requires that a qualified geotechnical engineer determine if the proposed works will negatively affect the global stability of the dune slope.

BACKGROUND

The property was previously investigated by McGlone and Associates in 1994. Two geotechnical boreholes were advanced through the dune soils to provided subsurface geotechnical and groundwater properties for the Site. WSP conducted an updated field assessment at the Site September 26, 2025. The subject slope contains an approximately 5 m high east facing slope and is not facing the Lake Erie shoreline; the toe of the slope is therefore not subject to Lake Erie wave erosion, and the site is located beyond the Stable Allowance for Great Lakes Shoreline Hazards. The slope was observed to be well vegetated at the time of inspection including mature trees. An existing septic system is located to the south of the slope in question.

WSP observed no evidence of soil creep, overturned trees or other signs of erosion. No evidence of slope movement or instability was observed at the time of the Site inspection. There was no visible displacement of the armour stone or the visible components of the septic system. In addition, no springs or seeps were observed on the slope. Photographs of the slope from the inspection are appended.

SLOPE ASSESSMENT

As part of the assessment of the slope, WSP completed the following work:

- A site visit to note site features and observations that could potentially impact on slope stability were noted.

- A review McGlone & Associates slope stability report (1994) and the AMEC slope stability report update (2014) appended.
- A review of historic information including historic air photos and local topographic contour maps including NPCA mapping.
- A 2-dimensional limit equilibrium assessment of the slope stability (Mohr-Coulomb analysis) was performed using assumed soil parameters.

Slope Stability Analysis

Historic air photos, and NPCA watershed mapping (2018) were also reviewed as inputs to the slope stability analysis.

A cross section of the property has been prepared based on NPCA data which conforms to our observations of the slope.

WSP modelled the inferred slope profile using GeoStudio 2023 R2 – SlopeW software. A Mohr-Coulomb analysis was used to evaluate the Factor of Safety (FOS) for a representative two-dimensional section. Conservative input soil parameters and groundwater conditions for the analysis were assumed based on previous work WSP has done in the area and data from the McGlone & Associates slope stability report (1994). A conservative shallow water table was assumed as shown in the attached section. A surcharge load of 50 kN/m^3 representing the potential structural load from the proposed new garage was applied to the dune surface of the construction area as shown in the architectural drawings provided by Forestgreen Creations (attached). This approach conservatively ignores the slope stabilizing forces of the subsurface building footings and concrete foundation.

In the seismic scenario (Figure 2), a horizontal peak ground acceleration (PGA) of 0.203 g was applied to generate a pseudo-seismic stability analyses for the slope cross-section. The PGA value corresponds to the 2%/50 year's probability earthquake for the site location, as determined using the 2015 National Building Code of Canada seismic hazard calculator.

Table 1: Soil Stability Analysis Parameters

Parameter		
Material	Dune Sand	Bedrock
Soil unit weight	19 kN/m^3	Impenetrable
Soil cohesion/undrained shear strength	0 kPa	Impenetrable
Soil internal friction angle (drained)	32	Impenetrable

Model outputs are attached as Figure 1 and Figure 2. In the attached figures, the Factor of Safety (FOS) associated with the new garage construction is above 1.5 in the static condition and at 1.0 in the pseudo –seismic case.

This minimum factor of safety is considered sufficient where:

- Structures are associated with the slope, or;

- Where human health and safety are at risk, or; and
- Where soil properties are assumed.

Therefore, the proposed new garage has an acceptable FOS against global stability of the existing slope and the construction will not negatively impact the global stability of the slope.

RECOMMENDATIONS

Our investigation indicates that the subject slope is stable with an acceptable FOS and should remain so provided care is taken not to disturb existing vegetated areas, or where disturbance occurs, the vegetation is replaced with new vegetation or suitable terracing that prevents erosion.

The following points are provided for further consideration:

- The construction shall not disturb the adjacent slope. Any additional excavation or fill placed on the slope, including toe and crest areas, should be approved by regulatory agencies in advance.
- Drainage systems shall discharge away from the slope surface. Grading should be completed to minimize runoff towards the slope and to prevent the development of concentrated flow channels and down-slope erosion. Resistive (deep-rooted) slope vegetation should be maintained to inhibit erosion from runoff. Permission should be obtained from the NPCA before any significant slope modifications are made.

WSP should be contacted prior to any slope alterations to review impacts on our assessment. Approval from the NPCA will be required for any slope modifications.

LIMITATIONS

This report is based on the existing site conditions and our understanding of the construction. Our comments are based on the observed Site conditions at the time of our inspection.

This report is not an assessment of the proposed design or its construction. Our analysis is an assessment of the stability of the subject slope and is not intended as instructions to the designers or contractors.

We trust this report satisfies your requirements. Please contact our office if you have any questions.

WSP Canada Inc.

Steven Kellerman, B.Sc., C. Tech., rcji
Project Technician

Kevin Fitzpatrick, P.Eng.
Senior Project Engineer

SK/KF/rc

CC: [Click here and type list of CCs]

Attachments: WSP ref: CA0059481.3139

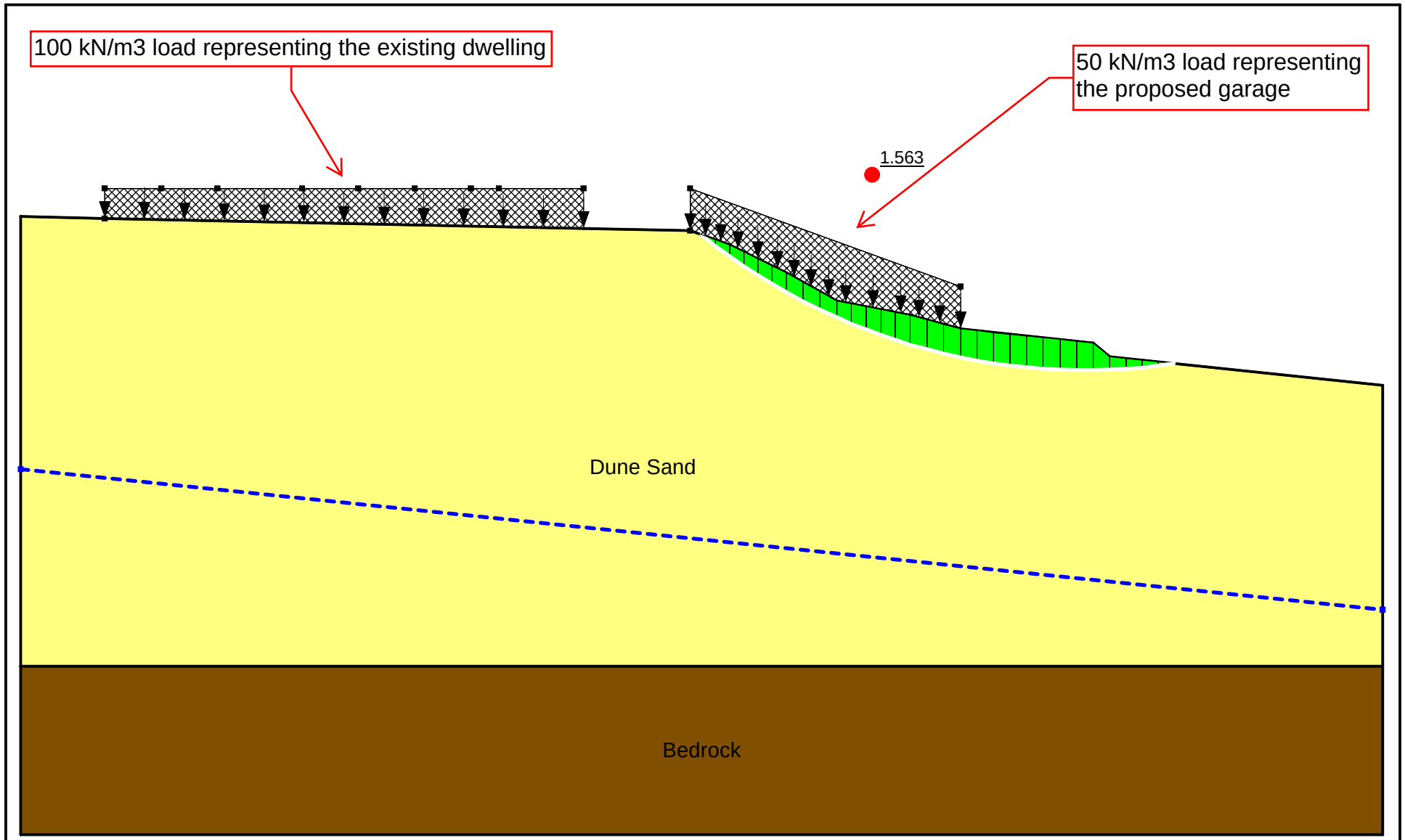
APPENDIX

PHOTOS:

SLOPE FACING WEST

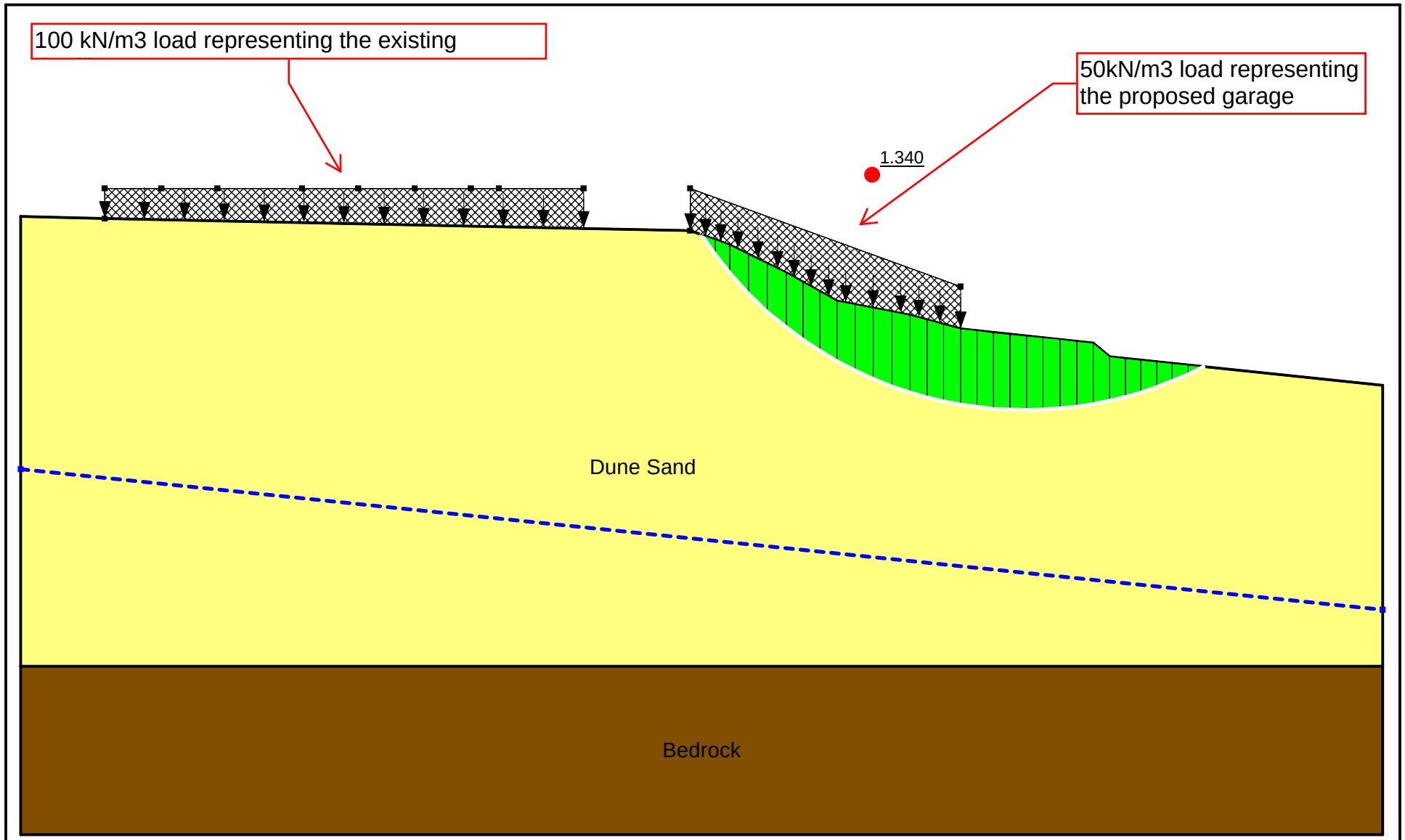
SLOPE FACING NORTH WEST

TOP OF SLOPE FACING SOUTH



Slope Stability with Proposed Structure 50 kN/m3	
SSA 10165 Cedar Crest 1.gsz	
2025-10-03	1:195.27957

FIGURE 1



Slope Stability with Proposed Structure 50 kN/m3 Pseudo-Seismic	
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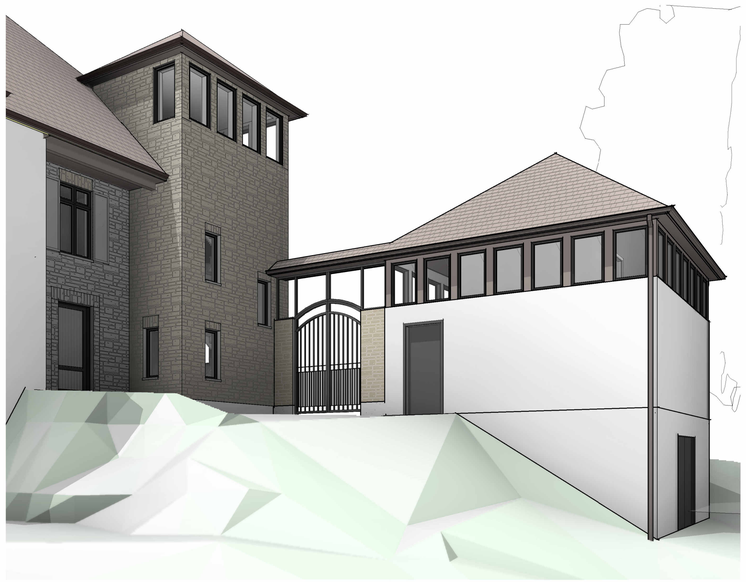
2025-10-03	1:195.27957

FIGURE 2



#	SHEET NAME
A0.0	Title Page
A1.0	Site Plan
A1.1	Grading Plan
A2.1	Floor + Roof Plans
A3.0	Elevations
A4.0	Building Sections
S1.0	Structural

PROJECT TEAM

OWNER
Merle + Stacie Beam
289 341 0510
merleb@blackcreekmetal.com

ARCHITECTURE
Forestgreen Design Build
Todd Barber
905-892-9737
todd@forestgreencreations.com

STRUCTURAL
Revive Structural Engineering
Matt Reid
905 606 0039
info@revive.team

MECHANICAL
OMG Engineering
Philip Gabany
289 686 2241
omgengineeringca@gmail.com

New Construction

Beam Garage Addition

10165 Cedar Crest Rd, Wainfleet, ON L3K 5V4

FORESTGREEN

FORESTGREEN CREATIONS INC.
DESIGN + BUILD

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L0S 1E0

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PROJECT

Beam Garage Addition

10165 Cedar Crest Rd, Wainfleet, ON L3K 5V4

GENERAL NOTES

Drawings represent only a portion of the work and are to be read in conjunction with all documentation to understand the full extent of the work required. This includes but is not limited to, specifications, and structural, mechanical and civil documentation. Contractor is to check and verify all dimensions and conditions on the project.

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Drawings not to be used for permit or construction unless specified in revision schedule and signed. Drawings are not to be scaled.

REVISION SCHEDULE

#	Revision Description	Date
	Issued for Concept	06.19.2025
	Issued for Client Review	07.18.2025
	Issued to Co-Consultants	08.19.2025
	Issued for Client Review	08.28.2025

PRELIMINARY

DATE	8/28/2025 11:44:57 AM
SCALE	
PROJECT NO.	25-001

The undersigned has reviewed and takes responsibility for this design, and has the qualifications and meets the requirements set out in the Ontario Building Code to be a Designer

QUALIFICATION INFORMATION
Required unless design is exempt under 3.2.4. Division C of the building code

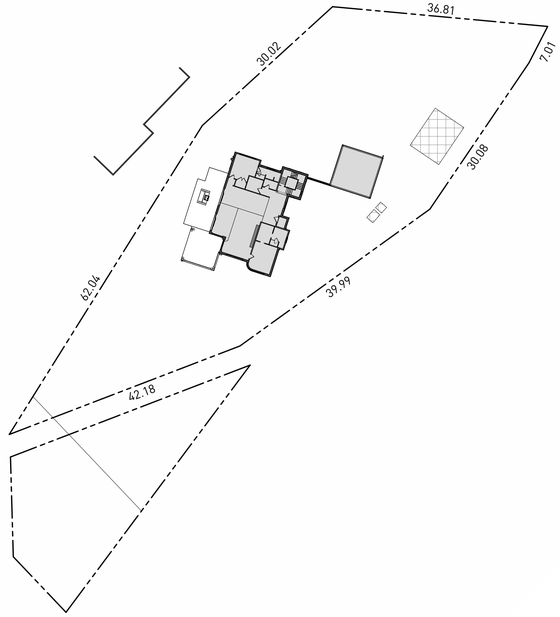
FULL NAME	BCIN	SIGNATURE
Todd Barber	22666	

REGISTRATION INFORMATION
Required unless design is exempt under 3.2.4. Division C of the building code

FULL NAME	BCIN	SIGNATURE
Forestgreen Creations Inc.	30817	FG

SHEET NAME
Title Page

SHEET NO.
A0.0



4 **Key Plan**
1" = 40'-0"

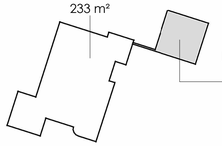
Zoning: RLS.C10-21
10% total lot coverage

Dwelling Zoning Details: Min. setback from any lot line: 6m
Min. front yard setbacks for detached private garage and detached carport: 2.1m

Existing Dwelling Area

2509 ft²

233 m²



Proposed Addition Area

587 ft²

55 m²

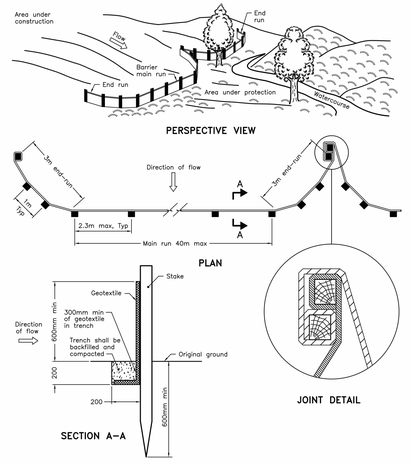
3 **Lot Coverage Plan**
1" = 40'-0"

Name	Area FT²	Area M²
Lot Area	32,425	3,012

Name	Area FT²	Area M²	% of Lot
Proposed Addition Area	587	55	1.73%
Existing Dwelling Area	2,509	233	7.40%
			9.13%

2 **Site Statistics**
N.T.S

1 **Site Plan**
3/32" = 1'-0"



NOTE: All dimensions are in millimetres unless otherwise shown

LIGHT-DUTY SILT FENCE BARRIER DETAIL

FORESTGREEN CREATIONS INC.
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PROJECT

Beam Garage Addition

10165 Cedar Crest Rd, Wainfleet, ON L3K 5V4

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REVISION SCHEDULE

#	Revision Description	Date
	Issued For Accessory Layout	04.08.2025
	Issued for Concept	06.19.2025
	Issued for Client Review	07.18.2025
	Issued to Co-Consultants	08.19.2025
	Issued For NPCA Review	08.28.2025
	Issued for Client Review	08.28.2025

DATE	8/28/2025 11:45:03 AM
SCALE	As indicated
PROJECT NO.	25-001

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Todd Barber	22666	
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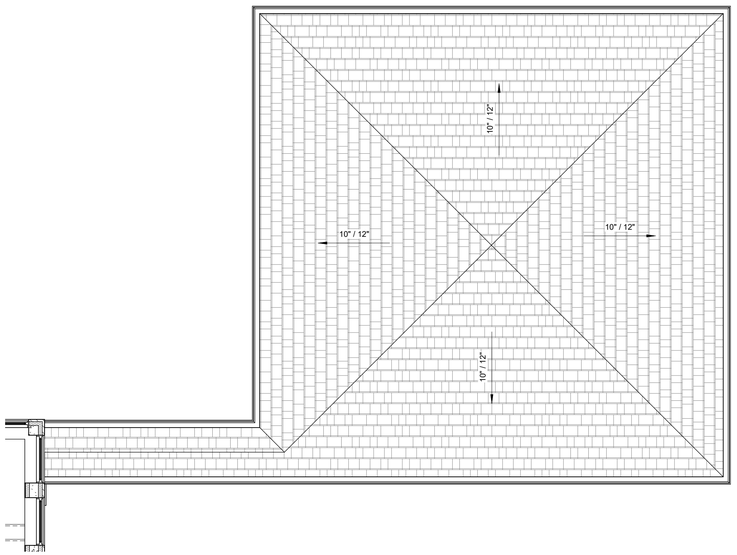
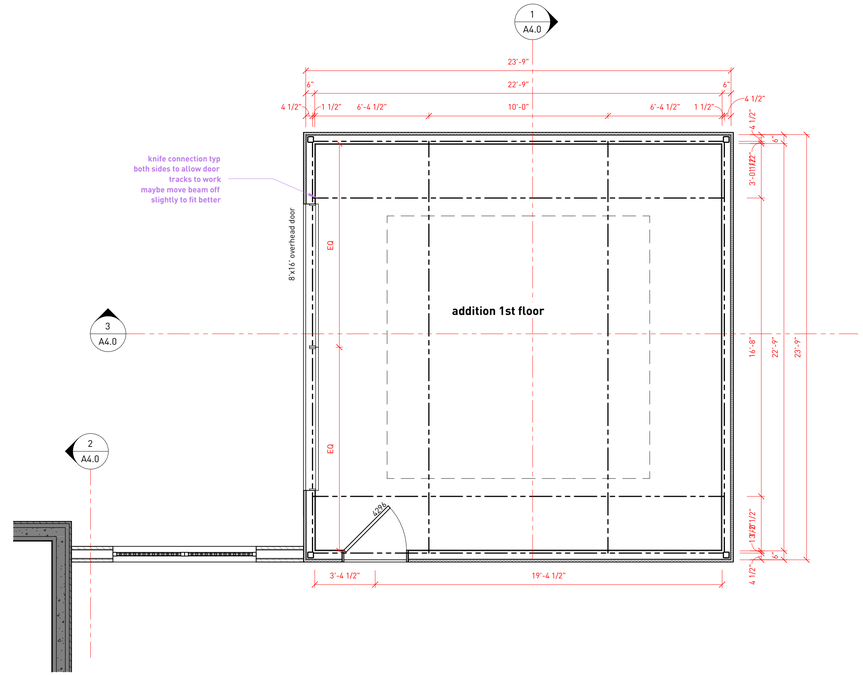
Forestgreen Creations Inc.	30817	FG
FULL NAME	**BCIN**	**SIGNATURE**

SHEET NAME
Site Plan

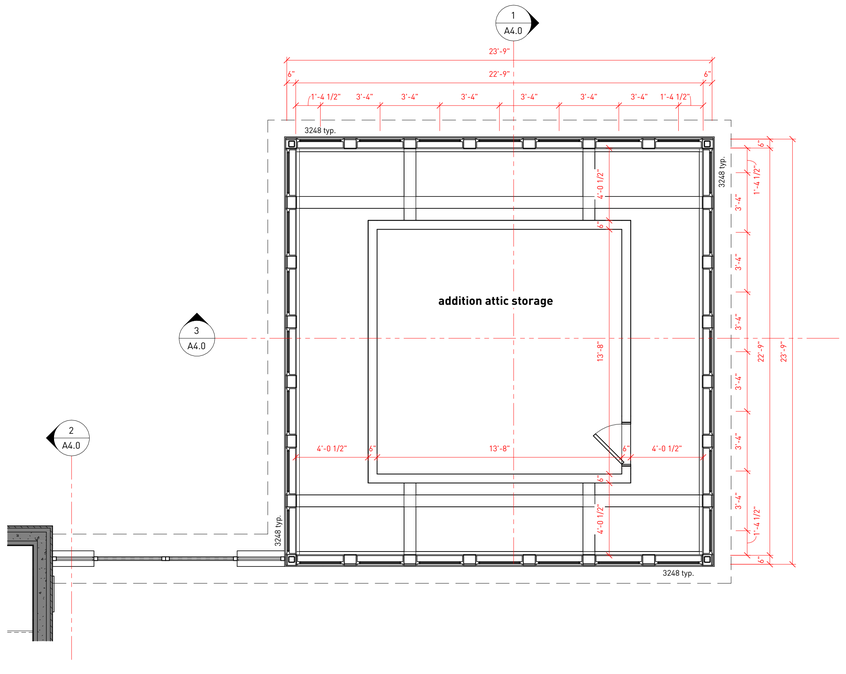
SHEET NO.
A1.0



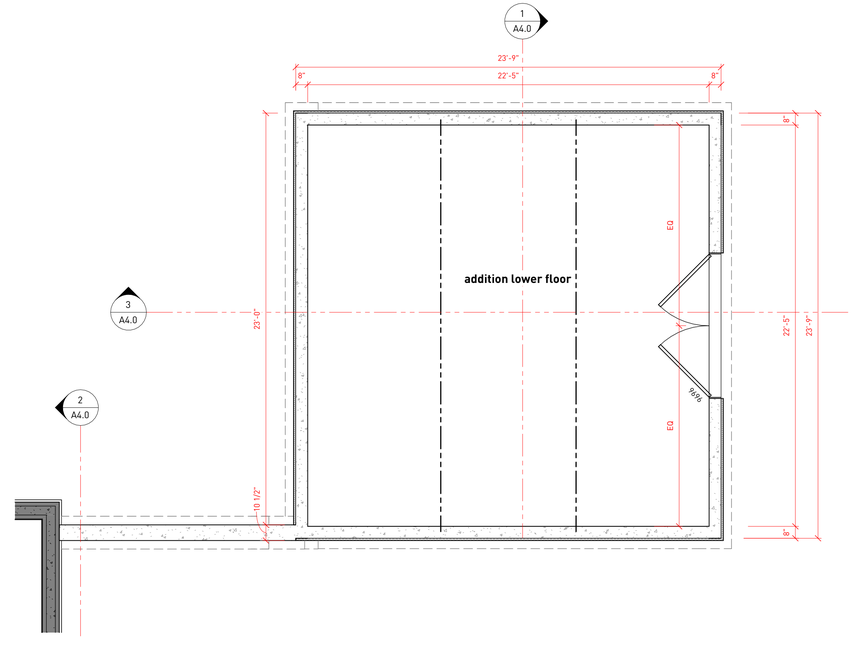
3 Roof Plan
1/4" = 1'-0"



2 Addition 1st Fl. Plan
1/4" = 1'-0"



4 Addition 2nd Fl. Plan
1/4" = 1'-0"



1 Addition Lower Fl. Plan
1/4" = 1'-0"

◯ S/Co	Smoke/CO detector to be installed per OBC 9.10.19 and 6.2.12

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PROJECT

Beam Garage Addition

10165 Cedar Crest Rd, Wainfleet, ON L3K 5V4

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	Issued for Client Review	08.28.2025

PRELIMINARY

DATE	8/28/2025 11:53:39 AM
SCALE	1/4" = 1'-0"
PROJECT NO.	25-001

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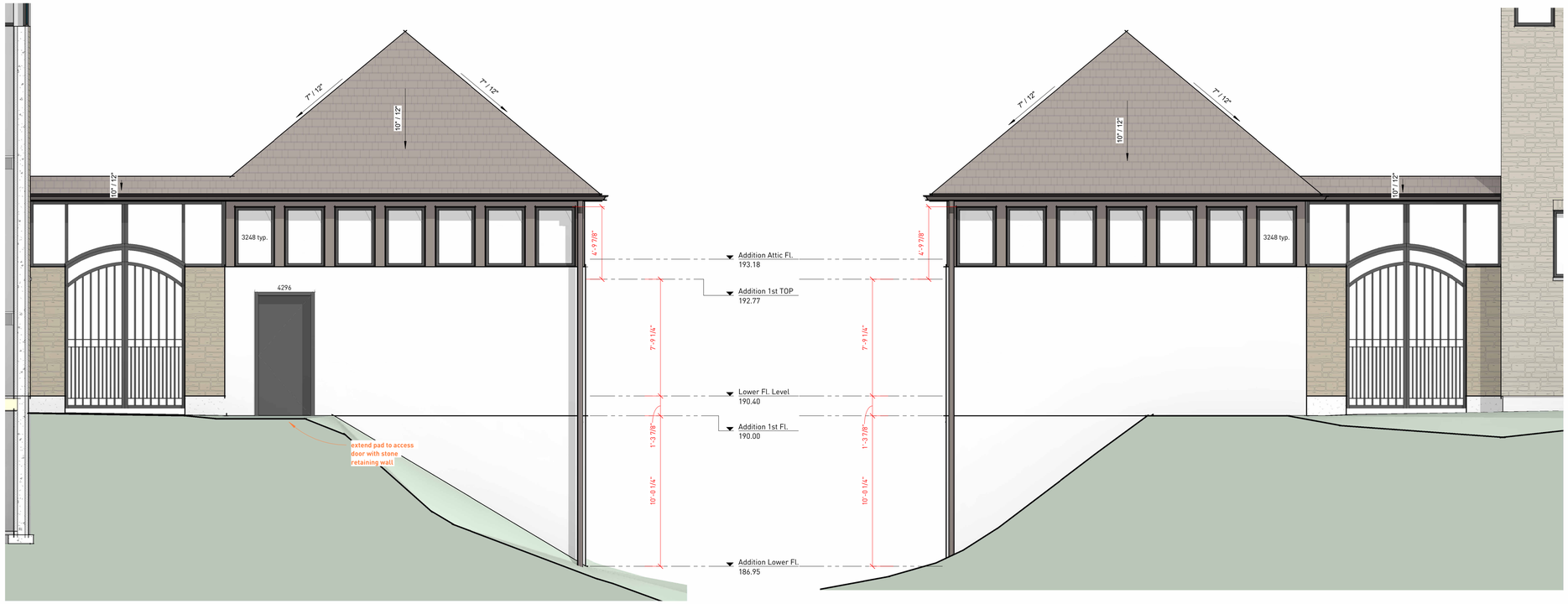
Forestgreen Creations Inc.	30817	FG
FULL NAME	**BCIN**	**SIGNATURE**

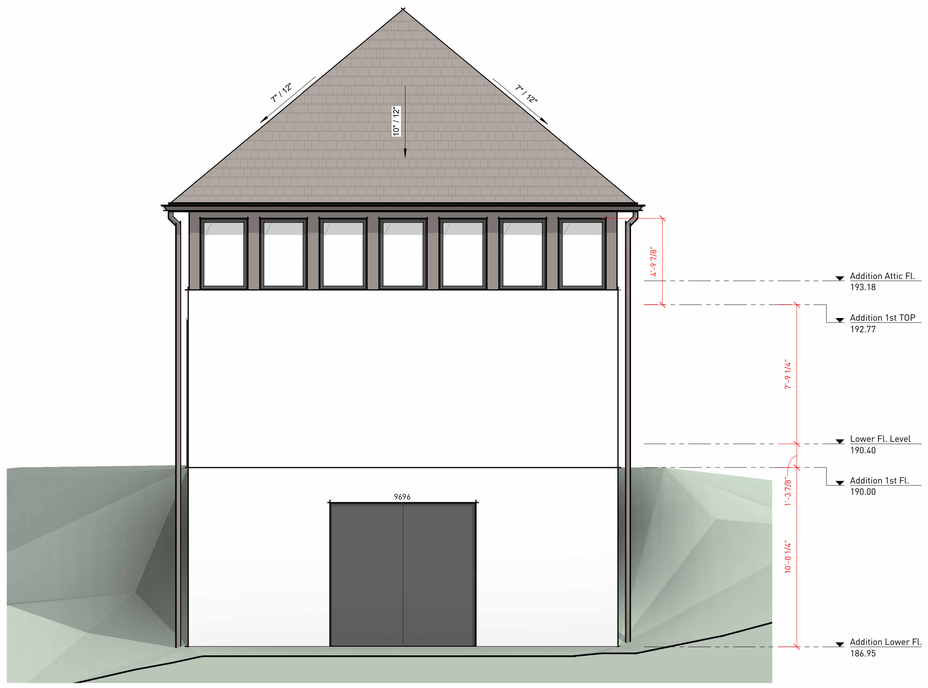
SHEET NAME
Floor + Roof Plans

SHEET NO.
A2.1



4 Right Elevation

1/4" = 1'-0"

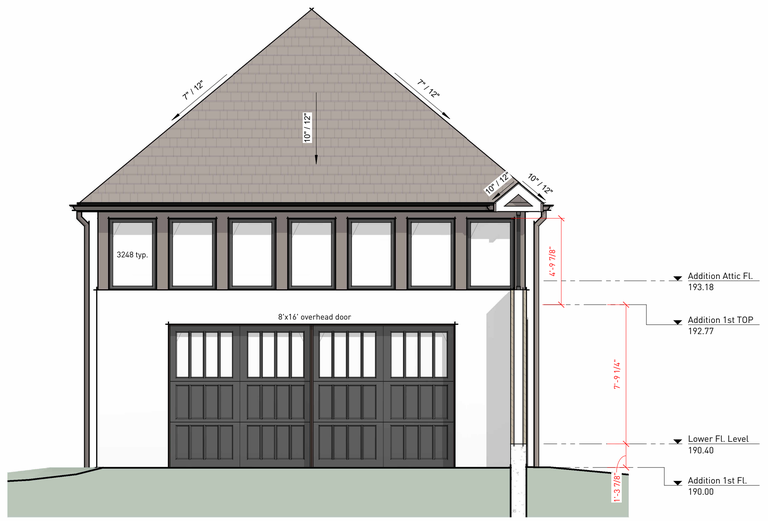


3 Rear Elevation

1/4" = 1'-0"

2 Left Elevation

1/4" = 1'-0"



1 Front Elevation

1/4" = 1'-0"

FORESTGREEN

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E: todd@forestgreencreations.com

PROJECT

Beam Garage Addition

10165 Cedar Crest Rd, Wainfleet, ON L3K 5V4

GENERAL NOTES

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PRELIMINARY

DATE	8/28/2025 11:45:12 AM
SCALE	1/4" = 1'-0"
PROJECT NO.	25-001

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QUALIFICATION INFORMATION
Required unless design is exempt under 3.2.4. Division C of the building code

Todd Barber	22666	
FULL NAME	**BCIN**	**SIGNATURE**

REGISTRATION INFORMATION
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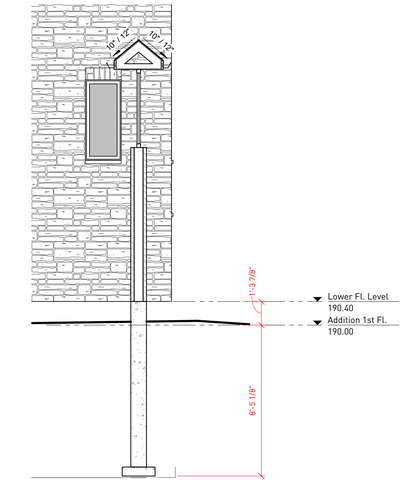
Forestgreen Creations Inc.	30817	
FULL NAME	**BCIN**	**SIGNATURE**

SHEET NAME

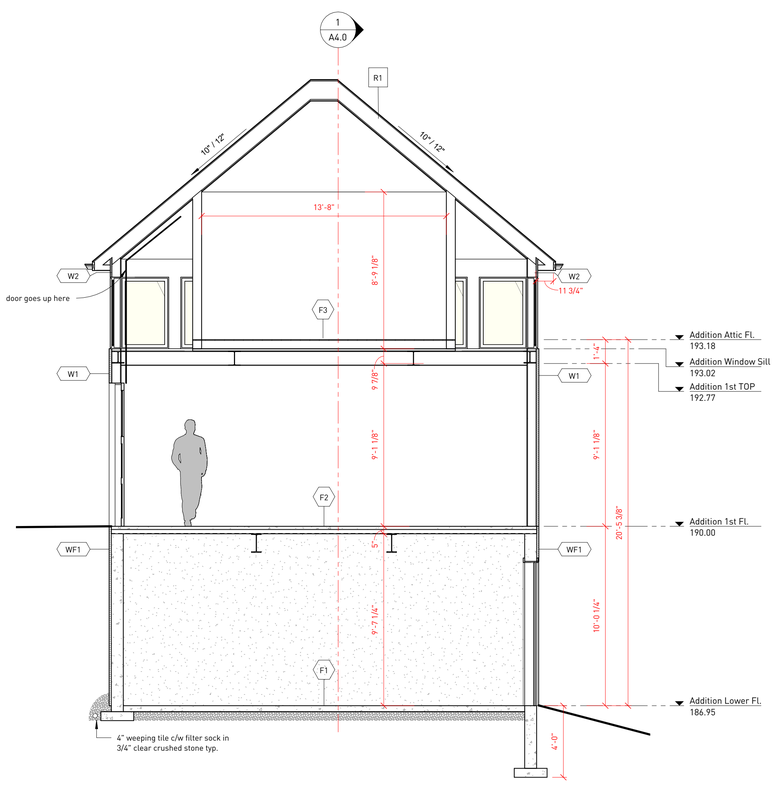
Elevations

SHEET NO.

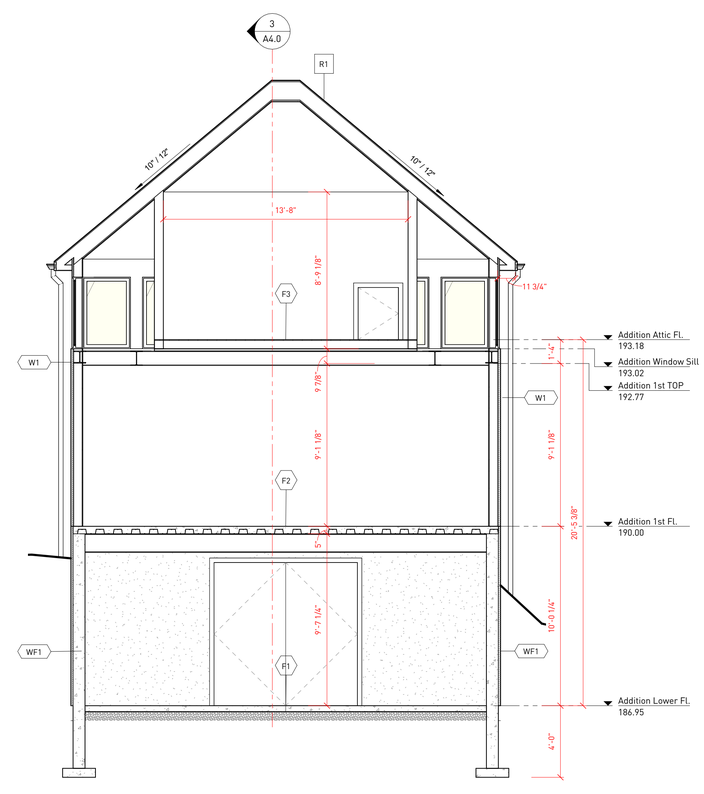
A3.0



2 **Section - attachment to tower**
1/4" = 1'-0"



3 **Section - through overhead doors**
1/4" = 1'-0"



1 **Section - facing East**
1/4" = 1'-0"

FORESTGREEN

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PROJECT

Beam Garage Addition

10165 Cedar Crest Rd, Wainfleet, ON L3K 5V4

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PRELIMINARY

DATE	8/28/2025 11:45:13 AM
SCALE	1/4" = 1'-0"
PROJECT NO.	25-001

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Todd Barber	22666	
FULL NAME	**BCIN**	**SIGNATURE**

REGISTRATION INFORMATION
Required unless design is exempt under 3.2.4. Division C of the building code

Forestgreen Creations Inc.	30817	FG
FULL NAME	**BCIN**	**SIGNATURE**

SHEET NAME
Building Sections

SHEET NO.
A4.0

McGlone & Associates Ltd.

3300 Merrittville Hwy., Unit #5
S.S. #1, Thorold, Ontario L2V 4Y6
Telephone: 905-687-6616 Facs: 905-687-6620

93361

SLOPE STABILITY &

SEWAGE DISPOSAL DESIGN

PROPOSED GRANT RESIDENCE

WAINFLEET, ONTARIO

For: Roger Grant
1L33
Cedar Crest
Wainfleet, Ontario
L3K 5V4

McGlone & Associates Ltd.

3300 Merrittville Hwy., Unit #5
S.S. #1, Thorold, Ontario L2V 4Y6
Telephone: 905-687-6616 Facs: 905-687-6620

93361

94 04 06

Roger Grant
1L33
Cedar Crest
Wainfleet, Ontario
L3K 5V4

Attention: Mr. Roger Grant

Re: Slope Stability & Sewage Disposal Design
Proposed Grant Residence
Wainfleet, Ontario

Gentlemen:

Enclosed herewith please find four copies of the report describing our geotechnical investigation for the above project.

The results of our geotechnical investigation indicate that the native soils at this site comprise medium grained uniform sand. This soil forms a wind deposited sand dune along the shore of Lake Erie. The sand is considered suitable to support conventional foundation construction.

The existing slope at this site is believed to be stable, and the proposed new structure should not adversely affect the stability of the slope, providing the recommendations outlined in our report are carried out. No major construction problems are anticipated.

Contained within the main body of the report may be found descriptions of the work performed and the soils encountered. Our discussion section gives recommendations on foundation design and construction, in conjunction with slope stability considerations. We have also carried out a preliminary sewage disposal design based on M.O.E.E. requirements, and the site conditions.

Whilst we believe this report to be complete within our present terms of reference, we would be more than happy to discuss any portion of it with you or your design consultant, should you so wish.

Yours very truly,

MCGLONE & ASSOCIATES LTD.

Peter M.A. McGlone, P.Eng.

4 copies Client
JD:jd
Encl.

INDEX

APPENDIX A

AUTHORIZATION

Authorization to proceed with this geotechnical investigation was received from Mr. Roger Grant on 93 12 20.

SITE & PROJECT DESCRIPTION

The site under investigation is a roughly wedge shaped parcel of land fronting on Lake Erie. It is situated east of the unopened road allowance between Lots 1 and 2 in the Township of Wainfleet, Ontario, as shown on the Site Location Plan appended as page A-1 of this report.

The site is presently occupied by a single storey cottage, and it is proposed to remove it to make way for the construction of a new, permanent single-family dwelling. The site lies on an elevated sand dune ridge. The topography drops off to the south and east immediately around the existing structure. The property also drops off inland to the north, although this is some distance away from the cottage. The general lot and proposed building envelopes are shown on page A-2.

The Niagara Peninsula Conservation Authority has requested that a geotechnical investigation be performed to analyze the stability of the slope, both pre- and post-development, to

determine if the proposed location of the new dwelling is suitable, and to recommend measures to minimize the potential for slope instability and erosion. McGlone & Associates Ltd. have also been asked to prepare a design for a permanent sewage disposal system to service the proposed new home.

Based on Quaternary Geological mapping, the soils across this site consist of dune sand with Lake Erie beach sand and gravel deposits at the south end. Directly north of the property, the subsoils comprise glaciolacustrine clay and silt. The entire area is underlain by cherty limestone of the Bois Blanc Formation.

FIELD WORK

The field work for this project was performed on 94 02 11. At that time, two boreholes were put down at locations shown on the Borehole Location Plan appended as page A-2 of this report. The boreholes were put down as close to the top of slope as was possible to determine the subsurface conditions for foundation recommendations.

The boreholes were laid out in the field by personnel from McGlone and Associates Ltd, who also related borehole locations to existing site features. The ground surface elevation of each borehole was interpolated from a survey plan prepared by Douglas G.

Marr, Ontario Land Surveyor, dated 93 04 01 and revised on 94 01 14.

Drilling was carried out using conventional soil sampling and drilling equipment supplied and operated by a specialist drilling contractor. An experienced geologist from our staff supervised the entire drilling procedure and prepared field borehole logs.

Both of the boreholes extended to 26.5 ft. below ground surface. Standard Penetration testing was carried out using a 2 inch diameter split spoon sampler. The samples obtained were initially identified in the field, placed in labelled containers and returned to the McGlone & Associates Ltd. laboratory for further examination and natural water content determinations.

The ground water conditions in each borehole were observed during the advancement, and after completion of the drilling procedure.

SUBSURFACE CONDITIONS

General - The subsurface soil and ground water conditions encountered in each borehole are described on the appended Logs of Boreholes, pages A-3 and A-4. The results of Standard Penetration testing and the natural moisture content are plotted on each log.

The subsoil encountered in our two boreholes comprised uniform fine to medium grained sand. Topsoil was encountered in each borehole, as well as 2.0 ft.(±) of fill in Borehole 2.

Fill and Topsoil - Approximately 6 inches of topsoil was encountered at ground surface in Borehole 1. In Borehole 2, 2.0 ft.(±) of sand fill was encountered, underlain by about 12 inches of topsoil.

Sand - Underlying the topsoil in Borehole 1, and the buried topsoil in Borehole 2, brown fine to medium grained sand was encountered. It extended to the maximum depth investigated in each borehole.

From the results of Standard Penetration testing, the sand was loose to compact, with 'N' values generally ranging from 4 to 26 blows per foot. The natural moisture content ranged from 3 to 6%.

GROUND WATER CONDITIONS

Upon completion of the drilling procedure, both boreholes remained dry, and open to depth.

The conditions encountered in our boreholes indicate that the ground water table in this area lies below the anticipated

foundation excavation depths.

DISCUSSION

This site is presently occupied by a single storey cottage, and it is proposed to demolish it to make way for the construction of a new, permanent single-family dwelling. The property limits and presently proposed building envelope are shown on page A-2, along with the existing cottage.

The site lies on an elevated sand dune ridge. Spot elevations from the topographic survey are shown on page A-2, along with interpolated contour lines. They show that the area immediately north of the existing cottage rises gradually to the access road and then beyond, to the north edge of the dune. Just west of the cottage, there is a small retaining wall, and the grade west of the wall lies roughly 3.0 ft. higher than that immediately surrounding the cottage. The southeast corner of the existing cottage sits just at the top of the slope. As a result, the topography drops off to the south and east around the existing structure.

An access road to the lake runs along the southeast side of the cottage. At its closest point, the road lies 21 feet away from the top of the slope (roughly 24 ft. from the southeast corner of the cottage), and roughly 16 feet below the ground surface at the

south east corner of the cottage.

Pre-Construction Analysis

The results of our investigation indicate that the subsoil in the vicinity of our two boreholes comprises medium grained uniform sand. This soil forms a large sand dune along the shore of Lake Erie. Dune sand is deposited by wind action. During the deposition process, the sand grains are sorted by size. The larger particles are deposited first while the smaller particles are transported and deposited further away from the source. Consequently, dune sand tends to be very uniform in grain size. The wind action also causes abrasion of the sand particles and so characteristically they are rounded and sub-rounded in shape. As the wind deposits them relatively gently, there is insufficient weight to pack them down, and in any case because of their uniform nature and rounded shape they are difficult to compact. The dune sand therefore remains as a loose to compact deposit.

The slope is steepest around the south east side of the cottage. Based on the survey data presented on the plan, the slope in this area is about 1 vertical to 1.3 horizontal, or about 37°. The upper limit for stable cohesionless soil slopes ranges from 35° to 45°, depending on the density of the deposit.

We believe that the slopes at the south and east of the existing cottage are presently stable. Because of the method of deposition of the sand, the natural angle of the dune slopes is stable. By the same reasoning, the slopes are at the upper limit of stability.

Slopes in cohesionless soils do not exhibit deep seated failures. Rather, if there is over-steepening of the slope (e.g. due to erosion or under-cutting of the toe), the mode of failure is typically surficial sloughing along the face of the slope, until a stable slope angle is achieved.

Photographs of the site taken during the summer months show that the site is protected from erosion by a lawn-cover at the top, and fairly thick brush and trees along the face of the slope. No obvious signs of instability were observed such as leaning trees or slumps.

Foundation Design

The ground floor elevation of the proposed new house will lie at roughly the same elevation of the existing cottage (494.3 ft.). The new home will have a basement, and the top of the basement floor slab will lie at elevation 485.5 ft.(±). Although plans are preliminary, we understand that the basement will be a walk-out

level along the south side.

All foundations must bear within the native competent soil, below any topsoil, fills and surficially loosened sand. Furthermore, we recommend that all footings be placed below a line drawn up from the toe of the steepest segment of the slope, at an angle not exceeding 2.5 horizontal to 1 vertical, as indicated on the sketch on page A-5. This may necessitate the gradual lowering of footings as foundation excavation proceeds to the south and east. However, this will depend on the final location of the new structure. The foundations should be stepped a maximum of 2 feet for each linear 4 foot run of footing.

An allowable soil bearing value of 100 kPa is considered appropriate for design. Generally, we have found that the 'N' values obtained from Standard Penetration testing in uniform sands are conservative. However, the allowable soil bearing values given above should be more than sufficient for the type of construction proposed.

With the exception of the south east corner, the existing ground surface across the proposed walkout area (directly south of the proposed house) lies at between elevation 490.0 and 493.6 ft. This means that a considerable thickness of soil will be removed from the top of slope at the south side, to accommodate the walk

out level (anticipated to lie just below the 585.5 feet).

We also understand that, since the grade west of the existing cottage lies up to 3 ft. higher than the anticipated ground floor slab level, some consideration is being given to cutting down the grade along the west side of the site. However, we understand that this has yet to be discussed with the owner of the adjoining property.

No unusual problems are anticipated during foundation excavation. However, the new house lies across the outline of the as yet to be demolished cottage, and two small retaining walls will have to be removed. All new foundations must be placed at, or below the level of the old footings, in order to found below any associated fills.

Any excavation into the sand will probably establish its own stable slope angle. The natural angle of repose for uniform sand is in the order of 40°, depending on its relative density. All excavations must be cut to comply with the Occupational Health and Safety Act.

For the preparation of all floor slab areas, any fills, organics or excessively loosened soils should be removed from the floor slab limits. The under slab area should be proof-rolled if

possible, and inspected. After approval of the subgrade, any low-lying areas could be brought up to design grades using either approved on-site borrow or an imported granular fill, such as Granular 'B', or better.

The native inorganic sand is considered suitable for reuse for fill purposes. Any interior foundation backfills should be placed in 25 cm maximum loose lifts and compacted to 95% of Standard Proctor Maximum Dry Density.

Based on the conditions encountered during our investigation, the groundwater table in this area lies below the maximum depth of 26.5 ft. investigated in our boreholes. This, combined with the free draining nature of the dune sand indicates that perimeter basement drainage is not required. We recommend however, that all exterior footings, and footings in unheated areas be provided with a minimum of 4 ft. of soil cover below exterior finished grades, to minimize the possibility of frost action.

Post-Construction Analysis

The existing slope areas surrounding the south and east limits of the proposed house area are typically steeper than 1 vertical to 2 horizontal. We believe that because of the soil type and method of deposition, these slope areas are currently stable. Our

recommendations for foundation levels have been made to ensure that all new loads are placed below any potential zones of instability of the dune sand slopes.

The Niagara Peninsula Conservation Authority has recently developed criteria for any development "within natural valleys, which are directly associated with riverine systems, where the bank height is equal to, or greater than 3 metres". This site, however, belongs to a coastal or shoreline system and therefore we believe that the new criteria is not applicable.

If soils are removed to accommodate a walk-out access from the basement, this will decrease the loading at the top of the slope. Also, it will create a new top of slope along the south side of the new house, that will be lower, and lie further away from the proposed new home. The exception to this is at the south east corner, where the existing grade already lies below the walkout level.

For general grading purposes, we recommend that any new slopes not exceed 1.5 horizontal to 1 vertical.

Other than this, the primary concern is that surficial erosion be prevented. Therefore, as much as possible of the existing vegetation should be preserved, and any bare slope areas should be

seeded immediately after construction has been completed. The root system will minimize the possibility of surficial erosion by either wind or water.

It is important that no concentrated surface runoff, for example meltwater, or from rain spouts or drains, be allowed to flow over the top of, and down the face of any slope. The fine grained sand will easily be eroded by continuous runoff.

Under no circumstances should any excavated materials or fills be placed or even stockpiled near the top edge or on the face of the existing banks. The additional weight of such materials could cause local slope instability.

Providing that our recommendations are followed, we anticipate that the proposed construction as outlined above, will not adversely affect the stability of the slope.

Sewage Disposal System

We have been asked to prepare a design for the installation of a permanent on-site sewage disposal system, suitable for a three bedroom home, which we assume will be in use year round. We understand that the number of water outlets for the new house will not exceed 24. Based on this criteria, the house is considered a

non-luxury home, and the Ministry of the Environment & Energy's Policy Manual indicates that a volume of effluent for sewage system design is 1,600 litres/day.

The legal status of the access road which divides the site is presently unclear. However, we understand that the normal setbacks for development adjacent to a right-of-way are not required. Other than this, the clearances required for leaching bed distribution pipe (Ontario Regulation 358, Table 4) have been taken into consideration.

The area available for a sewage disposal area on this site is limited. Therefore, a Class 6 System is proposed for use at this site. Because this system pre-treats the effluent before disposal, it allows for a reduced disposal area.

Our boreholes at this site indicate that the soils comprise dune sand to a depth of at least 26.5 ft. Based on work carried out on the adjoining property, we believe the dune sand extends to at least 40 feet below existing grade. The sands are deposited on a relatively impermeable base, either clay till or limestone (although this has not been verified at this particular site). The assumed soil conditions for which the following system has been designed consist of uniform granular material with a design T-time of 5 min/cm. We have also assumed, on the basis of our present and

previous work, that the water table lies a minimum of 20 feet below ground surface.

Ontario Regulation 358/90, Table 6, indicates that the minimum surface area of the filter medium for a 3 bedroom private dwelling having a Class 6 sewage system, is 11 m^2. This results in a maximum possible loading of the filter medium surface, of 150 litres/m^2/day.

For the minimum allowable contact area between the base of the filter medium and the underlying soil, the formula A = QT/850 is used (where A = the contact area, Q = the daily sewage flow in litres and T = the assumed percolation time of the underlying soil in min/cm.). The result has been calculated as 10 m^2. Since the surface area of the filter already exceeds this value, an expanded filter base is not required.

One of the possible locations being considered for the filter bed is along the north side of the site, just north of the access road. There is a small level area adjacent to the road which then slopes away to the northeast. We understand that the owner is giving some consideration to filling in the slope area, using native sand fills from the house construction. Presently, the flat area could accommodate the filter bed, along with the 100% spare area that the M.O.E.E. requires be reserved, in case the initial

system needs to be expanded sometime in the future. However, the placement of fills would increase the usable area, allowing the filter bed to be located further away from any traffic. In any case, we recommend that some protection (e.g. bollards) be installed to ensure that the filter bed area is not used as a vehicle turning area.

Specific design and construction details described in Ontario Regulation 358/90 will need to be strictly adhered to, along with the appropriate clearances from structures, lot lines and water sources. Typical filter bed design criteria, and the grading limits for sand filter material, prepared by the Ministry of the Environment, are shown on pages A-6 and A-7. The sand filter shown on page A-6 is partially raised, but for this project it should be completely in-ground.

Depending on the final location of the filter bed, the effluent may have to be pumped from the Class 6 treatment unit, to dose the filter bed area.

No construction is permissible in the area reserved for sewage disposal purposes. Proper final site grading will also be required. This is to ensure that surface water run-off is directed away from the disposal area.

Given the free-draining nature of the soils to at least a 26.5 ft. depth in this area, and the depth of the water table, ground water mounding is not anticipated to be a problem.

REPORT LIMITATIONS

This investigation was carried out, and the report prepared, in order to provide information on subsurface conditions and to supply geotechnical engineering recommendations regarding foundation design and construction for a proposed residence, as described previously in this report.

The recommendations provided are based on two boreholes and site plans supplied by the Client. If there are any changes to the plans as presently envisaged, and once final plans become available, it is recommended that McGlone & Associates Ltd. be contacted. This is to review the proposed works and to confirm or amend the recommendations contained herein.

The Logs of Boreholes are based on the results of non-continuous sampling and therefore should not be considered to represent exact soil horizons, but rather transitions from one soil type to another. Soil conditions can vary significantly with short distances. Therefore neither the borehole information, nor the recommendations contained herein should be extrapolated to cover

other areas without site specific verification by ourselves.

McGlone & Associates Ltd. qualified geotechnical personnel should inspect all bearing surfaces prior to concreting and/or backfilling. This is to verify that the soils exposed at founding grades are consistent with those described in the report and therefore competent to support the recommended loads. Compaction testing of all structural fills should be carried out as the materials are being placed. This is to confirm that the specified degree of compaction is being achieved.

Yours very truly,

MCGLONE & ASSOCIATES LTD.

Jane Doucette, P.Eng.

4 copies Client
JD:jd
Encl.

APPENDIX

GENERAL REPORT NOTES

DEFINITIONS OF PENETRATION RESISTANCE

Standard penetration resistance 'N': — The number of blows required to advance a standard split spoon sampler 12 inches into the subsoil, driven by means of a 140 pound hammer falling freely a distance of 30 inches.

Dynamic penetration resistance: — The number of blows required to advance a 2 inch, 60 degree cone, fitted to the end of drill rods, 12 inches into the subsoil, the driving energy being 350 foot pounds per blow.

SAMPLE TYPE ABBREVIATIONS USED IN BOREHOLE LOGS

S.S. Split spoon
A.S. Auger sample
P.H. Sample pushed hydraulically
T.W. Thinwall open
T.P. Thinwall piston
R.C. Rock core
W.S. Washed sample
P.M. Sample pushed manually

SOIL TEST SYMBOLS USED IN BOREHOLE LOGS

○ Standard penetration resistance
● Dynamic penetration resistance
▽ Laboratory vane
△ Field vane
X Penetrometer
□ Unconfined compression
■ Undrained triaxial
S Sensitivity

CONVENTIONAL SOIL DESCRIPTIONS

COHESIVE (CLAYS ETC.)

Consistency	'N' blows/ft.	c lb./ft.²
Very Soft	0 - 2	0 - 250
Soft	2 - 4	250 - 500
Firm	4 - 8	500 - 1000
Stiff	8 - 15	1000 - 2000
Very Stiff	15 - 30	2000 - 4000
Hard	> 30	> 4000

NON-COHESIVE (GRANULAR)

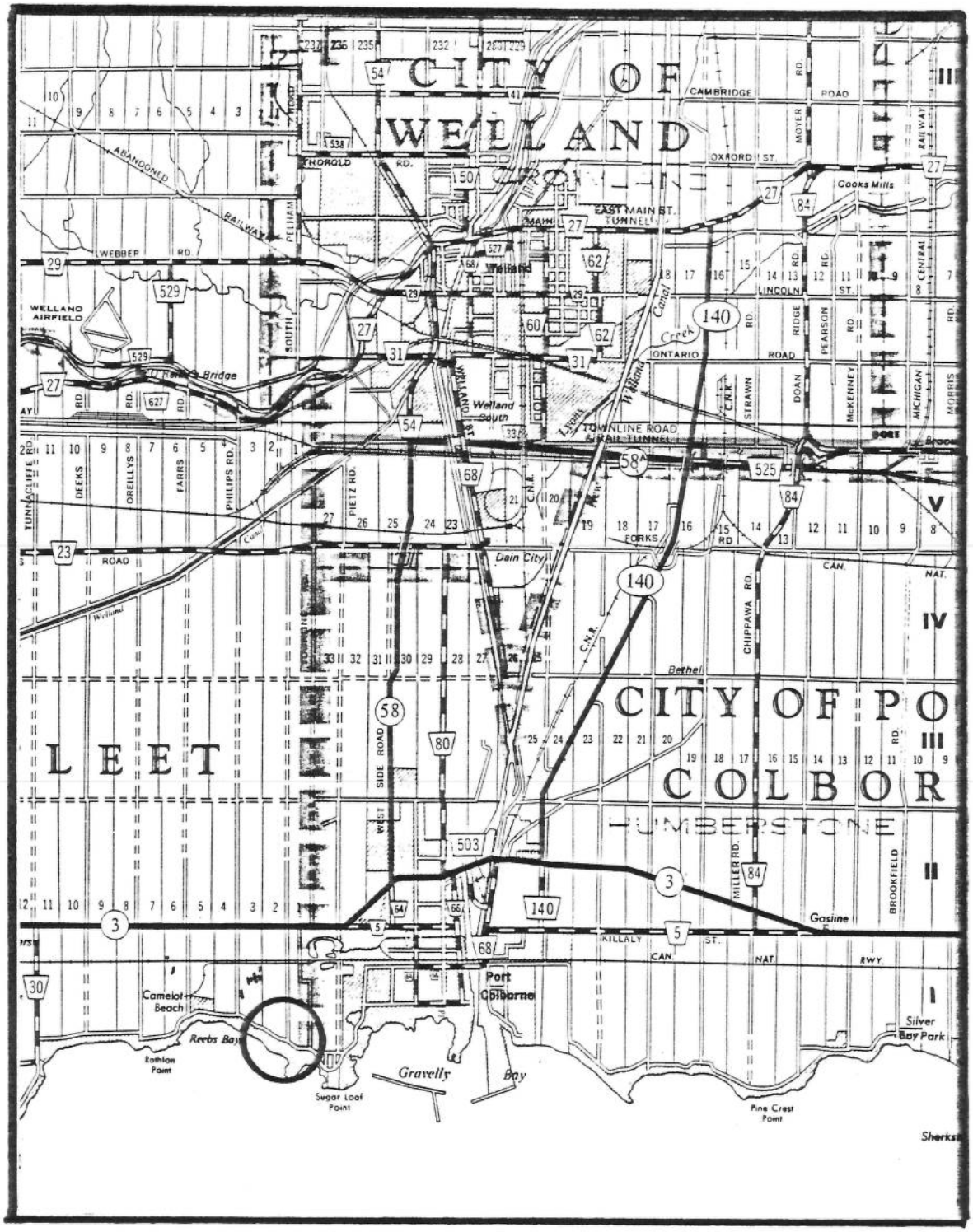
Denseness	'N' blows/ft.
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	> 50

ABBREVIATIONS FOR MOISTURE CONDITIONS

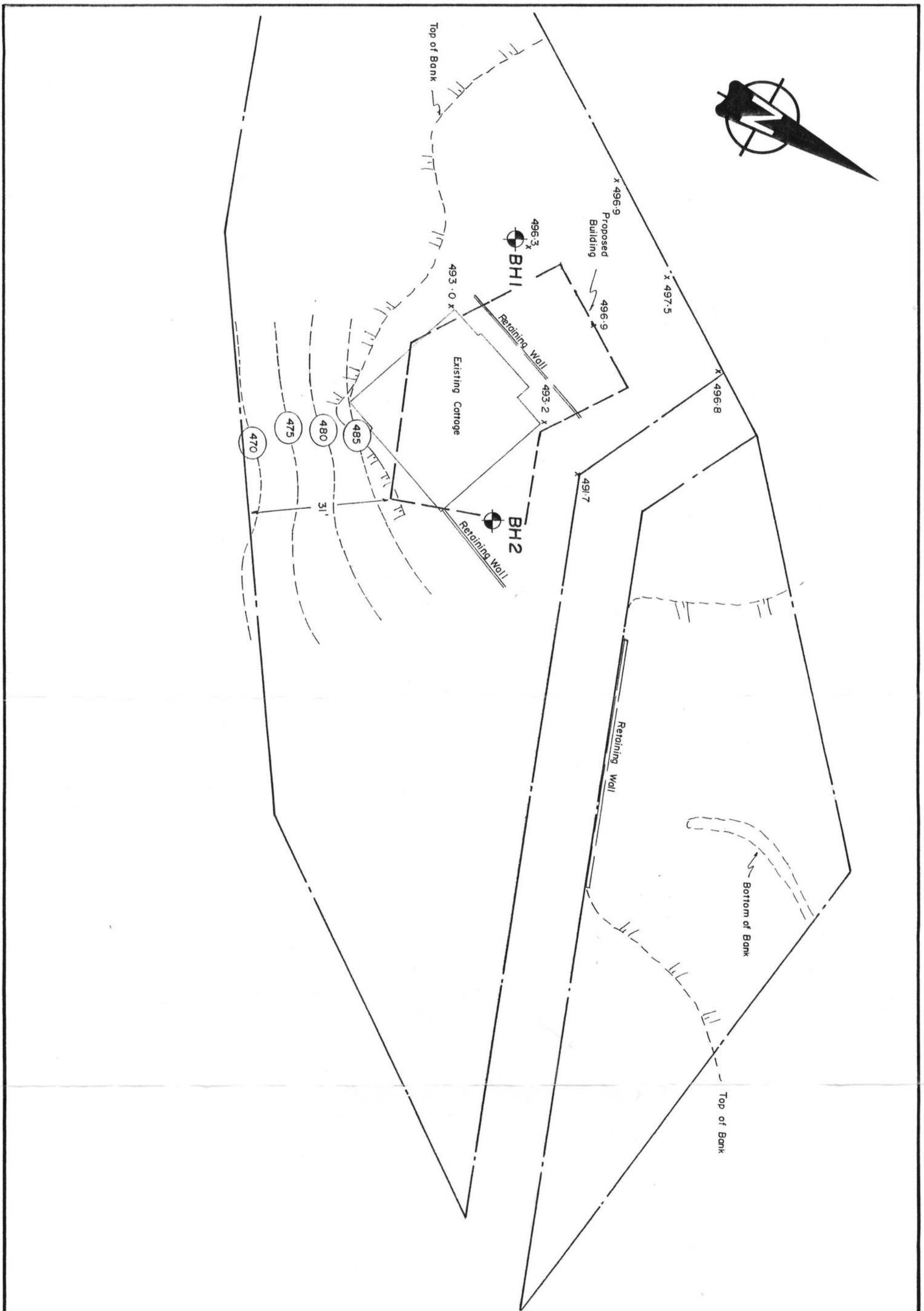
dtpl - drier than the plastic limit.
apl - about the plastic limit.
wtpl - wetter than the plastic limit.
mwtpl - much wetter than the plastic limit.

NOTE

The soil conditions, profiles, comments, conclusions and recommendations found in this report are based upon the samples recovered during the field work. Soils are heterogeneous materials and, consequently, variations (possibly extreme) may be encountered at site locations away from boreholes. During construction, competent, qualified inspection personnel should verify that no significant variations exist from the conditions described in this report.



SITE LOCATION PLAN



SCALE - 1" : 20'	McGLONE & ASSOCIATES LTD 3300 MERRITTVILLE HIGHWAY THOROLD ONTARIO	BOREHOLE LOCATION PLAN	A-2 9336

LOG OF BOREHOLE NO. 1

PROJECT Slope Stability and Sewage Disposal Consultations, Grant Residence

Job No. 93361

CLIENT Roger Grant

Scale:

Ground El. 496.3 ft. **Borehole Type** 4½ inch Augers **Boring Date** 94 02 11

Depth/Elev.	DESCRIPTION	SAMPLE Number	Type	Blows/ft.	Penetration Test Standard ○ Dynamic ● Blows/ft. 0 20 40 / Shear Strength psf	Liquid Limit W_L Plastic Limit W_P Water Content W; W_P W W_L / Water Content % 0 20 40
	6 inches of TOPSOIL over brown MEDIUM GRAINED SAND moist, loose to compact.	1	SS	5		
		2	SS	9		
		3	SS	4		
		4	SS	9		
		5	SS	15		
		6	SS	14		
469.8		7	SS	26		
26.5	Borehole terminated.					

COMMENTS: Upon Completion: Borehole dry and open.

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S.S. #1, Thorold, Ontario L2V 4Y6

LOG OF BOREHOLE NO. 2

PROJECT Slope Stability and Sewage Disposal Consultations, Grant Residence

Job No. 93361

CLIENT Roger Grant

Scale: 1 in:5 ft.

Ground El. 491.0 ft. **Borehole Type** $4\frac{1}{2}$ inch Augers **Boring Date** 94 02 11

Depth/Elev.	DESCRIPTION	SAMPLE Number	Type	Blows/ft.
489.0	Sand FILL.			
488.0 2.0±	BURIED TOPSOIL.			
3.0±	Brown MEDIUM GRAINED SAND, moist, loose to compact.	1	SS	6
		2	SS	6
		3	SS	10
		4	SS	8
		5	SS	16
		6	SS	9
464.5		7	SS	7
26.5	Borehole terminated.			

Penetration Test
Standard ○ Dynamic ●
Blows/ft.
0 20 40
Shear Strength psf

Liquid Limit W_L
Plastic Limit W_P
Water Content W
W_P W W_L
Water Content %
0 20 40

COMMENTS: Upon Completion: Borehole dry and open.

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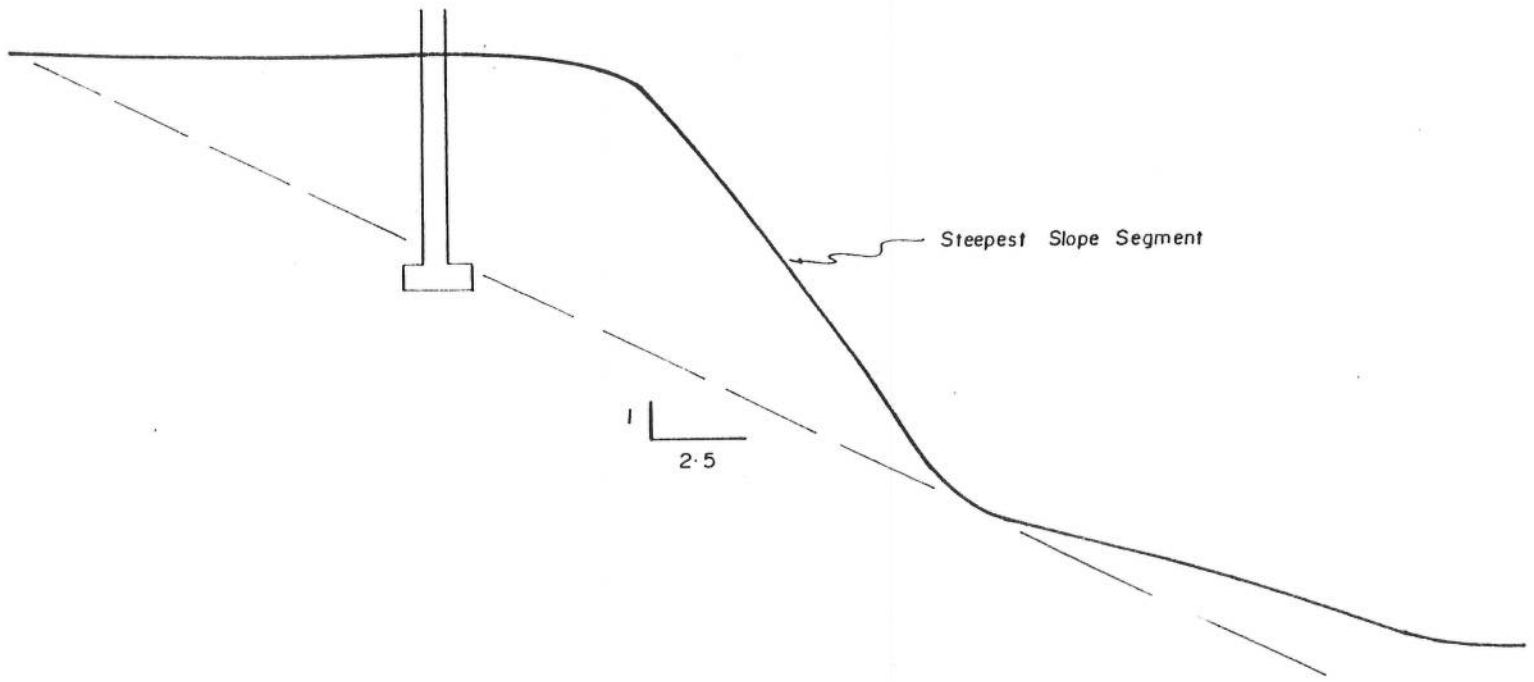
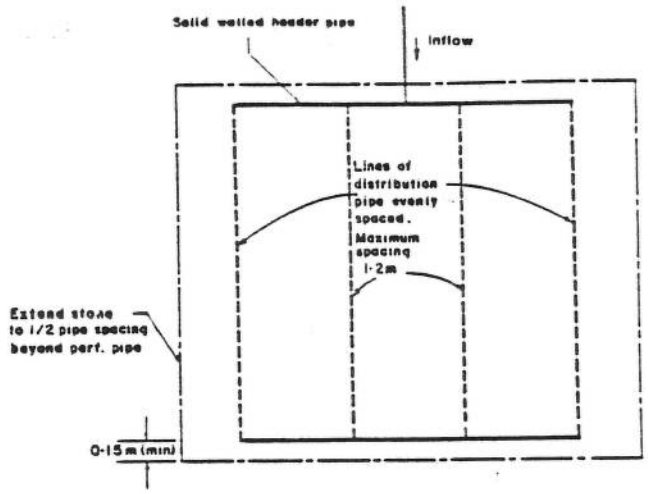
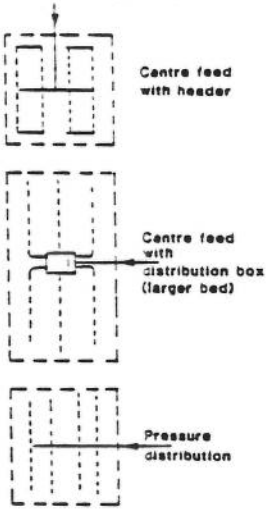


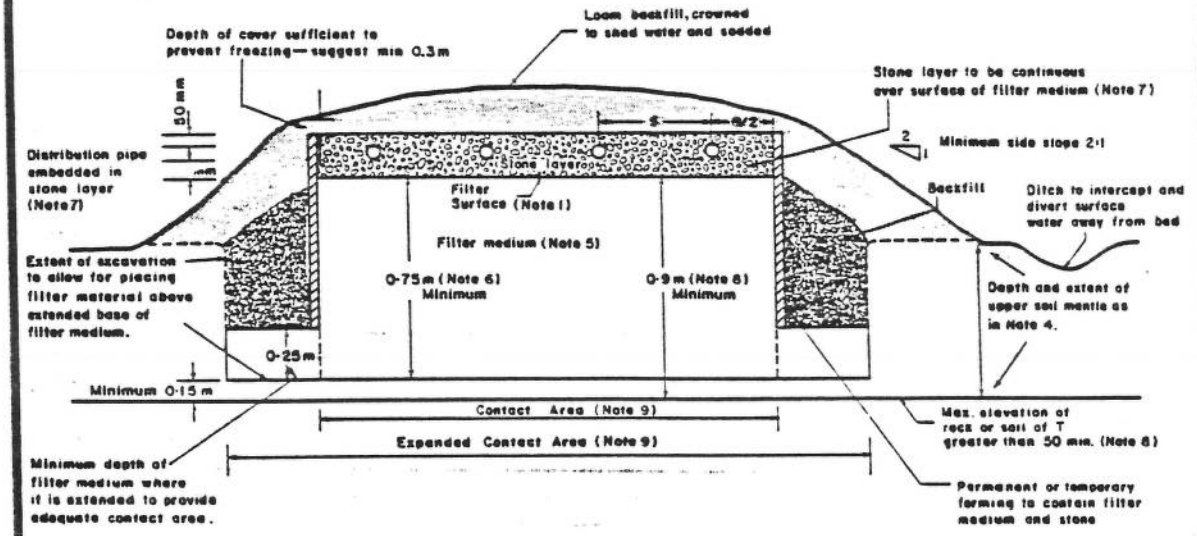
NOT TO SCALE	McGLONE & ASSOCIATES LTD 3300 MERRITTVILLE HIGHWAY THOROLD ONTARIO	FOUNDING LEVELS ADJACENT TO SLOPE	A-5 93361

TYPICAL SAND FILTER
(Adaptable for use with both class IV or class VI sewage system)



Some Alternative Pipe Layouts





NOTES

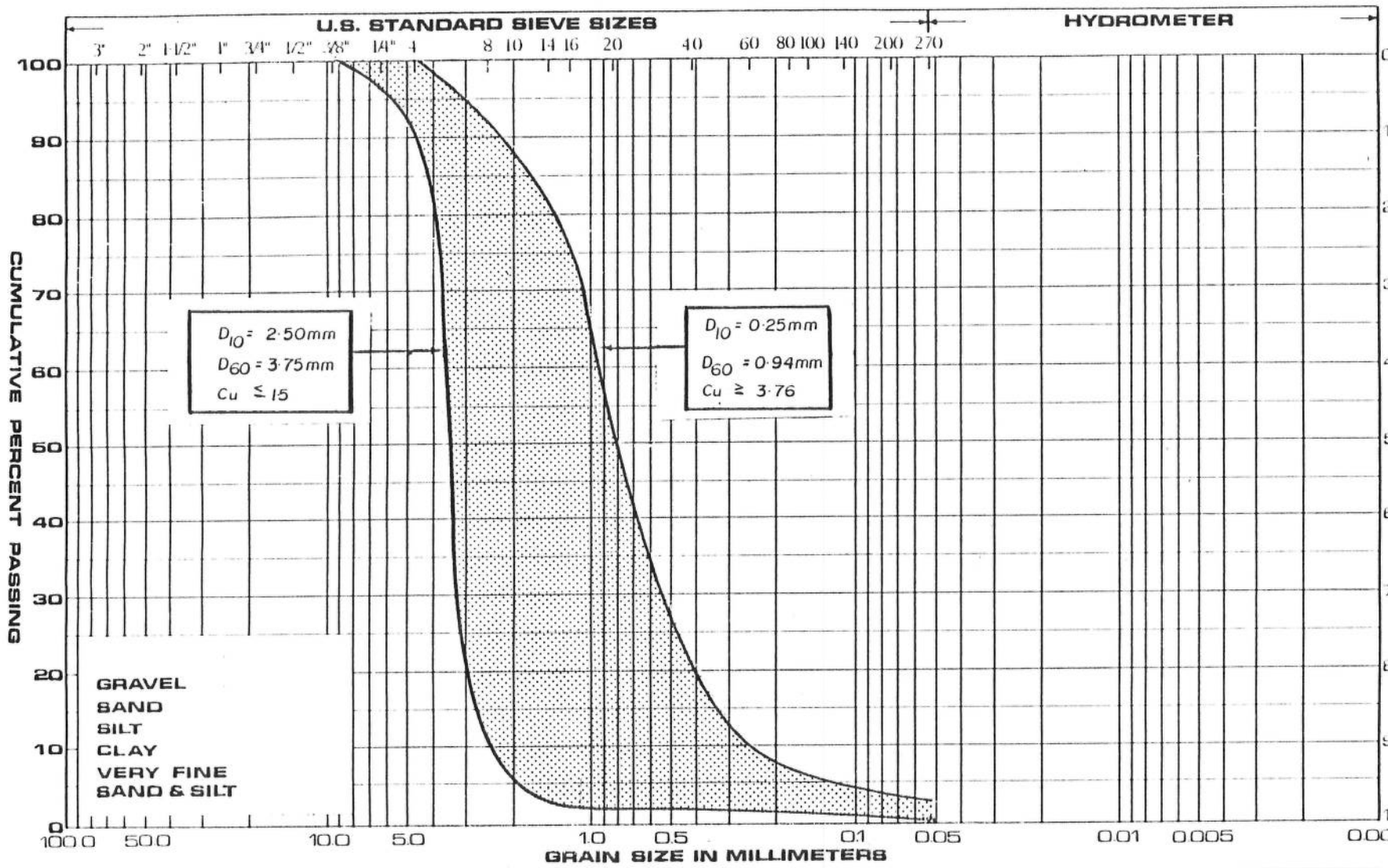
Refer to O. Reg 374/81 (Sec 10 and Sec 12) for regulations governing sand filter type Leaching beds.

1. Maximum area of filter surface 50 m^2.
2. Permissible loading on filters :
   - Class IV sewage systems: 75 L/m^2/day for flows up to 3000 L/day.
     50 L/m^2/day for flows between 3000 L/day – 5000 L/day.
   - Class VI sewage systems: 150 L/m^2/day for flows up to 6000 L/day.
     100 L/m^2 day for flows between 6000 L/day and 10,000 L/day.
3. The maximum daily sewage flow of a sewage system in which the leaching bed may be of the filter type is 5,000L for a class 4 sewage system and 10,000L for a class 6 sewage system. At maximum size in each case two 50 m^2 filters are required.
4. A soil mantle of T not greater than 15 min./cm and at least 0.25m in depth is required to extend at least 15m beyond the outer distribution pipes in any direction in which the effluent from the bed will move laterally. It must be added if the soil in or on which the filter bed is to be constructed has a T value exceeding 15 min/cm.
5. Only filter material meeting grading requirements acceptable to the Ministry of the Environment may be used.
6. Minimum depth of specified filter material 0.75m.
7. Pipe to be bedded in stone that is either 19 mm clear aggregate washed to be free of fine material, or clean gravel screened to be between 19 and 13 mm in size.
8. Surface of sand filter material to which sewage is applied must be a minimum of 0·9 m above rock or soil of T greater than 50 minutes/cm and at least 0·5 m above the high groundwater table.
9. Contact area between the filter medium and the underlying soil must not be less than the area A = QT/850 where Q is the daily sewage flow in litres and T is the percolation time of the underlying soil.

MINISTRY OF THE ENVIRONMENT	
LEACHING BEDS	
TYPICAL SAND FILTER	
SCALE NOT TO SCALE	
DRAWN BY L.L.S.	DATE APRIL 1982
CHECKED BY D.S.	DRAWING No S. S. 1.

GRADATION LIMITS FOR SAND FILTER MATERIAL

McGlone & Associates Ltd.



JOB NAME _____ JOB NO. _____ HOLE NO. _____ SAMPLE NO. _____

DEPTH _____ REMARKS _____

TG143026

July 24, 2014

Forestgreen Creations Inc.,
1423 Pelham St.,
Fonthill, ON
LOS 1E0

Attn.: Mr. Todd Barber

Re.; Update to McGlone & Associates Report #93361,
10165 Cedar Crest Road, Wainfleet

BACKGROUND

In April of 1994 McGlone & Associates Ltd. (a predecessor to AMEC) prepared a slope stability report and sewage design for 1L33 (now #10165) Cedar Crest Road in Wainfleet. The slope stability work concluded that the existing slopes were stable but provided recommendations that should be used for the design of a new structure. The sewage design consisted of a Class 6 System and a Filter Bed. It is assumed that this 1994 report is available to readers of this update and will be read in conjunction with it.

The 1994 report was submitted by Forestgreen Creations Inc. to the NPCA together with design plans for the 'Pulice Residence" as part of an application for a new residence that is proposed to be built on the site. As the report was 20 years old and pertained to a different development configuration, the NPCA requested that the report be updated with specific reference to the existing shore protection, the location of the Stable Top of Slope and the Post Construction Stability of the Slope. In order to perform this task, the writer revisited the site on July 11, 2014. The following is that updating with the exception that no comments will be made regarding the septic layout as that is now being designed by others and will be issued as a separate report/application.

As part of the work performed in 1994, a series of photographs were taken. These have been compared with the present site conditions and thus used to assess whether there has been any area where slope instability has occurred in the intervening 20 years.

In addition, the writer viewed the existing house, the surrounding slopes and the shore protection along the south limit of this property.

SHORE PROTECTION

The writer viewed the sheet pile wall that constitutes the existing shore protection. The examination was strictly visual but there was nothing noted that would indicate distress of the wall. The current owner estimated the shore protection to be 30 years old. The wall consisted of interlocking sheet steel piles with a steel cap and a steel reinforcing beam welded to the piles close to their top. The wall was straight with a level top and no noticeable depressions behind it

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The 1994 report contains recommendations regarding surface drainage, restoration of any slopes disturbed during construction etc. These still apply to the presently proposed project.

FOUNDATION DESIGN

The 1994 report also contains recommendations regarding foundation design which are applicable to the current design. The key recommendations are that all new footings be placed below any line with an inclination of 2.5 horizontal to 1 vertical that can daylight through any part of the slope face, and that a maximum soil bearing value of 100kPa be used.

TOP OF STABLE SLOPE

As described earlier, the current slopes are stable. However, the existing residence extends partially down the slope on the south and east sides. Therefore effectively the top of stable slope is the ground level at the south and east sides of the existing residence.

CLOSURE

The Report Limitations on the following page are an integral part of this report.
We trust that this report is complete within our present terms of reference. If you have any questions, please do not hesitate to contact our office.

Yours very truly,
AMEC Environment & Infrastructure
a division of AMEC Americas Limited

Prepared By:

Peter McGlone, P.Eng.
Principal Geotechnical Engineer

Reviewed By:

Michael Patterson, P.Eng.
Senior Geotechnical Engineer

3 copies Client
1 copy NPCA

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TABLE 4.2 - SLOPE STABILITY RATING CHART

Site Location: 10165 Cedar Crest File No. TG143026
Property Owner: Pulice Inspection Date: July 11, 2014
Inspected By: Peter MA McGlone Weather: Fine + Warm

1. SLOPE INCLINATION		
degrees	horiz. : vert.	
a) 18 or less	3 : 1 or flatter	0
b) 18 - 26	2 : 1 to more than 3 : 1	6
c) more than 26	steeper than 2 : 1	(16)
2. SOIL STRATIGRAPHY		
a) Shale, Limestone, Granite (Bedrock)		0
b) Sand, Gravel		(6)
c) Glacial Till		9
d) Clay, Silt		12
e) Fill		16
f) Leda Clay		24
3. SEEPAGE FROM SLOPE FACE		
a) None or Near bottom only		(0)
b) Near mid-slope only		6
c) Near crest only or, From several levels		12
4. SLOPE HEIGHT		
a) 2 m or less		0
b) 2.1 to 5 m		2
c) 5.1 to 10 m		(4)
d) more than 10 m		8
5. VEGETATION COVER ON SLOPE FACE		
a) Well vegetated; heavy shrubs or forested with mature trees		(0)
b) Light vegetation; Mostly grass, weeds, occasional trees, shrubs		4
c) No vegetation, bare		8
6. TABLE LAND DRAINAGE		
a) Table land flat, no apparent drainage over slope		(0)
b) Minor drainage over slope, no active erosion		2
c) Drainage over slope, active erosion, gullies		4
7. PROXIMITY OF WATERCOURSE TO SLOPE TOE		
a) 15 metres or more from slope toe		(0)
b) Less than 15 metres from slope toe		6
8. PREVIOUS LANDSLIDE ACTIVITY		
a) No		(0)
b) Yes		6
SLOPE INSTABILITY RATING VALUES INVESTIGATION RATING SUMMARY		**TOTAL 26**