patersongroup memorandum

consulting engineers

re: **Geotechnical Desktop Review**
2 via Modugno - Block 14
Ottawa, Ontario

to: Campanale Homes - **Mr. Christian Campanale** - christian@campanale.com

date: October 28, 2019

file: PG2119-MEMO.17 Revision 1

Paterson Group (Paterson) was commissioned by Campanale Homes to conduct a geotechnical desktop review for Block 14 of the proposed residential development. It should be noted that the existing geotechnical investigation was completed by Paterson for the overall site which includes a total of 2 test pits within the proposed Block 14 area. The existing test pits were excavated using a hydraulic shovel operated by a licensed contractor on February 15, 2013.

The following report contains our findings and geotechnical recommendations pertaining to the design and construction of the proposed development as they are understood at the time of writing this report.

Proposed Development

It is understood that the current phase of the proposed development will consist of a mixed-use building with commercial units within the main floor and 12 residential units at the upper level along Via Modugno and a 16 unit stacked back-to-back town-homes along Via Campanale. It is also understood that at-grade parking areas, landscaped areas and access lanes are also anticipated as part of the proposed development. The proposed development is anticipated to be municipally serviced.

Available Soils Information

Based on field observations, the subject site is currently vacant, grass covered with a gravel covered access road running across from west to east. The ground surface across the subject site is relatively flat and at grade with the surrounding roadways. The site bordered to the north and west by Via Campanale, to the east by Via Modugno and to the south by a residential building and the associated at-grade parking area.

The subsurface profile at the test pit locations consists mainly of brown silty clay with sand, gravel, cobbles and boulders fill. The fill is underlain by a very stiff to stiff brown silty clay deposit and followed by glacial till. The glacial till layer consists of compact to dense silty sand with gravel, cobbles and boulders. Reference should be made to the Soil Profile and Test Data Sheets attached to the current memorandum.

Based on available geological mapping, the bedrock within the subject site consists of interbedded sandstone and dolomite of the March formation with an overburden drift thickness ranging between 3 and 10 m below existing grade.

Geotechnical Design

Foundation Design

Bearing Resistance Values

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, stiff silty clay can be designed using a bearing resistance value at serviceability limit states (SLS) of **100 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **200 kPa**. A geotechnical resistance factor of 0.5 was applied to the reported bearing resistance values at ULS.

Footings placed on an undisturbed, compact glacial till bearing surface or placed over concrete in-filled zero entry, vertical trenches (minimum 15 MPa lean concrete) extending to a compact glacial till bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**. If concrete in-filled trenches are to be used, the trenches should be extended a minimum 150 mm beyond all footing faces.

Footings designed using the above noted bearing resistance value at SLS given above will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively.

An undisturbed soil bearing surface consists of a surface from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a stiff silty clay above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

Permissible Grade Raise

A permissible grade raise restriction of **2 m** is recommended above existing grade for the proposed buildings where footings are to be placed over a stiff silty clay bearing surface.

Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for the foundations considered at this site. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code (OBC) 2012 for a full discussion of the earthquake design requirements.

We trust that this information satisfies your immediate requirements.

Best Regards,

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Station Building - Longfields Drive
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the northeast corner of subject site, along Longfields Drive. Geodetic elevation = 94.72m.
REMARKS N 5014843; E 441539

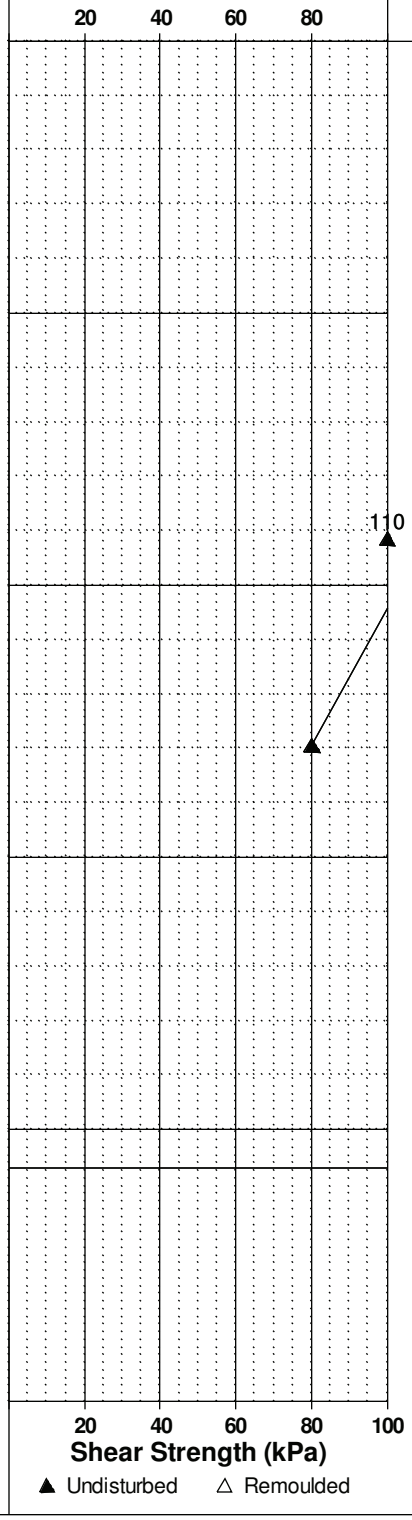
FILE NO. PG2119

HOLE NO. TP 2-13

BORINGS BY Hydraulic Shovel **DATE** February 15, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.69
FILL: Brown silty clay with sand, gravel and cobbles							
0.40							
Very stiff to stiff, brown **SILTY CLAY**		G	1			1	92.69
		G	2			2	91.69
3.20						3	90.69
GLACIAL TILL: Compact to dense, brown silty sand with gravel and cobbles		G	3			4	89.69
4.14							
End of Test Pit							
(TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Station Building - Longfields Drive
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the northeast corner of subject site, along Longfields Drive. Geodetic elevation = 94.72m.
REMARKS N 5014807; E 441520

FILE NO. PG2119

HOLE NO. TP 3-13

BORINGS BY Hydraulic Shovel **DATE** February 15, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.87
FILL: Brown silty clay with sand, gravel, cobbles, boulders		G	1			1	92.87
1.14							
		G	2			2	91.87
Very stiff, brown **SILTY CLAY**							
		G	3			3	90.87
		G	4				
3.86							
GLACIAL TILL: Dense, grey silty sand with clay, gravel, cobbles, boulders		G	5			4	89.87
4.27							
End of Test Pit							
(TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

105

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

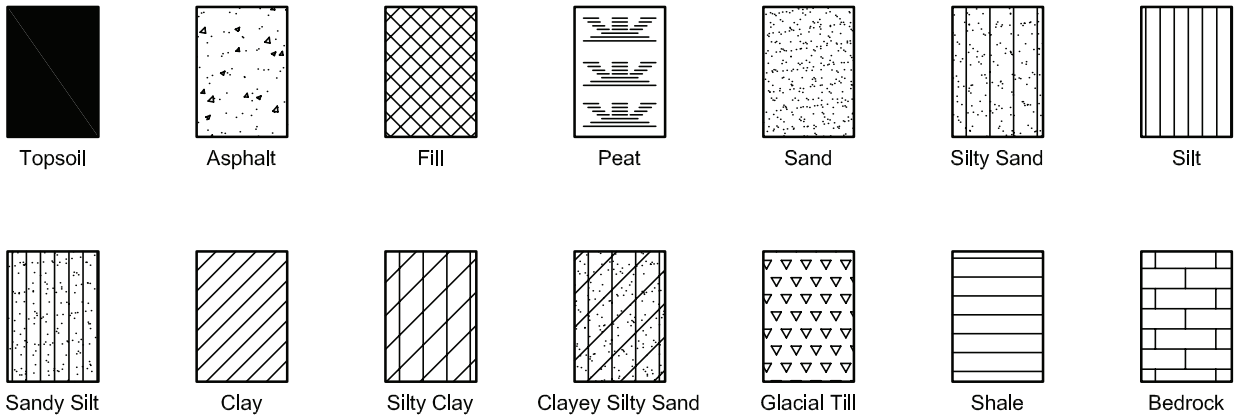
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

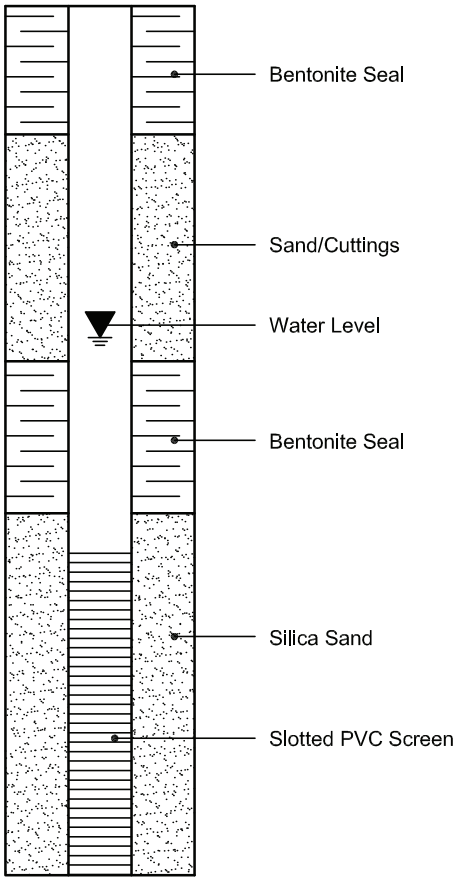
SYMBOLS AND TERMS (continued)

STRATA PLOT

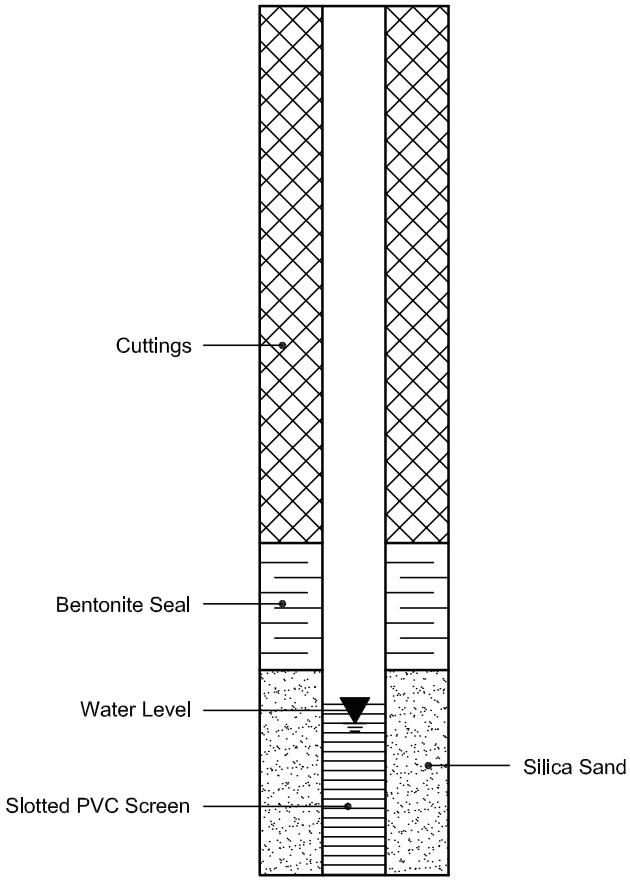


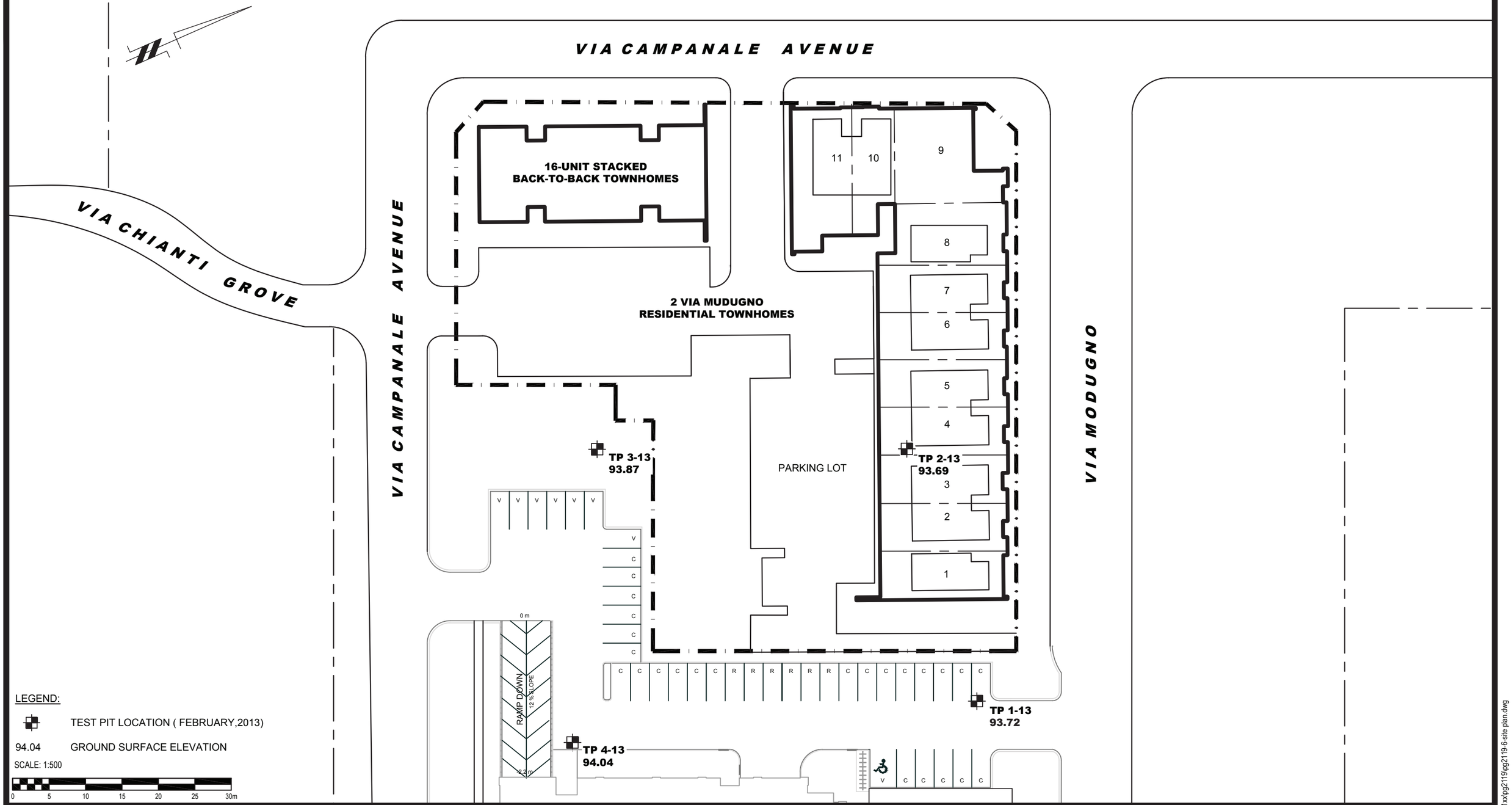
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





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NO.	REVISIONS	DATE	INITIAL

CAMPANALE HOMES

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL BUILDINGS
2 VIA MUDUGNO - BLOCK 14

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:500	Date: 10/2019
Drawn by: YA	Report No.: PG2119-1
Checked by: FA	Dwg. No.: PG2119-6
Approved by: FA	Revision No.:

11x17

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