TOWN OF CALEDON
PLANNING
RECEIVED
August 2, 2022

Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing

GEOTECHNICAL INVESTIGATION
PROPOSED PALGRAVE WEST ESTATES
MT. HOPE ROAD, SOUTH OF HIGHWAY 9
PALGRAVE, ONTARIO

Prepared For: Alliance Homes Inc.
1111 Creditstone Road
Concord, Ontario
L4K 4N7

Attention: Mr. Wayne Hancock

File No. 3-06-2046
July 6, 2006
© Terraprobe Limited

Distribution:

3 cc: Alliance Homes Inc.
1 cc: Cansult Limited
2 cc: Terraprobe Limited

TABLE OF CONTENTS

1.0 INTRODUCTION

We are pleased to present our report on the subsurface investigation carried out for the proposed Palgrave West Estates Subdivision, Mt. Hope Road south of Highway 9, in Palgrave, Ontario. Authorization to carry out this work was provided by Mr. Alex Troop on March 28, 2006.

The purpose of the investigation was to determine the soil and groundwater conditions on the site as they pertain to the design and installation of proposed private septic systems, municipal services, road construction and general house foundations. Also, preliminary geotechnical recommendations were required for proposed storm water management facilities and existing low areas of the site.

2.0 SITE AND PROJECT DESCRIPTION

The site is located on the west side of Mt. Hope Road, just south of Highway 9, north of Pine Avenue, in the Community of Palgrave, Ontario (see Figure 1).

It is proposed to proceed with design and construction of municipal water services and urban road design associated with the development of a residential subdivision. Private septic systems are proposed for each residential lot.

The property is currently vacant, treed and grassed land with undulating/rolling grades.

3.0 FIELD WORK

The field work associated with this project comprised of the advancement of seven (7) boreholes to depths of 2.0m to 6.6m.

The field work was carried out on May 1, 2006 using a crawler-mounted CME55 power auger provided by a specialist soil drilling contractor.

The boreholes were advanced using Standard Penetration Test methods at regular 0.75 to 1.5 m intervals in each borehole. All soil samples were sealed in plastic containers and returned to our laboratory for further evaluation and testing.

Following completion of the advancement of the boreholes, a standpipe type piezometer comprising of 13 mm diameter PVC tubing slotted at the base was installed in six of the seven boreholes.

A return visit was made to the site on May 8, 2006 to measure static water levels in the installed standpipes.

The supervision of the drilling process and caring for samples obtained was provided by a soil technician from Terraprobe.

4.0 SUBSURFACE CONDITIONS

The details of the subsurface conditions encountered at each borehole are presented on the attached Borehole Logs. It should be noted that the conditions are confirmed at the borehole locations only and could vary between and beyond these locations. In addition, the changes in soil stratigraphy delineated on the Borehole Logs have been inferred from non-continuous sampling. In this regard, the changes should be taken as transitions from one soil type to another as opposed to exact planes of geologic change.

In general, the boreholes encountered 100 to 450mm of sandy topsoil underlain by interlayered sand and sandy silt to silty sand soils with trace to some gravel. A fine silt layer was noted below 5.5m at Borehole 6.

No bedrock was encountered to the termination depths of 2.0 to 6.6m below existing grades.

In the proposed stormwater management facilities and existing low areas, (i.e. Boreholes 2, 6 and 7), Standard Penetration Tests conducted in the borehole generally indicated 'N' values ranging from 2 to50 blows per 0.3 m of penetration with depth. Therefore, these soils are considered to be very loose to very dense.

Standard Penetration Tests conducted in the remaining boreholes generally indicated similar 'N' values ranging from 3 to 48 blows per 0.3m of penetration. The higher 'N' values were generally encountered below 3 to 5m.

Five (5) grain size analyses were conducted on samples from Boreholes 2, 4, 6 and 7. The test reports are appended as Figures 3 to 7 and confirm a sand trace silt to silt and sand at these locations.

The moisture contents ranged from approximately 2 to 24% above the water level with the higher values representing siltier soils. Moisture contents below the encountered water level ranged from 5 to 20% by weight.

Static water levels, as measured on May 8, 2006 are tabulated below:

Borehole Number	Water Level Depth (m)	
	Noted During Drilling	Measured May 8/06
1	6.0	6.1
2	5.2	4.7
3	Dry to 6.6	5.7
4	Dry to 6.6	Standpipe destroyed
5	5.2	Dry to 5.4
6	2.1	2.5
7	Dry to 2.0	--

It is anticipated that some fluctuations of the groundwater table will occur seasonally. In particular, slightly perched conditions could develop in the upper loose to compact silty soils and in granular seams during wet seasons.

5.0 DISCUSSION AND RECOMMENDATIONS

The following discussion and recommendations are based on the factual data obtained from this investigation and are intended for use by the design engineers only. Contractors bidding on this project or conducting work associated with this project should make their own interpretation of the factual data and/or carry out their own investigations.

Generally, the site is underlain with loose to dense soils. No major groundwater problems are anticipated for the installation of the proposed services, road construction to depths of about 3 to 5m below existing grade.

5.1 House Foundations

The undisturbed soils beneath the topsoil layer are considered marginally suitable for the support of conventional spread footings for houses.

Conventional footings proposed for structures placed on the loose to compact soils may require a lower than normal design bearing pressure. The loose to marginally compact conditions encountered in the upper 1 to 2m will require house foundations, etc. to be designed for maximum net allowable bearing pressures as shown in the following table.

Borehole Number	Maximum Net Allowable Design Bearing Pressure (kPa)	Minimum Founding Level Below Grade (m)
1	75 150	0.5 2.0
2	75 150	0.5 2.0
3	100 150	0.5 1.5
4	150	0.5
5	150	0.5
6	150	0.5
7	75	0.5

A minimum soil cover of 1.2m or equivalent insulation is recommended for frost protection to footings in exterior or unheated areas. Construction during cold weather should also ensure temporary frost protection of footing bases.

The minimum footing widths to be used in conjunction with the above recommended soil bearing pressures should be 0.5m for continuous footings and 0.8m for individual footings. The above recommended bearing capacities are based on estimated maximum total settlements of 25 mm.

Higher design foundation pressures are available on the deeper dense to very dense soils but these should be evaluated by Terraprobe for specific cases and locations. It should also be noted that due to the very loose

to marginally dense conditions in the upper 1 to 2m, some downward stepping of footings may be required to extend to competent soils.

Prior to placement of concrete for footings, the footing bases should be cleaned of all deleterious materials such as topsoil, fill, softened or disturbed materials as well as any standing water. It is recommended that the foundations be inspected by Terraprobe in order to confirm the exposed soil conditions and recommended bearing capacities. If construction proceeds during freezing weather conditions, adequate temporary frost protection for the footing bases and concrete must be provided.

The native site soils maybe sandy in some cases, but are primarily not considered free draining. Therefore, perimeter drainage measures for house basements as per the Ontario Building Code (Section 9.14.2 1997 or newer versions) should be implemented.

Areas of the property may require engineered fill to raise grades. This should be completed under full time supervision by Terraprobe to monitor extent, lift thickness, compaction, material quality and the like.

Engineered fill material may consist of imported sandy soils placed with moisture control in maximum 200 mm loose lifts and compacted uniformly to a minimum of 98% of Standard Proctor Maximum Dry Density (SPMDD). Complete engineered fill specifications are available from Terraprobe upon request.

5.2 Concrete Slab - On - Grade or Basement Floors

Conventional lightly loaded concrete slab-on-grade or basement floors can be placed on the existing native soil subgrade or on engineered fill placed under full time supervision, below all deleterious materials provided a layer consisting of a minimum of 150 mm of OPSS Granular 'A' type material compacted to a minimum of 100% of Standard Proctor Maximum Dry Density (SPMDD) is placed directly below the slab as a moisture break.

All basement floors should be constructed above the seasonally high water table. Perimeter, filtered, weeping drains must also be installed leading to positive outlets such as a sump pump in the basement. Basement walls must be damp proofed and backfilled either with imported Granular 'B' type backfill or drainage mediums.

5.3 Excavations

The recommended safe side slope configuration for temporary unbraced excavations through the native loose to compact soils is 1 to 1 (horizontal to vertical) typically.

The soils encountered on the site are generally considered a Type 3 soil above the water level according to the Occupational Health and Safety Act. This criteria will permit excavations with 1 to 1 side slopes from the excavation base up to ground surface. This regulation applies in trenches that are greater than 1.2m depth and where workers must enter the trench to carry out work. Soils are generally Type 4 below the water level.

Given shallow storm sewer excavations up to about 2 to 3m below existing grades, we do not expect many excavations will encounter the groundwater table. Minor seepage could be handled adequately using filtered sump pumps placed at the base of most excavations. More positive dewatering methods, such as well points will be required where sandy deposits are encountered and where excavations must extend more than 0.3 m below the water table in silty sand and similar coarse deposits. Based on current site grades and water levels below 2.5m to 5m, we do not anticipate that many excavations will extend below the encountered water level.

5.4 Backfill

Based on our experience with sand, silty sand and sandy silt soils, the water contents of the native site soils above the water level are primarily in the range of 2 to 12% by weight. The estimated optimum water content for Standard Proctor compaction is about 9 to 12%. Generally, soils can be sufficiently compacted at moisture contents up to about 3% wetter than optimum. In this regard, the majority of the site soils fall within this range with the exception of the lower wet silty soils. The majority of the site soils may be reused as compacted backfill.

It should be noted that the silty nature of some of the soils makes them very susceptible to water content. In this regard, if construction proceeds during wet inclement weather, difficulties in compacting these materials will increase dramatically.

Earth fill materials placed beneath settlement sensitive areas such as floor slabs, pavement structures and the like should be compacted to a minimum of 95% of SPMDD in lifts not exceeding 200 mm.

The topsoil materials encountered at the site should not be used as backfill in settlement sensitive areas such as those noted above. The topsoil material may be stockpiled and reused for landscaping purposes.

In our opinion, this investigation did not encounter any significant deposits of free draining Granular 'B' type materials that could be practically considered as borrow for use in pavement construction or the like. If during construction, sections appear more consistent, sampling and testing could be carried out to assess possible reuse of spectific materials in the subbase structure.

Should construction be conducted during the winter season, it is imperative to ensure that frozen materials are not utilized as trench backfill.

It is recommended that inspection and testing be carried out by Terraprobe during construction to confirm trench backfill quality, thickness and to ensure adequate compaction.

5.5 Lateral Earth Pressures on Subsurface Walls

The boreholes encountered primarily sand, silty sand and sandy silt soils, for the most part in a loose to compact condition within the upper 1 to 3m of ground surface.

For design of rigid concrete walls such as basements the following design parameters are recommended.

		Loose to Compact
soil unit weight	γ	19 kN/m^3
angle of internal friction	Φ'	32°
coefficient of lateral earth pressure "at rest"	k_o	0.5

The recommended design angle of friction between concrete and the native soil is 24°. Associated with the above is the inherent assumption that hydrostatic pressure will not be allowed to develop behind these wall structures. In this regard, perimeter drainage systems will need to be implemented.

5.6 Pipe Bedding

Based on anticipated sewer inverts, the trench base is expected to consist of loose to compact sand and silty sand to sandy silt in most cases. The native soils at the site are suitable for support of sewers and/or watermain. The undisturbed native soils encountered at the site will generally be suitable for support of underground services with conventional Class 'B' granular bedding. Additional granular bedding may be necessary for stabilization of wet trench bases. The granular bedding should consist of a well graded material such as Granular 'A'.

Any soft, loose or disturbed soils encountered as a result of groundwater seepage or construction traffic should be subexcavated and replaced with suitably compacted granular fill. Granular 'A' bedding material should be placed in thin lifts and compacted to a minimum of 95% of SPMDD. If HL 8 course aggregate or 19mm clear stone is used this will require light tamping only. However, it should be cautioned that this HL 8 aggregate or clear stone should not be used directly against native deposits unless a geotextile fabric is also considered as a complete wrap to prevent migration of fines into the bedding from the surrounding fine soil.

5.7 Thrust Blocks and Pipe Restraints

It is recommended that the thrust blocks be cast directly against undisturbed native ground. The maximum allowable bearing pressures for design of thrust blocks against undisturbed native soil where there is soil cover over the block that equals the height of the block, is as shown in the Table of Section 5.1 of this report.

The internal angle of friction between the thrust block and the soil may be taken as 33°.

The following design parameters are recommended for design of restrained joints;

- Ultimate friction angle between plastic or ductile iron pipe and compact bedding 24°
- Ultimate friction angle between concrete pipe and compact bedding 33°

5.8 Pavement Design

The pavement subgrade is expected to comprise of a sand and silty sand to sandy silt in most cases or perhaps clean earth fill compacted to a minimum of 95% of SPMDD. The exposed subgrade should be shaped and graded with a 3% cross-fall, directed towards continuous subdrains.

The pavement subgrade should be proof rolled to evaluate its stability. All unstable areas will require sub-excavation and re-compaction or increased thickness of granular subbase. It should be noted that the majority of the upper site soils are considered frost susceptible. Therefore, adequate subgrade drainage is recommended.

Based on the soil conditions encountered during our investigation, we recommend that the minimum pavement for this site is as follows (Town of Caledon Standard);

HL 3 (surface) asphalt	40 mm
HL 8 (binder) asphalt	65 mm
OPSS Granular 'A' (base course)	150 mm
OPSS Granular 'B' (subbase course)	300 mm
Total	555 mm

The above design assumes that sub-drainage of the granular fill will be provided. This should consist of continuous subdrains leading to catch basins.

It should be reiterated that while the subgrade may be a sand in some cases, the fine sand is often silty and very frost susceptible. The subdrains are considered a valuable protection against frost heave damage and subgrade softening particularly impacting the long term performance of the pavement.

All topsoil and any organic material should be removed from below settlement sensitive areas such as pavements. Immediately prior to placement of the pavement granular courses, the subgrade should be proof rolled with a heavy rubber tired vehicle (such as a grader) and any loose, soft or unstable areas should be subexcavated and backfilled with compacted materials. The subgrade should then be shaped and graded with a 3% cross-fall, directed towards the subdrains.

The upper site soils are generally too silty to consider a reduction in the thickness of the subbase course granulars (see attached grain size analyses).

The granular subbase and base fill materials should be compacted to a minimum of 100% of SPMDD, placed in lifts of 150 mm or less. Asphaltic concrete materials should be rolled and compacted to a minimum of 97% of Marshall Bulk Density (MBD) based on nuclear density testing.

The above pavement design thicknesses are considered adequate for the design traffic. However, if pavement construction occurs in wet inclement weather it may be necessary to provide additional subgrade support for heavy construction traffic by increasing the thickness of the granular subbase or base course materials. Further, main traffic access areas for construction equipment may experience unstable subgrade conditions. These may need stabilization utilizing additional thickness of granular materials and/or geosynthetic products.

It is recommended that inspection and testing be carried out during construction to confirm material quality, thickness and to ensure adequate compaction. The asphalt mix design should be reviewed well before the planned paving date.

5.9 Stormwater Management Facilities

Boreholes 2, 6 and 7 were advanced in proposed stormwater management facilities and existing low areas as shown approximately on Figure 2.

Figures 3, 4, 6 and 7 attached, indicate grain size analyses for the different strata encountered in Boreholes 2, 6 and 7. Based on the above, we would expect the base of proposed facilities to be situated above the encountered water level. We would estimate a coefficient of permeability of about 10^{-3} cm/s in the sand trace silt (Figures 4 and 6), grading to about 10^{-5} cm/s in the silt and sand (Figures 3 and 7).

5.10 Septic Systems

In general, two criteria must be satisfied for construction of conventional Class IV septic tank and tile field systems:

i) The high water table must be situated a minimum of 1.5m below the finished grade in the tile bed area.

ii) The soils beneath the proposed tile bed area must have an acceptable percolation rate (generally 2 to 30 minutes per centimeter).

In summary, while the soil conditions generally appear to be suitable for construction of conventional in-ground septic tile fields for much of the site, raised sand beds will be required in some areas of the site, (i.e. Borehole 7 and possibly Borehole 2) due to the heavier sandy silt soils.

Our borehole investigation conducted May 1, 2006 to evaluate the soil and groundwater conditions suggests that raised or partially raised beds will be required for some of the currently proposed lots.

The groundwater table was encountered at depths greater than 2.5m in all boreholes. The sand and silt soils depicted on Figures 3 and 7 (i.e. approximately Lots 1 to 4 and Lots 30 to 31) will have estimated percolation 'T' Times of about 40 to 50 min/cm, while the sand shown on Figures 4, 5 and 6 over most of the remaining portions of the site will have 'T' Times of about 6 to 8 min/cm.

Individual septic bed areas should be investigated and designed on a lot-by-lot basis due to the variation across this property.

We trust the foregoing information will satisfy your present requirements. If you should have any questions, or if we can be of further assistance, please do not hesitate to contact us.

Sincerely,

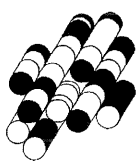
Terraprobe Limited

Blair E. Goss, P. Eng.

Kirk R. Johnson, P. Geo, P. Eng.
Associate

BEG/lc
Barrie Office

BOREHOLE LOGS



Terraprobe
Limited

Terraprobe

ABBREVIATIONS, TERMINOLOGY, GENERAL INFORMATION

BOREHOLE LOGS

SAMPLING METHOD

SS	split spoon
ST	Shelby tube
AS	auger sample
WS	wash sample
RC	rock core
WH	weight of hammer
PH	pressure, hydraulic

PENETRATION RESISTANCE

Standard Penetration Test (SPT) resistance ('N' values) is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.).

Dynamic Cone Test (DCT) resistance is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a conical steel point of 50 mm (2 in.) diameter and with 60° sides on 'A' size drill rods for a distance of 0.3 m (12 in.).

SOIL DESCRIPTION - COHESIONLESS SOILS

Relative Density	'N' value
very loose	< 4
loose	4 - 10
compact	10 - 30
dense	30 - 50
very dense	> 50

SOIL DESCRIPTION - COHESIVE SOILS

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 - 16
very stiff	100 - 200	16 - 32
hard	> 200	> 32

SOIL COMPOSITION

	% by weight
'trace' (e.g. trace silt)	< 10
'some' (e.g. some gravel)	10 - 20
adjective (e.g. sandy)	20 - 35
'and' (e.g. sand and gravel)	35 - 50

TESTS, SYMBOLS

MH	mechanical sieve and hydrometer analysis
w, w_c	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity index
k	coefficient of permeability
γ	soil unit weight, bulk
ϕ'	angle of internal friction
c'	cohesion shear strength
C_c	compression index

GENERAL INFORMATION, LIMITATIONS

The conclusions and recommendations provided in this report are based on the factual information obtained from the boreholes and/or test pits. Subsurface conditions between the test holes may vary.

The engineering interpretation and report recommendations are given only for the specific project detailed within, and only for the original client. Any third party decision, reliance, or use of this report is the sole and exclusive responsibility of such third party. The number and siting of boreholes and/or test pits may not be sufficient to determine all factors required for different purposes.

It is recommended Terraprobe be retained to review the project final design and to provide construction inspection and testing.

Terraprobe

LOG OF BOREHOLE ..1..

PROJECT NAME: Palgrave West Estates
PROJECT No.: 3-06-2046
CLIENT: Alliance Homes Inc.
BORING DATE: May 1, 2006
LOCATION: Palgrave, Ontario
ELEVATION DATUM:

BORING METHOD: CME 55 Crawler-mounted Drill Rig / 108mm Diameter Solid Stem Augers

DEPTH SCALE IN METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUE	PENETRATION RESISTANCE PLOT 20 40 60 80	SHEAR STRENGTH kPa nat.V − + Q − ● rem.V − ⊕ U − ○ 20 40 60 80	WATER CONTENT (%) WP W WL 10 20 30	INSTALLATION INFORMATION
0	GROUND SURFACE									
	150mm – TOPSOIL Brown Loose to Dense Moist to Wet		0.0	1	SS	3	x		○	Bentonite Seal
1				2	SS	7	x		○	
2	SAND, silty to trace silt, trace gravel			3	SS	5	x		○	
				4	SS	13	x		○	
3				5	SS	24		x	○	
4										
5				6	SS	25		x	○	
6				7	SS	35		x	○	▼ 6.1m
	End of Borehole		6.6							
7										
8										
9										

1. Borehole remained open upon completion of drilling.

2. Water level noted at 6m during drilling.

3. Water level on May 8, 2006, measured at 6.1m.

Terraprobe

LOG OF BOREHOLE ..2..

PROJECT NAME: Palgrave West Estates
PROJECT No.: 3-06-2046
CLIENT: Alliance Homes Inc.
BORING DATE: May 1, 2006
LOCATION: Palgrave, Ontario
ELEVATION DATUM:

BORING METHOD: CME 55 Crawler-mounted Drill Rig / 108mm Diameter Solid Stem Augers

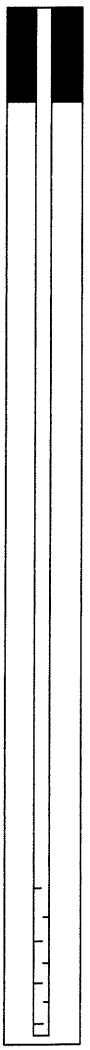
DEPTH SCALE IN METRES

DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUE
GROUND SURFACE					
450mm – TOPSOIL		0.0			
Brown Very Loose to Dense Moist to Wet			1	SS	4
			2	SS	7
SILT & SAND, grading to SAND, some to trace silt below 2m			3	SS	2
			4	SS	17
			5	SS	25
			6	SS	32
			7	SS	50
End of Borehole		6.6			

PENETRATION RESISTANCE PLOT
20 40 60 80
SHEAR STRENGTH kPa
nat.V – + Q – ●
rem.V – ⊕ U – ○
20 40 60 80

WATER CONTENT (%)
wP w wL
10 20 30

INSTALLATION INFORMATION



1. Borehole caved at 5.2m during drilling.
2. Water level noted at 5.2m during drilling.
3. Water level on May 8, 2006, measured at 4.7.

Terraprobe

LOG OF BOREHOLE ..3..

PROJECT NAME: Palgrave West Estates
PROJECT No.: 3-06-2046
CLIENT: Alliance Homes Inc.
BORING DATE: May 1, 2006
LOCATION: Palgrave, Ontario
ELEVATION DATUM:

BORING METHOD: CME 55 Crawler-mounted Drill Rig / 108mm Diameter Solid Stem Augers

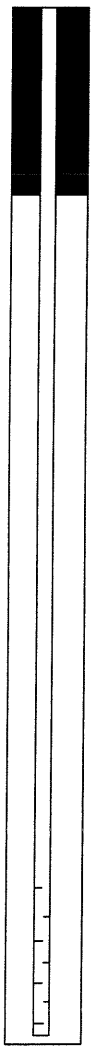
DEPTH SCALE IN METRES

DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUE
GROUND SURFACE					
100mm – TOPSOIL		0.0			
Brown Loose to Dense Moist			1	SS	3
			2	SS	9
			3	SS	16
SAND, some to trace silt					
			4	SS	16
			5	SS	18
			6	SS	31
			7	SS	39
End of Borehole		6.6			

PENETRATION RESISTANCE PLOT
20 40 60 80
SHEAR STRENGTH kPa
nat.V – + Q – ●
rem.V – ⊕ U – ○
20 40 60 80

WATER CONTENT (%)
wP w wL
10 20 30

INSTALLATION INFORMATION



1. Borehole remained open and dry upon completion of drilling.

2. Water level on May 8, 2006, measured at 5.7m.

Terraprobe

LOG OF BOREHOLE ..4..

PROJECT NAME: Palgrave West Estates
PROJECT No.: 3-06-2046
CLIENT: Alliance Homes Inc.
BORING DATE: May 1, 2006
LOCATION: Palgrave, Ontario
ELEVATION DATUM:

BORING METHOD: CME 55 Crawler-mounted Drill Rig / 108mm Diameter Solid Stem Augers

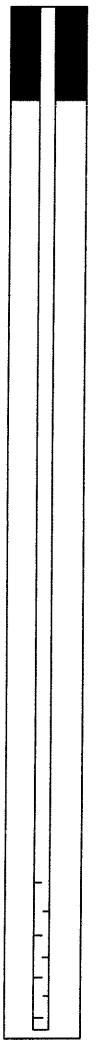
DEPTH SCALE IN METRES

DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	"N" VALUE
GROUND SURFACE					
Brown Loose to Compact Moist to Wet		0.0	1	SS	6
SAND, trace to some silt, silty layers at 2m			2	SS	19
			3	SS	16
			4	SS	21
			5	SS	20
			6	SS	28
Brown Compact Moist		5.5	7	SS	26
SILTY SAND, fine					
End of Borehole		6.6			

PENETRATION RESISTANCE PLOT
20 40 60 80
SHEAR STRENGTH kPa
nat.V – + Q – ●
rem.V – ⊕ U – ○
20 40 60 80

WATER CONTENT (%)
wP w wL
10 20 30

INSTALLATION INFORMATION



1. Borehole remained open and dry upon completion of drilling.

2. Standpipe blocked on May 8, 2006.

Terraprobe

LOG OF BOREHOLE ..5..

PROJECT NAME: Palgrave West Estates
PROJECT No.: 3-06-2046
CLIENT: Alliance Homes Inc.
BORING DATE: May 1, 2006
LOCATION: Palgrave, Ontario
ELEVATION DATUM:

BORING METHOD: CME 55 Crawler-mounted Drill Rig / 108mm Diameter Solid Stem Augers

DEPTH SCALE IN METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	TYPE	"N" VALUE	PENETRATION RESISTANCE PLOT 20 40 60 80 / SHEAR STRENGTH kPa (nat.V - +, rem.V - ⊕, Q - ●, U - ○) 20 40 60 80	WATER CONTENT (%) wP w wL 10 20 30	INSTALLATION INFORMATION
0	GROUND SURFACE								
	150mm - TOPSOIL		0.0						
	Brown Compact to Dense Moist			1	SS	10	x		Bentonite Seal
1	SAND, some to trace sand, trace to some gravel			2	SS	28	x		
2				3	SS	26	x		
3				4	SS	31	x		
				5	SS	31	x		
4	Brown Dense Wet		4.0						
	SILT & SAND, trace gravel			6	SS	43	x		
5									
6				7	SS	48	x		
	End of Borehole		6.6						
7									
8									
9									

1. Borehole remained open upon completion of drilling.

2. Water level noted at 5.2m during drilling.

3. Water level on May 8, 2006, measured dry to 5.4m.

Terraprobe

LOG OF BOREHOLE ..6..

PROJECT NAME: Palgrave West Estates
PROJECT No.: 3-06-2046
CLIENT: Alliance Homes Inc.
BORING DATE: May 1, 2006
LOCATION: Palgrave, Ontario
ELEVATION DATUM:

BORING METHOD: CME 55 Crawler-mounted Drill Rig / 108mm Diameter Solid Stem Augers

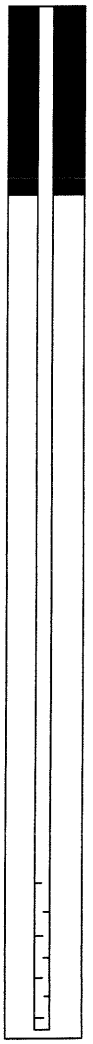
DEPTH SCALE IN METRES

DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	"N" VALUE
GROUND SURFACE					
125mm – TOPSOIL Brown Compact to Dense Moist to Wet		0.0	1	SS	20
			2	SS	26
SAND, trace gravel, trace to some silt			3	SS	32
			4	SS	29
			5	SS	22
			6	SS	45
Brown Dense Wet		5.5			
SILT, trace clay, trace fine sand			7	SS	40
End of Borehole		6.6			

PENETRATION RESISTANCE PLOT
20 40 60 80
SHEAR STRENGTH kPa
nat.V – + Q – ●
rem.V – ⊕ U – ○
20 40 60 80

WATER CONTENT (%)
wP w wL
10 20 30

INSTALLATION INFORMATION



1. Borehole caved at 3m during drilling.
2. Water level noted at 2.1m during drilling.
3. Water level on May 8, 2006, measured at 2.5m.

Terraprobe

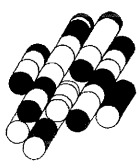
LOG OF BOREHOLE ..7..

PROJECT NAME: Palgrave West Estates
PROJECT No.: 3-06-2046
CLIENT: Alliance Homes Inc.
BORING DATE: May 1, 2006
LOCATION: Palgrave, Ontario
ELEVATION DATUM:

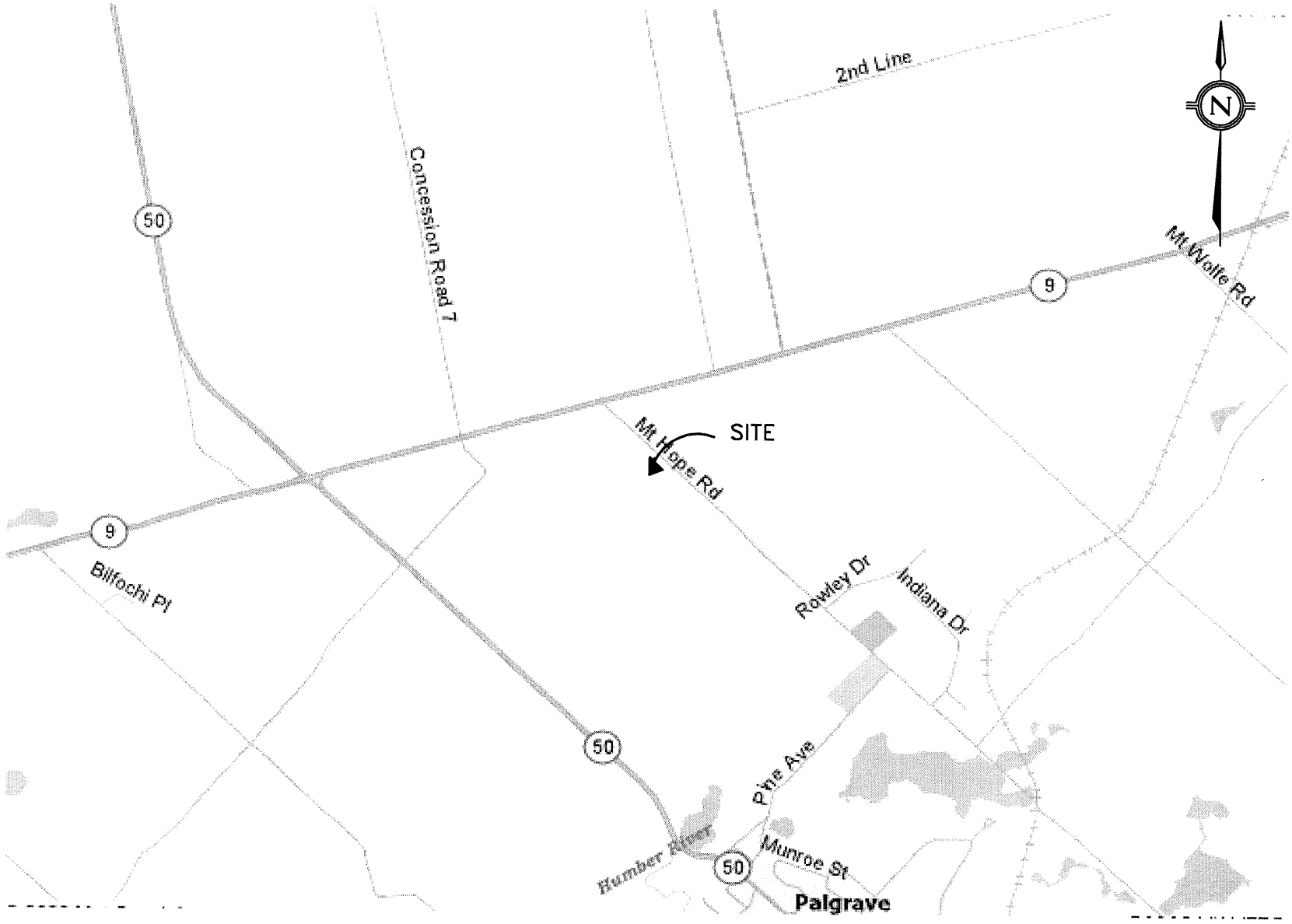
BORING METHOD: CME 55 Crawler-mounted Drill Rig / 108mm Diameter Solid Stem Augers

DEPTH SCALE IN METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUE	PENETRATION RESISTANCE PLOT (20 40 60 80) / SHEAR STRENGTH kPa (nat.V – +, rem.V – ⊕, Q – ●, U – ○) (20 40 60 80)	WATER CONTENT (%) (wP, w, wL) (10 20 30)	INSTALLATION INFORMATION
0	GROUND SURFACE								
	100mm – TOPSOIL Brown Very Loose Moist		0.0	1	SS	2	x	○	1. Borehole remained open and dry upon completion of drilling.
1	SILTY SAND to SANDY SILT, some silt to silty, organic stained			2	SS	4	x	○	2. Water level on May 8, 2006, measured dry to 2.0m
2				3	SS	4	x		
	End of Borehole		2.0						
3									
4									
5									
6									
7									
8									
9									

FIGURES



Terraprobe
Limited



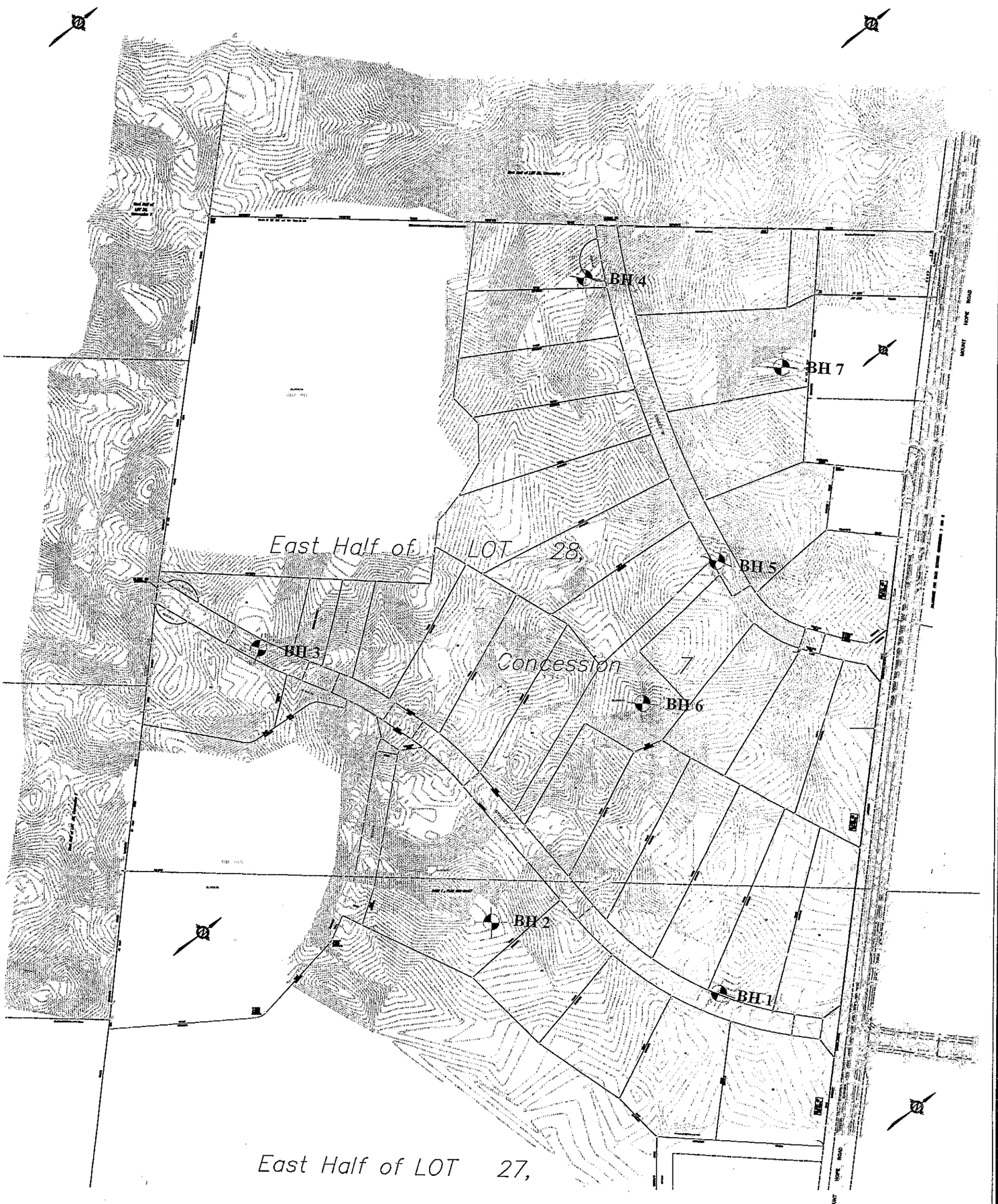
JULY 2006

SITE LOCATION PLAN

3-06-2046

Terraprobe

FIGURE 1



MAP NOT TO SCALE.
BOREHOLE LOCATIONS ARE APPROXIMATE.

JULY 2006

BOREHOLE LOCATION PLAN

3-06-2046

Terraprobe

FIGURE 2

Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

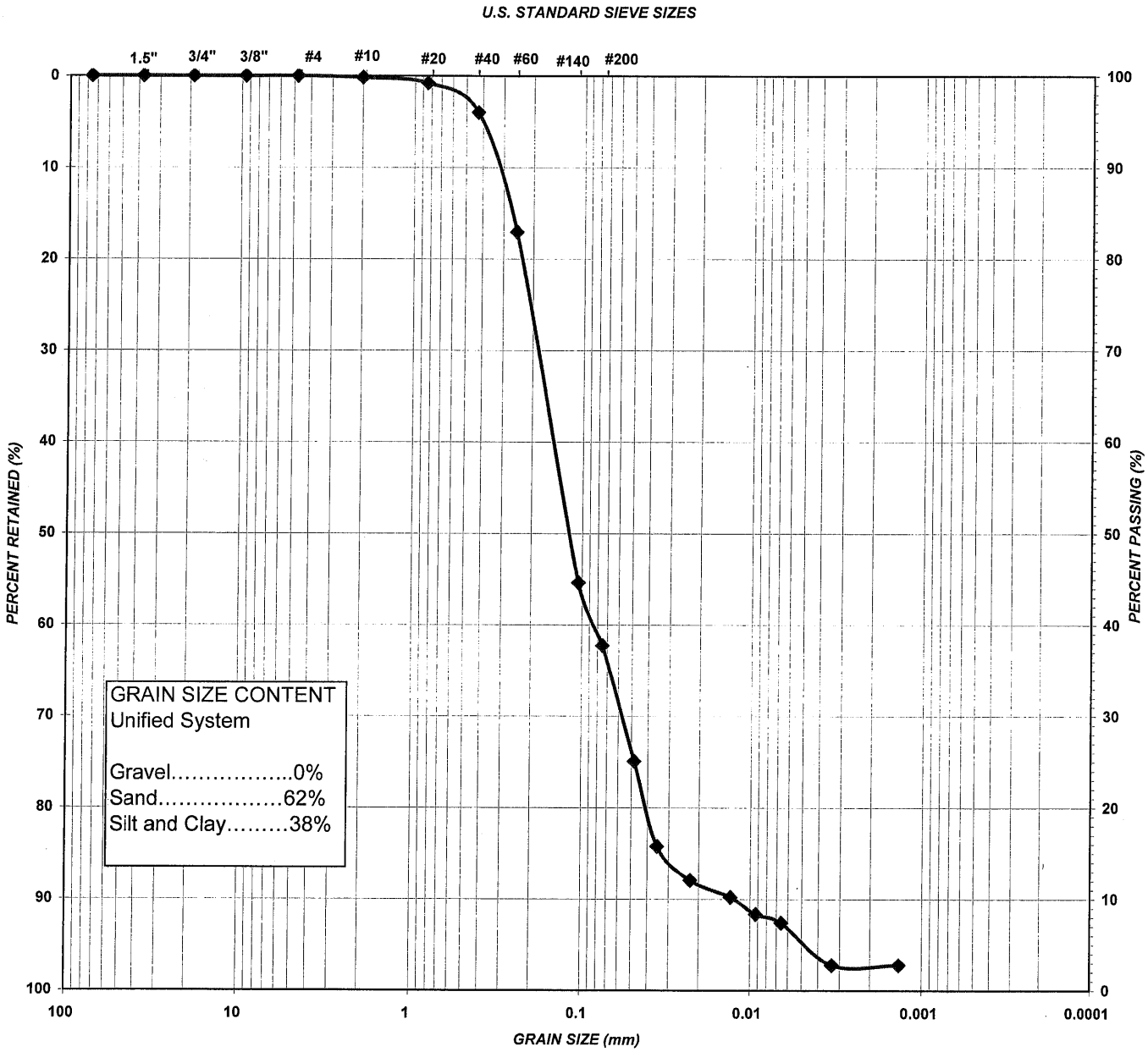
PROJECT: **Palgrave West Estates**
LOCATION: **Palgrave, ON**
CLIENT: **Alliance Homes Inc.**

FILE NO.: **3-06-2046**
LAB NO.: **3619a**
SAMPLE DATE: **May-01-06**
SAMPLED BY: **M.K.**

TEST PIT NUMBER: **2** SAMPLE DEPTH: **n/g**
SAMPLE NUMBER: **2**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Brown sand and silt**

Figure 3

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL		SAND			SILT	CLAY
			COARSE	MEDIUM	FINE		

UNIFIED SYSTEM	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Terraprobe

WASH SIEVE ANALYSIS TEST REPORT

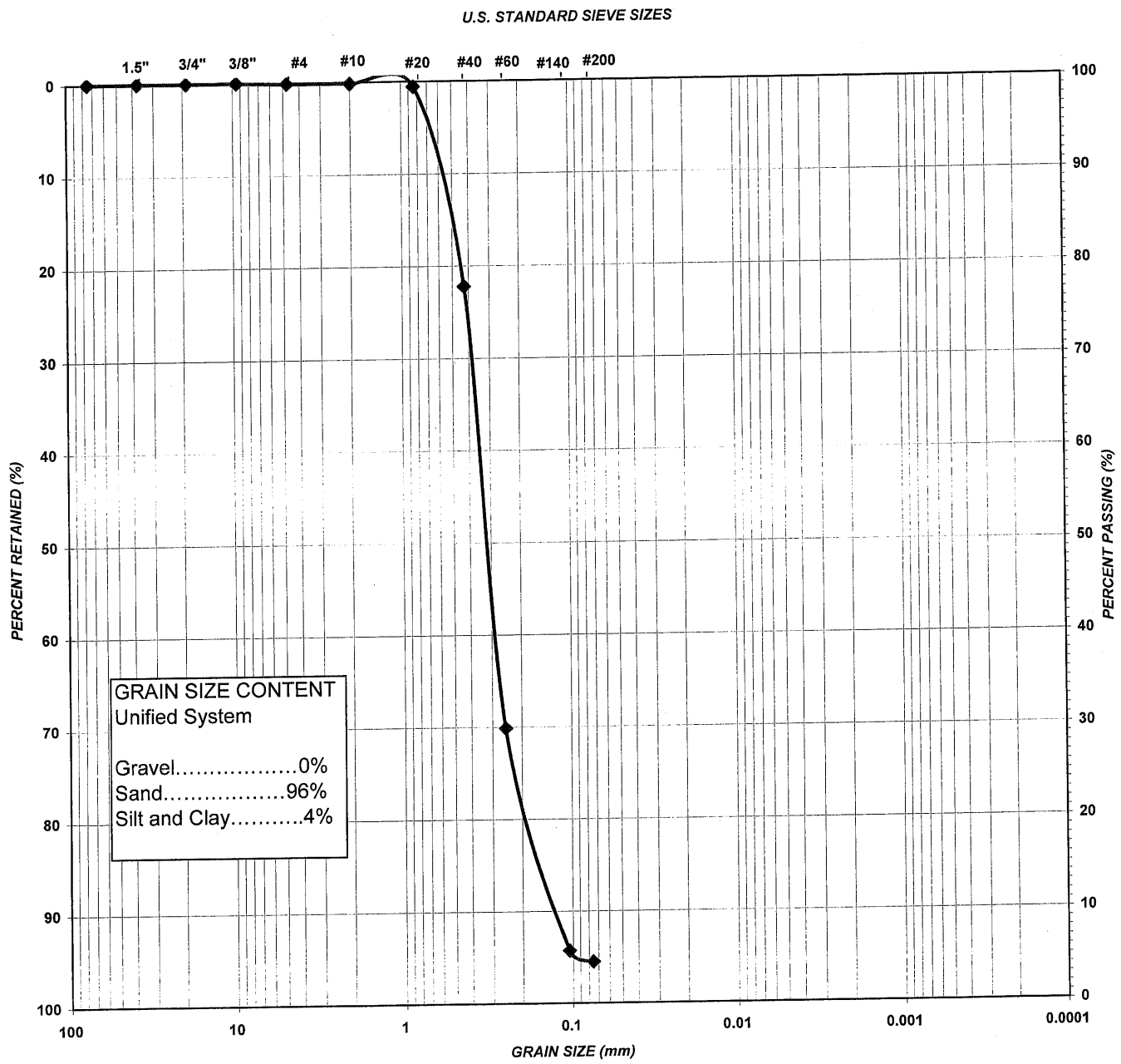
PROJECT: **Palgrave West Estates**
LOCATION: **Palgrave, ON**
CLIENT: **Alliance Homes Inc.**

FILE NO.: **3-06-2046**
LAB NO.: **3618a**
SAMPLE DATE: **May-01-06**
SAMPLED BY: **M.K.**

TEST PIT: **2** SAMPLE DEPTH: **n/g**
SAMPLE NUMBER: **4**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Brown sand, trace silt**

Figure 4

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

Terraprobe

WASH SIEVE ANALYSIS
TEST REPORT

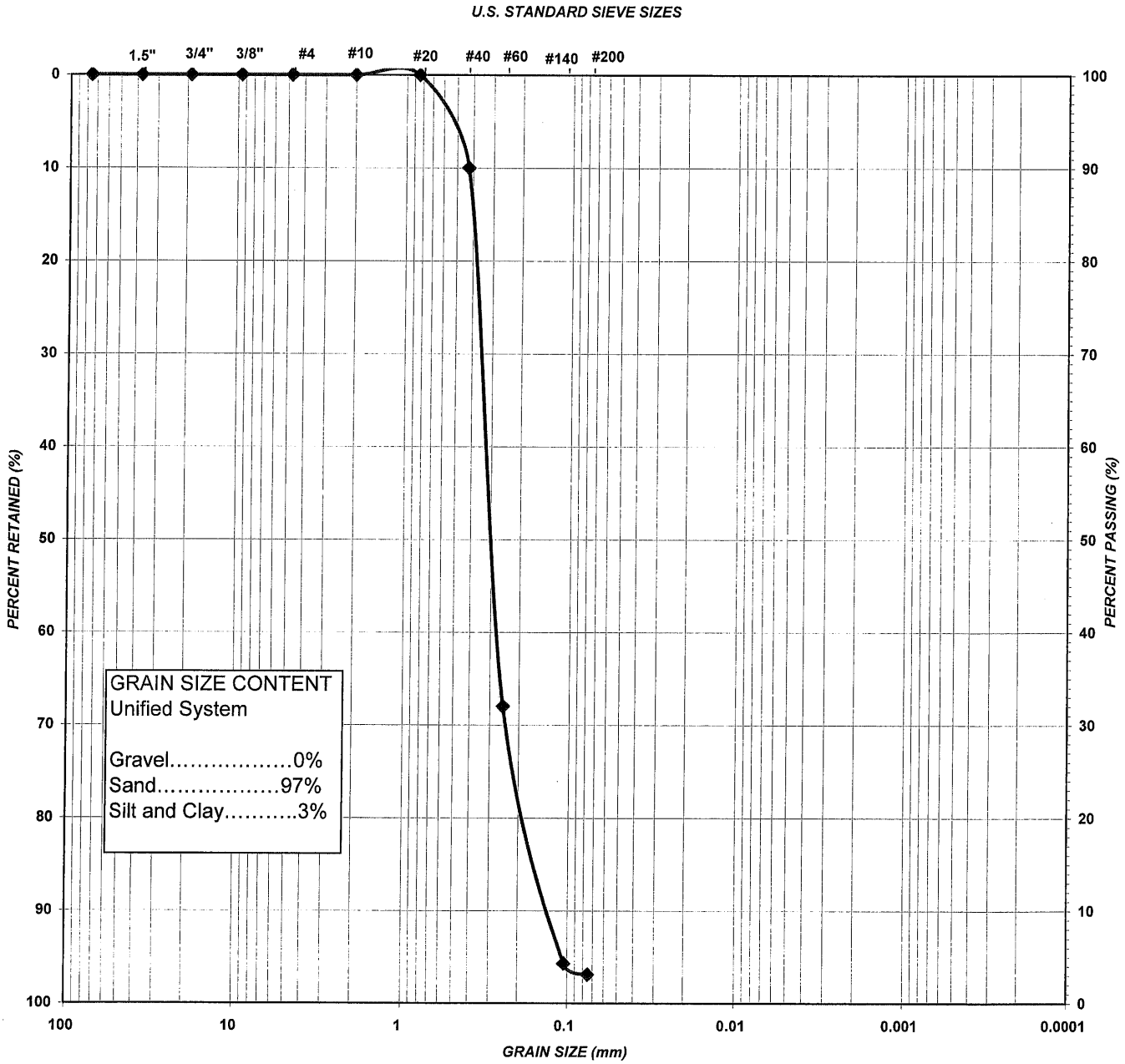
PROJECT: **Palgrave West Estates**
LOCATION: **Palgrave, ON**
CLIENT: **Alliance Homes Inc.**

FILE NO.: **3-06-2046**
LAB NO.: **3618b**
SAMPLE DATE: **May-01-06**
SAMPLED BY: **M.K.**

TEST PIT: **4** SAMPLE DEPTH: **n/g**
SAMPLE NUMBER: **4**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Brown sand, trace silt**

GRAIN SIZE DISTRIBUTION

Figure 5



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				

Terraprobe

WASH SIEVE ANALYSIS TEST REPORT

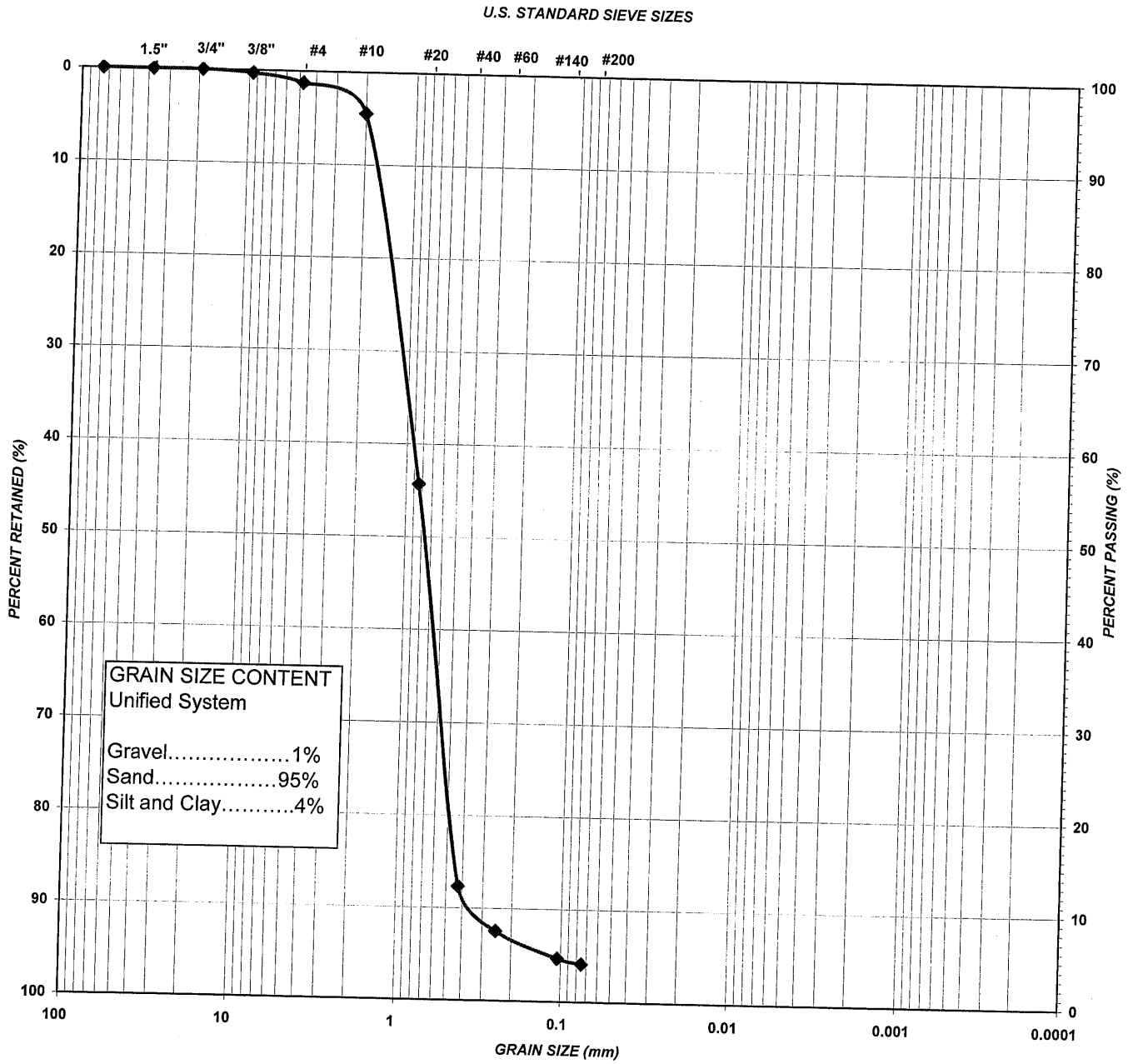
PROJECT: **Palgrave West Estates**
LOCATION: **Palgrave, ON**
CLIENT: **Alliance Homes Inc.**

FILE NO.: **3-06-2046**
LAB NO.: **3618c**
SAMPLE DATE: **May-01-06**
SAMPLED BY: **M.K.**

TEST PIT: **6** SAMPLE DEPTH: **n/g**
SAMPLE NUMBER: **2**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Brown sand, trace silt, trace gravel**

GRAIN SIZE DISTRIBUTION

Figure 6



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				

Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

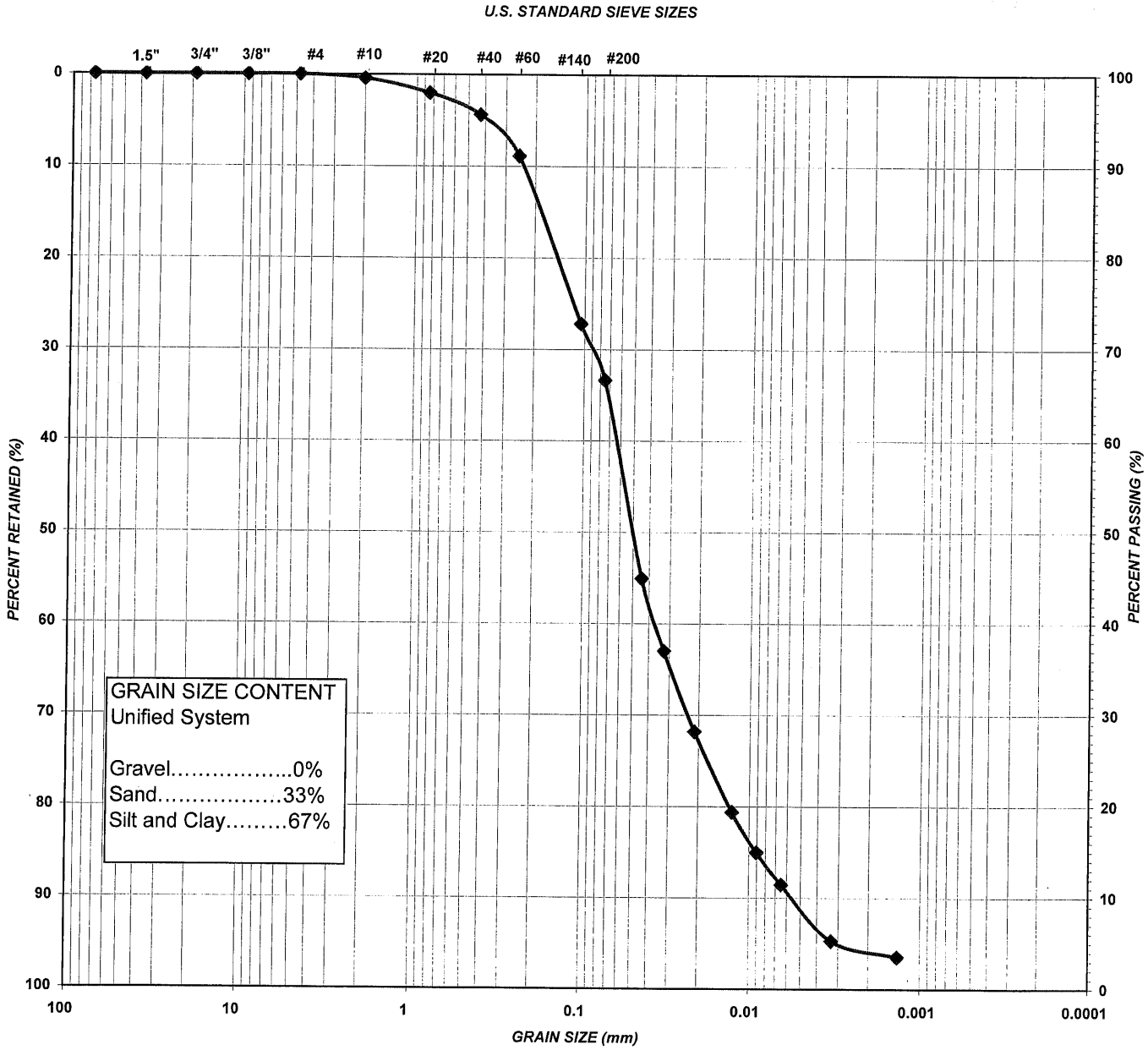
PROJECT: **Palgrave West Estates**
LOCATION: **Palgrave, ON**
CLIENT: **Alliance Homes Inc.**

FILE NO.: **3-06-2046**
LAB NO.: **3619b**
SAMPLE DATE: **May-01-06**
SAMPLED BY: **M.K.**

TEST PIT NUMBER: **7**
SAMPLE DEPTH: **n/g**
SAMPLE NUMBER: **3**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Brown silt, some sand**

Figure 7

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				