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OUR REF.: 23311REV1

YOUR REF.:

30th November 2012

Tongaat Hulett Developments
P.O. Box 22319
GLENASHLEY
4022

Email: Greg.Veerasamy@tongaat.com

Attention : Mr Greg Veerasamy

Dear Sirs,

REPORT ON THE GEOTECHNICAL INVESTIGATION FOR THE SUITABILITY FOR DEVELOPMENT OF AN AREA DESIGNATED AS CANELANDS EAST, VERULAM

Further to our discussions and appointment to undertake the above-mentioned investigation, we confirm that the field work has now been completed on the 18th August 2012.

1. SITE DESCRIPTION

The site comprises a total area of 7.22 ha and is situated in the outer north eastern part of Canelands, Verulam. The site is located directly south of the meandering Umdloti River and is bordered by Dow AgroSciences and the Verulam-tongaat Railway line to the east and south respectively.

The majority of the site is presently under cane cultivation by a farmer lessee to the Client.

A triangular shape portion of the total area has mistakenly been included into the fenced off area of Dow AgroSciences SA (Pty) Ltd. The gravel access road leading to Dow AgroSciences SA (Pty) Ltd along which servitudes and a substation are present crosses through the centre of the site.

The southern boundary of the site is marked by the property of the railways accommodating the main railway line connecting Tongaat with Verulam.

The southern part of the project area south of the road crossing through the project area is sloping gently with a concave slope conformation in a north to north-westerly direction. The northern part comprises a fairly level north-western portion with a wider north westerly trending valley line located to the north east. The entire valley line has been marked as wetland by the Client as has the outermost south eastern part.

2. FIELD INVESTIGATION

The field work comprised the mechanical excavation of inspection pits using a 4x4 TLB provided, supplemented with dynamic cone penetrometer tests and hand auger excavations as well as material sampling. Three representative samples were collected and taken to Thekwini Soils Laboratory in order to determine materials suitability for further use in construction.

The field investigation was partly restricted by the presence of infrastructures such as servitudes, roads, fences and a substation. Further agreement was reached with the farming lessee to minimize crop damage. In total an area of 4.65 ha was classified on the plan provided either as wetland areas, lying below the theoretical 100-year-flood-line or as existing services was excluded.

Separate access had to be arranged for the triangular area fenced off by Dow AgroSciences SA (Pty) Ltd. Due to TLB accessibility restrictions, only auger excavations and dynamic cone penetrometer tests were proposed for this portion. However, on the day of testing, the entire area was flooded, which is a common occurance according to the representatives of Dow AgroSciences SA (Pty) Ltd). As such field work was restricted to a single auger excavation and a single dynamic cone penetrometer test.

2.1 Inspection Pits (IP 1 - IP 9)

A total of nine inspection pits were excavated across the project area. The subsoil profiles exposed were examined and logged. The pits were numbered IP 1 to IP 9 and the approximate positions are marked on the site plan (Figure 1). The logs are presented in Appendix 1 included at the rear of this report.

2.2 Auger Excavations (AH 1 - AH 3)

A total of three hand augers were excavated, two along slopes of the main valley line and a third within the previously mentioned fenced off area. Both excavations along the embankment met with refusal at shallow depths less than 500mm on what is believed to be boulders.

Due to flooding within the fenced area only one auger hole (AH3) was excavated. All the auger hole profiles are included in Appendix 1 of this report.

2.3 Dynamic Cone Penetration Testing

A total of 13 Dynamic Cone Penetrometer probes (DCP's) were carried out. The aim of DCP testing was to establish the consistency of the subsoil underlying the site at shallow to moderate depths as well as to establish the depth to weathered bedrock.

The DCP results are recorded graphically in Figures 2 to 14 and represented as Appendix 2. In order to facilitate the interpretation of the DCP test results with respect to the subsoil consistency in the non-cohesive and cohesive materials underlying the site, the following Table is provided as a guide only.

Table 1 : Subsoil Consistency Inferred from the DCP Test Results

Cohesive Soils		Non-Cohesive Soils	
DCP Blow Count Blow /300mm	Subsoil Consistency	DCP Blow Count Blows /300mm	Subsoil Consistency
0 - 4	Very Soft	0 - 8	Very Loose
4 - 8	Soft	8 - 18	Loose
8 - 15	Firm	18 - 54	Medium Dense
15 - 24	Stiff	54 - 90	Dense
24 - 54	Very Stiff	>90	Very Dense
> 54	Hard		

Specific to DMP equipment

3. GEOLOGY AND SOILS

The majority of the project area is underlain by the diamictic bedrock of the Ordovician Dwyka Formation and the soils derived therefrom. Along the upper slope of the valley as well as at the northern end of the project area. Quaternary alluvial terrace sediments comprising loose sands, gravel and boulder capping the Dwyka Formation at depth. Pits could not be established along the valleys embankment due to the limited accessibility for the TLB, furthermore hand auger excavations refused at shallow depths on likely boulders contained within the alluvial terrace sediments.

Fill materials were encountered along the western portion of the site. We assume, a north west - south east trending depression or shallow drainage line leading towards the Dow AgroSciences SA (Pty) Ltd pond has been filled in order to level the area.

In general the depth to completely to highly weathered, very soft rock, sedimentary bedrock exceeds 3.00m depth with the exception of the south western most area where weathered bedrock was exposed at a depth of 2.40m below existing ground level in IP5.

Loose alluvial terrace sediments associated with the nearby meandering uMdloti River cap the underlying Dwyka Formation both along the embankment of the valley line as well as at the north western boundary around IP 9.

4. LABORATORY RESULTS

A total of three representative bulk samples recovered were taken to Thekwini Soils Laboratory for testing which included full grading analyses, Mod AASHTO and CBR tests to determine the suitability of the materials for possible use as construction material. The results are summarised in Table 2 below and listed as Figures 15, 16 and 17 in Appendix 3 included at the end of this report

4.1 Results

Table 2 : Laboratory tests and Result summary

IP №	Depth (m)	Description	Tests			Results	
			Full Ind	Mod AASHTO	CBR	AASHTO Class	THR 14
2	1.5 - 2.0	Residual Tillite	√	√	√	**A-2-4(0)**	**G7**
4	2.6 - 3.0	Residual Tillite	√	√	√	**A-7-6(10)**	**>G10**
9	0.0 - 0.3	Colluvium	√	√	√	**A-2-4(0)**	**G7**

4.1.1 *Colluvium*

The material encountered in IP 9 classifies as a gravelly sand with a clay content of 7.4% and a grading modulus of 1.40. The material is non-plastic and has no linear shrinkage. In terms of the Revised U.S. Classification this material classifies as an A - 2 - 4 (0) which is considered an excellent to good subgrade material.

The maximum Mod AASHTO density of the material is 2023 kg/m³ at an optimum moisture content of 6.8 %. The material has a CBR of 19 at a compaction of 93% increasing to 40 at a compaction of 98% of the materials maximum Mod AASHTO density. The material has no CBR swell.

In terms of TRH 14 (1985) the material classifies as a G7 material and is considered suitable for re-use as subgrade and in selected layer works for road and pavement works.

4.1.2 *Residual Tillite*

- The residual material encountered in IP 2 classifies as a clayey sand with a clay content of 14.2% and a grading modulus of 0.92. The plasticity index of the materials fines is 8.2 with a linear shrinkage of 0.7%. In terms of the Revised U.S. Classification these materials are A - 2 - 4 (0) which is considered an excellent to good subgrade material.

  The maximum Mod AASHTO density of the material is 1903 kg/m³ at an optimum moisture content of 10.4 %. The material has a CBR of 21 at a compaction of 93% increasing to 45 at a compaction of 98% of the materials maximum Mod AASHTO density. The material has no CBR swell.

  In terms of TRH 14 (1985) the material classifies as a G7 material and is considered suitable for re-use as subgrade and in selected layer works for road and pavement works.

- The residual material encountered in IP 4 classifies as a gravelly, sandy, silty clay with a clay content of 34.6% and a grading modulus of 0.84. The plasticity index of the materials fines is 21 with a linear shrinkage of 13.3%. In terms of the Revised U.S. Classification these materials are A - 7 - 6 (10) which is considered a fair to poor subgrade material.

  The maximum Mod AASHTO density of the material is 1800 kg/m³ at an optimum moisture content of 17 %. The material has a CBR of 1.1 at a compaction of 93% increasing to 1.6 at a compaction of 98% of the materials maximum Mod AASHTO density. The material has a maximum CBR swell of 3.69%.

  Due to the low CBR results, in terms of TRH 14 (1985) the material does not classify as a G10 material and is not considered suitable in road and pavement layer works.

5. GEOTECHNICAL ASSESSMENT

5.1 Excavatabliity

Excavatability in general is expected to be soft according to SABS 1200D through the fill body, colluvial, alluvial as well as completely weathered bedrock. Abnormal fill material, boulders or less weathered dropstones as are common within the Dwyka tillite and the soils deriving therefrom might reduce the trenchability locally. Blasting of sizable relic dropstones / corestones might be required locally.

5.2 Subsoil Seepage

Subsoil seepage was identified during the investigation predominantly within the residual and completely to highly weathered Dwyka Formation. Additionally perched water tables may build up during periods of high rain fall, at the base of the loose alluvial terraces where underlain by less permeable in-situ materials.

5.3 Founding Conditions

Throughout the site founding conditions within competent residual and the upper competent weathered sedimentary bedrock of the Dwyka Formation are considered good. The bearing capacity of the in-situ sandy clays and clayey sand may locally allow up to a maximum of 150kPa, whereas competent weathered Dwyka bedrock is likely to exceed 200 kPa depending on the composition and degree of weathered bedrock.

In general neither fill materials, nor colluvial or alluvial materials are considered suitable for founding and all founding should ideally be taken through these materials into competent materials of the Dwyka Formation.

6. CONCLUSION

6.1 In terms of the results of this assessment, we consider the investigated 2.54ha portion of the 7.22ha site as stable in its existing condition, and capable of development as such. The development of the site should, however, be carried out in terms of the recommendations given below. These recommendations amount to no more than sound building practices, appropriate for the geotechnical conditions existing on the site.

Areal restrictions are given by the legislation regarding buffer zones for any proposed development within a certain proximity of wetlands, 100-year-flood lines, servitudes and substations as present in the area.

7. GENERAL DEVELOPMENT RECOMMENDATIONS

7.1 General Development

It must be understood, all development will be restricted by the existing servitudes and the areas designated as wetland and within the 100-year-flood line with the buffer zones applying.

However, the remaining areas are considered suitable for general development. We assume, it is most likely to create individual platforms suitable for proposed development. Within the southern portion of the area, given the generally gently sloping concave topography, some earthworks will be required, consisting of cutting and / or filling for the creation of engineered platforms.

7.2 Earthworks

Excavation is considered soft according SABS 1200D through all fill material and residual clays into the upper weathered diamictic bedrock of the Ordovizian Dwyka Formation.

Shoring of any excavation deeper than 1.20m is advised and must be implemented at the discretion of the Engineer.

Where the alluvial terraces are present along the southern embankment of the north easterly valley sidewalls are likely to be unstable and might have to be shored at depth less than 1.20m.

Aggressive earthworks along the southern boundary may endanger the stability of the adjacent railway line. Any earthworks in the vicinity of the railway line may require detailed geotechnical studies.

Although no further details on any proposed development have been made available at this stage, general recommendations regarding cut and fill embankments are given below.

7.2.1 *Cut Embankments*

We assume building platforms are likely to be created for potential development. Since no details have been forwarded, the following will be of a general nature. As soon as the individual sites have been identified more specific recommendations can be made:

- Building platforms should ideally be created entirely in cut.

- All permanent cut slopes into sandy materials should be restricted to a maximum of 1:2 (26°). The maximum height of any cut slope should not exceed 3.00m without being assessed by an Engineering Geologist.

- All permanent cut slope batters into clayey materials should be trimmed back to a maximum batter of 1:1.75 (30°). Temporary cut banks during construction may be laid back to a slope batter of 1:1.5 (33°).

- All cut embankments must be protected against surface erosion by the planting of vegetation immediately after construction.

- In the hard to medium weathered bedrock, cut slopes may be steepened to 1:1 (45°) or steeper at the discretion of the Engineer.

- Should it not be possible to accommodate the above slope angles, the slopes will need to be supported by retaining structures. In addition, it may be necessary to shore excavations or cut faces during construction.

7.2.1.1_Fill Embankments

Where fill platforms have to be created the following generalized recommendations apply:

- Fill platforms should not be placed onto any unstable materials such as colluvium materials or alluvial terraces.

- Prior to the placement of any fill the in-situ subsoil materials containing vegetation should be removed.

- The fills should be constructed in layers not exceeding a maximum of 300mm loose thickness and be compacted to 93% of the materials maximum Mod AASHTO Density for clayey materials and 95% of the materials maximum Mod AASHTO Density for sandy materials prior to the placement of the next layer.

- The maximum particle size within the fill should be restricted to two thirds of the layers loose thickness.

- Permanent fill batters should be no steeper than 1:1,75(30°) and should not exceed a maximum vertical height of about 3m.

- For generally well constructed engineered fills, internal settlements within the fill of up to 1% of the fill thickness should be anticipated. As such, settlements across the cut/fill line or from natural ground to maximum fill, depending on the thickness of fill, may vary across the platform.

7.3 Subsoil Drainage

Seepage may occur along the contact between the capping colluvial sandy materials and the in-situ residual clays or weathered bedrock formations during periods of high rainfall. Control of seepage by the installation of subsoil drains may be necessary locally depending on the nature of the development.

7.4 Sanitation

Due to the site being situated inbetween two areas apparently classified as wetland, all effluent waters should ideally be collected and piped towards the nearest treatment system. Alternatively, systems such as conservancy tanks or package plant may be considered.

Systems such as french drain systems are not considered ideal due to the amount of unsealed area required for evapotranspiration and environmental restrictions implemented by the nearby eco-sensitive wetlands.

7.5 Materials

The colluvium material encountered classified as a G7 material, whereas the residual in-situ soils varied from a G7 sandy material to a clay material not classifying as a G10 material. We expect the in-situ residual soils and upper completely to highly weathered bedrock materials of the Ordovizian Dwyka Formation to provide materials within this range, depending on the composition as well as the degree of weathering.

We trust that this report meets your immediate requirements.

Yours faithfully
DRENNAN, MAUD & PARTNERS

M.J. HADLOW Pr.Sci.Nat.

Encls. Appendix 1 - Soil Profiles
Appendix 2 - DCP's 1 - 13
Appendix 3 - Lab Test Results
Figure 1 - Site Plan

/kmc/aj/kc

APPENDIX 1

SOIL PROFILES

(IP 1 - IP 9 & AH 1 - AH 3)

APPENDIX 2

DYNAMIC CONE PENETROMETER TEST
RESULTS (DCP 1 - DCP 13)

APPENDIX 3

LABORATORY TEST RESULTS

FIGURE 1

SITE PLAN

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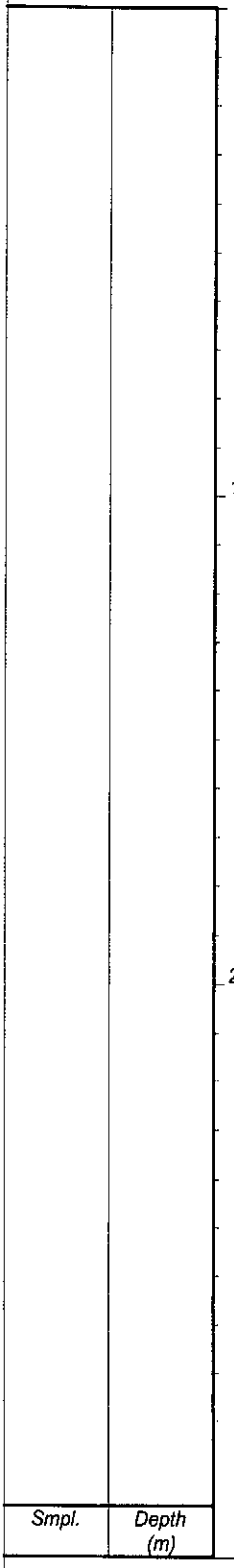
Canelands

HOLE No: IP 1
Sheet 1 of 1

JOB NUMBER: 23311



Smpl.	Depth (m)	
	0.00	Slightly moist, dark brown, medium dense, slightly gravelly silty SAND – (Top Soil)
	0.10	Slightly moist, orange brown, brown and dark grey, medium dense, very gravelly very clayey SAND – (Fill). Containing shale fragments.
	0.60	Slightly moist, orange brown, stiff, very gravelly very sandy CLAY (Fill) Containing shale fragments.
	1.00	Slightly moist, dark brown, firm, very sandy CLAY – (Top Soil) Containing roots.
	2.20	Slightly moist, very dark grey, firm, highly organic, silty sandy CLAY – (Alluvium)
	2.90	

CONTRACTOR : NA
MACHINE : 4x4 TLB
DRILLED BY : NA
PROFILED BY : K.M.C.

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DATE : 04.09.2012

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Y-COORD :

HOLE No: IP 1

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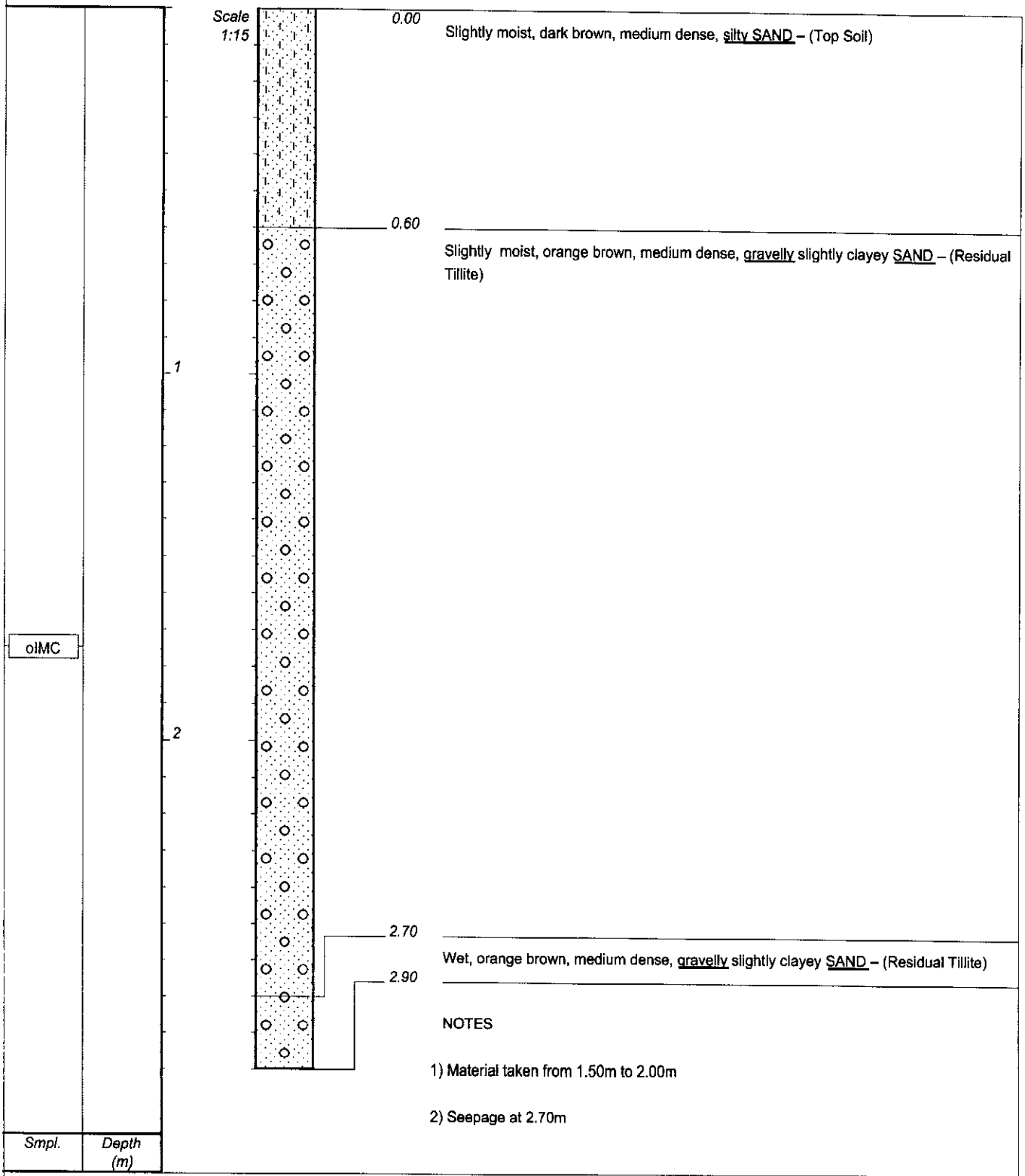
HOLE No: IP 2
Sheet 1 of 1

JOB NUMBER: 23311



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DATE : 04.09.2012

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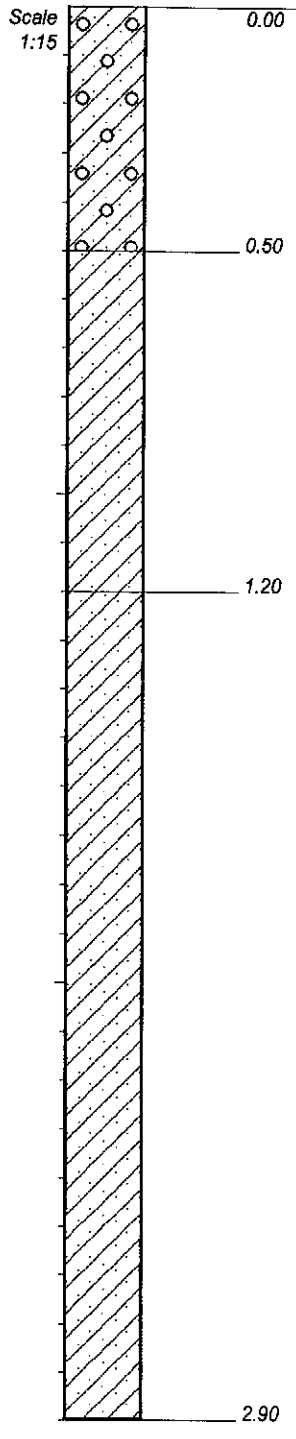
Tongaat Hulett Development
Canelands

HOLE No: IP 3
Sheet 1 of 1

JOB NUMBER: 23311



Slightly moist, brown, grey and off-white, stiff, gravelly sandy CLAY – (Fill)

Slightly moist, very dark brown, firm to stiff, sandy CLAY – (Top Soil)

Slightly moist, dark yellow brown, firm to stiff, slightly gravelly sandy CLAY – (residual Tillite)

Smpl.	Depth (m)

CONTRACTOR : NA
MACHINE : 4x4 TLB
DRILLED BY : NA
PROFILED BY : K.M.C.

TYPE SET BY : TR
SETUP FILE : DMPSP.SET

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Y-COORD :

HOLE No: IP 3

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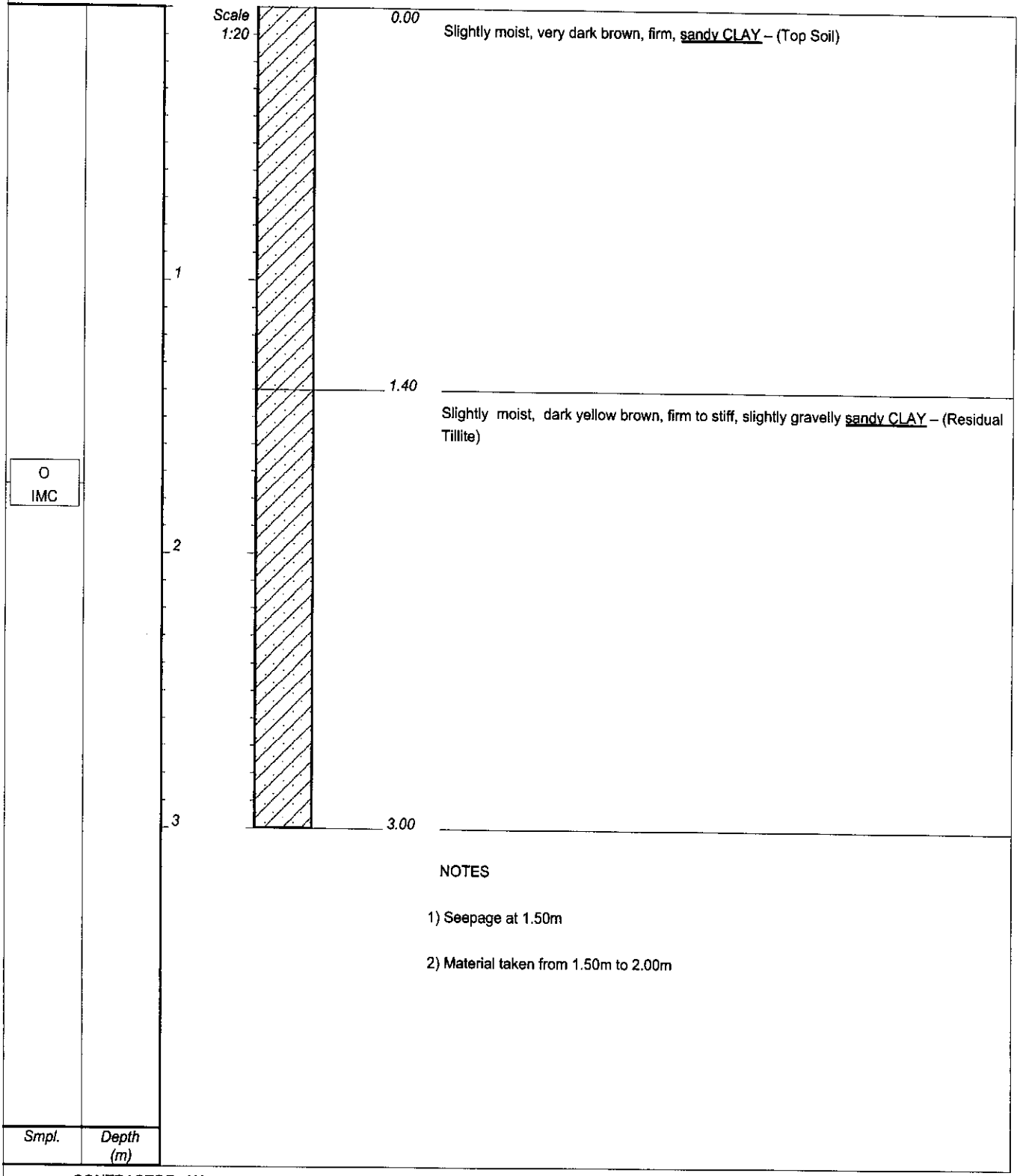
Canelands

HOLE No: IP 4
Sheet 1 of 1

JOB NUMBER: 23311



NOTES

1) Seepage at 1.50m

2) Material taken from 1.50m to 2.00m

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MACHINE : 4x4 TLB
DRILLED BY : NA
PROFILED BY : K.M.C.

INCLINATION :
DIAM : NA
DATE : NA
DATE : 04.09.2012

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HOLE No: IP 5
Sheet 1 of 1

JOB NUMBER: 23311

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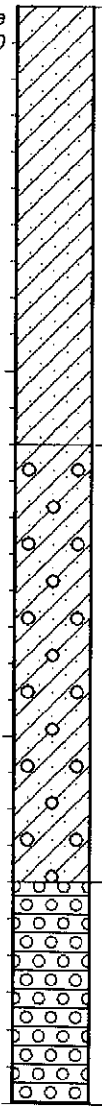

Smpl.	Depth (m)	
	0.00	Slightly moist, very dark brown, firm, sandy CLAY – (Top Soil)
	1.20	Slightly moist, yellow orange brown, stiff, gravelly sandy CLAY – (Residual Tillite)
	2.40	Highly weathered to completely weathered, dark yellow grey, highly fractured, very soft to soft rock TILLITE – (Dwyka Formation)
	3.00	

CONTRACTOR : NA
MACHINE : 4x4 TLB
DRILLED BY : NA
PROFILED BY : K.M.C.

TYPE SET BY : TR
SETUP FILE : DMPSP.SET

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DATE : NA
DATE : 04.09.2012

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ELEVATION :
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Y-COORD :

HOLE No: IP 5

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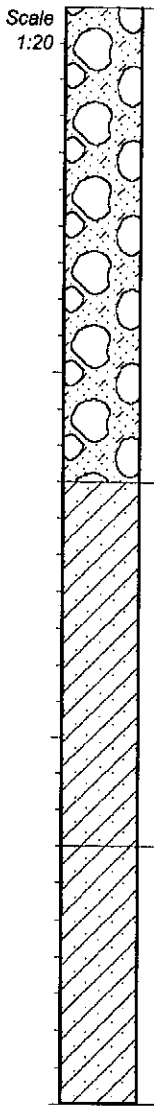
HOLE No: IP 6
Sheet 1 of 1

JOB NUMBER: 23311



Smpl.	Depth (m)	
	0.00	Slightly moist to dry, red brown, dense, clayey SAND – (Fill) Containing boulders.
	1.30	Slightly moist, very dark grey, highly organic, firm, sandy CLAY – (Top Soil)
	2.30	Slightly moist, olive brown, stiff, sandy CLAY – (Residual Tillite)
	3.00	

CONTRACTOR : NA
MACHINE : 4x4 TLB
DRILLED BY : NA
PROFILED BY : K.M.C.

TYPE SET BY : TR
SETUP FILE : DMPSP.SET

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Y-COORD :

HOLE No: IP 6

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HOLE No: IP 7
Sheet 1 of 1

JOB NUMBER: 23311

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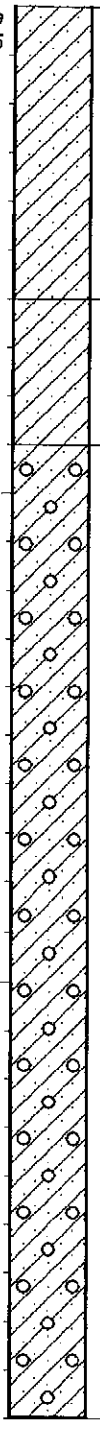

Smpl.	Depth (m)	
	0.00	Slightly moist, very dark brown, firm, sandy CLAY – (Top Soil)
	0.60	Slightly moist, olive brown, stiff, sandy CLAY – (Residual Tillite)
	0.90	Slightly moist, yellow orange brown, stiff, gravelly sandy CLAY – (Residual Tillite)
	1	
	2	
	2.90	

CONTRACTOR : NA
MACHINE : 4x4 TLB
DRILLED BY : NA
PROFILED BY : K.M.C.

TYPE SET BY : TR
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Y-COORD :

HOLE No: IP 7

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Canelands

HOLE No: IP 8
Sheet 1 of 1

JOB NUMBER: 23311

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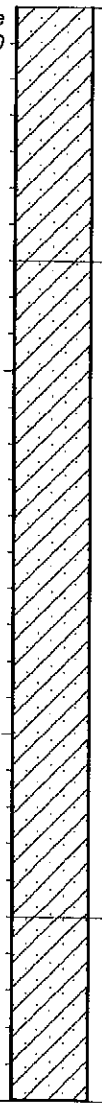

Smpl.	Depth (m)	
	0.00	Slightly moist, dark brown, firm, very sandy CLAY – (Top Soil)
	0.70	Slightly moist, yellow brown, brown and grey, stiff, sandy CLAY – (Residual Tillite)
	2.50	Slightly moist, light grey, very stiff, slightly gravelly sandy CLAY – (Residual Tillite). Containing dropstone relics.
	3.00	

CONTRACTOR : NA
MACHINE : 4x4 TLB
DRILLED BY : NA
PROFILED BY : K.M.C.

INCLINATION :
DIAM : NA
DATE : NA
DATE : 04.09.2012

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY : TR
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HOLE No: IP 8

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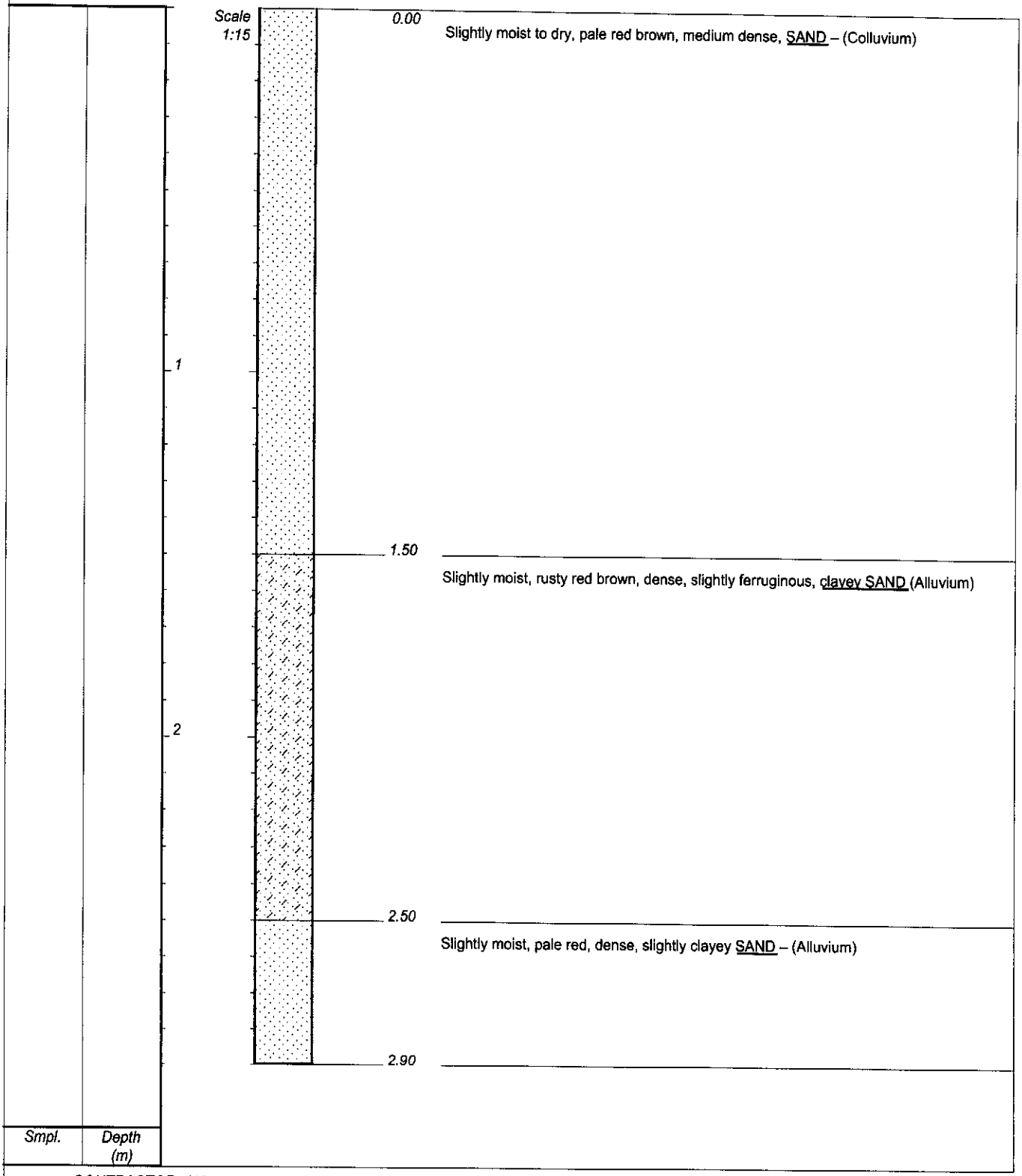
Tongaat Hulett Development
Canelands

HOLE No: IP 9
Sheet 1 of 1

JOB NUMBER: 23311



CONTRACTOR : NA
MACHINE : 4x4 TLB
DRILLED BY : NA
PROFILED BY : K.M.C.

TYPE SET BY : TR
SETUP FILE : DMPSP.SET

INCLINATION :
DIAM : NA
DATE : NA
DATE : 04.09.2012

DATE : 29/11/12 15:05
TEXT : ..C:\DOTIN\SPMASTER.DOC

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: IP 9

DRENNAN MAUD & PARTNERS

Consulting Civil Engineers and Engineering Geologists

TONGAAT HULETT
CANELANDS EAST

HOLE No: AH 1
Sheet 1 of 1

JOB NUMBER: 23311

Smpl.	Depth (m)	Scale 1:10	
			0.00 Slightly moist, dark brown, loose slightly gravelly SAND – (Top Soil / Alluvium)
			0.40

NOTES

1) Refusal on what believed is a boulder.

CONTRACTOR : NA
MACHINE : HAND AUGER
DRILLED BY : NA
PROFILED BY : K.M.C

TYPE SET BY : B.R
SETUP FILE : DMPSP.SET

INCLINATION : NA
DIAM : NA
DATE : NA
DATE : 04.09.2012

DATE : 29/11/12 15:09
TEXT : ..C:\DOTIN\BHMASTER.DOC

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: AH 1

DRENNAN MAUD & PARTNERS

Consulting Civil Engineers and Engineering Geologists

TONGAAT HULETT
CANELANDS EAST

HOLE No: AH 2
Sheet 1 of 1

JOB NUMBER: 23311

Smpl.	Depth (m)	Scale 1:10	
			0.00 Slightly moist, dark brown, loose slightly gravelly SAND – (Top Soil / Alluvium)
			0.30

NOTES

1) Refusal on what believed is a boulder.

CONTRACTOR : NA
MACHINE : HAND AUGER
DRILLED BY : NA
PROFILED BY : K.M.C

TYPE SET BY : B.R
SETUP FILE : DMPSP.SET

INCLINATION :
DIAM : NA
DATE : NA
DATE : 04.09.2012

DATE : 29/11/12 15:09
TEXT : ..C:\DOTIN\BHMASTER.DOC

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: AH 2

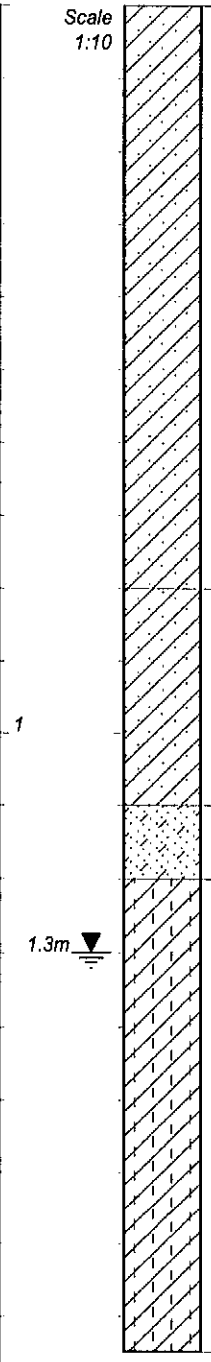
DRENNAN MAUD & PARTNERS

Consulting Civil Engineers and Engineering Geologists

TONGAAT HULETT
CANELANDS EAST

HOLE No: AH 3
Sheet 1 of 1

JOB NUMBER: 23311



Smpl.	Depth (m)	
	0.00	Moist, brown patched dark yellow, sandy CLAY (Fill).
	0.80	Very moist, greyish brown patched dark red, sandy CLAY (Fill).
	1.10	Wet, brown, clayey SAND (Alluvium).
	1.20	Wet, dark greyish brown streaked dusky yellow, silty CLAY (Residual Tillite).
	1.85	

NOTES

1) Water table intersected at 1.3m.

2) Auger hole was abandoned as we were unable to extract saturated clayey material below the water table due to the effects of suction.

3) Inferred from the result of the DCP probe at this location, weathered tillite bedrock is expected at approximately 4.8m below existing ground level.

CONTRACTOR : NA
MACHINE : HAND AUGER
DRILLED BY : NA
PROFILED BY : B.R
TYPE SET BY : B.R
SETUP FILE : DMPSP.SET

INCLINATION : NA
DIAM : NA
DATE : NA
DATE : 18/10/2012
DATE : 29/11/12 16:03
TEXT : ..C:\DOTIM\BHMASTER.DOC

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: AH 3

Dynamic Cone Penetrometer

Test No. : 1

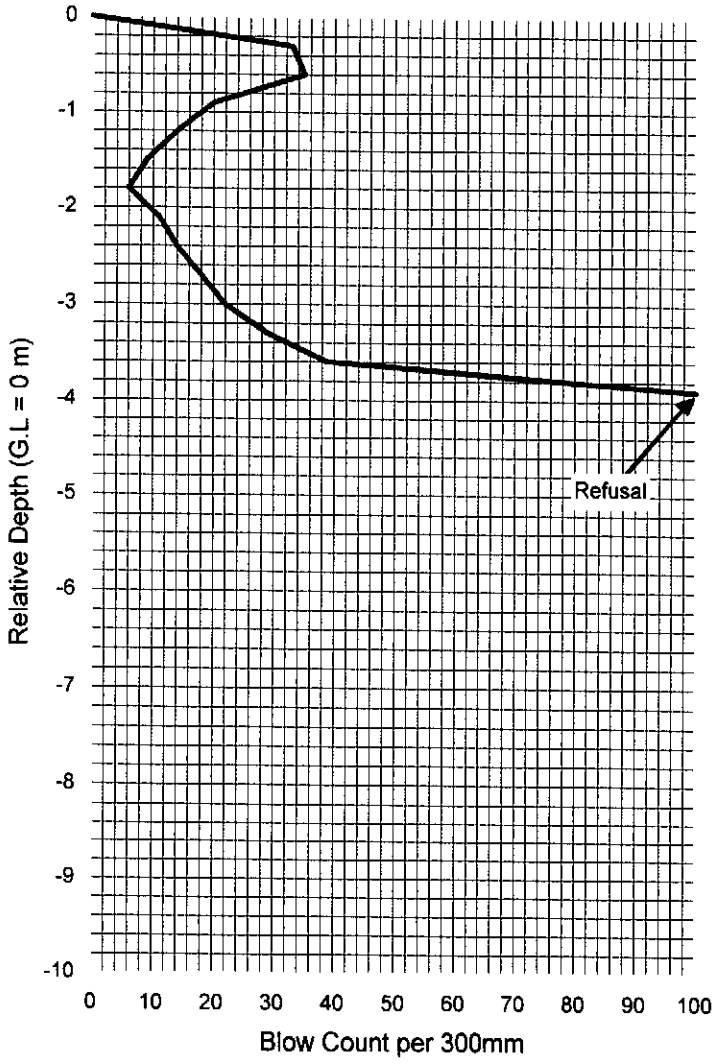
Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks:

Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	33
-0.6	35
-0.9	20
-1.2	14
-1.5	9
-1.8	6
-2.1	11
-2.4	14
-2.7	18
-3.0	22
-3.3	29
-3.6	39
-3.9	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 2

Dynamic Cone Penetrometer

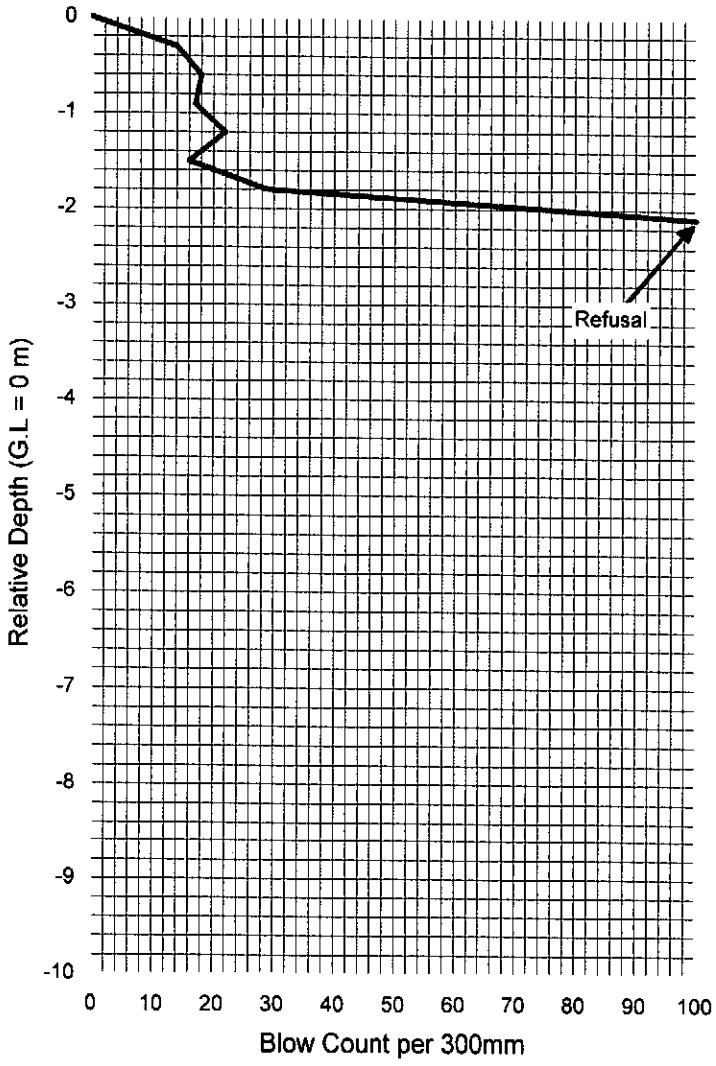
Test No. : 2

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks: -
-
Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	14
-0.6	18
-0.9	17
-1.2	22
-1.5	16
-1.8	29
-2.1	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 3

Dynamic Cone Penetrometer

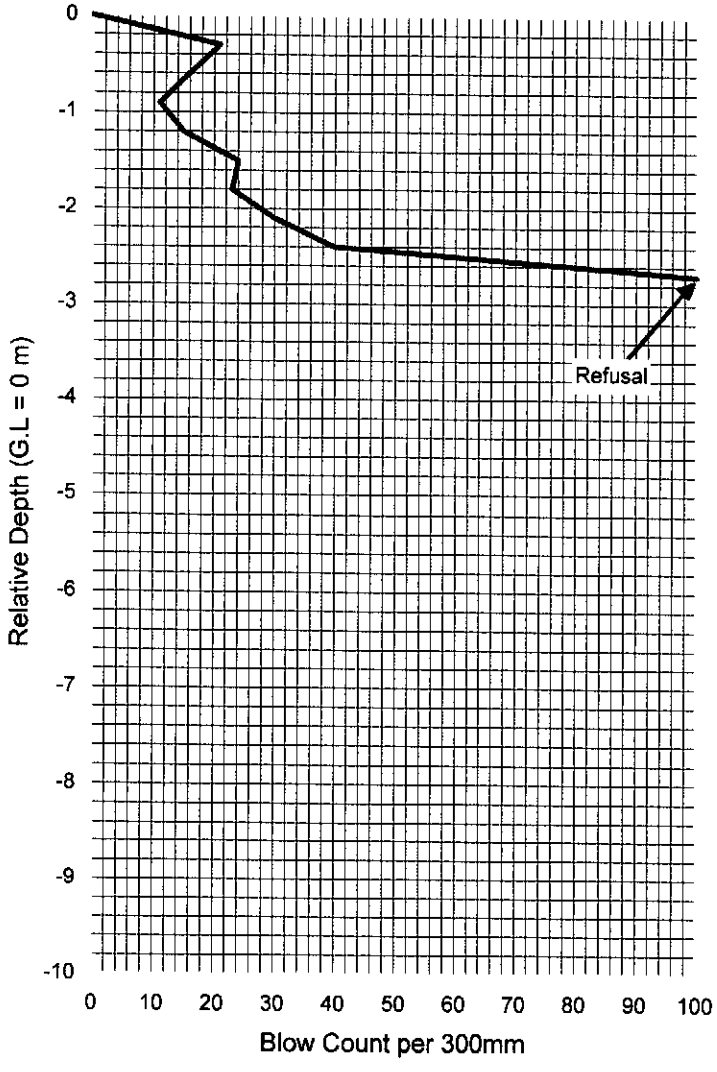
Test No. : 3

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks: -
-
Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	21
-0.6	16
-0.9	11
-1.2	15
-1.5	24
-1.8	23
-2.1	30
-2.4	40
-2.7	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 4

Dynamic Cone Penetrometer

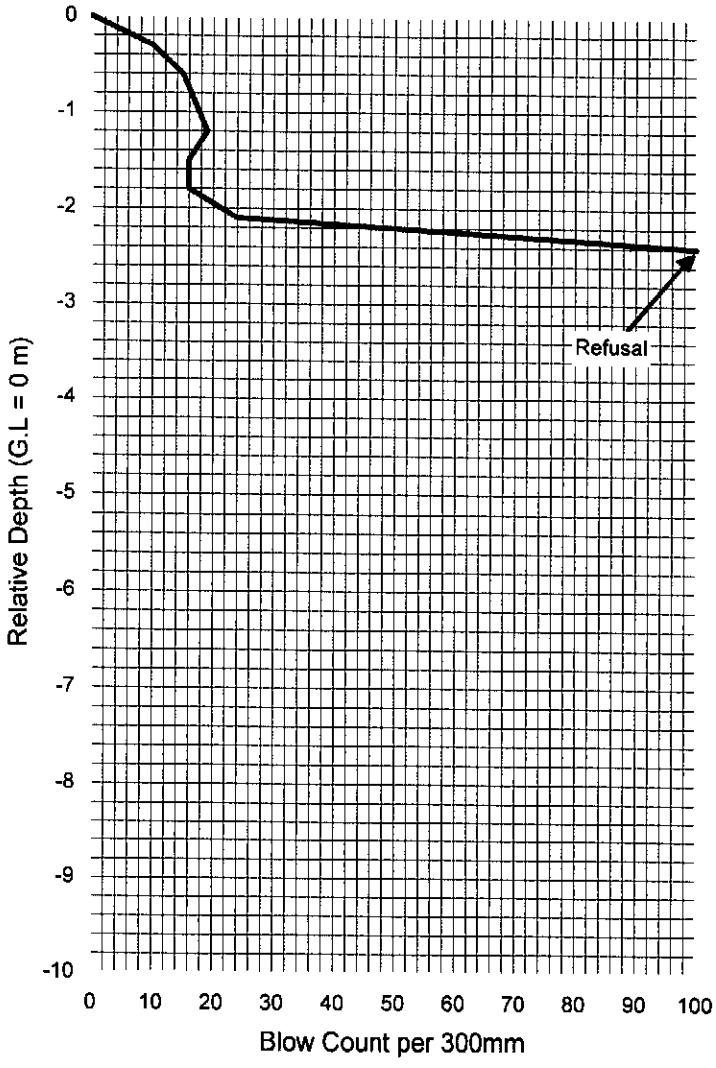
Test No. : 4

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks: -
-
Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	10
-0.6	15
-0.9	17
-1.2	19
-1.5	16
-1.8	16
-2.1	24
-2.4	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 5

Dynamic Cone Penetrometer

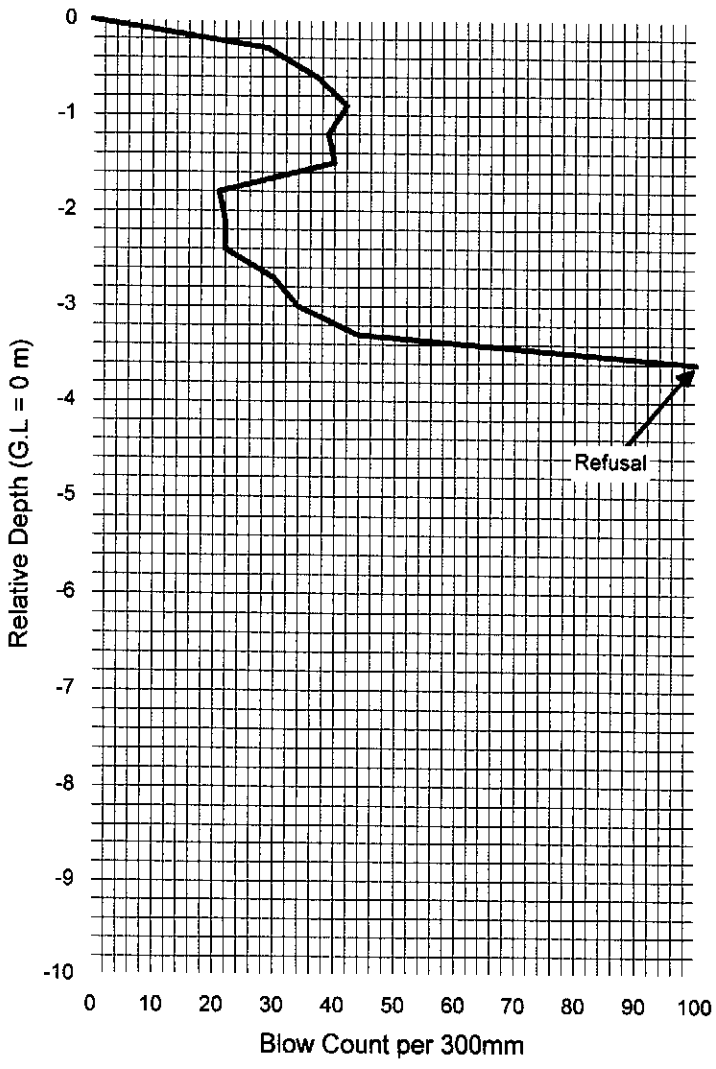
Test No. : 5

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks: -
-
Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	29
-0.6	37
-0.9	42
-1.2	39
-1.5	40
-1.8	21
-2.1	22
-2.4	22
-2.7	30
-3.0	34
-3.3	44
-3.6	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 6

Dynamic Cone Penetrometer

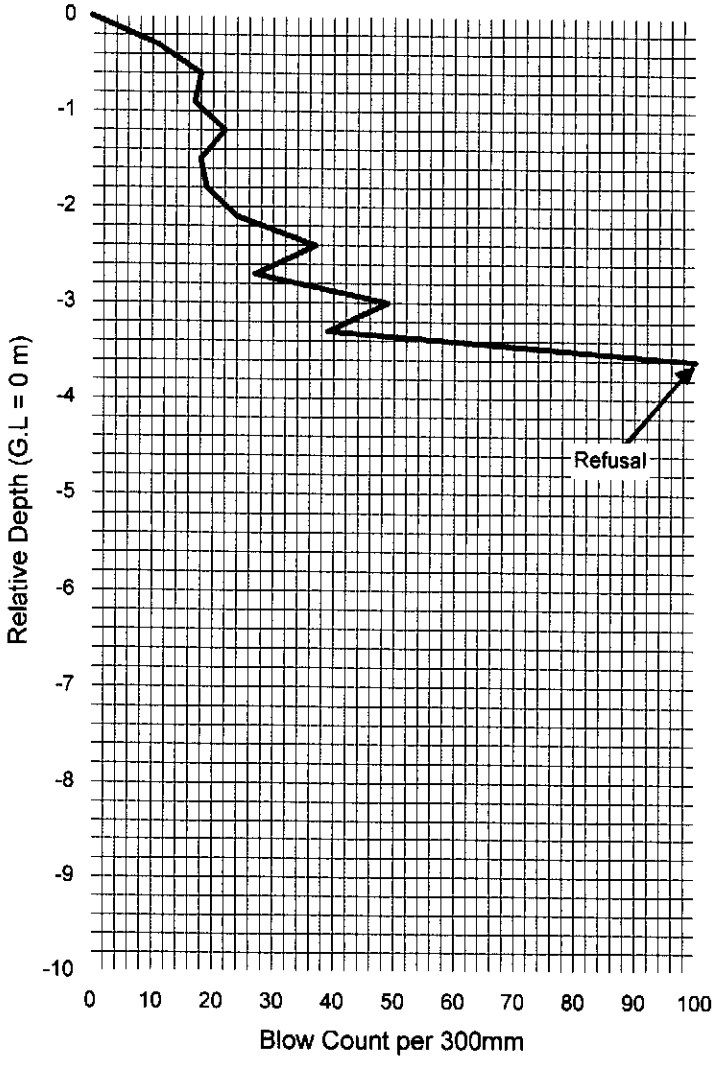
Test No. : 6

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks: -
-
Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	11
-0.6	18
-0.9	17
-1.2	22
-1.5	18
-1.8	19
-2.1	24
-2.4	37
-2.7	27
-3.0	49
-3.3	39
-3.6	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 7

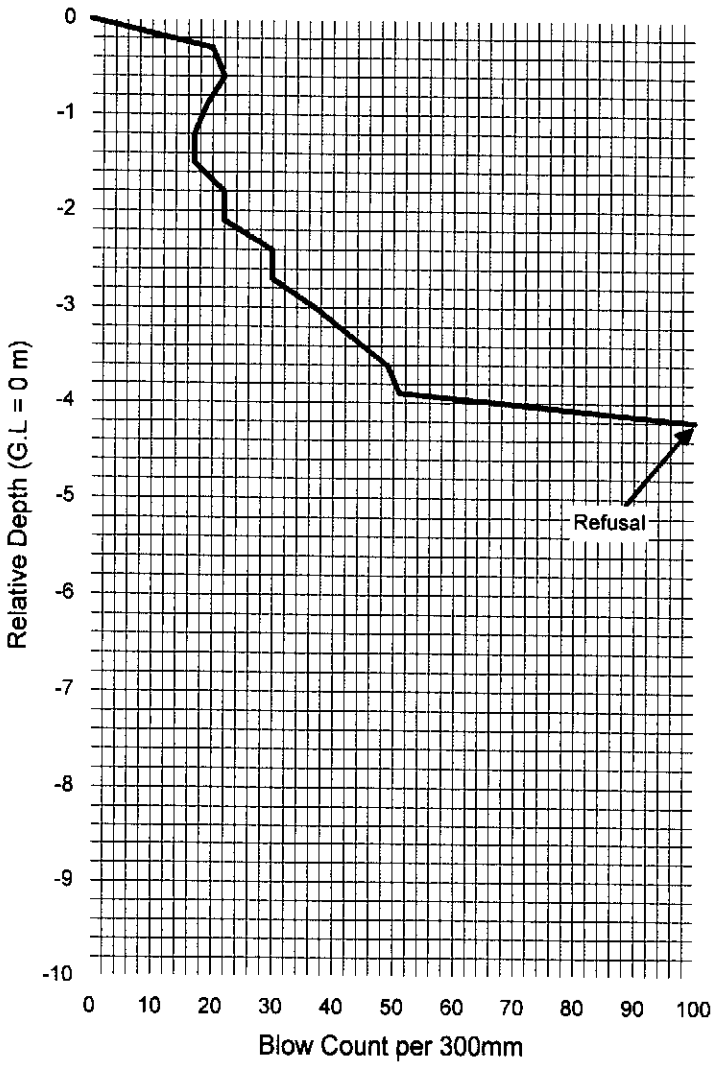
Dynamic Cone Penetrometer

Test No. : 7

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012 Remarks: -
Test Location: Canelands -
Date of Test: 04.09 & 18.10 Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	20
-0.6	22
-0.9	19
-1.2	17
-1.5	17
-1.8	22
-2.1	22
-2.4	30
-2.7	30
-3.0	37
-3.3	43
-3.6	49
-3.9	51
-4.2	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 8

Dynamic Cone Penetrometer

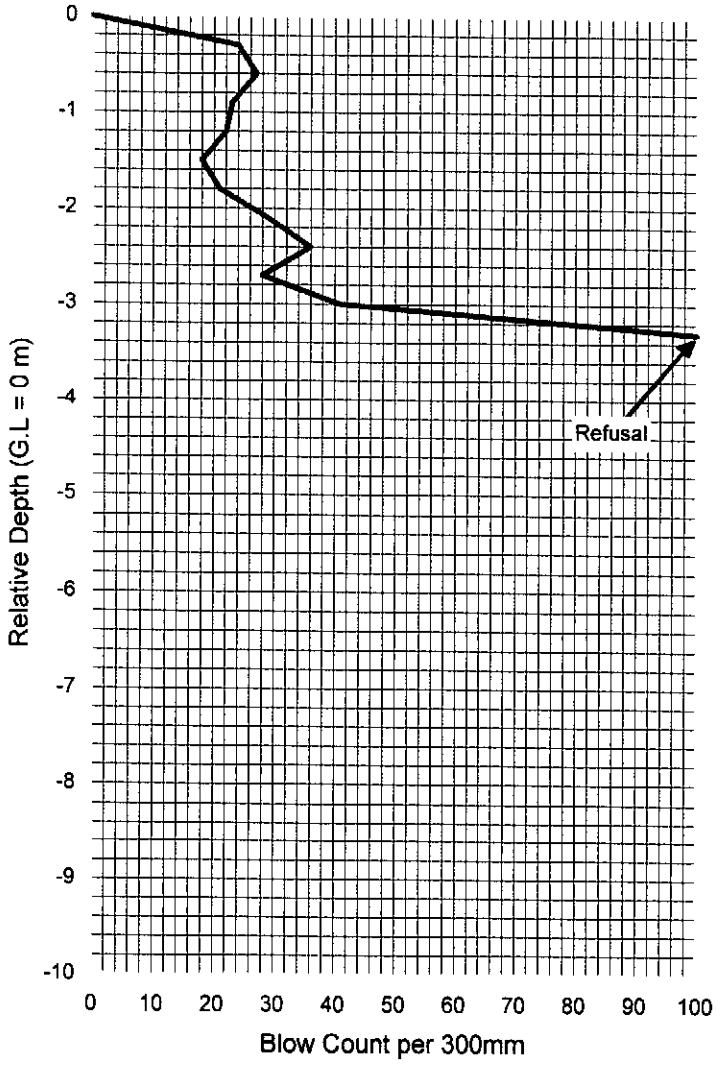
Test No. : 8

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks: -
-
Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	24
-0.6	27
-0.9	23
-1.2	22
-1.5	18
-1.8	21
-2.1	29
-2.4	36
-2.7	28
-3.0	41
-3.3	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 9

Dynamic Cone Penetrometer

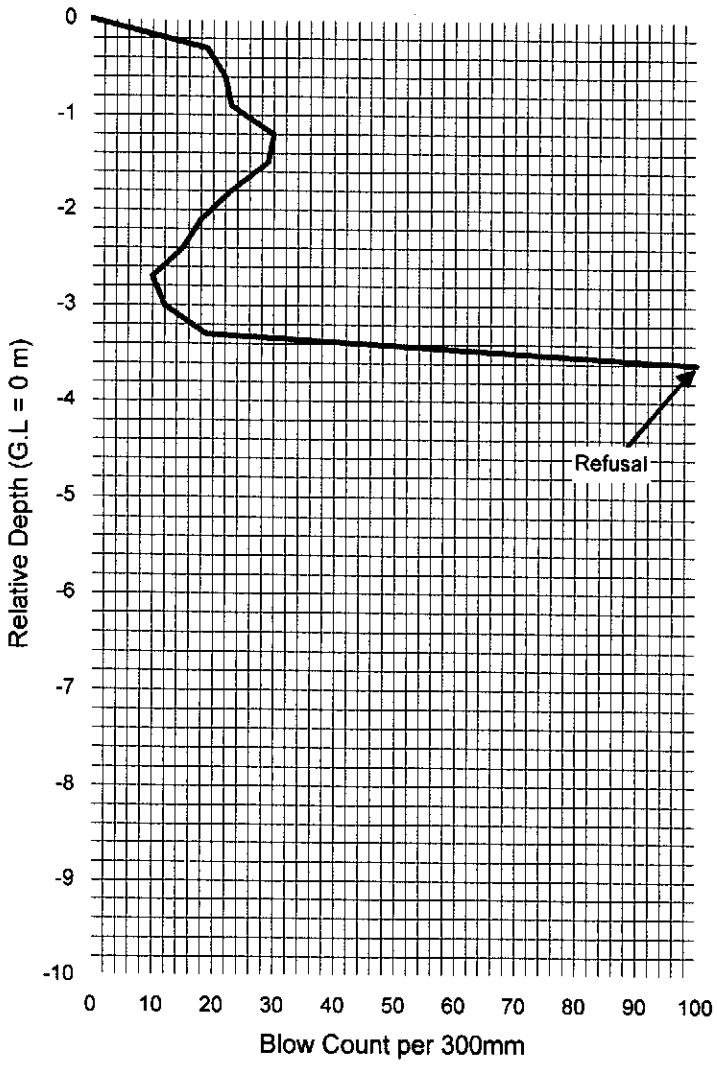
Test No. : 9

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks: -
-
Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	19
-0.6	22
-0.9	23
-1.2	30
-1.5	29
-1.8	23
-2.1	18
-2.4	15
-2.7	10
-3.0	12
-3.3	19
-3.6	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 10

Dynamic Cone Penetrometer

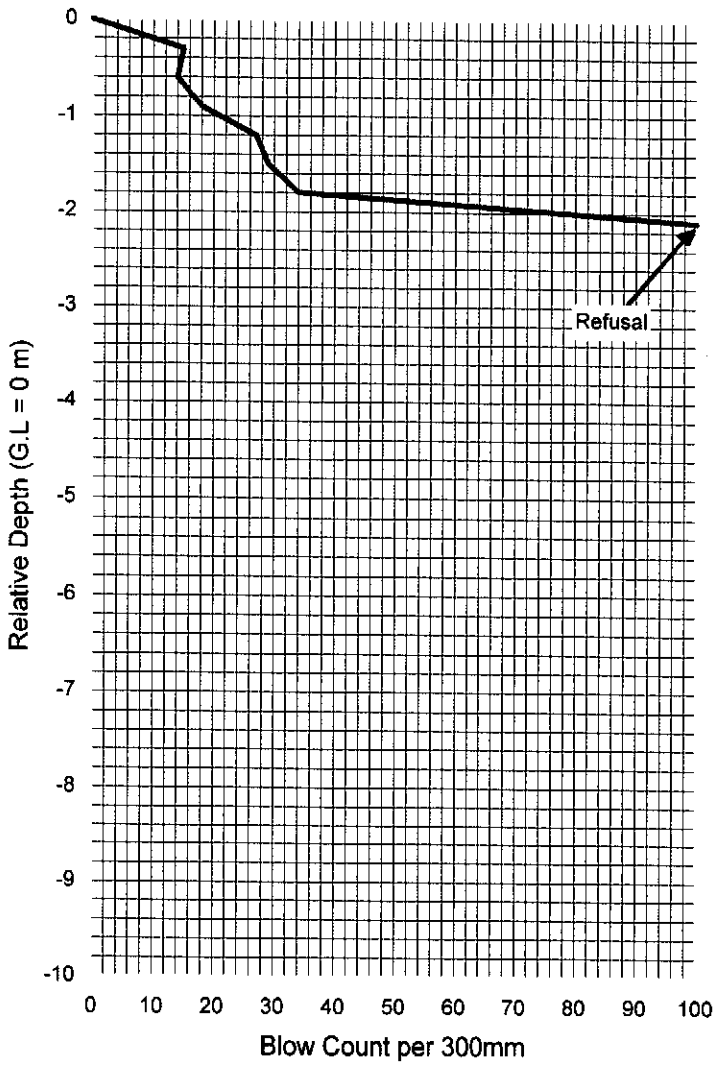
Test No. : 10

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks: -
-
Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	15
-0.6	14
-0.9	18
-1.2	27
-1.5	29
-1.8	34
-2.1	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 11

Dynamic Cone Penetrometer

Test No. : 11

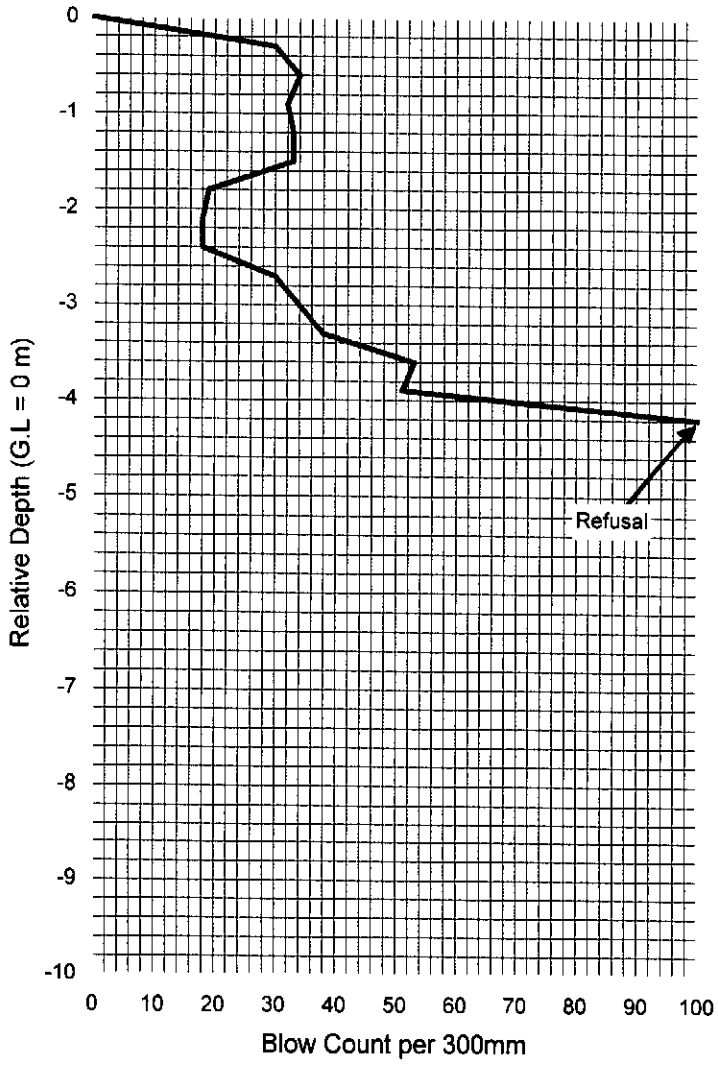
Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks:

Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	30
-0.6	34
-0.9	32
-1.2	33
-1.5	33
-1.8	19
-2.1	18
-2.4	18
-2.7	30
-3.0	34
-3.3	38
-3.6	53
-3.9	51
-4.2	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 12

Dynamic Cone Penetrometer

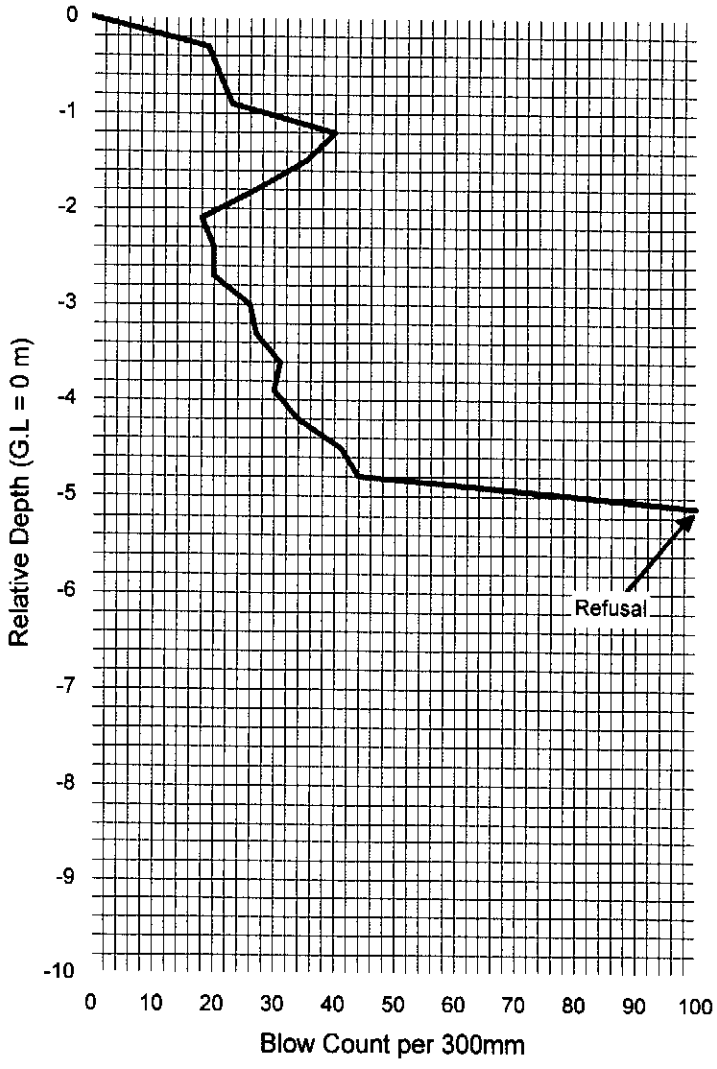
Test No. : 12

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks: -
-
Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	19
-0.6	21
-0.9	23
-1.2	40
-1.5	35
-1.8	27
-2.1	18
-2.4	20
-2.7	20
-3.0	26
-3.3	27
-3.6	31
-3.9	30
-4.2	34
-4.5	41
-4.8	44
-5.1	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 13

Dynamic Cone Penetrometer

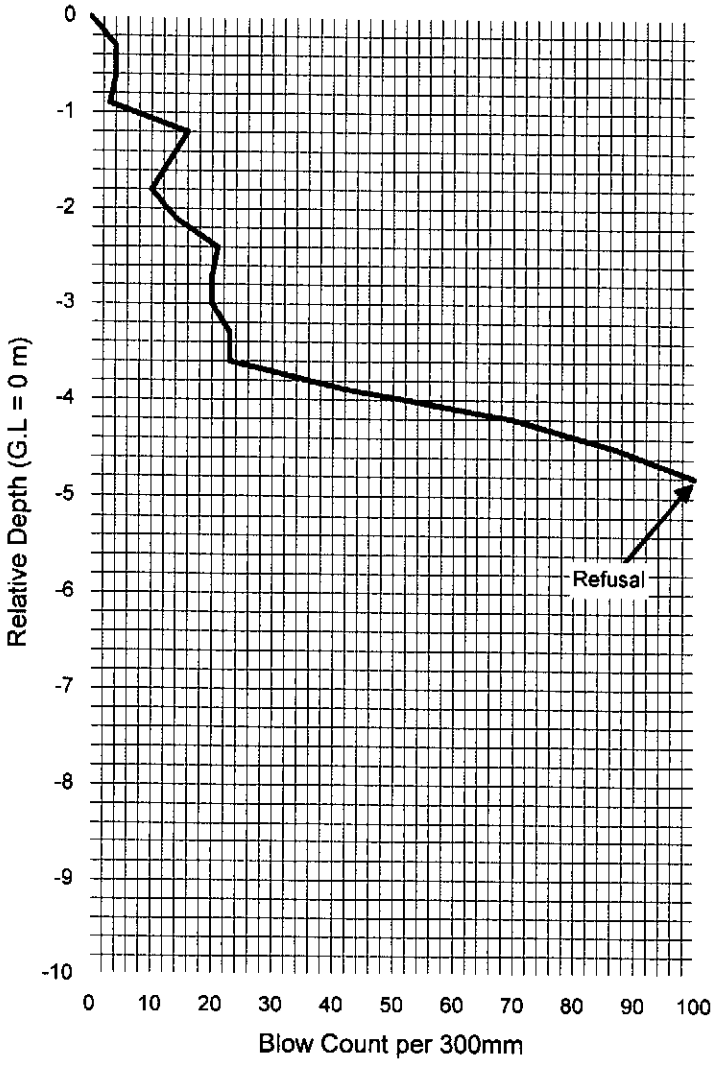
Test No. : 13

Project : **Canelands**
Client: **Tongaat Huelett**
Date: 24.10.2012
Test Location: Canelands
Date of Test: 04.09 & 18.10

Remarks: -
-
Depth Interval (m) : 0.3

Depth (m)	Count Blows/0.3m
0	0
-0.3	4
-0.6	4
-0.9	3
-1.2	16
-1.5	13
-1.8	10
-2.1	14
-2.4	21
-2.7	20
-3.0	20
-3.3	23
-3.6	23
-3.9	43
-4.2	70
-4.5	87
-4.8	100

Blow Count vs Depth



Reference No. : 23311

Drennan Maud & Partners.

Fig. No. 14

Laboratory Test Summary

THEKWINI SOILS LAB. CC
V.A.T. REGISTRATION NO. 4590210901
68 Ridge Road, Tollgate, DURBAN Tel : (031) 201-8992
P.O. Box 30464, MAYVILLE, 4058 Fax : (031) 201-7920

Job Description: Canelands East
Job no.: 23311
Date: 31.10.2012

Lab no.		0900	09001	09002							
Location		IP 2	IP 4	IP 9							
Depth		1.5 - 2.0	1.5 - 2.0	0.0 - 0.3							
Description		Residual Tillite	Residual Tillite	Colluvium							
			0	0							
Binder Material		-	-	-							
Particle Size (mm)	75		100								
	53		99	100							
	37.5		98	99							
	26.5		97	97							
	19		96	95							
	13.2	100	92	83							
	9.5	99	89	82							
	4.75	99	85	80							
	2	99	82	76							
	0.425	89	77	62							
	0.25	62	73	51							
	0.15	32	68	37							
	0.075	20	57	22							
	0.05	20	54	19							
	0.02	16	45	11							
	0.005	14	38	10							
	0.002	14	35	7							
Soil Mortar	Coarse Sand <2.0 >0.425mm	9.7	6.6	17.9							
	Fine Sand <0.425>0.05mm	72.4	43.3	66.5							
	Silt <0.05 >0.005	4.9	14.6	7.7							
	Clay <0.005	13.0	35.5	7.9							
Atterberg Limits	Liquid Limit	19.1	47.1	0							
	Plasticity Index	8.2	21	N.P.							
	Linear Shrinkage	0.7	13.3	0							
	Natural MC	-	-	-							
Mod AASHTO Density	Density Kg/m^3	1903	1800	2023							
	OMC	10.4	17	6.8							
CBR	100%	58	1.9	58							
	98%	45	1.6	40							
	95%	29	1.2	24							
	93% (Inferred)	21.0	1.1	18.8							
	90%	13	1.05	13							
	CBR Swell	0.00	5.94	0.00							
AASHTO Soil Classification		A - 2 - 4 (0)	A - 7 - 6 (10)	A - 2 - 4 (0)							
Grading Modulus		0.92	0.84	1.40							
TRH 14 (1985)		G7	>G10	G7							

MATERIALS ANALYSIS

THEKWINI SOILS LAB. CC
V.A.T. REGISTRATION NO. 4090210961
68 Ridge Road, Tollgate, DURBAN Tel.: (031) 201-8992
P.O. Box 30464, MAYVILLE, 4058 Fax: (031) 201-7020

Project: Canelands East

Ref no.: 23311 **Lab no.:** 0900 **Borehole/Pit no.:** IP 2 **Fig no.:** 15

Depth: 1.5 - 2.0

Grading Analysis	
Grain Size (mm)	%Passing
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
13.2	100.0
9.5	99.1
4.75	99.0
2	98.9
0.425	89.3
0.25	61.5
0.15	31.9
0.075	20.0
0.05	19.8
0.02	16.5
0.005	14.4
0.002	14.2

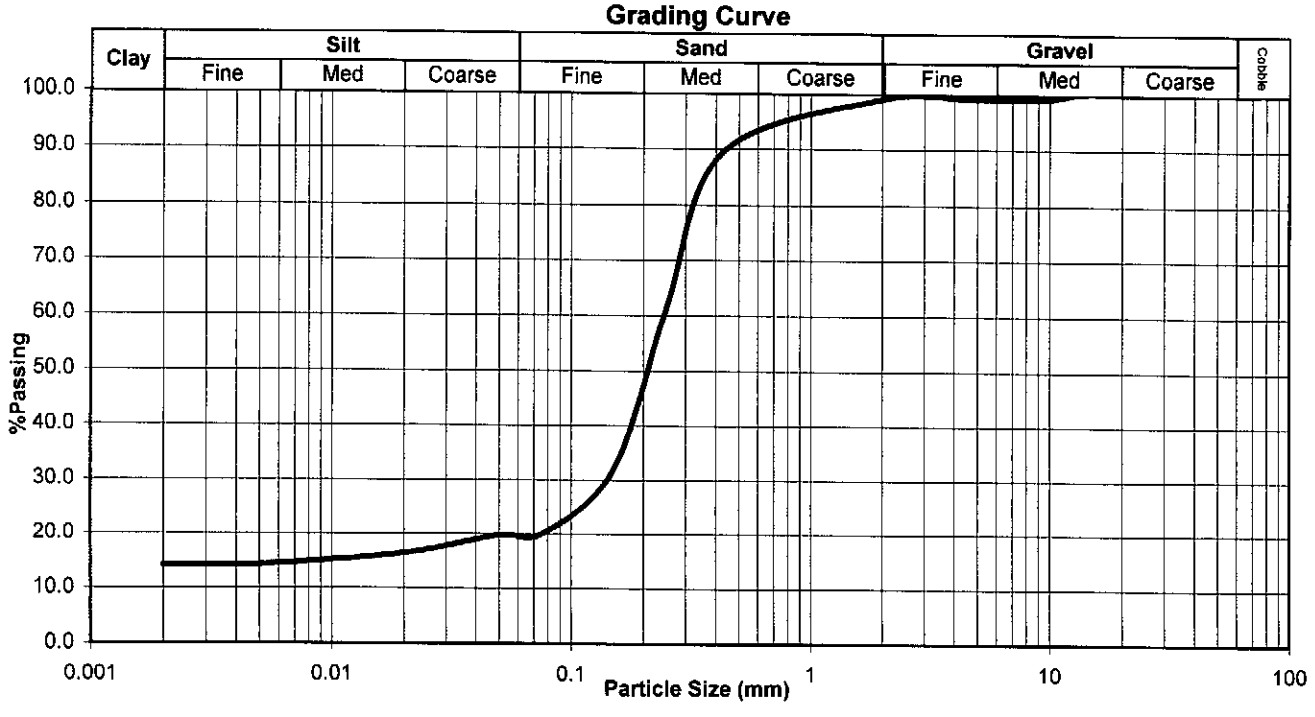
M.I.T SIZE CLASSIFICATION	
Cobble%	0.0
Gravel%	1.1
Coarse	0.0
Medium	0.9
Fine	0.1
Sand%	79.1
Coarse	8.6
Medium	43.7
Fine	26.9
Silt%	5.6
Coarse	3.4
Medium	1.9
Fine	0.3
Clay%	14.2

PLASTICITY	
Liquid Limit	19.1
Plasticity Index	8.2
Linear Shrinkage	0.7

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0.92

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	0
AASHTO Soil Classification	A - 2 - 4
Unified Classification	SC

Grading Curve



Ref no.: 23311 Fig no.: 15

MATERIALS ANALYSIS

THEKWINI SOILS LAB. CC
V.A.T. REGISTRATION NO. 4560210951
68 Ridge Road, Tollgate, DURBAN
Tel : (031) 201-8962
P.O. Box 30484, MAYVILLE, 4058
Fax : (031) 201-7920

Project: Canelands East

Ref no.: 23311 **Lab no.:** 09001 **Borehole/Pit no.:** IP 4 **Fig no.:** 16

Depth: 1.5 - 2.0

Grading Analysis	
Grain Size (mm)	%Passing
75	100.0
53	99.3
37.5	98.3
26.5	97.0
19	96.0
13.2	92.4
9.5	89.3
4.75	85.4
2	82.3
0.425	76.8
0.25	73.1
0.15	67.9
0.075	57.1
0.05	53.7
0.02	45.1
0.005	38.0
0.002	34.6

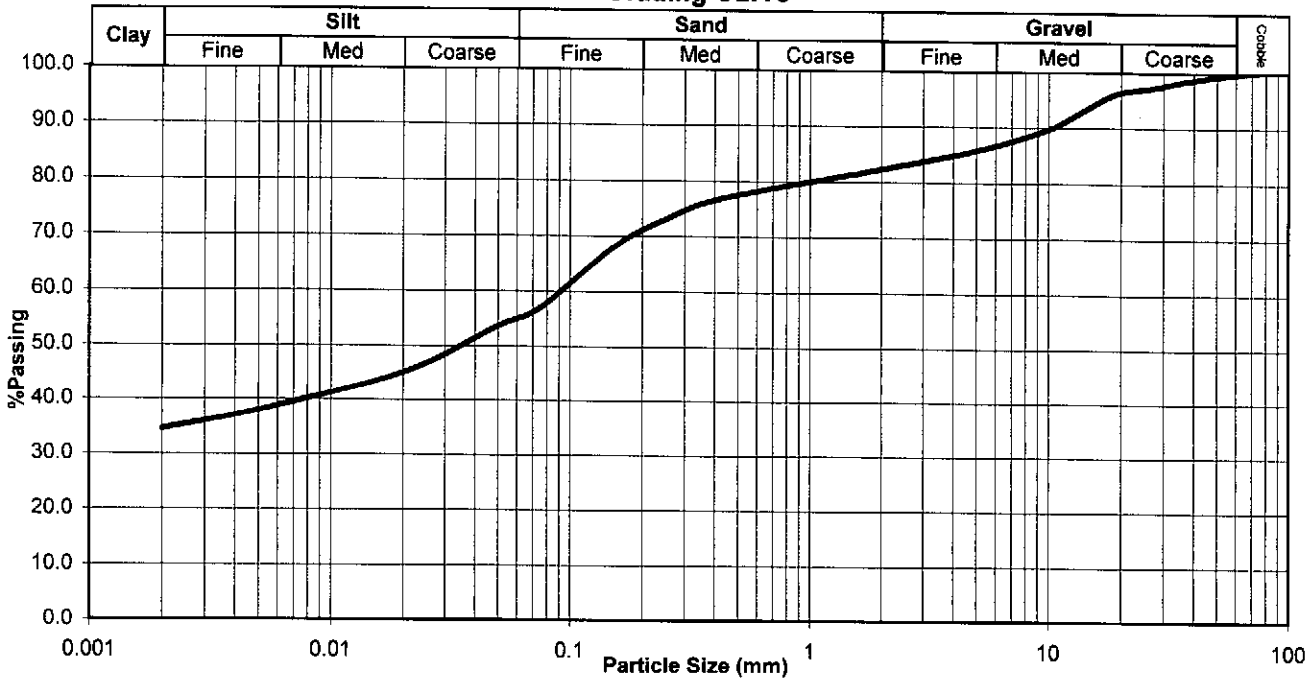
M.I.T SIZE CLASSIFICATION	
Cobble%	0.5
Gravel%	17.2
Coarse	3.4
Medium	9.7
Fine	4.2
Sand%	27.3
Coarse	4.8
Medium	7.0
Fine	15.5
Silt%	20.4
Coarse	9.9
Medium	6.7
Fine	3.9
Clay%	34.6

PLASTICITY	
Liquid Limit	47.1
Plasticity Index	21
Linear Shrinkage	13.3

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0.84

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	10
AASHTO Soil Classification	A - 7 - 6
Unified Classification	CL or OL

Grading Curve



Ref no.: 23311 Fig no.: 16

MATERIALS ANALYSIS

THEKWINI SOILS LAB. CC
VAT REGISTRATION NO 4562210961
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Project: Canelands East

Ref no.: 23311 **Lab no.:** 09002 **Borehole/Pit no.:** IP 9 **Fig no.:** 17

Depth: 0.0 - 0.3

Grading Analysis	
Grain Size (mm)	%Passing
75	100.0
53	100.0
37.5	98.7
26.5	96.8
19	94.9
13.2	83.0
9.5	82.3
4.75	79.5
2	75.6
0.425	62.1
0.25	51.1
0.15	36.8
0.075	22.2
0.05	19.0
0.02	11.3
0.005	9.7
0.002	7.4

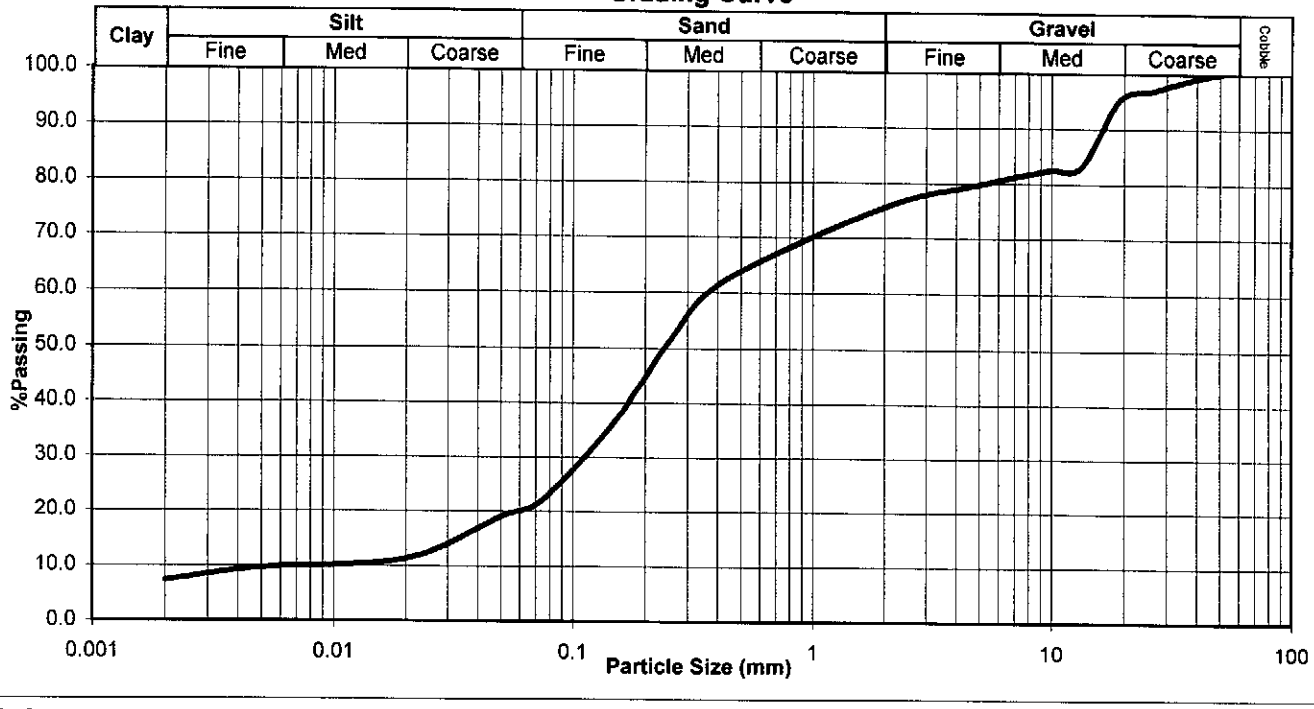
M.I.T SIZE CLASSIFICATION	
Cobble%	0.0
Gravel%	24.4
Coarse	4.8
Medium	14.9
Fine	4.6
Sand%	55.3
Coarse	12.0
Medium	19.7
Fine	23.6
Silt%	12.9
Coarse	9.0
Medium	1.6
Fine	2.4
Clay%	7.4

PLASTICITY	
Liquid Limit	
Plasticity Index	
Linear Shrinkage	

GRADING	
D10 Size (mm)	0.0066
Uniformity Coefficient	58.06
Grading Modulus	1.40

CLASSIFICATION	
Potential Expansiveness	NA
Group Index	NA
AASHTO Soil Classification	NA
Unified Classification	NA

Grading Curve



Ref no.: 23311 Fig no.: 17

Tongaat Hulett
DEVELOPMENTS

CANELANDS EAST

2010 Aerial Photography

AH1
DCP11
DCP12
IP9
AH2
DCP10
IP8
DCP9
IP1
DCP1
IP2
DCP13/AH3
DCP2
IP3
DCP7
DCP8
DCP3
IP4
IP6
DCP6
IP7
DCP5
DCP4
IP5

LEGEND

Boundary	7.2185Ha
Wetlands	2.09Ha
1:100 Year Floodline	0.96Ha
Main Roads	0.31Ha
Servitudes	0.73Ha
Exclusion Zone (Wetland)	

KEY

DCP1 ⊗	APPROX. POSITION OF DYNAMIC CONE PENETROMETER TESTS
IP1 ■	APPROX. POSITION OF INSPECTION PITS
AH1 ●	APPROX. POSITION OF AUGER HOLE

N

0 10 20 40 60
Meters

REF. NO. 23311 FIG. NO. 1

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