

Former Brooklands Garage

330 Tilehurst Road, Reading, RG30 2NG
Phase 2 Geotechnical Assessment Report

CONTENTS

1.0	INTRODUCTION.....	2
1.1	Appointment.....	2
1.2	Background and Development Proposals	2
1.3	Objectives	2
1.4	Scope of Work.....	2
2.0	SITE DETAILS AND SETTING	3
3.0	RECORDED GEOLOGY AND HYDROGEOLOGY.....	3
3.1	Geology	4
3.2	Groundwater Occurrence.....	4
4.0	GEOTECHNICAL EVALUATION.....	5
4.1	Geotechnical Laboratory Analysis	5
4.2	Discussion of Results	7
4.3	Geotechnical Recommendations.....	8
5.0	DISCUSSION AND CONCLUSIONS	10
6.0	CLOSURE.....	11

TABLES

Table 2-1	Site Details	3
Table 2-2	Physical Site Features Summary.....	3
Table 4-1	Summary of Geotechnical Laboratory Results.....	6
Table 4-2	Pile Bearing Capacity	9

APPENDICES

Appendix A	Proposed Site Layout
Appendix B	Investigation Fieldwork
Appendix C	Borehole Logs
Appendix D	Groundwater Monitoring Results
Appendix E	Geotechnical Laboratory Test Certificates

DRAWINGS

Drawing 1	Site Location Plan
Drawing 2	Site Layout Sketch Plan
Drawing 3	Borehole Location Plan

1.0 INTRODUCTION

1.1 Appointment

SLR Consulting Ltd (SLR) was commissioned by Gables Homes Ltd (GHL) in October 2015, to undertake a Phase 2 Geo-environmental Assessment of the former Brooklands Garage (also known as Westward Garage) at 330 Tilehurst Road, Reading, RG30 2NG (the Site) (Drawing 1).

The area considered by this assessment comprises two parts:

- 1) the former Petrol Filling Station (PFS) fronting Tilehurst Road in the southeast; and
- 2) the former Garage (Workshop) to the rear (northwest, Drawing 2).

This report forms an addendum to SLR's December 2015¹ Phase 2 Geo-environmental assessment report and presents the findings of the geotechnical analysis from the earlier assessment.

This report has been prepared by the Land Quality Group based at 8 Stow Court, Stow Road, Stow Cum Quy, Cambridge, CB25 9AS. Tel: 44 (0)1223-813805.

1.2 Background and Development Proposals

GHL is proposing to redevelop the Site for residential use. Proposals include demolition of existing buildings and construction of two blocks of apartments for the elderly with associated access routes, car parking and landscaping. The proposed site layout is presented as Appendix A.

1.3 Objectives

The objective of this assessment is to provide geotechnical information to be used by others for future foundation design.

1.4 Scope of Work

The scope of work for the Phase 2 Geo-environmental Assessment was devised by SLR and outlined in a proposal to GHL dated 2nd October 2015. Reference should be made SLR's earlier report for full details of the scope of work.

The investigation fieldwork is outlined in Appendix B.

¹ Phase 2 Geo-Environmental Assessment, Former Brooklands Garage. SLR Consulting Ltd., Reference 408.05913.00001, December 2015.

2.0 SITE DETAILS AND SETTING

Tables 2-1 and 2-2 summarise the Site details and setting. Reference should be made to SLR's earlier report for full details of the Site, its setting and history.

**Table 2-1
Site Details**

Address	330 Tilehurst Road, Reading, RG30 2NG.	
Site Location	The Site is located on the western side of Reading, approximately 1km from Reading town centre. (Drawing 1). National grid reference 468736,173021 identifies the approximate site location.	
Current Usage	The Site is unoccupied and disused.	
Site Surfacing	The majority of the Site is surfaced with a mixture of tarmac (PFS side) and concrete (Workshop side). Sections of the Workshop side are unsurfaced.	
Surrounding Land Use	North	Residential properties are adjacent and commercial/industrial units are 20m further north.
	East	Residential.
	South	Tilehurst Road beyond which is Prospect Park Public Open Space.
	West	Residential.

**Table 2-2
Physical Site Features Summary**

Published Geography and Geology	Gradient	The Site is relatively level with a slight slope on the PFS side down towards Tilehurst Road.
	Elevation	Approximately 63mAOD.
	Superficial Drift Geology	No Superficial deposits are recorded.
	Solid Geology	- Lambeth Group Formation (interbedded clay, silt and sand); - Chalk (Seaford Chalk Formation And Newhaven Chalk Formation).
Hydrology	Surface Water	The nearest identified surface waters are: - A pond - 400m to the southeast; - Holly Brook - 1.4km to the south; - The River Thames - 1.6m to the north.
	Surface Water Abstractions	There are no identified surface water abstractions within 1km.
Published Hydrogeology	Aquifer Status	Lambeth Group - Secondary A bedrock aquifer. Chalk – Principal bedrock aquifer.
	Groundwater Abstractions	Three historical groundwater abstractions were identified within 2km of the Site, the nearest of which is 1352m northeast which is used for drinking.
	Source Protection Zones (SPZ)	The Site is within the Total Catchment of a SPZ (Zone III).

3.0 RECORDED GEOLOGY AND HYDROGEOLOGY

3.1 Geology

Reference should be made to the appended borehole logs (Appendix C) for full details of the strata encountered by this investigation.

Made Ground

The boreholes recorded a variably mixed sequence of fine grained (cohesive) and coarse grained (granular) Made Ground on both sections of the Site:

PFS – The boreholes encountered deep, coarse grained Made Ground to a maximum of 4.1m depth comprising sandy gravel of brick and concrete which contained subordinate quantities of flint, tarmacadam and timber.

Garage – a thin layer of Made Ground was encountered which comprised predominantly clay with subordinate fragments of flint, brick, concrete and clinker.

Lambeth Group

Natural soils were encountered at depth below the PFS part and from shallow depth in the Garage part (from 0.1m). Natural soils comprised interbedded sand, clayey sand and sandy clay which are consistent with Lambeth Group geology.

Chalk

The Lambeth Group was underlain by Chalk solid geology which was encountered within the cable percussion boreholes at 12m to 13m depth². The Chalk was disturbed by the boring and consequently recovered at the surface as a gravelly chalk silt and chalk gravel.

3.1.2 Distribution Trends

The greater thickness of Made Ground beneath the PFS is considered to be a result of earlier tank excavation works undertaken by the previous owners. The tank excavation involved the removal of quantities of soil and replacement with recycled aggregate (fill).

3.2 Groundwater Occurrence

Groundwater was recorded in one newly installed monitoring well (BH202) at a depth of 8.783m within the Lambeth Group geology. Groundwater was encountered in existing wells installed within Lambeth Group geology at depths of between 7.555m (EXB) and 8.068m (EX2).

Within the Chalk, groundwater was encountered between depths of 23.177m (MW7) and 23.950m (MW103).

The groundwater monitoring results are presented in Appendix D.

² All depths are in metres below existing ground level unless otherwise stated.

4.0 GEOTECHNICAL EVALUATION

4.1 Geotechnical Laboratory Analysis

Eleven bulk and disturbed samples were submitted for analysis at an accredited geotechnical laboratory. Testing included:

- Moisture content;
- Atterberg (plasticity) testing;
- Direct shear box;
- Particle size distribution (psd);
- pH; and,
- Water soluble sulphate by 2:1 aqueous solution.

The full results are presented in Appendix E and a summary is provided in Table 4-1, overleaf.

Table 4-1 Summary of Geotechnical Laboratory Results

BH No.	Depth (m bgl)	Type	Moisture Content (%)	LL (%)	PL (%)	PI (%)	% passing <425µm sieve	Chemical		Shear box		Particle Size Distribution			
								pH	WSO ₄	Cohesion (kPa)	Angle of Shear Resistance (°)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH201	1.2-1.7	B	-	-	-	-	-	10.5	1.2	-	-	-	-	-	-
BH201	3.0	D	-	-	-	-	-	10.9	0.53	-	-	-	-	-	-
BH201	7.5-8.0	B	-	-	-	-	-	-	-	-	-	4.9	15.2	79.3	0.6
BH201	9.2	D	42	56	17	39	98	-	-	-	-	-	-	-	-
BH201	10.5-11.0	B	-	-	-	-	-	-	-	-	-	5.4	9.2	85.2	0.2
BH202	2.5-3.0	B	-	-	-	-	-	-	-	5	30.0	-	-	-	-
BH202	3.5-4.0	B	-	-	-	-	-	-	-	-	-	3.8	8.4	87.7	0.1
BH202	4.0	D	-	-	-	-	-	8.6	0.02	-	-	-	-	-	-
BH202	8.0	D	-	-	-	-	-	8.8	0.01	-	-	-	-	-	-
BH202	10.1	D	28	54	19	35	98	-	-	-	-	-	-	-	-
BH202	15.0	D	-	-	-	-	-	8.7	0.14	-	-	-	-	-	-

B = Bulk Sample, D = Disturbed Sample

4.2 Discussion of Results

4.2.1 Moisture Content

Moisture content testing was carried out on two disturbed samples at 9.2m in BH201 and 10.1m in BH202. Moisture contents ranged from 28% to 42%. Variability in the moisture content may be a result of moisture within sand pockets recorded during the ground investigation.

4.2.2 Atterberg Limits

Two samples of Lambeth Group clay were submitted for Atterberg testing. The plasticity index is comparable between the two samples ranging from 35% at 10.1m in BH202 to 39% at 9.2m in BH201.

Both of the samples plot above the 'A-line' and are considered to display clay-like behaviour. The samples are considered to be of high plasticity clay.

4.2.3 Particle Size Distribution

Three samples of the granular Lambeth Group material were submitted for psd analysis. Analysis returned 79.3% to 87.7% sand with 0.1% to 0.6% gravel. The sample collected at 7.5m to 8.0m in BH201 returned the highest proportion of fines with 15.2% silt and 4.9% clay. The remaining two samples returned less than 10% silt and 3.8% to 5.4% clay.

4.2.4 Shear Strength by Direct Shear

Small shear box analysis of the Lambeth Group sand at 2.5m to 3.0m in BH202 returned an angle of shearing resistance of 30° with 5kPa cohesion. This angle of shearing resistance is considered to be representative of the granular material.

As recorded in the psd analysis the material contains a small proportion of fines. The cohesion result obtained from shear box analysis is considered to be apparent cohesion in undrained conditions and is not representative of effective stress properties. The majority of the Lambeth Group sand is likely to display low cohesion. It is considered good practice to discount the cohesion and consider a conservative value of 0kPa for any analysis.

4.2.5 Chemical Analysis

pH testing recorded alkali to highly alkali results ranging from 8.6 to 8.8 in natural ground and up to 10.5 to 10.9 in the Made Ground in BH201.

Testing to determine soluble sulphate content returned low concentrations of between 0.01g/l to a maximum of 0.14g/l water soluble sulphate in the natural ground. Sampling within the Made Ground returned moderately high values of 0.53g/l to 1.2g/l WS SO₄. This needs to be considered when selecting the concrete for construction. Based on BRE guidelines³ the samples within the natural ground are classified as an ACEC (aggressive chemical environment for concrete) AC-1s in design class DS-1. The Made Ground is AC-1s in design class DS-2.

Based on a conservative assessment of the results obtained it is recommended that the site is classified as ACEC Class AC-1s and Design Sulphate Class DS-2.

³ BRE Construction Division. Special Digest 1: Concrete in Aggressive Ground. Third edition 2005

4.3 Geotechnical Recommendations

The proposed development consists of two two-storey blocks of apartments for the elderly with associated access routes, car parking and landscaping.

4.3.1 Foundation Recommendations

Former PFS (Southeast)

The PFS area in southeast of the Site is underlain by a significant thickness of Made Ground. The Made Ground extends up to 4.1m and comprises sandy gravel of brick and concrete with flint, tarmacadam and timber. The Made Ground represents the backfill to earlier tank excavations and needs to be taken into account during foundation design.

During foundation design a worst case scenario is considered. This uses the softest ground conditions with the highest load. This allows for variation within the ground as well as considering a maximum load.

The variability in the Made Ground in the southeast of the Site will impact bearing capacity and settlement as a result of building loads. In order to minimise differential settlement and to support the two-storey structure a piled foundation will be most appropriate. This will transmit the load into the underlying sand and chalk at depth. In order to minimise differential settlement it is recommended the whole apartment block on the PFS is constructed with a piled foundation.

Variation in the Made Ground may result in negative skin friction on the pile shaft. This has not been taken into account during bearing capacity calculations and will need to be considered as part of detailed design.

Outline pile design calculations have been carried out using the laboratory shear strength and in-situ standard penetration tests (SPTs). Where values are not available, suitable values have been applied between samples utilising the data from both boreholes and field observations. Calculations assume no load is accommodated in the Made Ground to allow for loss of skin friction due to variability in the shallow ground conditions.

The safe working loads for piles of 300mm and 450mm diameter are shown below. The ultimate pile capacity and safe working load have been calculated combining shear strength and SPT (N-value) results in Table 4-2. A factor of safety of 3 is considered suitable for permanent structures, such as the apartment blocks.

The pile capacities provided below should be considered as a guide only and it is recommended that a competent piling contractor is instructed to provide a detailed piling design, in line with their proposed piling method and plant.

Table 4-2 Pile Bearing Capacity

Pile Diameter (mm)	Depth (m bgl)	Ultimate Pile Capacity (kN)	Safe Working Load (kN)	Factor of Safety
300	11	1581.04	527.01	3
450	11	3019.66	1006.55	3

Where more favourable ground conditions are recorded it may be possible to zone pile depths and diameters to optimise pile size and spacing to minimise the extent (and therefore cost) of the overall foundation solution.

Former Garage (Northwestern)

The former Garage (northwestern) is underlain by shallow Made Ground overlying natural medium dense to very dense sands of the Lambeth Group. Based on the ground conditions encountered in BH202, a shallow foundation solution is considered appropriate for the apartment block constructed in this area. The dense to very dense sands returned SPT N-values between 27 and 50 (refusal). The granular material is likely to have a bearing capacity in excess of 300kPa.

Any settlement in the natural ground is likely to occur quickly, during construction, and therefore will not impact the final structure.

Notwithstanding the above, prior to construction, foundation excavations should be proof rolled with a Wacker plate to highlight any soft areas. These should be removed and replaced with suitable granular material to ensure the structure remains stable.

4.3.2 General

In addition to the above recommendations it is recommended that all design and construction works be carried out on site in accordance with recognised engineering codes of practice including BS 8004 (1986: Code of Practice for Foundations) and BS 6031 (1981: Code of Practice for Earthworks).

4.3.3 Pavements and Hardstanding Areas

Reference to IAN 73/06⁴ suggests that shallow granular material of the nature recorded at the Site will have a California Bearing Ratio (CBR) value in excess of 20%. Based on this a minimum, conservative, design CBR value of 15% is recommended for the outline design of pavement and hardstanding areas. It is also recommended that confirmatory field testing (in the form of either in-situ CBR tests or plate loading tests) are carried out at the design formation level prior to construction.

⁴ Interim Advice Note 73/06 Revision 1 (2009). Design Guidance for Road Pavement Foundations

5.0 DISCUSSION AND CONCLUSIONS

From a geotechnical perspective, the Site can be split into two areas:

- PFS (southeast) - is underlain by up to 4.1m of Made Ground, associated with the backfilled tank decommissioning excavations.
- Garage (northwest) - the site Made Ground is much thinner and in-situ sand and gravel of the Lambeth Group is encountered at shallow depths.

It is recommended that loads from the apartment block constructed over the former PFS are transferred to the deeper in-situ Lambeth Group and underlying Chalk. Piled foundations are considered the most appropriate solution in this instance and outline recommendations on pile dimensions and capacities are provided.

Shallow foundations are considered appropriate for the apartment block in the northwestern (former Garage) part of the Site.

Redevelopment of the Site will require the demolition of the existing structures and the removal of buried services, foundations and obstructions. It is recommended that as part of any planned demolition and site clearance works that the appointed contractor remove all associated underground construction so as not to hinder the performance of new foundations. Where foundations and underground structures are removed they should be replaced with an inert well compacted clean granular fill.

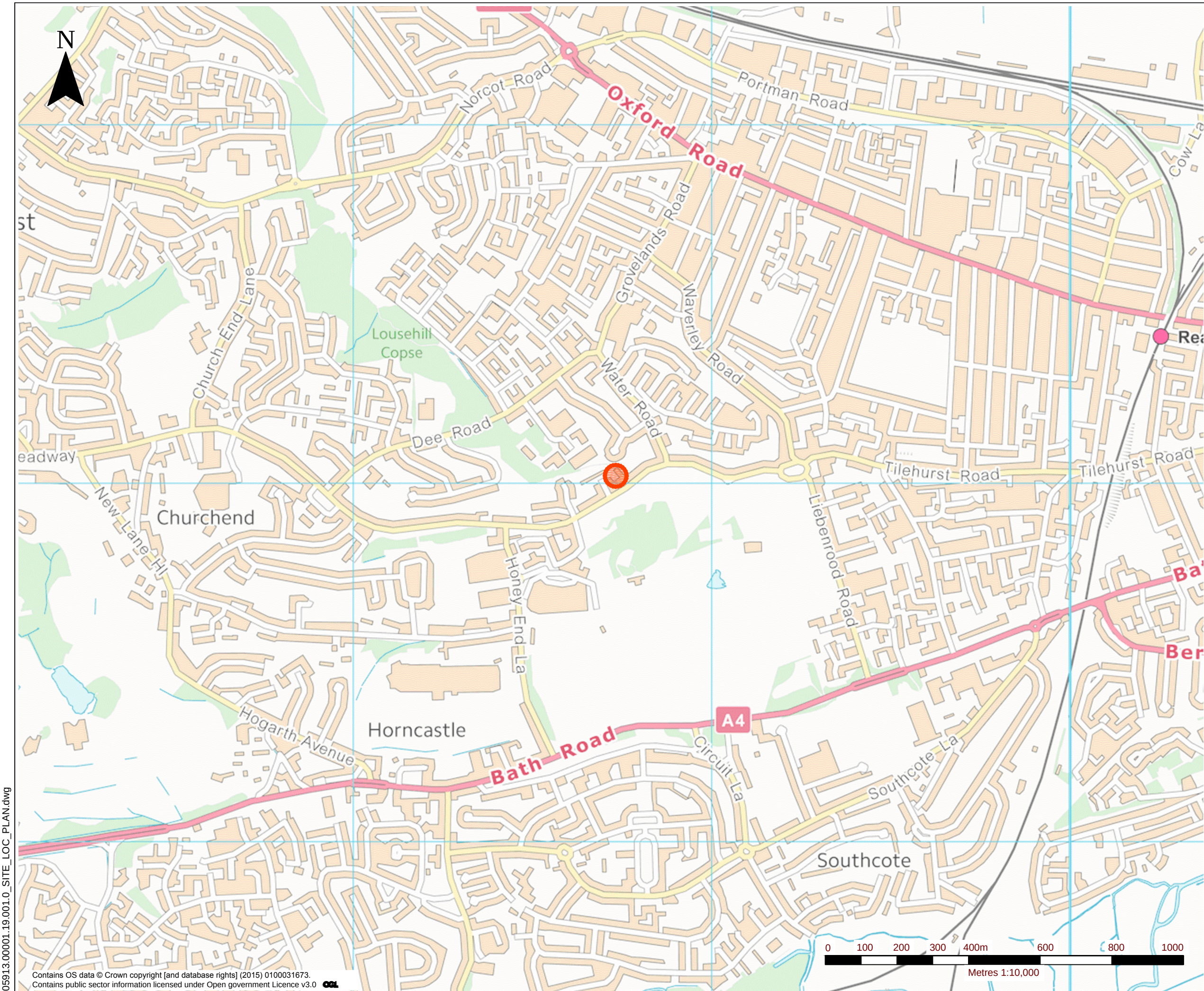
6.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected during the desk study, site visits and subsurface investigations.

The evaluation and conclusions presented do not preclude the existence of contamination, which could not reasonably have been revealed by the desk studies and site visit, nor do they preclude variation of conditions between test holes or the existence of other chemical compounds. Hence, this report should be used for information purposes only and should not be construed as a comprehensive characterisation of all site conditions. Information provided to SLR staff at the subject site has been accepted as being accurate and valid.

This report is for the exclusive use of Gables Homes Ltd and their exclusive agents; no warranties or guarantees are expressed or should be inferred by any third parties. Any such party relies upon the report at their risk.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.



LEGEND



SITE LOCATION

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BROOKLANDS GARAGE

ENVIRONMENTAL ASSESSMENT

SITE LOCATION PLAN

DWG No. 1

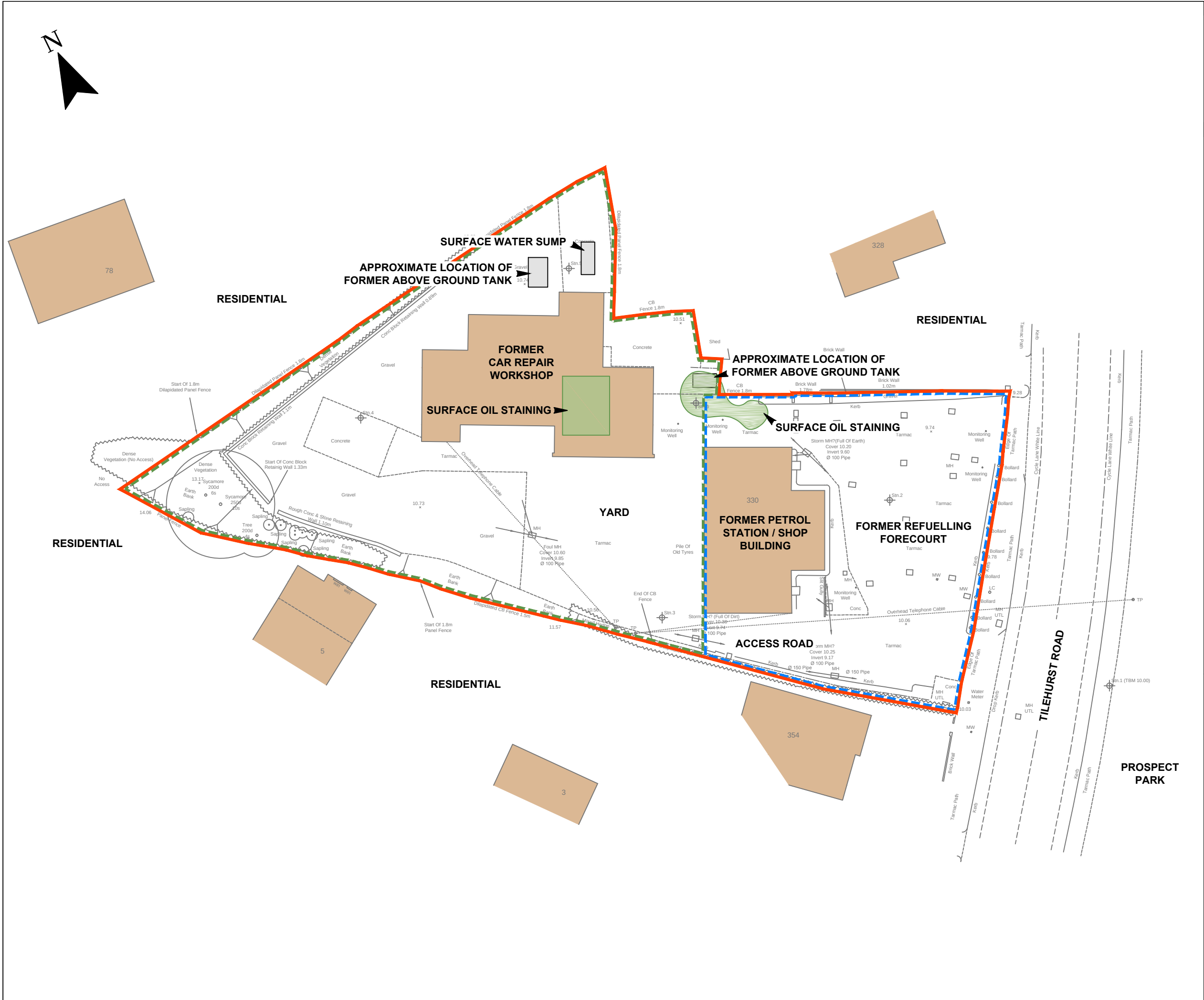
Scale
1:10,000 @ A3

Date
OCTOBER 2015

05913.00001.19.0010 SITE_LOC_PLAN.dwg

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05913.00001.19.002.1_SITE_SKETCH_PLAN.dwg



NOTES

1. DRAWING IS BASED ON PETER JH ROBERTS AND ASSOCIATES SURVEY DRAWING, NUMBER BG-1, DATED SEPTEMBER 2013.

LEGEND

SITE BOUNDARY

FORMER CAR REPAIR GARAGE

FORMER PETROL FILLING STATION

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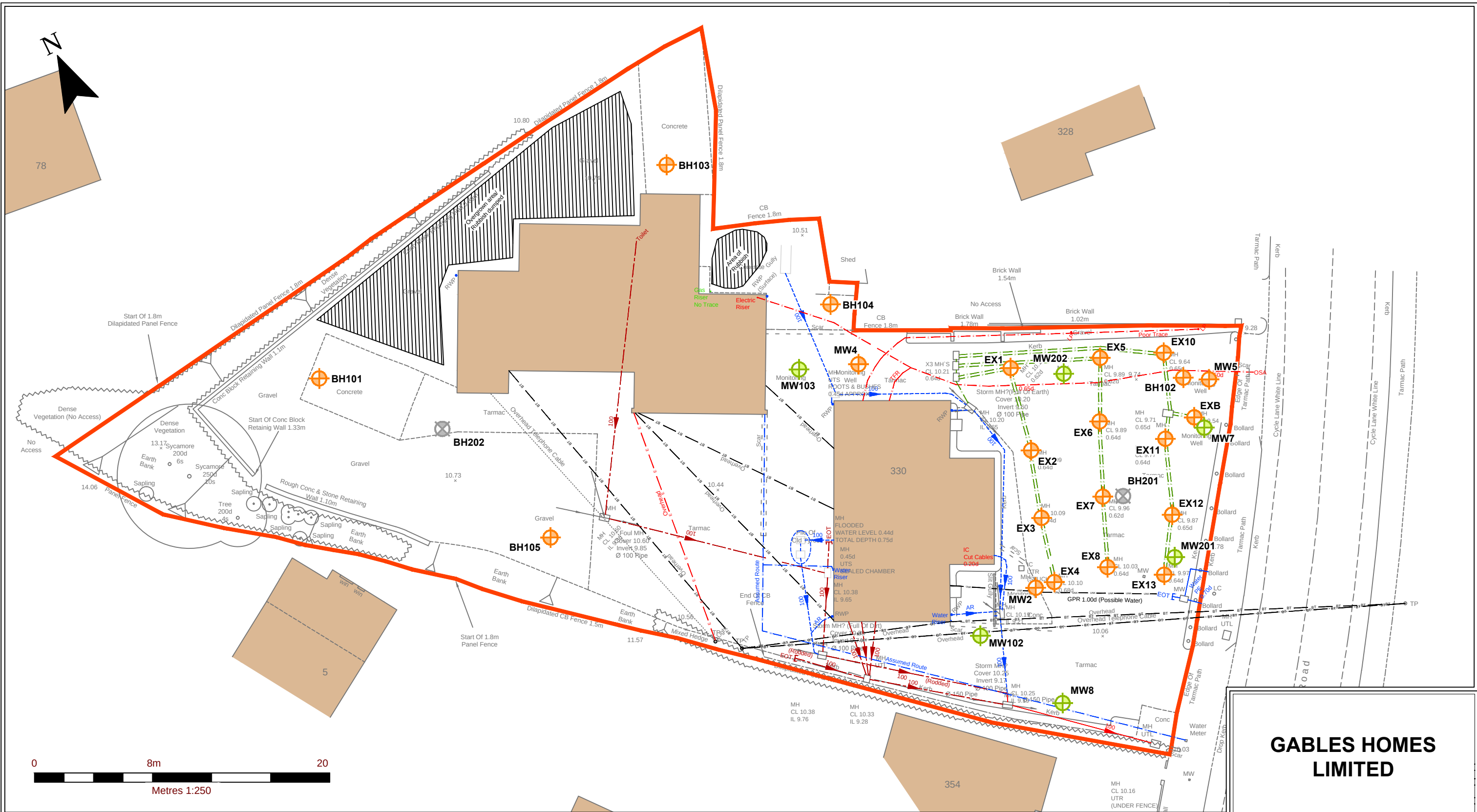
BROOKLANDS GARAGE
ENVIRONMENTAL ASSESSMENT
SITE LAYOUT SKETCH
DWG No. 2

Scale
NTS (A3)

Date
OCTOBER 2015

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05913.00001.19.003.1_BH_LOC_PLAN.dwg



LEGEND

- | | | | |
|---------------------------------------|-----------------------------------|--|---|
| | SITE BOUNDARY | | DEEP BOREHOLE (CHALK) |
| APPROXIMATE BOREHOLE LOCATIONS | | | |
| ARCADIS BOREHOLES (2002 - 2010) | | | |
| | SHALLOW BOREHOLE (LAMBETH GROUP) | | DYNAMIC SAMPLE BOREHOLE (LAMBETH GROUP) |
| | REMEDIAL BOREHOLE (LAMBETH GROUP) | | SLR CABLE PERCUSSION BOREHOLE |

NOTES

1. DRAWING IS BASED ON PETER JH ROBERTS AND ASSOCIATES SURVEY DRAWING, NUMBER BG-1, DATED SEPTEMBER 2013.

UTILITY SURVEY LEGEND

- | | |
|--|-------------------|
| | FOUL DRAINAGE |
| | SURFACE DRAINAGE |
| | COMBINED DRAINAGE |
| | ELECTRICITY |
| | WATER |
| | BRITISH TELECOM |
| | PIPE |

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BROOKLANDS GARAGE
ENVIRONMENTAL ASSESSMENT
BOREHOLE LOCATION PLAN

DWG No. 3

Scale
1:250 @ A3

Date
DECEMBER 2015



1m 5m 10m 20m
Scale Bar 1:250

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Project Title	RESIDENTIAL DEVELOPMENT BROOKLANDS GARAGE 330 TILEHURST ROAD READING RG30 2NG		
Client	GABLE HOMES LTD		
Status	PLANNING		
Scale	1:250	Drawing Size	A3
Drawn By	TVT	Checked By	IC
Date	04.12/14		

Drawing Title	PROPOSED COLOUR SITE PLAN		
Job-Dwg No	12086-120	Rev	-
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1.0 FIELD WORK

1.1 Principal Tasks

The Site works were undertaken in October and November 2015 and comprised the following main tasks:

- public utility searches and utility tracing survey;
- dynamic sample (DS) boreholes;
- light cable percussion (LCP) boreholes;
- well development, groundwater monitoring and sampling.

Each of the above tasks is discussed below and the approximate exploratory hole locations are shown on Drawing 3.

1.2 Utility Clearance

Public utility records and site drawings were reviewed to ensure that boreholes were positioned clear of known underground and overhead services.

Site Vision Surveys carried out a utility tracing survey on 22nd October 2015.

At all of the borehole locations hand excavated starter pits were dug to 1.20m¹ and each location was screened with a cable avoidance tool to ensure the absence of unrecorded services.

1.3 Drive in Dynamic Sample Boreholes

A total of 5 drive-in (window) dynamic sample (DS) boreholes were sunk using a mini-tracked rig and temporary stainless steel casing between 5th and 6th November 2015.

On completion, soil gas monitoring wells were installed in four of the DS boreholes (BH101, BH103, BH104 and BH105). The wells comprised a 50mm diameter HDPE access tube, slotted (screened) from its base to 1.0m below ground level and surrounded by a granular filter. The well casing was surrounded with bentonite and capped above ground with a lockable security cover that was concreted into place.

Details of the individual well installations are shown on the appended borehole logs.

1.4 Light Cable Percussion Boreholes

Two boreholes (BH201 and BH202) were sunk using conventional cable percussive techniques in 200mm and 150mm diameter temporary steel casing.

Small disturbed samples were recovered throughout the boring depth for screening for VOCs and for laboratory testing.

On completion of boring, the boreholes were backfilled with hydrated bentonite pellets up to the desired monitoring interval. Monitoring wells were installed in the LCP boreholes to

¹ All depths referred to in this report are in metres below existing ground level unless otherwise stated.

permit the monitoring and sampling of groundwater and testing for hazardous soil gases as follows:

- BH201 – shallow well installation (4.1m) within Made Ground for soil gas monitoring;
- BH202 – deeper well installation (10.1m) within Lambeth Group geology for groundwater monitoring and sampling.

The wells comprised a 50mm diameter HDPE access tube with a slotted screen section surrounded by a geotextile wrap and granular filter and above the screen zone was plain casing surrounded with bentonite. The wells were capped at ground level with a gas valve and lockable security cover that was concreted into place.

Details of the individual well installations are shown on the appended borehole logs.

1.5 Soil Sampling

Soil samples from the boreholes were inspected and logged on site by a consultant from SLR. Samples were recovered at approximately 0.5m to 1.0m intervals and screened for volatile organic compounds (VOCs) using a MiniRae Lite photoionisation detector with 10.6eV lamp calibrated to isobutylene. A set of duplicate subsamples were also recovered for laboratory chemical analysis and separate soil samples recovered for geotechnical testing.

1.6 Groundwater Monitoring and Sampling

Groundwater sampling has been undertaken on three occasions:

- 15th October 2015 – sampling of the existing Chalk wells;
- 21st – 29th October 2015 – sampling of the existing Lambeth Group wells;
- 19th November 2015 – sampling of the of the existing and newly installed Lambeth Group wells.

On each occasion, the level of groundwater and presence/absence of non-aqueous phase liquid (NAPL) in each well was recorded using an electronic interface probe.

BOREHOLE LOG				BOREHOLE No. BH101	
Client: GABLES HOMES LTD					
Project No: 408.05913.00001		Date: 05/11/15	Ground Level: 11.04mATBM		
Project: FORMER BROOKLANDS GARAGE, READING				Sheet: 1 of 1	

SAMPLES & TESTS						Water	STRATA				Instrument/ Backfill
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N		Reduced Level	Legend (Thick-ness)	Depth	DESCRIPTION	
0.30	E	0					10.89		0.15	MADE GROUND: Concrete hardstanding	
							10.79		0.25	MADE GROUND: Firm light greyish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded clinker and concrete.	
									(0.50)	Firm light yellowish brown sandy CLAY.	
0.80	E	0					10.29		0.75	Light yellowish brown medium clayey SAND.	
1.20	HS	0					9.74		1.30	Orange medium SAND.	
									(1.00)		
											
1.50 1.50	E HS	1									
2.00	HS	0					8.74		2.30	Greyish brown medium SAND.	
2.50	E	0							(0.70)		
3.00	HS	0					8.04		3.00	Borehole complete at 3.00m	

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
											Hand dug pit from ground level to 1.2m bgl. Well installed, screened 1m - 3m.

All dimensions in metres Scale 1:31.25	Contractor: Endeavour Plant:	Method: Dynamic Sample Hole Size: 100	Logged By: JH/CB	Approved By: PW
---	---------------------------------	--	---------------------	--------------------

BOREHOLE LOG				BOREHOLE No. BH102	
Client: GABLES HOMES LTD					
Project No: 408.05913.00001		Date: 05/11/15	Ground Level: 9.48mATBM	Co-ordinates:	
Project: FORMER BROOKLANDS GARAGE, READING					
Sheet: 1 of 1					

SAMPLES & TESTS						Water	STRATA				Instrument/ Backfill
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N		Reduced Level	Legend (Thick-ness)	Depth	DESCRIPTION	
0.20	E	0					9.38		0.10	MADE GROUND: Tarmacadam hardstanding	
									(0.30)	MADE GROUND: Greyish brown clayey sandy GRAVEL of fine to coarse angular to subrounded brick, flint, concrete, occasional clinker.	
							9.08		0.40		
0.70	E	1							(1.00)	MADE GROUND: Firm greenish black becoming orange brown mottled firm sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded flint, brick, occasional clinker.	
							8.08	1.40			
1.50	HS	1							(0.80)	Orangey brown fine to medium SAND.	
1.60	E										
2.00	HS	1					7.28		2.20		
									(0.80)	Greyish brown clayey fine to medium SAND.	
2.30	E								(0.80)		
2.50	E	1									
3.00	HS	0					6.48		3.00		
										Borehole complete at 3.00m	

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
											Hand dug pit from ground level to 1.2m bgl. Borehole backfilled with arisings.

All dimensions in metres Scale 1:31.25	Contractor: Endeavour Plant:	Method: Dynamic Sample Hole Size: 100	Logged By: JH/CB	Approved By: PW
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BOREHOLE LOG				BOREHOLE No. BH103			
Client: GABLES HOMES LTD							
Project No: 408.05913.00001		Date: 05/11/15				Ground Level: 10.63mATBM	
Project: FORMER BROOKLANDS GARAGE, READING				Sheet: 1 of 1			

SAMPLES & TESTS						Water	STRATA				Instrument/ Backfill
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N		Reduced Level	Legend (Thick-ness)	Depth	DESCRIPTION	
1	0.30	E	0				10.48		0.15	MADE GROUND: Concrete hardstanding	
	0.50	HS	0						(0.45)	MADE GROUND: Firm brown sandy slightly gravelly CLAY. Gravel is medium to coarse subrounded flint and occasional subangular clinker.	
							10.03		0.60		
	1.00	HS	0						(0.80)	Orange brown clayey medium SAND.	
							9.23		1.40		
2	1.50	HS	0							Orange fine to medium SAND.	
	1.60	E							(0.80)		
							8.43		2.20		
	2.30	E	0						2.40	Orange mottled grey clayey fine to medium SAND.	
3							8.23			Orange fine to medium SAND.	
									(0.60)		
	2.90	HS	0				7.63		3.00		
4										Borehole complete at 3.00m	

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
											Hand dug pit from ground level to 1.2m bgl. Well installed, screened 1m - 3m.

All dimensions in metres Scale 1:31.25		Contractor: Endeavour Plant:		Method: Dynamic Sample Hole Size: 100		Logged By: JH/CB	Approved By: PW
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BOREHOLE LOG				BOREHOLE No. BH104	
Client: GABLES HOMES LTD					
Project No: 408.05913.00001		Date: 05/11/15	Ground Level: 10.51mATBM	Co-ordinates:	
Project: FORMER BROOKLANDS GARAGE, READING					Sheet: 1 of 1

SAMPLES & TESTS						STRATA				Instrument/ Backfill
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N	Water	Reduced Level	Legend (Thick-ness)	Depth	
							10.31		0.20	MADE GROUND: Concrete hardstanding
0.30	E	1							(0.25)	MADE GROUND: Light brown sandy GRAVEL of fine to coarse subangular to subrounded concrete, flint, brick, clinker. Occasional concrete cobble.
0.50	HS	0					10.06		0.45	MADE GROUND: Firm orange brown sandy slightly gravelly CLAY. Gravel is medium to coarse subangular flint, medium subangular brick and occasional clinker.
									(0.85)	
1							9.21		1.30	
1.40	E	1								Yellowish brown medium SAND.
1.80	HS	1							(1.70)	
2.30	HS	1								
2.80	HS	0					7.51		3.00	
3										Borehole complete at 3.00m
4										

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
											Hand dug pit from ground level to 1.2m bgl. Well installed, screened 1m - 3m.

All dimensions in metres Scale 1:31.25	Contractor: Endeavour Plant:	Method: Dynamic Sample Hole Size: 100	Logged By: JH/CB	Approved By: PW
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BOREHOLE LOG				BOREHOLE No. BH105	
Client: GABLES HOMES LTD					
Project No: 408.05913.00001		Date: 05/11/15	Ground Level: 10.64mATBM	Co-ordinates:	
Project: FORMER BROOKLANDS GARAGE, READING					Sheet: 1 of 1

SAMPLES & TESTS						Water	STRATA				Instrument/ Backfill
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N		Reduced Level	Legend (Thick-ness)	Depth	DESCRIPTION	
1	0.50	E	0				10.54		0.10	MADE GROUND: Reddish brown sandy GRAVEL of medium to coarse subangular to subrounded flint and concrete, occasional tarmacadam fragment.	
									(2.00)	Light greyish brown medium SAND.	
	1.20	HS	0								
2	1.70	E	0								
	2.20	HS	1				8.54		2.10	Light yellowish brown clayey medium SAND.	
	2.70	HS	1				8.14		2.50	Light greyish brown medium SAND.	
3							7.64		3.00		
4										Borehole complete at 3.00m	

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
											Hand dug pit from ground level to 1.2m bgl. Well installed, screened 1m - 3m.

All dimensions in metres Scale 1:31.25	Contractor: Endeavour Plant:	Method: Dynamic Sample Hole Size: 100	Logged By: JH/CB	Approved By: PW
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BOREHOLE LOG

BOREHOLE No.
BH201

Client:
GABLES HOMES LTD

Project No:
408.05913.00001

Date:
11/11/15

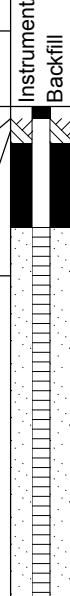
Ground Level:
9.94mATBM

Co-ordinates:



Project:
FORMER BROOKLANDS SERVICE STATION

Sheet:
1 of 2

SAMPLES & TESTS						Water	STRATA			Instrument/ Backfill
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N		Reduced Level	Legend (Thick-ness)	Depth	
0.30	E	0			34			0.10	MADE GROUND: Tarmacadam hardstanding	
								0.20	MADE GROUND: Purplish grey sandy GRAVEL of angular fine to coarse limestone (sub-base).	
								(1.20)	MADE GROUND: Light greyish brown sandy GRAVEL of angular to subangular fine to coarse brick and concrete, rounded to subrounded flint and occasional brick and flint cobble. Occasional fragments of coarse gravel size subangular tarmacadam and wood.	
1.20-1.70	B				50	8.54		1.40	MADE GROUND: Medium dense to very dense brown clayey sandy GRAVEL of angular to subrounded fine to coarse of brick, concrete, flint and occasional tile. Frequent brick cobbles. Occasional large cobbles of concrete.	
1.50	E	1								
2.00-2.50	B	1								
2.00	D				14					
2.00	HS	3								
2.50	HS	3								
3.00-3.50	B	3			37					
3.00	D									
3.00	HS	3								
3.50	HS	3								
4.00-4.50	B				50/230	5.84		4.10	Dense to very dense yellowish brown slightly clayey fine SAND. Sand becoming coarse below 8.0m. Hydrocarbon odour noted between 4.20-5.50m.	
4.00	D									
4.50	E	597								
5.00	D	326			52					
5.00	HS									
5.50-6.00	B	329								
5.50	HS									
6.00-6.50	B	18			35					
6.00	D									
6.00	E									
6.50-7.00	B	14			25					
6.50	D									
6.50	HS									
7.00	HS	5								
7.50-8.00	B	1			35					
7.50	E									
8.00	HS	1								
8.50-9.00	B	1			25					
8.50	HS									
9.00	HS	3								
9.20	D					0.84		9.10	Stiff mottled grey orange sandy CLAY with pockets of coarse orange SAND.	
9.50	HS	1				0.44		9.50	Stiff grey slightly sandy CLAY.	

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
											Hand dug starter pit to 1.2m. Dual Casing String: 200mm casing to 10.60m, Bentonite seal 9.6m-10.6m prior to using 150mm casing to 13m depth. Borehole backfilled with bentonite. Well installed, screened 1m - 4.1m.

All dimensions in metres
Scale 1:62.5

Contractor: Endeavour Drilling
Plant: Dando 2000

Method: Cable Percussion
Hole Size: 200mm to 150mm

Logged By:
BJ

Approved By:
MR

BOREHOLE LOG				BOREHOLE No. BH201			
Client: GABLES HOMES LTD							
Project No: 408.05913.00001		Date: 11/11/15				Ground Level: 9.94mATBM	
Project: FORMER BROOKLANDS SERVICE STATION				Sheet: 2 of 2			

SAMPLES & TESTS						Water	STRATA				Instrument/ Backfill
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N		Reduced Level	Legend (Thick-ness)	Depth	DESCRIPTION	
10.00	D	1						10.10	Very dense pale yellow fine grained SAND with nodules of grey sandy clay		
10.00	E										
10.10-	B										
10.50		1						10.50			
10.50-	B										
11.00											
11	10.50	D	0		50/160						
	10.50	E									
	11.00	D						(1.70)			
	11.00	HS	1								
	11.50	D									
	11.50	HS									
12	12.00	D	1					12.20	CHALK (recovered as off white slightly gravelly slightly sandy SILT). Gravel is very weak to weak, subangular to subrounded chalk.		
	12.00	HS									
	12.20-	B						(0.80)			
	13.00										
	12.50	HS	1								
13	13.00	D	1		24			13.00			
	13.00	HS							Borehole complete at 13.00m		
14											
15											
16											
17											
18											
19											

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
											Hand dug starter pit to 1.2m. Dual Casing String: 200mm casing to 10.60m, Bentonite seal 9.6m-10.6m prior to using 150mm casing to 13m depth. Borehole backfilled with bentonite. Well installed, screened 1m - 4.1m.

All dimensions in metres Scale 1:62.5	Contractor: Endeavour Drilling Plant: Dando 2000	Method: Cable Percussion Hole Size: 200mm to 150mm	Logged By: BJ Approved By: MR
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BOREHOLE LOG

BOREHOLE No.
BH202

Client:
GABLES HOMES LTD

Project No:
408.05913.00001

Date:
06/11/15

Ground Level:
10.77mATBM

Co-ordinates:



Project:
FORMER BROOKLANDS SERVICE STATION

Sheet:
1 of 2

SAMPLES & TESTS						STRATA				Instrument/ Backfill
Depth	Type No	HS (ppm)	HV (kPa)	PP (kPa)	SPT-N	Water	Reduced Level	Legend (Thickness)	Depth	
0.15	HS	1					10.66		0.09	MADE GROUND: Concrete hardstanding
0.25	D	0					10.56		0.21	
0.25	HS	0					10.34		0.43	
0.50-1.00	B									
0.50	HS									MADE GROUND: Brown sandy GRAVEL comprising brick rubble and occasional clinker
1.00	D	0								
1.00	HS				50					MADE GROUND: Light brown mottled grey slightly gravelly fine to medium grained SAND with occasional bands of firm brown clay. Gravel is fine to coarse of red brick.
1.20-1.65	B									
1.50-2.00	B	0								Dense to very dense orangish brown mottled grey fine and medium grained SAND with bands of firm brown clay.
1.50	HS									
2.00	D	0			28					
2.00	HS									
2.50-3.00	B	0								
2.50	HS									
3.00	D	0			50/150					
3.00	HS									
3.50-4.00	B	0								
3.50	HS									
4.00	D	0			50/220					
4.00	HS									
4.50-5.00	B	0							(8.57)	
4.50	HS									
5.00	D	0								
5.00	HS									
5.50-6.00	B									
5.50	HS									
6.00	D									
6.00	HS									
6.50-7.00	B				30					
6.50	HS									
7.00	D	0								
7.00	HS									
7.50-8.00	B	1								
7.50	HS									
8.00	D	0			34					
8.00	HS									
8.50-9.00	B	0								
8.50	HS									
9.00	D	0					1.77		9.00	Medium dense brown clayey fine to medium grained SAND.
9.00	HS								(0.95)	
9.50	HS	0			27		0.82		9.95	

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
											Hand dug starter pit to 1.2m. Dual Casing String: 200mm casing to 10.10m, Bentonite seal 9.1m-10.10m, prior to using 150mm casing to 17m depth. Borehole backfilled with bentonite to 10.1m. Well installed, screened 5m - 10.1m.
All dimensions in metres Scale 1:62.5				Contractor: Endeavour Drilling Plant: Dando 2000		Method: Cable Percussion Hole Size: 200mm to 150mm			Logged By: CB & BJ		Approved By: MR

BOREHOLE LOG

BOREHOLE No.
BH202

Client:
GABLES HOMES LTD

Project No:
408.05913.00001

Date:
06/11/15

Ground Level:
10.77mATBM

Co-ordinates:



Project:
FORMER BROOKLANDS SERVICE STATION

Sheet:
2 of 2

SAMPLES & TESTS						Water	STRATA			Instrument/ Backfill
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N		Reduced Level	Legend (Thick-ness)	Depth	
9.95-10.00	B	0								
10.00	HS				50		0.67	10.10	Firm to stiff mottled grey orange CLAY with pockets of fine to medium grained SAND. <i>(continued)</i>	
10.10	D						0.27	10.50	Stiff grey CLAY	
10.10-10.55	U100	0			33				Firm grey mottled brown green sandy CLAY with abundant shell fragments	
10.50	HS									
11	D	0								
11.00-11.50	B							(1.70)		
11.50	HS	0								
11.50	HS									
12	D	0					-1.43	12.20		
12.00	HS				33				Brown mottled grey sandy gravelly CLAY. Gravel is sub angular coarse of flint, shells and weak cream chalk.	
12.20	D							(0.80)		
12.50	D	0								
12.50	HS									
12.50-12.95	U100	0					-2.23	13.00		
13	HS								CHALK (recovered as off white slightly gravelly slightly sandy SILT). Gravel is very weak to weak chalk.	
12.95										
13.00	HS	0								
13.50-14.00	B	1								
14	HS									
13.50	D	1			28					
14.00	HS									
14.00	HS									
14.50-15.00	B	0								
15	HS									
14.50	D	1						(4.00)		
15.00	HS									
15.00	HS									
15.50	HS	1			27					
16	D	1								
16.00	HS									
16.00	HS									
16.50-17.00	B	1								
17	HS									
16.50	D	1			23		-6.23	17.00		
17.00	HS								Borehole complete at 17.00m	
17.00	HS									
18										
19										

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
											Hand dug starter pit to 1.2m. Dual Casing String: 200mm casing to 10.10m, Bentonite seal 9.1m-10.10m, prior to using 150mm casing to 17m depth. Borehole backfilled with bentonite to 10.1m. Well installed, screened 5m - 10.1m.

All dimensions in metres
Scale 1:62.5

Contractor: Endeavour Drilling
Plant: Dando 2000

Method: Cable Percussion
Hole Size: 200mm to 150mm

Logged By:
CB & BJ

Approved By:
MR

Date	Borehole	EX1	EX2	EX3	EX4	EX5	EX6	EX7	EX8	EX10	EX11	EX12	EX13	EXB	MW2	MW4	MW5	MW7	MW8	MW102	MW103	MW201	MW202	BH101	BH103	BH104	BH105	BH201	BH202
	Well Screen Zone (m)	4.0-9.5	4.0-9.0	2.0-10.2	4.0-9.5	4.0-9.5	4.0-9.2	4.0-9.3	4.0-9.0	4.0-9.0	4.0-9.0	4.0-9.0	4.0-9.0	4.0-10.0	-	-	-	23.0-28.0	23.5-28.5	20.0-30.0	20.0-30.0	16.0-29.0	16.0-29.0						
	Borehole Elevation (mASD)	10.120	10.100	10.090	10.090	9.845	9.890	9.960	10.020	9.640	9.710	9.859	10.000	9.6	10.13	10.37	9.48	9.62	10.1	10.22	10.48	9.98	9.93	11.038	10.626	10.513	10.644	9.939	10.772
Sep '08	Depth to NAPL (m)	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	-	-	-	NP	NP	NP	NP	NP	NP						
	NAPL (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Groundwater depth (m)	7.85	7.80	7.76	7.76	7.56	7.60	7.63	7.69	7.34	7.44	7.53	7.63	7.32	dry	-	-	22.80	23.28	23.41	23.500	23.17	23.13						
	Groundwater Elevation (m)	2.270	2.300	2.330	2.330	2.285	2.290	2.330	2.330	2.300	2.270	2.329	2.370	2.314	-	-	-	-13.180	-13.180	-13.190	-13.020	-13.190	-13.200						
May '09	Depth to NAPL (m)	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	-	-	-	-	NP	-	NP	NP	NP						
	NAPL (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Groundwater depth (m)	7.90	7.90	7.80	7.80	7.60	7.62	7.67	7.74	7.37	7.47	7.58	7.66	7.35	dry	-	-	-	23.12	-	23.350	23.25	23.21						
	Groundwater Elevation (m)	2.220	2.200	2.290	2.290	2.245	2.270	2.290	2.280	2.270	2.240	2.279	2.340	2.284	-	-	-	-	-13.020	-	-12.870	-13.270	-13.280						
Dec '09	Depth to NAPL (m)	NP	NP	NP	NP	NP	NP	NP	-	NP	NP	NP	NP	NP	-	-	-	NP	NP	NP	NP	NP	NP						
	NAPL (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Groundwater depth (m)	8.03	7.99	7.97	7.97	7.74	7.78	7.83	dry	7.53	7.64	7.71	9.06	7.52	dry	-	-	22.92	23.44	23.57	23.740	23.33	23.24						
	Groundwater Elevation (m)	2.090	2.110	2.120	2.120	2.105	2.110	2.130	-	2.110	2.070	2.149	0.940	2.114	-	-	-	-13.075	-13.340	-13.350	-13.260	-13.350	-13.310						
Jan '10	Depth to NAPL (m)	NP	NP	NP	NP	NP	NP	NP	-	NP	NP	NP	NP	NP	-	-	-	NP	NP	-	NP	NP	NP						
	NAPL (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Groundwater depth (m)	7.97	7.94	7.92	7.91	7.68	7.71	7.76	dry	7.47	7.59	7.70	7.80	7.45	-	-	-	21.9	22.42	-	22.300	22.89	22.26						
	Groundwater Elevation (m)	2.150	2.160	2.170	2.180	2.165	2.180	2.200	-	2.170	2.120	2.159	2.200	2.184	-	-	-	-12.055	-12.320	-	-11.820	-12.910	-12.330						
07-08/04/11	Depth to NAPL (m)	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	-	-	-	NP	NP	NP	NP	NP	NP						
	NAPL (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Groundwater depth (m)	8.094	8.049	8.026	8.021	7.792	7.837	7.887	7.964	7.579	7.689	7.782	7.896	7.583	dry	dry	dry	22.989	23.454	23.581	23.737	23.357	23.307						
	Groundwater Elevation (m)	2.026	2.051	2.064	2.069	2.053	2.053	2.073	2.056	2.061	2.021	2.077	2.104	2.051	-	-	-	-13.144	-13.354	-13.361	-13.257	-13.377	-13.377						
	Head Space*	20	75	20	10	70	30	<5	10	30	<5	15	10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5						
15/10/2015	Depth to NAPL (m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NP	NP	NP	NP	NP	NP						
	NAPL (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Groundwater depth (m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23.177	23.660	23.779	23.950	23.545	23.531						
	Groundwater Elevation (m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-13.557	-13.560	-13.559	-13.470	-13.565	-13.601						
	Head Space*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1						
21/10/2015 - 29/10/2015	Depth to NAPL (m)	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	-	-	-	-	-	-	-	-	-						
	NAPL (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Groundwater depth (m)	8.053	8.022	7.986	7.985	7.771	7.806	7.853	7.921	7.558	7.664	7.765	7.867	7.555	-	-	-	-	-	-	-	-	-						
	Groundwater Elevation (m)	2.067	2.078	2.104	2.105	2.074	2.084	2.107	2.099	2.082	2.046	2.094	2.133	2.079	-	-	-	-	-	-	-	-	-						
	Head Space*	<1	<1	<1	<1	<1	10	25	<1	5	<1	<1	5	<1															
19/11/2015	Depth to NAPL (m)	-	NP	-	-	NP	-	-	-	-	-	NP	-	NP	-	-	-	-	-	-	-	-	-	NP	NP	NP	NP	NP	NP
	NAPL (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Groundwater depth (m)	-	8.068	-	-	7.798	-	-	-	-	-	7.804	-	7.568	-	-	-	-	-	-	-	-	-	DRY	DRY	DRY	DRY	DRY	8.783
	Groundwater Elevation (m)	-	2.032	-	-	2.047	-	-	-	-	-	2.055	-	2.066	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.989
	Head Space*	-	<1	-	-	<1	-	-	-	-	-	<1	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1

Key	
All depths are in metres below ground level.	
NP	Not present.
NAPL	Non aqueous phase liquid
-	No data recorded
mASD	Metres above Site Datum
*	Soil gas vapour as parts per million Total Organic Volatiles, measured using either GMI Gas Surveyor calibrated to pentane or PID (10.6eV lamp) calibrated to isobutylene.
	Well installed in Made Ground
	Well installed in Lambeth Group
	Well installed in Chalk
-	Unknown Strata/Screen

SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole / Trial Pit	Sample Ref	Depth (m)	Type	Description	MC (%)	LL (%)	PL (%)	PI (%)	<425 µm (%)	Bulk Mg/m³	Dry Mg/m³	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 (g/L)	W/S Mg (mg/L)	
BH201		1.20-1.70	B												10.5	1.20		
BH201		3.00	D												10.9	0.53		
BH201		7.50-8.00	B	Light brown clayey silty SAND.														Particle Size Distribution
BH201		9.20	D	Multicoloured slightly sandy CLAY with rare fine gravel	42	56	17	39	98									
BH201		10.50-11.00	B	Light brown and grey brown clayey silty fine to medium SAND.														Particle Size Distribution
BH202		2.50-3.00	B	Light brown mottled light grey silty fine SAND														Direct Shear
BH202		3.50-4.00	B	Yellow brown clayey silty fine to medium SAND.														Particle Size Distribution
BH202		4.00	D												8.6	0.02		
BH202		8.00	D												8.8	0.01		
BH202		10.10	D	Grey silty CLAY with a rare coating of brown sand	28	54	19	35	98									

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by  Senior Technician 14/12/2015	Project Number: Project Name: GEO / 23429 FORMER BROOKLANDS SERVICE STATION 408.05913.00001	
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SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole / Trial Pit	Sample Ref	Depth (m)	Type	Description	MC	LL	PL	PI	<425 µm	Bulk	Dry	Cell Pressure	Deviator Stress	Shear Stress	pH	2:1 W/S SO4	W/S Mg	
					(%)	(%)	(%)	(%)	(%)	Mg/m³	Mg/m³	kPa	kPa	kPa		(g/L)	(mg/L)	
BH202		15.00	D												8.7	0.14		

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by



Senior Technician
14/12/2015

Project Number:

GEO / 23429

Project Name:

FORMER BROOKLANDS SERVICE STATION
408.05913.00001



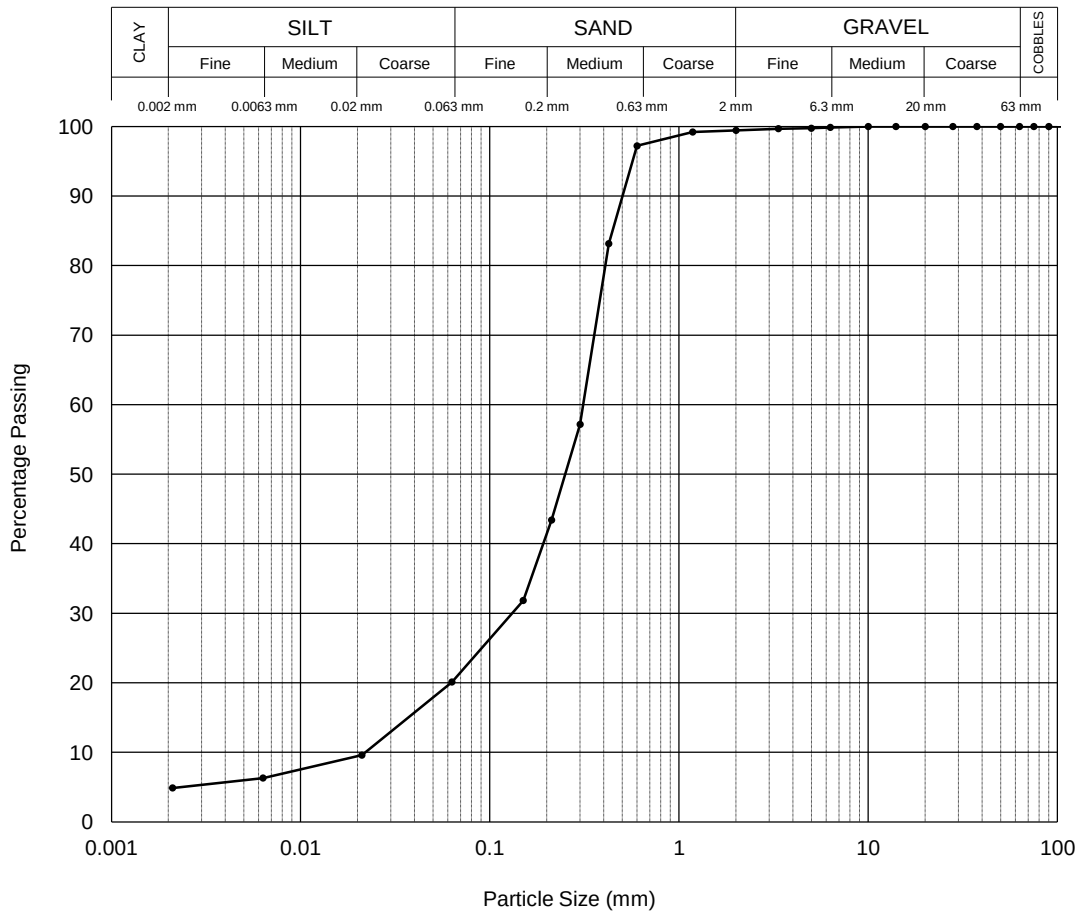
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH201
 Depth (m): 7.50-8.00
 Sample Type: B

Description:
 Light brown clayey silty SAND.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method
 BS1377 : Part 2 : Clause 9.4 : 1990 Sedimentation by the Pipette Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	99
1.18	99
0.6	97
0.425	83
0.3	57
0.212	43
0.15	32
0.063	20



Pipette	
P. Size (µm)	% pass
21.1	10
6.3	6
2.1	5

Preparation:
No Pre-treatment used

Temp (°C)	20
-----------	----

Particle Proportions	
Cobbles	0.0 %
Gravel	0.6 %
Sand	79.3 %
Silt	15.2 %
Clay	4.9 %

Checked and Approved by

Senior Technician
 14/12/2015

Project Number:

GEO / 23429

Project Name:

FORMER BROOKLANDS SERVICE STATION
408.05913.00001

GEOLABS

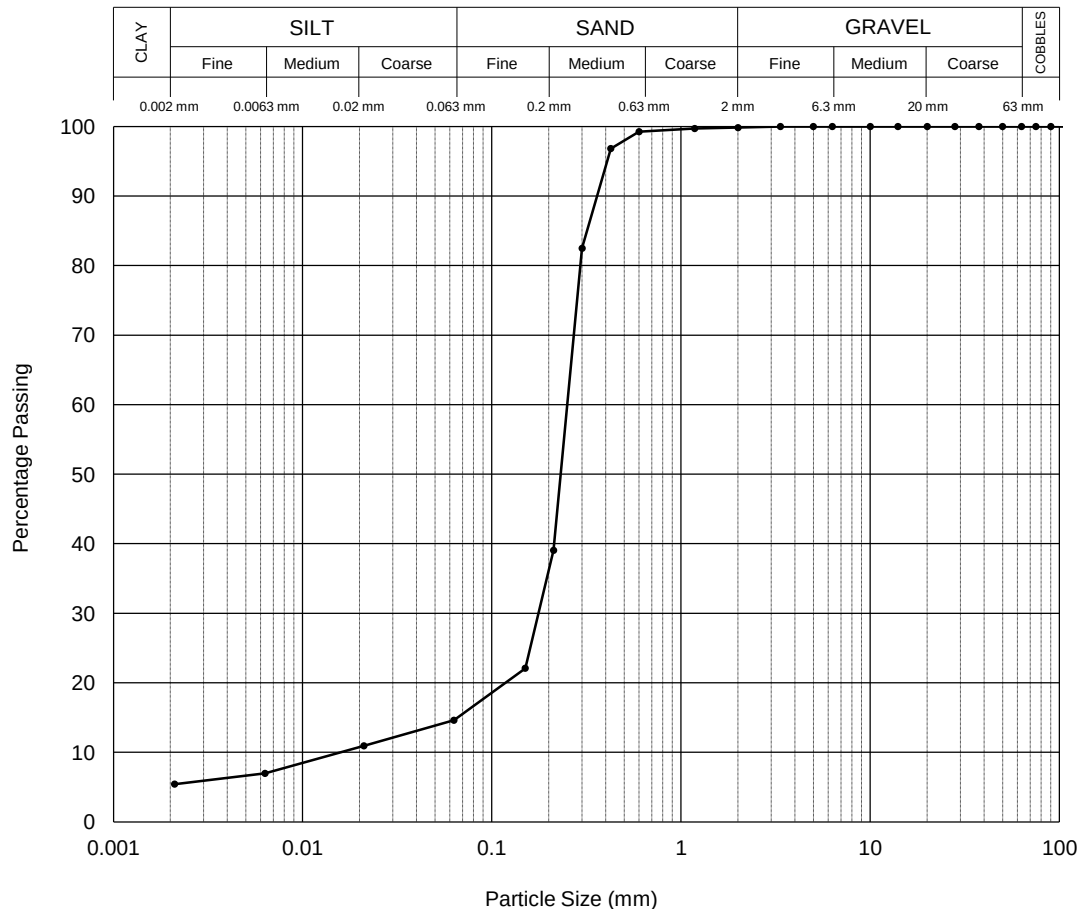
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH201
 Depth (m): 10.50-11.00
 Sample Type: B

Description:
 Light brown and grey brown clayey silty fine to medium SAND.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method
 BS1377 : Part 2 : Clause 9.4 : 1990 Sedimentation by the Pipette Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	99
0.425	97
0.3	82
0.212	39
0.15	22
0.063	15



Pipette	
P. Size (µm)	% pass
21.1	11
6.3	7
2.1	5

Preparation:
No Pre-treatment used

Particle Proportions	
Cobbles	0.0 %
Gravel	0.2 %
Sand	85.2 %
Silt	9.2 %
Clay	5.4 %

Temp (°C)	20
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Checked and Approved by

Senior Technician
 14/12/2015

Project Number:

GEO / 23429

Project Name:

FORMER BROOKLANDS SERVICE STATION
408.05913.00001

GEOLABS

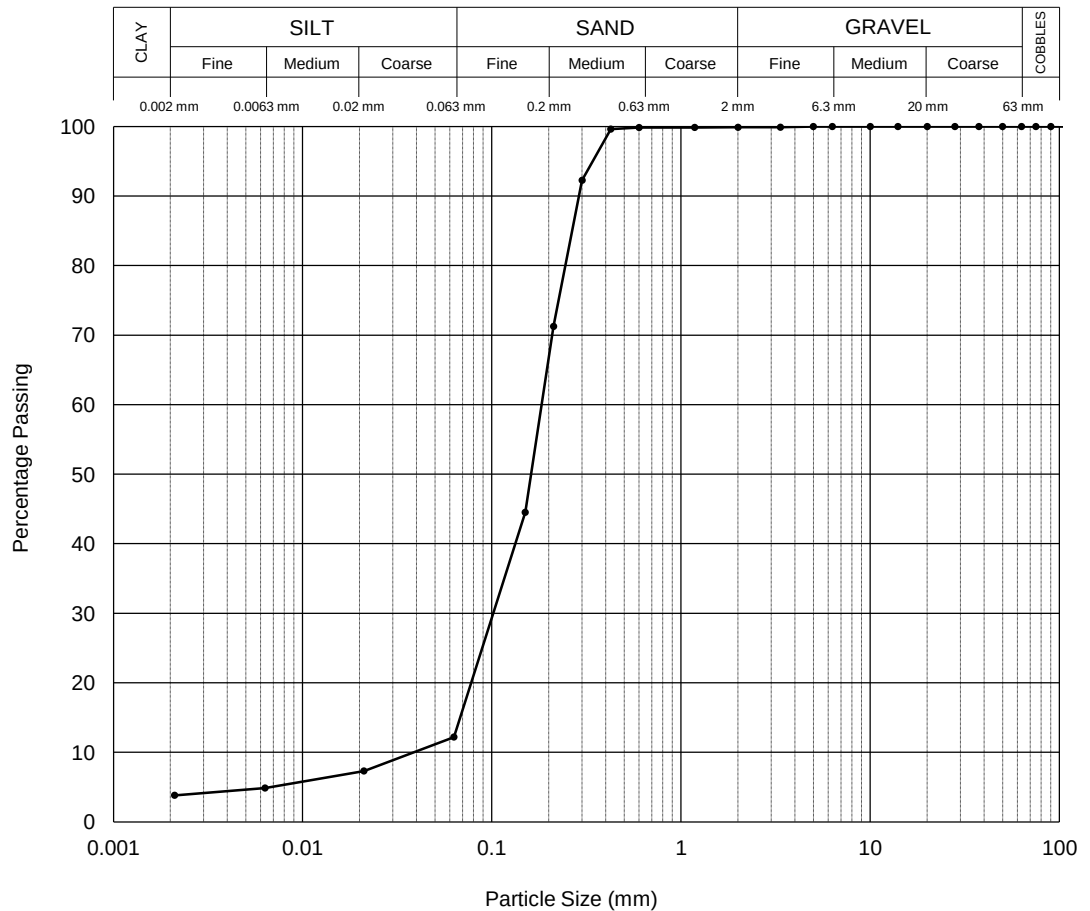
PARTICLE SIZE DISTRIBUTION

BH/TP No: BH202
 Depth (m): 3.50-4.00
 Sample Type: B

Description:
 Yellow brown clayey silty fine to medium SAND.

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method
 BS1377 : Part 2 : Clause 9.4 : 1990 Sedimentation by the Pipette Method

Sieve	
Sieve (mm)	% pass
200	100
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	100
1.18	100
0.6	100
0.425	100
0.3	92
0.212	71
0.15	45
0.063	12



Pipette	
P. Size (µm)	% pass
21.1	7
6.3	5
2.1	4

Preparation:
No Pre-treatment used

Temp (°C)	20
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Particle Proportions	
Cobbles	0.0 %
Gravel	0.1 %
Sand	87.7 %
Silt	8.4 %
Clay	3.8 %

Checked and Approved by

Senior Technician
 14/12/2015

Project Number:

GEO / 23429

Project Name:

FORMER BROOKLANDS SERVICE STATION
408.05913.00001

GEOLABS

Determination of Shear Strength by Direct Shear

(small shearbox apparatus)

Borehole No: BH202
Depth (m): 2.50 - 3.00

Description:
Light brown mottled light grey silty fine SAND.

Specimen Details

Depth within original sample *mm* n/a
Orientation within original sample n/a
Test condition Submerged
Preparation < 2mm material remoulded by light tamping.

Particle density *Mg/m³* 2.66 (assumed)

Specimen Number	1	2	3
Length <i>mm</i>	59.72	60.68	60.36
Width <i>mm</i>	59.74	60.46	60.42
Height <i>mm</i>	23.53	24.61	24.27
Initial moisture content %	25	25	25
Initial wet density <i>Mg/m³</i>	2.16	2.16	2.17
Initial dry density <i>Mg/m³</i>	1.74	1.74	1.74
Initial voids ratio	0.53	0.53	0.53

Consolidation Stage

		25	50	100
Normal stress <i>kPa</i>				
Duration <i>day(s)</i>		0	0	0

Shearing Stage

		25	50	100
Normal stress <i>kPa</i>				
Peak Conditions:				
Rate of horizontal displacement <i>mm/min</i>		0.18	0.18	0.18
Maximum shear stress <i>kPa</i>		20.3	33.1	63.3
Horizontal displacement at MSS <i>mm</i>		4.6	2.1	7.1
Residual Conditions:				
Rate of horizontal displacement		n/a	n/a	n/a
Residual shear stress		n/a	n/a	n/a
Final cumulative displacement		n/a	n/a	n/a
Total traverses		n/a	n/a	n/a
Method of reversal		n/a	n/a	n/a
Final moisture content %		19	20	17
Duration <i>day(s)</i>		1	1	1

Shear Strength Parameters**Maximum Condition:**

Apparent Cohesion <i>kPa</i>	5
Angle of Shearing Resistance <i>degrees</i>	30.0

Notes:

Checked and Approved by

SRA

S R Allen (Tech)

Date: 09/12/2015

Project Number:

GEO / 23429

Project Name:

FORMER BROOKLANDS SERVICE STATION**Project Ref: 408.05913.00001****GEOLABS®**

Determination of Shear Strength by Direct Shear

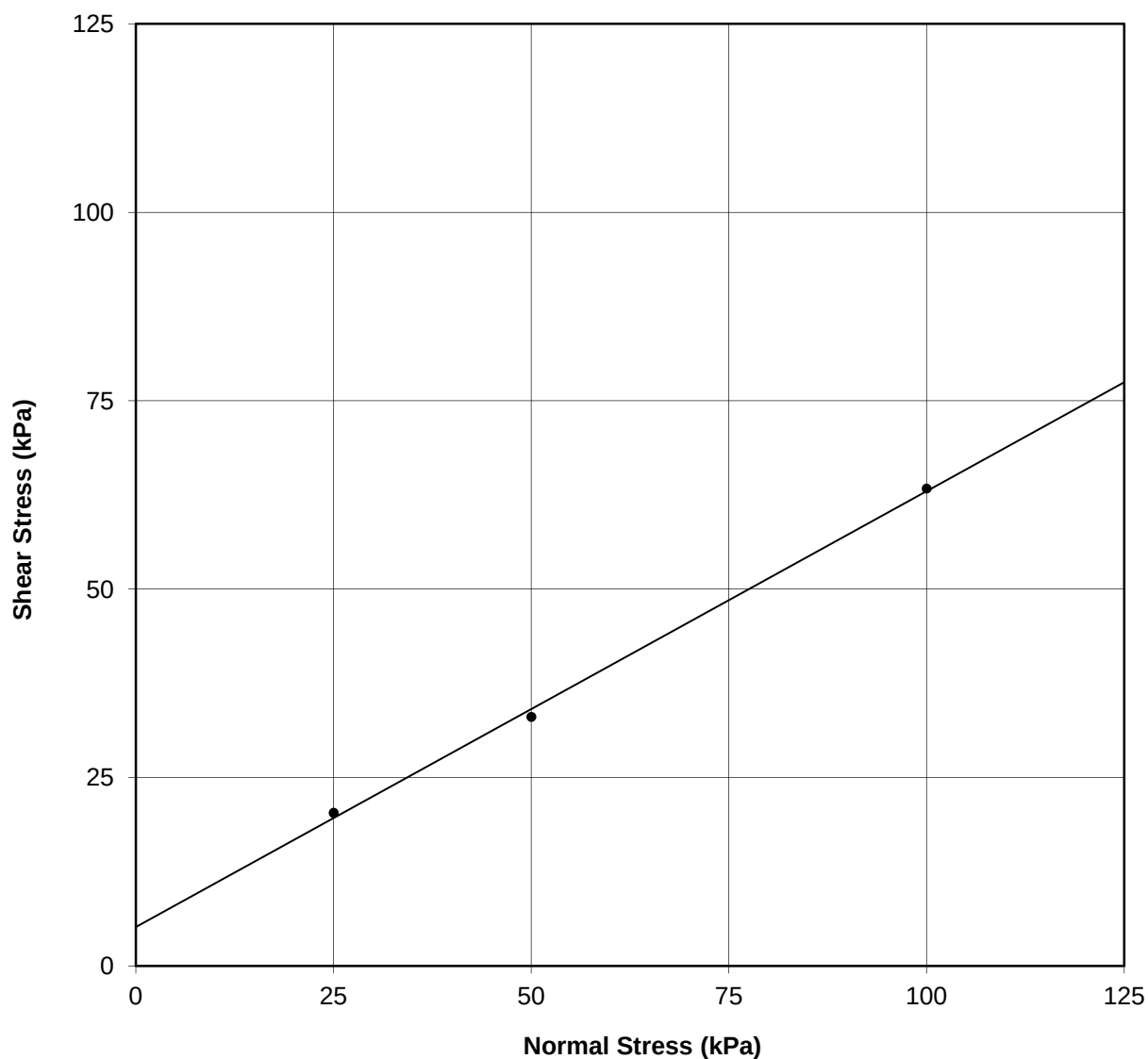
(small shearbox apparatus)

Borehole No: BH202

Depth (m): 2.50 - 3.00

Description:

Light brown mottled light grey silty fine SAND.

Shear Stress v Normal Stress

Checked and Approved by

SRA

S R Allen (Tech)

Date: 09/12/2015

Project Number:

GEO / 23429

Project Name:

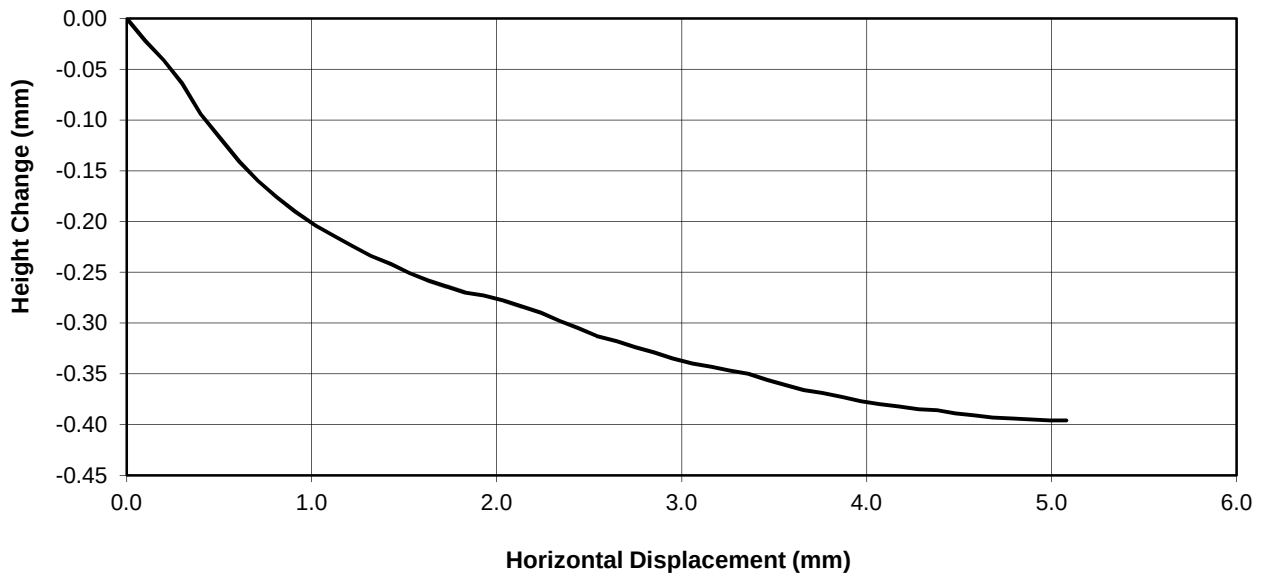
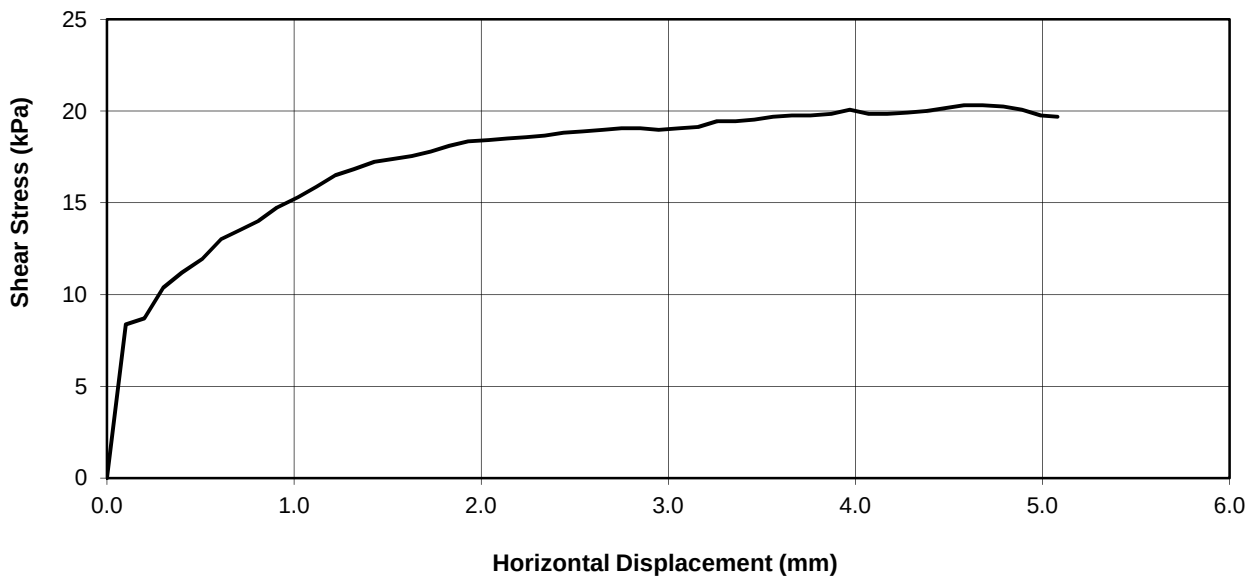
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Determination of Shear Strength by Direct Shear

(small shearbox apparatus)

Borehole No: BH202
Depth (m): 2.50 - 3.00

Description:
Light brown mottled light grey silty fine SAND.

Specimen No 1**Normal Pressure = 25 kPa****Height Change v Horizontal Displacement****Shear Stress v Horizontal Displacement**

Checked and Approved by

SR4

S R Allen (Tech)

Date: 09/12/2015

Project Number:

GEO / 23429

Project Name:

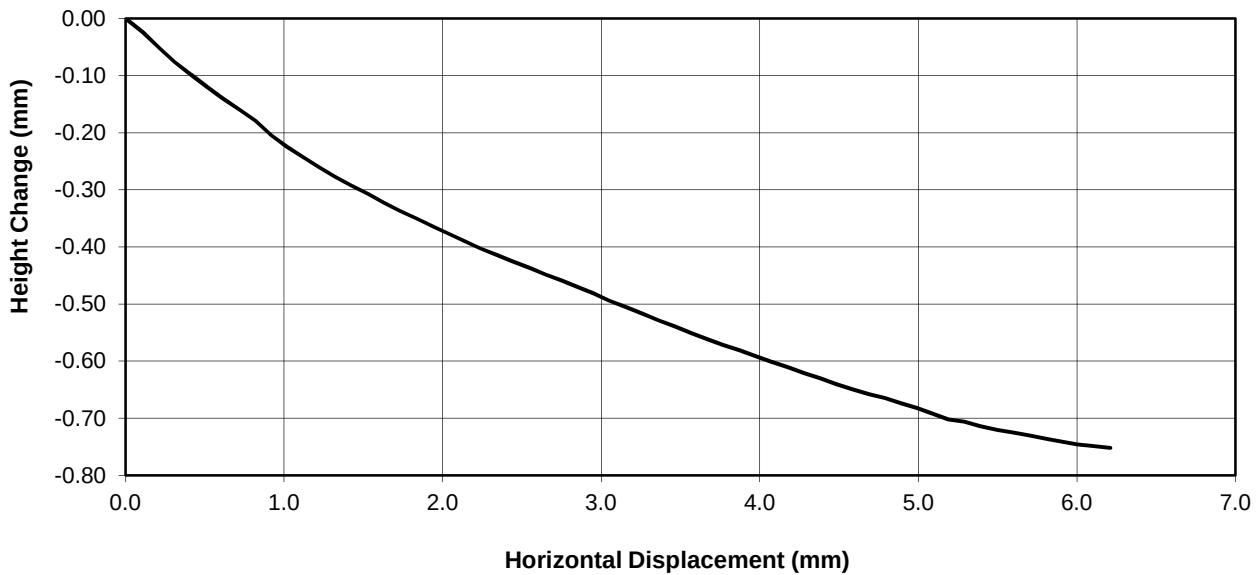
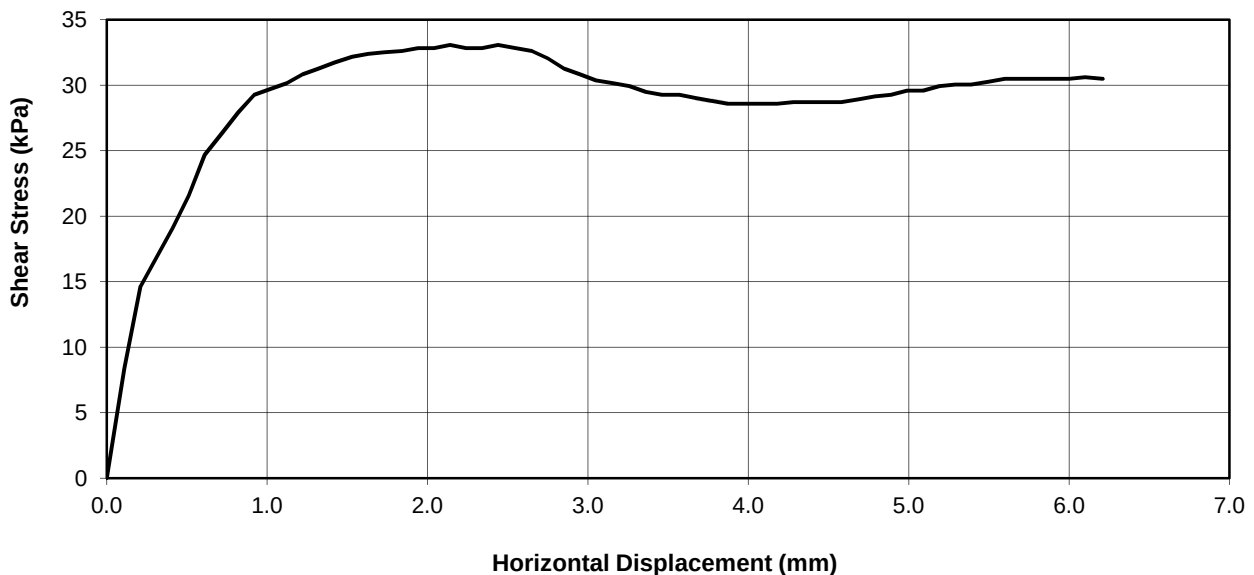
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Determination of Shear Strength by Direct Shear

(small shearbox apparatus)

Borehole No: BH202
Depth (m): 2.50 - 3.00

Description:
Light brown mottled light grey silty fine SAND.

Specimen No 2**Normal Pressure = 50 kPa****Height Change v Horizontal Displacement****Shear Stress v Horizontal Displacement**

Checked and Approved by

SRA

S R Allen (Tech)

Date: 09/12/2015

Project Number:

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Project Name:

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Project Ref: 408.05913.00001

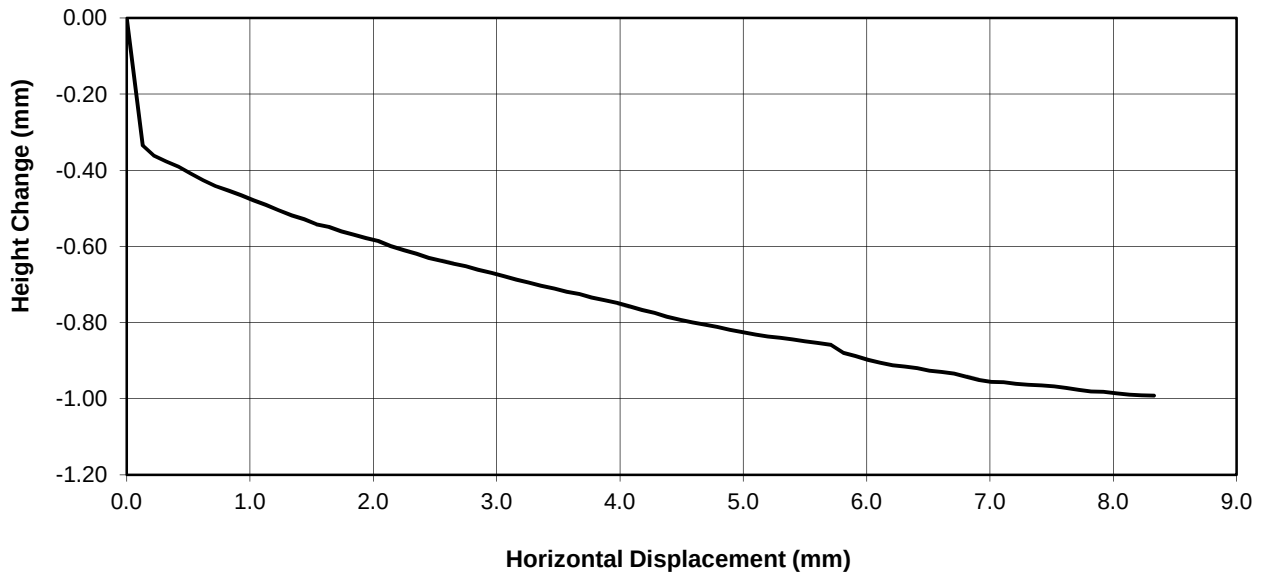
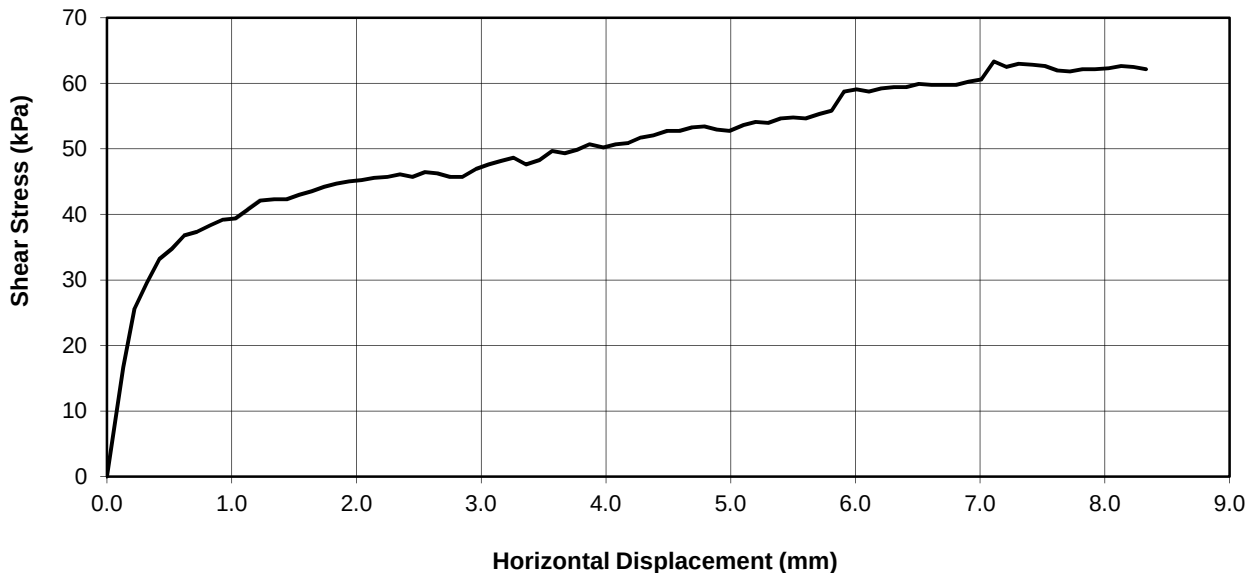
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Determination of Shear Strength by Direct Shear

(small shearbox apparatus)

Borehole No: BH202
Depth (m): 2.50 - 3.00

Description:
Light brown mottled light grey silty fine SAND.

Specimen No 3**Normal Pressure = 100 kPa****Height Change v Horizontal Displacement****Shear Stress v Horizontal Displacement**

Checked and Approved by

SR4

S R Allen (Tech)

Date: 09/12/2015

Project Number:

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Project Name:

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