

APPENDIX 7.2 2006 SITE INVESTIGATION

**Proposed Development
at Portmarnock,
Co. Dublin**

Report No. 06-693

Client: Ballymore Residential Ltd

Engineer: JB Barry & Partners Ltd

SITE INVESTIGATION

Proposed Development at Portmarnock , Co. Dublin

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Methods of describing soils and rocks

Soil and rock descriptions are based on the guidance in Section 6 of BS 5930: 1999, *The Code of Practice for Site Investigation*, with the following exceptions:

- Where the strength of clay is based on field assessment without the availability of laboratory or in-situ test results the following terms are used, where applicable:
 - soft to firm: clay with undrained shear strength close to the BS5930 boundary (40kPa) between soft and firm soil.
 - firm to stiff: clay with undrained shear strength close to the BS5930 boundary (75kPa) between firm and stiff soil.
- The relative density of coarse-grained soils, described in trial pit logs, is based on field observations including stability of pit sides and the ease/difficulty of excavation. The description is for indicative purposes only: as required by BS 5930, the relative density should only be determined by use of insitu tests, including standard penetration tests.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample
P	Nominal 100mm diameter undisturbed piston sample
B	Bulk disturbed sample
D / J	Small disturbed sample
W	Water sample
ES	Soil sample for environmental testing
SPT	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
CPT	Standard penetration test using 60 degree solid cone
X,X/X,X,X,X	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length.
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
X*/Y	Incomplete standard penetration test where the seating drive could not be completed. The blows 'X' represent the total blows for the given length of seating drive 'Y' (mm)
X/Z	Incomplete standard penetration test where the seating drive was achieved but the full test length was not. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa
VR	V: undisturbed vane shear strength VR: remoulded vane shear strength
dd/mm/yy: 1.0 dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
Abbreviations relating to rock core – reference Clause 44.4.4 of BS 5930: 1999	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of <i>solid core</i> to the total length of core run. <i>Solid core</i> has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of <i>solid core</i> pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.

SITE INVESTIGATION

Proposed Development at Portmarnock, Co. Dublin

1 AUTHORITY

On the instructions of the JB Barry & Partners Ltd, acting on behalf of the Client Ballyore Residential Ltd. a ground investigation was undertaken at the above site to establish the subsoil conditions with regard to the proposed development (Appendix A).

2 SCOPE

The extent of the investigation was as directed and designed by the Engineer and included the sinking of cable percussion boreholes, the installation of groundwater monitoring wells, trial pits, soak away tests, sampling, in-situ and laboratory testing, and the preparation of a report on the findings.

3 DESCRIPTION OF SITE

The site is located south of Portmarnock, it is bounded to the west by the Belfast – Dublin railway and to the south and east by the R123 and R106 respectively. The majority of the site is within private agricultural land which is divided into fields with small hedgerows along some boundaries.

A site location plan is presented in Appendix A.

4 FIELDWORK

The fieldwork undertaken for the investigation was between 20 September 2006 and 13 October 2006 under the supervision of an Engineer from Glover Site Investigations Ltd.

The number, location and depths of exploratory holes were as directed by the Engineer.

4.1 Boreholes by cable percussion drilling methods

Six boreholes were sunk by means of a Dando 2000 drilling rig using shell and auger techniques. The boreholes were drilled 200mm diameter using temporary casing and boring tools and extended to depths of 10.00m below existing ground level.

Disturbed (small jar and bulk bag) samples were taken from the strata encountered.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

The borehole locations are shown on the plan in Appendix A and its log is provided in Appendix B.

4.1.1 Standard Penetration Tests

Standard Penetration Tests, using either a split barrel sampler (SPT) or solid 60' cone (CPT) to enable measurement of the penetration resistance (N) to be determined under dynamic loading. When the number of blows for the seating drive exceeds 25 blows the distance driven is recorded and the test drive started. If the test drive exceeds 50 blows (increased to 100 blows in soft rock) then the distance driven is recorded and the test terminated.

4.1.2 Groundwater Monitoring Installations

Installations in selected boreholes (BH's 1, 2, 3, 4, 5 & 6) included 50mm standpipes. Details of individual installations are presented on the instrumentation data sheet that accompanies the relevant borehole logs (Appendix B).

Standpipe depths range from 9.60m – 10.00m depth below existing ground level. Gas valves where fitted to standpipe installations.

4.2 Trial pits

Six trial pits were excavated using a 3 tonne tracked excavator fitted with a 600mm wide toothed bucket. The pits extended to depths of 3.00m

Disturbed (bulk bag) and environmental samples were taken of the strata encountered.

Any groundwater entries to the pits were recorded along with any rise in groundwater during excavation. The stability of the pit walls was noted.

The trial pit logs are provided in Appendix C.

4.3 Percolation tests

Three percolation tests were conducted in a further three trial pits at locations P1, P2 & P3. The tests were conducted in accordance with CIRIA Report 156 (1996), *Infiltration drainage – Manual of good practice*.

The percolation results of the tests are provided in Appendix D. However, the static water level during the tests precluded the calculation of the infiltration coefficient of the soil.

4.4 California Bearing Ratio Tests

California Bearing Ratio (CBR) tests were completed at trial pit locations which are at or close to grade using a Dynamic Cone Penetrometer. Results of in situ testing are given in Appendix E.

4.5 Exploratory Hole Position and Elevation

All exploratory hole excavations were surveyed by means of a Trimble Global Positioning System (GPS). An Ordnance Survey GPS base station was used to give us Irish grid co-ordinates and elevation, from this information we are able to survey the site with an accuracy of +/- 20mm. Exploratory hole co-ordinates and elevations are presented on each exploratory hole log.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described and their descriptions incorporated into the preliminary borehole logs. The logs were revised, where necessary, based on the results of the laboratory tests.

Laboratory testing, conducted as scheduled by the Engineer, comprised the following:

- Classification tests: moisture content, particle size distribution and Atterberg Limits,
- Soil/groundwater chemistry tests: pH and sulphate content

The test results are tabulated in Appendix F (parts i-iii) unless noted otherwise; tests were conducted in accordance with BS 1377:1990, *Methods of test for soils for civil engineering purposes. Parts 1 to 9*.

6 PROPOSED CONSTRUCTION

It is proposed to construct a housing development with associated access roads and car parking.

6.1 Ground types

Examination of the exploratory hole logs reveals that the general ground conditions can be summarised as follows;

Exploratory Hole Location	Topsoil (m thickness)	Made Ground (m thickness)	Peat (m thickness)	Peaty Clays (m thickness)	Sands and Gravels (m thickness)	Glacial Clays (m thickness)	Water ingress m b.g.l
BH 1	0.40	-	-	-	-	>10.00	Dry
BH 2	0.30	-	-	-	-	>10.00	7.40
BH 3	0.40	-	-	-	-	>10.00	Dry
BH 4	0.40	-	-	-	-	>10.00	Dry
BH 5	0.40	-	-	-	-	>10.00	Dry
BH 6	0.40	-	-	-	-	>10.00	Dry
TP 1	0.25	-	-	-	-	>2.50	Dry
TP 2	0.25	-	-	-	-	>3.00	Dry
TP 3	0.25	-	-	-	-	>2.60	Dry
TP 4	0.20	-	-	-	-	>2.60	Dry
TP 5	0.25	-	-	-	-	>2.60	Dry
TP 6	0.25	-	-	-	-	>2.60	Dry

(m b.g.l – metres below ground level)

No rock was encountered.

6.2 Groundwater

Groundwater was encountered only encountered in borehole 2 at 7.40m which was under sub artesian pressure and rose to 7.00m below existing ground level.

All other exploratory hole were dry during excavation.

7 PRELIMINARY FOUNDATION DESIGN

7.1 Proposed housing development

At the time of preparation of this report no detailed information was available with respect to foundation loading or anticipated final ground levels and structures to be constructed.

In this report it has been assumed that all foundations in natural ground, if suitable, will as a minimum be placed 0.80m below finished ground level to guard against the effects of frost action.

Strip or pad foundations placed at 1.00m depth within the firm to stiff glacial soils may be suitable with an allowable bearing capacity of 120kN/m². On removal of topsoil floating ground floor slabs placed on the glacial soils would be feasible.

Where ground levels are raised by filling, floating slabs might be subject to unpredictable settlement and the use of suspended floors in these areas should be considered.

If cut and fill techniques are planned for the site, consideration could be given to compaction trials to ensure that a maximum amount of material is re-used in fill areas. Fill material should be placed in layers in accordance with current earthworks standards and in situ measurements of dry density should be carried out on a regular basis to ensure that the required compaction is being achieved.

7.2 Proposed Pavements

No information was supplied during the preparation of this report with regard to final ground levels of the proposed access roads. However, it is assumed that the levels of the proposed roads will be similar to existing.

Topsoil and vegetation shall be thoroughly stripped away in areas of filling. Following the topsoil strip, any localised areas of soft ground shall be excavated and backfilled with granular fill.

The following assess the sub-grade along the route, applying the recommendations of the Department of Transport's HD 25/94. This document relates soil properties to California Bearing Ratio (CBR) and the design CBR to the required capping layer and sub-base thickness.

Where the sub-grade is on existing in-situ soils, the soils will comprise glacial clays: their

properties, at or near sub-grade level vary.

In-situ California Bearing Ratio (CBR) tests were completed at six locations and results presented give a range of CBR values of between 2%- 12% at 250mm below existing ground level with an average of 6%. A CBR of 4% requires a 300mm capping and a 150mm thick sub-base or 280mm sub-base (Figure 3.1 of HD 25/94).

However we would recommend that in-situ CBR's are undertaken when the sub-grade is exposed in order to assure that the capping/sub-base thickness is correct.

The use of geotextiles may enable a reduction in construction thickness. The advice of specialist contractors should be sought on this matter.

A narrow filter drain or fin drain shall be provided on the low side(s) of pavement layers to collect and dispose of water seeping into the pavement. The pipe for such a system shall be set lower than the sub-grade top surface to enable the system to act as a sump for percolation along the interface between the capping and sub-grade.

All materials used within 450mm of the finished road surface level shall be non frost-susceptible, as required by the Specification for Highway Works (Series 700) and tested according to BS 812 : Part 124 : (1989).

8 SOIL AGGRESSIVENESS

Chemical tests (pH and total SO₄ contents) on soil samples (Appendix F part i) show a range between 24mg/l – 78mg/l – reference Table C2 of BRE Special Digest 1 (2005).

The table shows a design Sulphate limit based on 2:1 water/soil extract, for Class DS-1 the limits are <500mg/l and class DS-2 between 500-1500mg/l. We would suggest that a design Sulphate class DS-1 can be adopted for the site with ACEC Class AC-1s.

9 BRIEF GEOLOGY OF THE SITE

The Geological Survey of Ireland geological map of the area sheet 13, Meath Solid Edition, 1:100000 series shows the bedrock to be of the Carboniferous in age and consists of the Malahide Formation which is comprised of argillaceous bioclastic limestone, shale (Appendix G).

10 REFERENCES

British Standards Institute (1999) *BS 5930:1999, Code of practice for site investigations.*

British Standards Institute (1990) *BS 1377:1990, Methods of test for soils for civil engineering purposes. Parts 1 to 9.*

Geological Survey of Ireland (1995) *Geology of South Cork, Sheet 25, Scale 1:100,000*

APPENDIX A
Site Location Plans



PROJECT: Proposed Development at Potmarnock, Co. Dublin

CLIENT: Ballymore Residential Ltd.

ENGINEER: J B Barry & Partners Ltd.

SCALE: NTS

SERIES: 1 of 1

DRWN: OC

CHK: TR

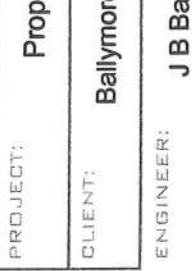
DATE: 13/10/06

TITLE: Site location plan

KEY:

REV: 06-693-SLoc-001

DATE: DETAILS: DWG: DRK:





TRIAL PIT CO-ORDINATES SCHEDULE		
No.	NORTHING.	EASTING.
TP. 1.	242258	323051
TP. 2.	242192	323278
TP. 3.	242055	323087
TP. 4.	242280	323519
TP. 5.	242057	323603
TP. 6.	241872	323420

BOREHOLE CO-ORDINATES SCHEDULE		
No.	NORTHING.	EASTING.
BH. 1.	242356	323075
BH. 2.	242356	323364
BH. 3.	242241	323184
BH. 4.	242015	323208
BH. 5.	242173	323493
BH. 6.	241990	323443

PERCOLATION TEST CO-ORDINATES SCHEDULE		
No.	NORTHING.	EASTING.
P. 1.	242152	323180
P. 2.	242072	323467
P. 3.	242175	323625

NOTES :

THIS DRAWING IS VALID FROM A COMPLETE SET OF DRAWINGS.
OTHER DETAILS SEE SEPARATE SHEETS.

Surveying Dept. 10
 Merrion Road, Dublin 4
 Telephone: 01-454 4000
 Fax: 01-454 4001
 Email: reception@barrypartners.com
 Web: www.barrypartners.com

LEGEND :

- △ P1, BOREHOLE WITH PERCOLATION TEST
 - BH. 1, BOREHOLE WITH SAMPLE
 - ⊕ TP. 1, TRIAL PIT WITH TEST
 - ⊕ TP. 1, BOREHOLE WITH SAMPLE IN BOREHOLE
 - ⊕ TP. 1, BOREHOLE WITH SAMPLE
 - ⊕ TP. 1, BOREHOLE WITH SAMPLE & TEST
- CON SAMPLES TO BE TAKEN AT 500mm DEPTH
 ACCORDING TO BS 5938 TO A DEPTH OF 150mm
 THIS HAS TO BE RECORDED TO A DEPTH OF 1.5m
 PERCOLATION TESTS TO BE CARRIED OUT IN ACCORDANCE
 WITH BRE DIGEST 365.

Rev.	Description	SN	JD	Date
A	INITIAL ISSUE			

Client: HELSINGOR LIMITED.

Client Representative:



J. B. Barry & Partners (Ireland)
 Merrion Road, Dublin 4
 Dublin 22, Ireland
 Phone: 353-1-454 4000
 Fax: 353-1-454 4001
 Email: reception@barrypartners.com

Project: RESIDENTIAL DEVELOPMENT AT PORTMARNOCK.

Drawing Title: PRELIMINARY GROUND INVESTIGATION.

Drawn by : [Signature] Date : [Date]
 Checked by : [Signature] Date : [Date]
 Approved by : [Signature] Date : [Date]

Scales : 1:2500
 Drawing No. : Y4240-C-117. Revision : A.

APPENDIX B
Exploratory Borehole Logs

Glover Site Investigations Ltd						Site Proposed Development at Portmarnock, Co. Dublin		Borehole Number BH01	
Boring Method Cable Percussion		Casing Diameter 200mm cased to 10.00m		Ground Level (mOD) 14.16		Client Ballymore Residential Ltd		Job Number 06-693	
		Location AS PLAN		Dates 12/10/2006- 13/10/2006		Engineer J B Barry & Partners Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	B1					(0.40)	TOPSOIL		
0.50-0.95 0.50-0.95	CPT N=18 B2			2,2/4,4,5,5	13.76	0.40	Firm to stiff brown slightly sandy gravelly CLAY containing smooth sub-rounded cobbles. Gravel is sub-angular fine to coarse		
1.50-1.95 1.50-1.95	CPT N=23 B3			1,3/4,6,7,6		(1.60)			
2.50-2.95 2.50-2.95	CPT N=39 B4			4,7/8,9,11,11	12.16	2.00	Stiff to very stiff black sandy gravelly CLAY containing occasional smooth sub-rounded cobbles and boulders. Gravel is sub-angular fine to coarse		
3.50-3.95 3.50-3.95	CPT N=47 B5			3,7/11,12,11,13					
4.50-4.95 4.50-4.95	CPT N=48 B6			4,8/10,10,12,16					
6.00-6.45 6.00-6.45	CPT N=42 B7			3,6/9,11,11,11		(8.00)			
7.50-7.80 7.50-7.95	CPT 50/150 B8			5,9/10,17,23					
9.00-9.45 9.00-9.45	CPT N=37 B9			3,6/8,8,10,11					
				12/10/2006:DRY 13/10/2006:5.80m					
				13/10/2006:DRY	4.16	10.00			
Remarks Standpipe installed to 10.00m. Chiselling from 5.40m to 5.60m for 0.75 hours. Water added from 0.50m to 7.50m.								Scale (approx) 1:50	Logged By TR/HH
								Figure No. 06-693 BH01	

Glover Site Investigations Ltd

Site
Proposed Development at Portmarnock, Co. Dublin
Borehole Number
BH02

Boring Method Cable Percussion	Casing Diameter 200mm cased to 10.00m	Ground Level (mOD) 10.23	Client Ballymore Residential Ltd	Job Number 06-693
	Location AS PLAN	Dates 10/10/2006- 11/10/2006	Engineer J B Barry & Partners Ltd	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	B1				9.93	(0.30) 0.30	TOPSOIL		
0.50-0.95 0.50-0.95	CPT N=25 B2			1,3/5,6,7,7		(1.90)	Firm to stiff brown slightly sandy gravelly CLAY containing smooth sub-rounded cobbles. Gravel is sub-angular fine to coarse		
1.50-1.95 1.50-1.95	CPT N=23 B3			2,4/6,5,6,6		2.20	Stiff to very stiff black sandy gravelly CLAY containing occasional smooth sub-rounded cobbles and boulders. Gravel is sub-angular fine to coarse		
2.50-2.95 2.50-2.95	CPT N=35 B4			3,5/7,9,8,11	8.03	(4.00)			
3.50-3.95 3.50-3.95	CPT N=45 B5			4,7/9,12,11,13					
4.50-4.95 4.50-4.95	CPT N=50 B6			10/10/2006:DRY 11/10/2006:DRY 4,8/12,13,14,11					
6.00-6.45 6.00-6.45	CPT N=40 B7			3,6/8,11,11,10	4.03	6.20	Very stiff brown slightly sandy gravelly CLAY containing smooth sub-rounded cobbles. Gravel is sub-angular fine to coarse		▼1
7.50-7.95 7.50-7.95	B8 CPT N=43			Water Strike(1) at 7.40m, rose to 7.00m in 20 mins. 4,7/9,10,11,13		(3.80)			▼1
9.00-9.45 9.00-9.45	CPT N=38 B9			3,5/8,8,10,12					
				11/10/2006	0.23	10.00			

Remarks
Standpipe installed to 10.00m.
Chiselling from 3.90m to 4.00m for 0.25 hours. Water added from 0.50m to 3.50m. Water added from 4.00m to 9.50m.

Scale (approx)	Logged By
1:50	TR/HH
Figure No. 06-693.BH02	




Glover Site Investigations Ltd

Site Proposed Development at Portmarnock, Co. Dublin	Borehole Number BH02
Client Ballymore Residential Ltd	Job Number 06-693
Engineer J B Barry & Partners Ltd	Sheet 1/1

Installation Type WATER MONITORING	Dimensions Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 200 mm
	Location AS PLAN

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling																
						Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)							
						5 min	10 min	15 min	20 min													
			10.03	0.20	Concrete Cement/Bentonite Grout			7.40		Water Strike				7.00								
			9.23	1.00	Gravel Filter																	
			8.73	1.50																		
						Groundwater Observations During Drilling																
						Start of Shift					End of Shift											
						Date	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Date	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)					
						10/10/06						11/10/06	0800	4.00	4.00	DRY		1700	4.00	4.00	DRY	
						Instrument Groundwater Observations																
						Inst. [A] Type :																
						Instrument [A]			Remarks													
						Date	Time	Depth (m)	Level (mOD)													
			0.23	10.00	Slotted Standpipe																	

Remarks
Upright cover fitted.

Glover Site Investigations Ltd						Site Proposed Development at Portmarnock, Co. Dublin		Borehole Number BH03	
Boring Method Cable Percussion		Casing Diameter 200mm cased to 10.00m		Ground Level (mOD) 14.79		Client Ballymore Residential Ltd		Job Number 06-693	
		Location AS PLAN		Dates 13/10/2006		Engineer J B Barry & Partners Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	B1					(0.40)	TOPSOIL		
0.50-0.95 0.50-0.95	CPT N=20 B2			2,3/4,3,5,8	14.39	0.40	Firm to stiff brown slightly sandy gravelly CLAY containing smooth sub-rounded cobbles. Gravel is sub-angular fine to coarse		
1.50-1.95 1.50-1.95	CPT N=19 B3			1,5/4,6,5,4		(1.70)			
2.50-2.95 2.50-2.95	CPT N=34 B4			2,4/6,8,10,10	12.69	2.10	Stiff to very stiff black sandy gravelly CLAY containing occasional smooth sub-rounded cobbles and boulders. Gravel is sub-angular fine to coarse		
3.50-3.95 3.50-3.95	CPT N=44 B5			3,7/10,9,11,14					
4.50-4.95 4.50-4.95	CPT N=47 B6			4,8/10,12,12,13					
6.00-6.45 6.00-6.45	CPT N=50 B7			4,6/9,12,12,17		(7.90)			
7.50-7.95 7.50-7.95	CPT N=47 B8			3,7/9,10,12,16					
9.00-9.45 9.00-9.45	CPT N=44 B9			6,6/10,10,11,13					
				13/10/2006: DRY	4.79	10.00			
Remarks Standpipe installed to 10.00m. Chiselling from 4.10m to 4.40m for 0.5 hours. Water added from 0.50m to 9.00m.							Scale (approx)	Logged By	
							1:50	TR/HH	
							Figure No.	06-693.BH03	

Glover Site Investigations Ltd

Site
Proposed Development at Portmarnock, Co. Dublin

Borehole Number
BH03

Installation Type WATER MONITORING	Dimensions Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 200 mm		Client Ballymore Residential Ltd	Job Number 06-693
	Location AS PLAN	Ground Level (mOD) 14.79	Engineer J B Barry & Partners Ltd	Sheet 1/1

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling										
						Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)	
			14.59	0.20	Concrete Cement/Bentonite Grout						5 min	10 min	15 min	20 min		
			13.79	1.00	Gravel Filter											
			13.29	1.50												
Groundwater Observations During Drilling																
						Start of Shift					End of Shift					
						Date	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
						13/10/06							10.00			DRY
Instrument Groundwater Observations																
						Inst. [A] Type :										
						Date	Instrument [A]			Remarks						
							Time	Depth (m)	Level (mOD)							
			4.79	10.00	Slotted Standpipe											

Remarks
Upright cover fitted.

Glover Site Investigations Ltd

Site
Proposed Development at Portmarnock, Co. Dublin
Borehole Number
BH04

Boring Method Cable Percussion	Casing Diameter 200mm cased to 7.50m	Ground Level (mOD) 15.34	Client Ballymore Residential Ltd	Job Number 06-693
	Location AS PLAN	Dates 11/10/2006- 12/10/2006	Engineer J B Barry & Partners Ltd	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	B1					(0.40)	TOPSOIL		
0.50-0.95 0.50-0.95	CPT N=19 B2			1,2/3,5,5,6	14.94	0.40	Firm to stiff brown slightly sandy gravelly CLAY containing smooth sub-rounded cobbles. Gravel is sub-angular fine to coarse		
1.50-1.95 1.50-1.95	CPT N=17 B3			2,3/4,3,5,5		(1.60)			
2.50-2.95 2.50-2.95	CPT N=50 B4			4,8/12,11,14,13	13.34	2.00	Stiff to very stiff black sandy gravelly CLAY containing occasional smooth sub-rounded cobbles and boulders. Gravel is sub-angular fine to coarse		
3.50-3.95 3.50-3.95	CPT N=45 B5			3,7/9,12,11,13					
4.50-4.95 4.50-4.95	CPT N=50 B6			3,6/10,11,14,15					
6.00-6.30 6.00-6.45	CPT 50/150 B7			6,10/17,33		(8.00)			
7.50-7.95	B8			11/10/2006:DRY					
7.50-7.95	CPT N=45			12/10/2006:6.20m 3,7/10,11,11,13					
9.00-9.45 9.00-9.45	CPT N=47 B9			4,8/9,9,12,17					
				12/10/2006:DRY	5.34	10.00			

Remarks
Standpipe installed to 10.00m.
Chiselling from 3.80m to 4.00m for 0.5 hours. Chiselling from 7.00m to 7.30m for 0.5 hours. Water added from 0.50m to 7.50m.

Scale (approx)	Logged By
1:50	TR/HH
Figure No. 06-693.BH04	

Glover Site Investigations Ltd

Site
Proposed Development at Portmarnock, Co. Dublin

Borehole Number
BH05

Boring Method Cable Percussion	Casing Diameter 200mm cased to 9.60m	Ground Level (mOD) 11.49	Client Ballymore Residential Ltd	Job Number 06-693
	Location AS PLAN	Dates 10/10/2006	Engineer J B Barry & Partners Ltd	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	B1					(0.40) 0.40	TOPSOIL		
0.50-0.95 0.50-0.95	CPT N=23 B2			2,3/5,6,5,7	11.09		Firm to stiff brown slightly sandy gravelly CLAY containing smooth sub-rounded cobbles. Gravel is sub-angular fine to coarse		
1.50-1.95 1.50-1.95	CPT N=26 B3			2,4/4,6,8,8		(1.90)			
2.50-2.95 2.50-2.95	CPT N=38 B4			3,5/8,10,11,9	9.19	2.30	Stiff to very stiff black sandy gravelly CLAY containing occasional smooth sub-rounded cobbles and boulders. Gravel is sub-angular fine to coarse		
3.50-3.95 3.50-3.95	CPT N=42 B5			4,6/8,8,12,14					
4.50-4.95 4.50-4.95	CPT N=51 B6			5,8/10,11,13,17					
6.00-6.45 6.00-6.45	CPT N=50 B7			4,9/11,12,13,14		(7.30)			
7.50-7.80 7.50-7.95	CPT 50/150 B8			7,11/17,33					
9.00-9.45 9.00-9.45	CPT N=50 B9			4,9/11,13,16,10					
				10/10/2006: DRY	1.89	9.60			

Remarks
Standpipe installed to 9.60m.
Chiselling from 7.75m to 7.90m for 0.5 hours. Chiselling from 9.50m to 9.60m for 1 hour. Water added from 0.50m to 9.00m.

Scale (approx)	1:50	Logged By	TR/HH
Figure No.	06-693.BH05		

Glover Site Investigations Ltd

Site Proposed Development at Portmarnock, Co. Dublin	Borehole Number BH05
Client Ballymore Residential Ltd	Job Number 06-693
Engineer J B Barry & Partners Ltd	Sheet 1/1

Installation Type WATER MONITORING	Dimensions Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 200 mm
	Location AS PLAN

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling											
						Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)		
			11.29	0.20	Concrete												
					Cement/Bentonite Grout												
			10.49	1.00	Gravel Filter												
			9.99	1.50													
Groundwater Observations During Drilling																	
						Start of Shift					End of Shift						
						Date	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	
						10/10/06							9.60			DRY	
Instrument Groundwater Observations																	
Inst. [A] Type :																	
					Slotted Standpipe	Instrument [A]			Remarks								
						Date	Time	Depth (m)								Level (mOD)	
			1.89	9.60													

Remarks
Upright cover fitted.

Glover Site Investigations Ltd

Site Proposed Development at Portmarnock, Co. Dublin	Borehole Number BH06
Client Ballymore Residential Ltd	Job Number 06-693
Engineer J B Barry & Partners Ltd	Sheet 1/1

Boring Method Cable Percussion	Casing Diameter 200mm cased to 10.00m	Ground Level (mOD) 13.88
	Location AS PLAN	Dates 09/10/2006

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	B1				13.48	(0.40) 0.40	TOPSOIL		
0.50-0.95 0.50-0.95	CPT N=20 B2			1,3/6,6,5,3		(1.60)	Firm to stiff brown slightly sandy gravelly CLAY containing smooth sub-rounded cobbles. Gravel is sub-angular fine to coarse		
1.50-1.95 1.50-1.95	CPT N=20 B3			1,2/3,5,5,7	11.88	2.00	Stiff to very stiff black sandy gravelly CLAY containing occasional smooth sub-rounded cobbles and boulders. Gravel is sub-angular fine to coarse		
2.50-2.95 2.50-2.95	CPT N=37 B4			4,6/7,9,10,11					
3.50-3.95 3.50-3.95	CPT N=48 B5			5,8/11,12,13,12					
4.50-4.95 4.50-4.95	CPT N=48 B6			4,7/10,13,11,14					
6.00-6.45 6.00-6.45	CPT N=50 B7			3,6/9,11,13,17		(8.00)			
7.50-7.95 7.50-7.95	CPT N=50 B8			4,9/11,11,14,14					
9.00-9.45 9.00-9.45	CPT N=49 B9			5,6/10,12,13,14					
				09/10/2006:DRY	3.88	10.00			

Remarks
Standpipe installed to 10.00m.
Chiselling from 6.90m to 7.20m for 0.5 hours. Water added from 0.50m to 9.50m.

Scale (approx)	Logged By
1:50	TR/HH
Figure No. 06-693.BH06	

Glover Site Investigations Ltd

Site Proposed Development at Portmarnock, Co. Dublin	Borehole Number BH06
Client Ballymore Residential Ltd	Job Number 06-693
Engineer J B Barry & Partners Ltd	Sheet 1/1

Installation Type WATER MONITORING	Dimensions Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 200 mm
	Location AS PLAN

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling										
						Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)	
			13.68	0.20	Concrete Cement/Bentonite Grout						5 min	10 min	15 min	20 min		
			12.88	1.00	Gravel Filter											
			12.38	1.50												
Groundwater Observations During Drilling																
						Start of Shift					End of Shift					
						Date	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
						09/10/06							10.00		DRY	
Instrument Groundwater Observations																
Inst. [A] Type :																
					Slotted Standpipe	Date	Instrument [A]			Remarks						
							Time	Depth (m)	Level (mOD)							
			3.88	10.00												

Remarks
Upright cover fitted.

APPENDIX C

Exploratory Trial Pit Logs

Glover Site Investigations Ltd

Site
Proposed Development at Portmarnock, Co. Dublin
Trial Pit Number
TP01

Excavation Method 3 TONNE TRACKED EXCAVATOR	Dimensions	Ground Level (mOD) 15.56	Client Ballymore Residential Ltd	Job Number 06-693
	Location AS PLAN	Dates 20/09/2006	Engineer J B Barry & Partners Ltd	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D1			15.31 15.16	(0.25) 0.25 (0.15) 0.40	TOPSOIL Firm light brown friable slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse		
1.00	D2				(2.00)	Stiff grey brown friable slightly sandy slightly gravelly CLAY with occasional subangular cobbles. Sand is fine to coarse. Gravel is fine to coarse		
2.00	D3							
2.50	D4		20/09/2006:DRY	13.16 13.06	2.40 (0.10) 2.50	Stiff dark grey friable slightly sandy slightly gravelly CLAY with occasional subrounded to subangular cobbles. Sand is fine to coarse. Gravel is fine to coarse Complete at 2.50m		

Plan 	Remarks Pit stable and level on completion CBR test from surface using DCP equipment		
	Scale (approx) 1:50	Logged By TR/EC	Figure No. 06-693.TP01

Glover Site Investigations Ltd

Site
Proposed Development at Portmarnock, Co. Dublin

Trial Pit Number
TP02

Excavation Method 3 TONNE TRACKED EXCAVATOR	Dimensions	Ground Level (mOD) 14.05	Client Ballymore Residential Ltd	Job Number 06-693
	Location AS PLAN	Dates 20/09/2006	Engineer J B Barry & Partners Ltd	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D1			13.80	(0.25) 0.25	TOPSOIL		
				13.45	(0.35) 0.60	Firm brown friable slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse		
1.00	D2				(1.40)	Stiff grey brown friable slightly sandy slightly gravelly CLAY with occasional subangular cobbles. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse		
2.00	D3			12.05	2.00	Stiff dark grey friable slightly sandy slightly gravelly CLAY with occasional subrounded to subangular cobbles. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse		
3.00	D4		20/09/2006:DRY	11.05	3.00	Complete at 3.00m		

Plan 	Remarks Pit stable and level on completion CBR test from surface using DCP equipment		
	Scale (approx) 1:50	Logged By TR/EC	Figure No. 06-693.TP02

Glover Site Investigations Ltd

Site
Proposed Development at Portmarnock, Co. Dublin
Trial Pit Number
TP03

Excavation Method 3 TONNE TRACKED EXCAVATOR	Dimensions	Ground Level (mOD) 15.79	Client Ballymore Residential Ltd	Job Number 06-693
	Location AS PLAN	Dates 20/09/2006	Engineer J B Barry & Partners Ltd	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D1			15.54	(0.25)	TOPSOIL		
0.70	B1			15.19	(0.35)	Firm brown friable slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse		
1.00	D2				(1.30)	Stiff grey brown friable slightly sandy slightly gravelly CLAY with occasional subangular cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse		
2.00	D4			13.89	1.90	Stiff dark grey friable slightly sandy slightly gravelly CLAY with occasional subrounded to subangular cobbles. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse		
2.00	D3		20/09/2006:DRY	13.19	(0.70)	Complete at 2.60m		

Plan 	Remarks Pit stabel and level on completion CBR test from surface using DCP equipment		
	Scale (approx) 1:50	Logged By TR/EC	Figure No. 06-693.TP03

Glover Site Investigations Ltd

Site
Proposed Development at Portmarnock, Co. Dublin
Trial Pit Number
TP04

Excavation Method 3 Tonne tracked excavator	Dimensions	Ground Level (mOD) 8.48	Client Ballymore Residential Ltd	Job Number 06-693
	Location As Plan	Dates 20/09/2006	Engineer J B Barry & Partners Ltd	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D1			8.28	(0.20)	TOPSOIL		
					0.20	Firm light brown friable slightly sandy slightly gravelly LCAY		
				7.98	(0.30)			
				7.88	0.50	Stiff brown grey friable slightly sandy slightly gravelly CLAY		
					(0.10)			
					0.60	Stiff dark grey friable slightly sandy slightly gravelly CLAY		
1.00	D2				(2.00)			
2.00	D3							
2.50	D4		20/09/2006:DRY	5.88	2.60	Complete at 2.60m		

Plan 	Remarks Trial pit stable and dry on completion CBR test from surface using DCP equipment		
	Scale (approx) 1:50	Logged By TR/KL	Figure No. 06-693.TP04

Glover Site Investigations Ltd

Site
Proposed Development at Portmarnock, Co. Dublin
Trial Pit Number
TP05

Excavation Method 3 Tonne tracked excavator	Dimensions	Ground Level (mOD) 11.84	Client Ballymore Residential Ltd	Job Number 06-693
	Location As Plan	Dates 20/09/2006	Engineer J B Barry & Partners Ltd	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D1			11.59	(0.25)	TOPSOIL		
0.70	B1			11.24	0.25 (0.35)	Firm brown slightly friable slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse		
1.00	D2				0.60 (1.20)	Stiff grey brown friable slightly sandy slightly gravelly CLAY with occasional subangular cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse		
2.00	D3			10.04	1.80 (0.80)	Very stiff dark grey friable slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse		
2.50	B2		20/09/2006:DRY	9.24	2.60	Complete at 2.60m		

Plan 	Remarks trial pit stable and dry on completion CBR test from surface using DCP equipment		
	Scale (approx) 1:50	Logged By TR/KL	Figure No. 06-693.TP05

Glover Site Investigations Ltd

Site
Proposed Development at Portmarnock, Co. Dublin
Trial Pit Number
TP06

Excavation Method 3 tonne tracked excavator	Dimensions	Ground Level (mOD) 15.07	Client Ballymore Residential Ltd	Job Number 06-693
	Location As Plan	Dates 20/09/2006	Engineer J B Barry & Partners Ltd	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D1			14.82	(0.25)	TOPSOIL		
0.70	B1			14.47	0.25	Firm light brown friable slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium		
1.00	D2				(0.35)			
1.50	B2				0.60	Stiff slightly friable grey brown slightly sandy slightly gravelly CLAY with occasional subangular cobbles. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse		
2.00	D3			13.27	(1.20)			
2.60	D4		20/09/2006:DRY	12.47	1.80	Stiff dark grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse		
					(0.80)			
					2.60	Complete at 2.60m		

Plan •	Remarks trial pit stable and dry on completion CBR test from surface using DCP equipment					
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Scale (approx)	Logged By	Figure No.				
1:50	TR/KL	06-693.TP06				

APPENDIX D

Results of Percolations Tests

Project No.

06-693

Glover Site Investigations Ltd

Site

Proposed Development Portmarnock

Full analysis not possible using method as described in BRE Digest 365/CIRIA Report

Test Location

P1

156

width (m) length (m)

test pit top dimensions 1 1.9

test pit base dimensions 1 1

test pit depth 1.3 m

test infiltration rate (q) = #DIV/0! m/h

depth to groundwater before adding water = DRY

depth to water surface at start of test 0.8 m

time (mins)	depth to water surface (m)	depth of water in pit (m)	time elapsed from test start (mins)	volume of water lost from test start (m3)	Area of walls and base at 50% drop from test start (m2)	q from start of test (m/min)	q from start of test (m/h)
0	0.8	0.5	0	0	3.173076923		
5	0.8	0.5	5	0	3.173076923	0.000	0.000
10	0.8	0.5	10	0	3.173076923	0.000	0.000
15	0.8	0.5	15	0	3.173076923	0.000	0.000
20	0.8	0.5	20	0	3.173076923	0.000	0.000
60	0.8	0.5	60	0	3.173076923	0.000	0.000
80	0.8	0.5	80	0	3.173076923	0.000	0.000
115	0.8	0.5	115	0	3.173076923	0.000	0.000
160	0.8	0.5	160	0	3.173076923	0.000	0.000
200	0.8	0.5	200	0	3.173076923	0.000	0.000
240	0.8	0.5	240	0	3.173076923	0.000	0.000

Project No. 06-693
 Site Proposed Development Portmarnock
 Test Location P3

Glover Site Investigations Ltd
 Full analysis not possible using method as
 described in BRE Digest 365/CIRIA Report

width (m) length (m)
 test pit top dimensions 1.1 2 test infiltration rate (q) = #DIV/0! m/h
 test pit base dimensions 1 1.1 depth to groundwater before adding water = DRY
 test pit depth 1.3 m depth to water surface at start of test 0.8 m

time (mins)	depth to water surface (m)	depth of water in pit (m)	time elapsed from test start (mins)	volume of water lost from test start (m3)	Area of walls and base at 50% drop from test start (m2)	q from start of test (m/min)	q from start of test (m/h)
0	0.8	0.5	0	0	3.392307692		
5	0.8	0.5	5	0	3.392307692	0.000	0.000
10	0.8	0.5	10	0	3.392307692	0.000	0.000
15	0.8	0.5	15	0	3.392307692	0.000	0.000
20	0.8	0.5	20	0	3.392307692	0.000	0.000
60	0.8	0.5	60	0	3.392307692	0.000	0.000
80	0.8	0.5	80	0	3.392307692	0.000	0.000
115	0.8	0.5	115	0	3.392307692	0.000	0.000
160	0.8	0.5	160	0	3.392307692	0.000	0.000
200	0.8	0.5	200	0	3.392307692	0.000	0.000
240	0.8	0.5	240	0	3.392307692	0.000	0.000

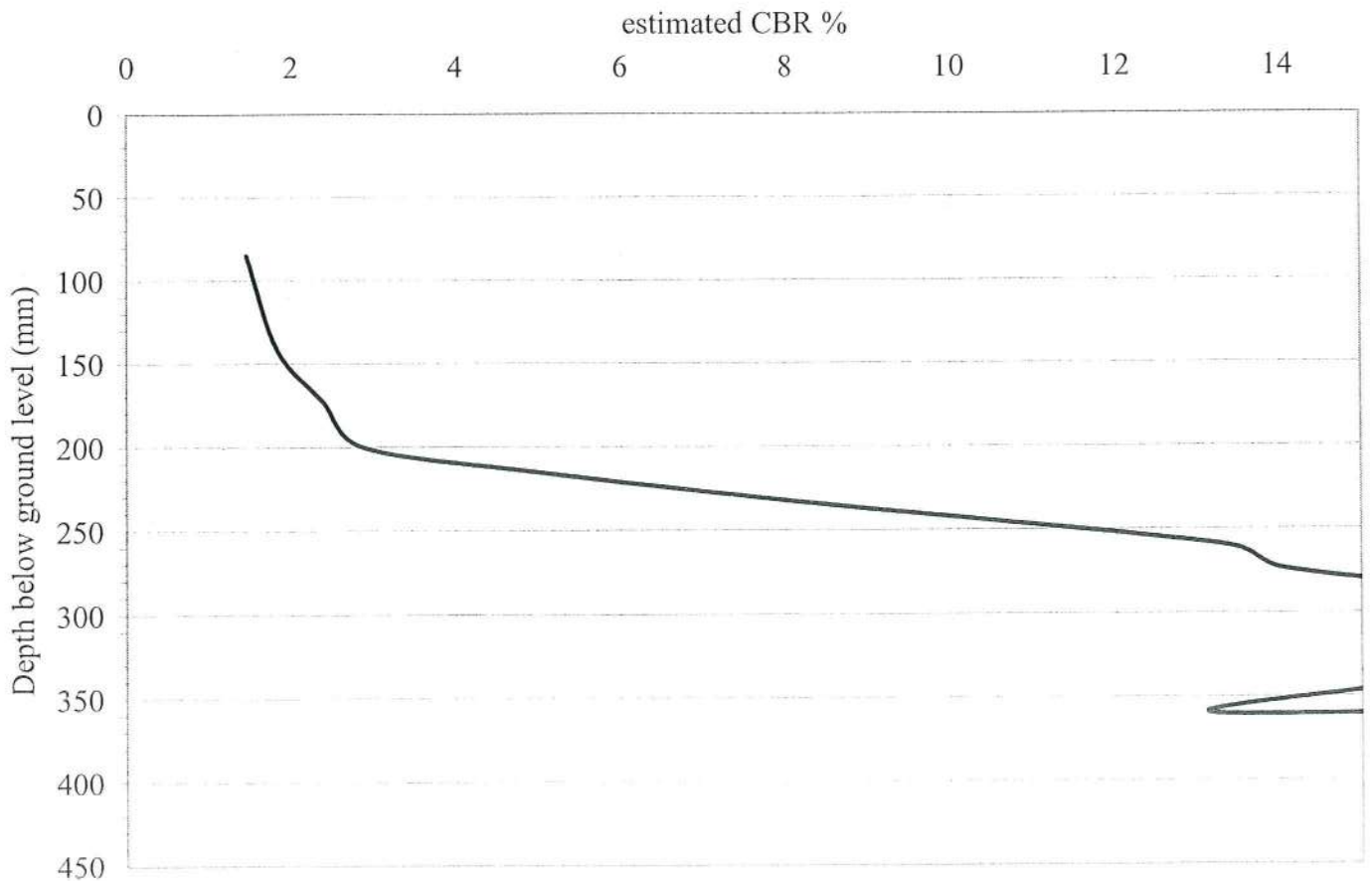
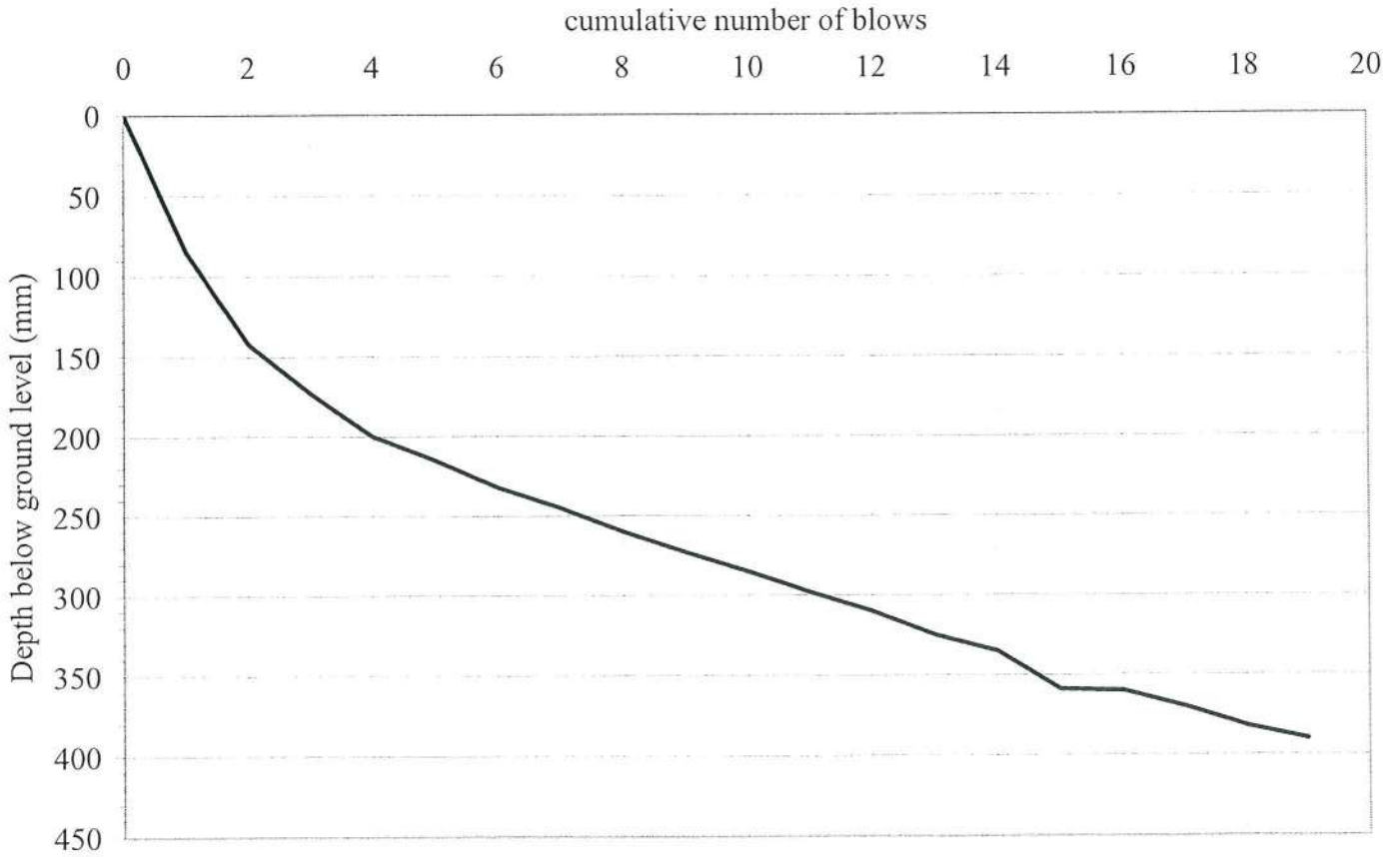
APPENDIX E
CBR Test Results

Glover Site Investigations Ltd.

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Proposed Development at Portmarnock
Test Number: DCP01

Report No: 06-693
Date: 20-Sep-06

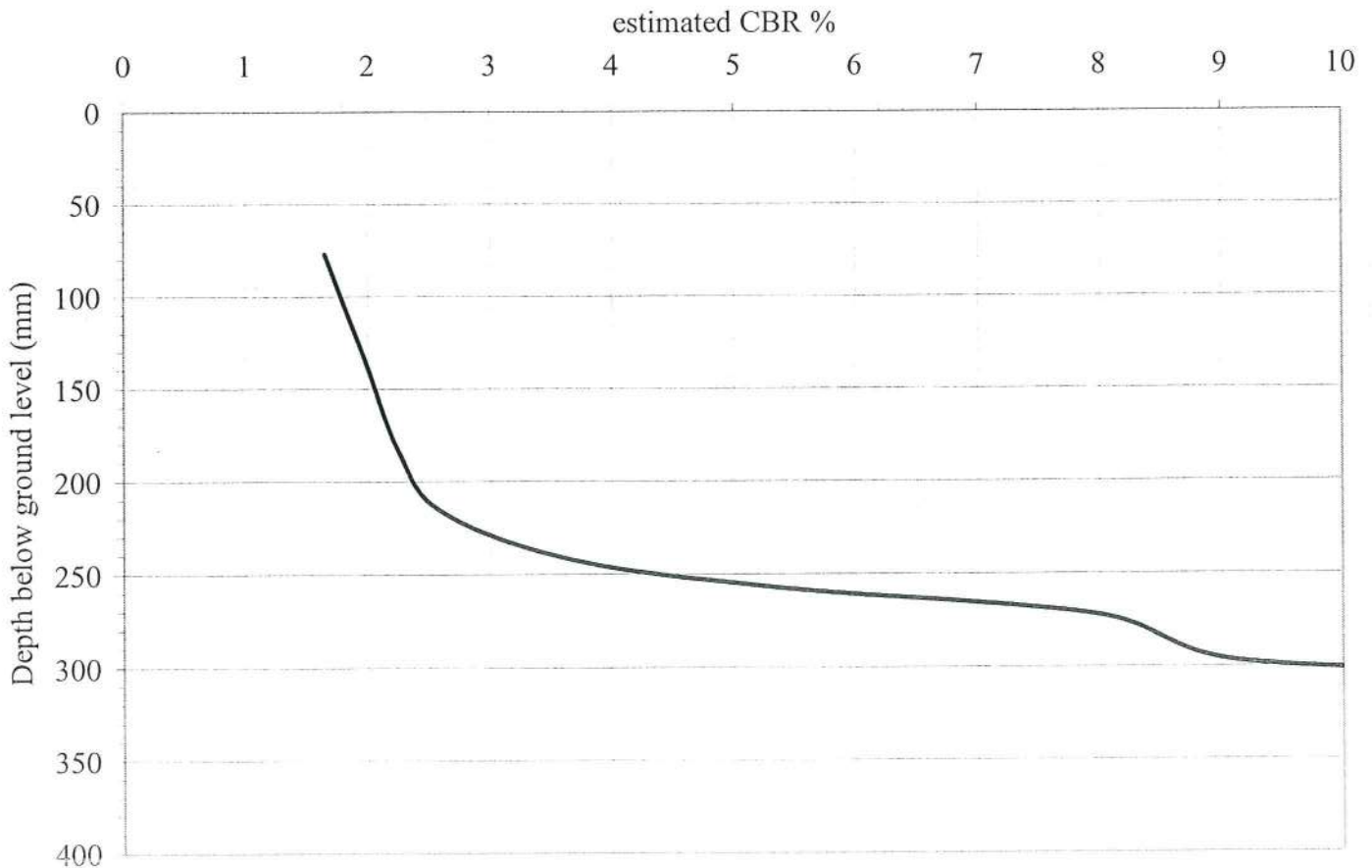
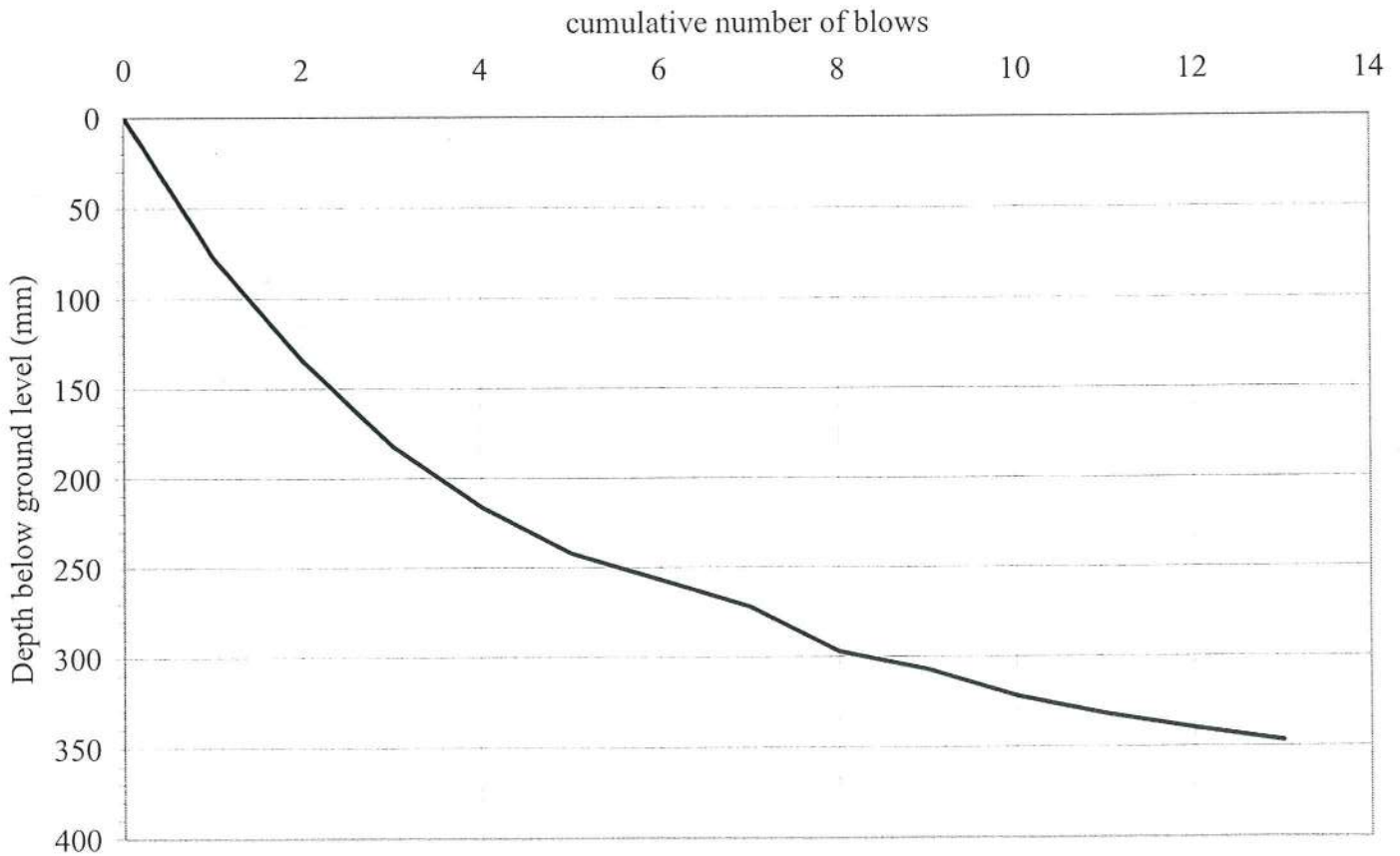


Glover Site Investigations Ltd.

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Proposed Development at Portmarnock
Test Number: DCP02

Report No: 06-693
Date: 20-Sep-06



Glover Site Investigations Ltd.

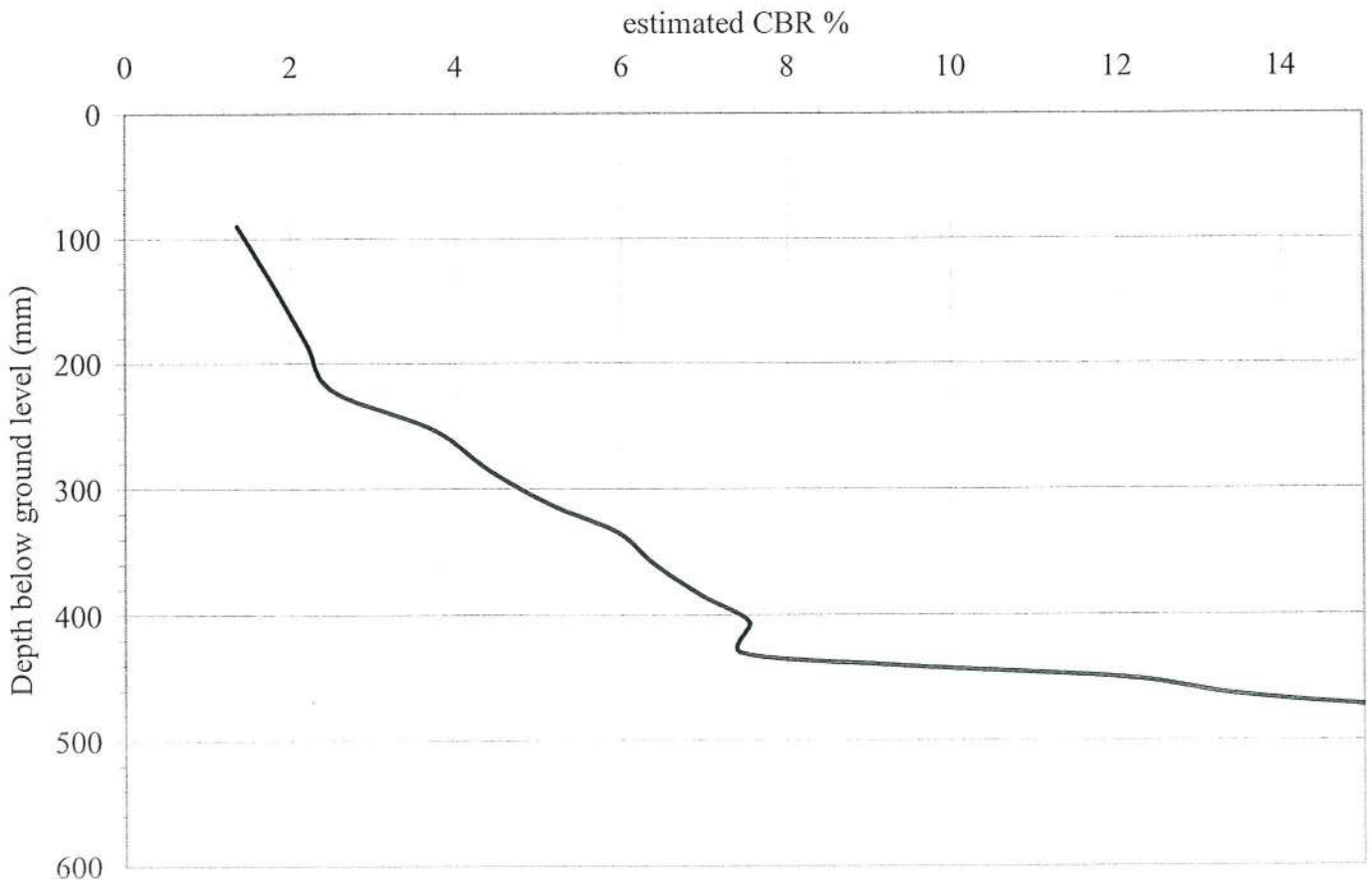
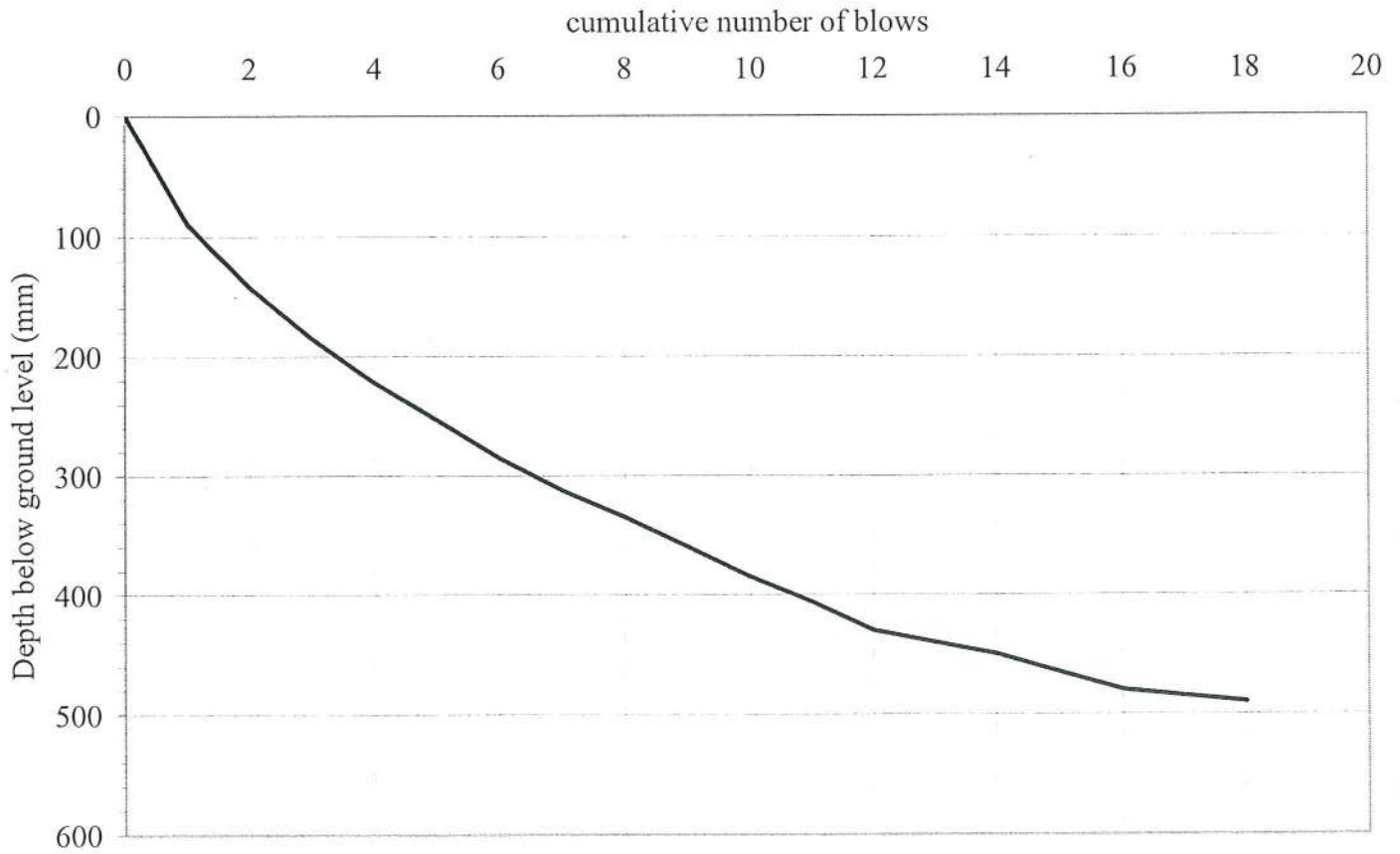
Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Proposed Development at Portmarnock

Report No: 06-693

Test Number: DCP03

Date: 20-Sep-06



Glover Site Investigations Ltd.

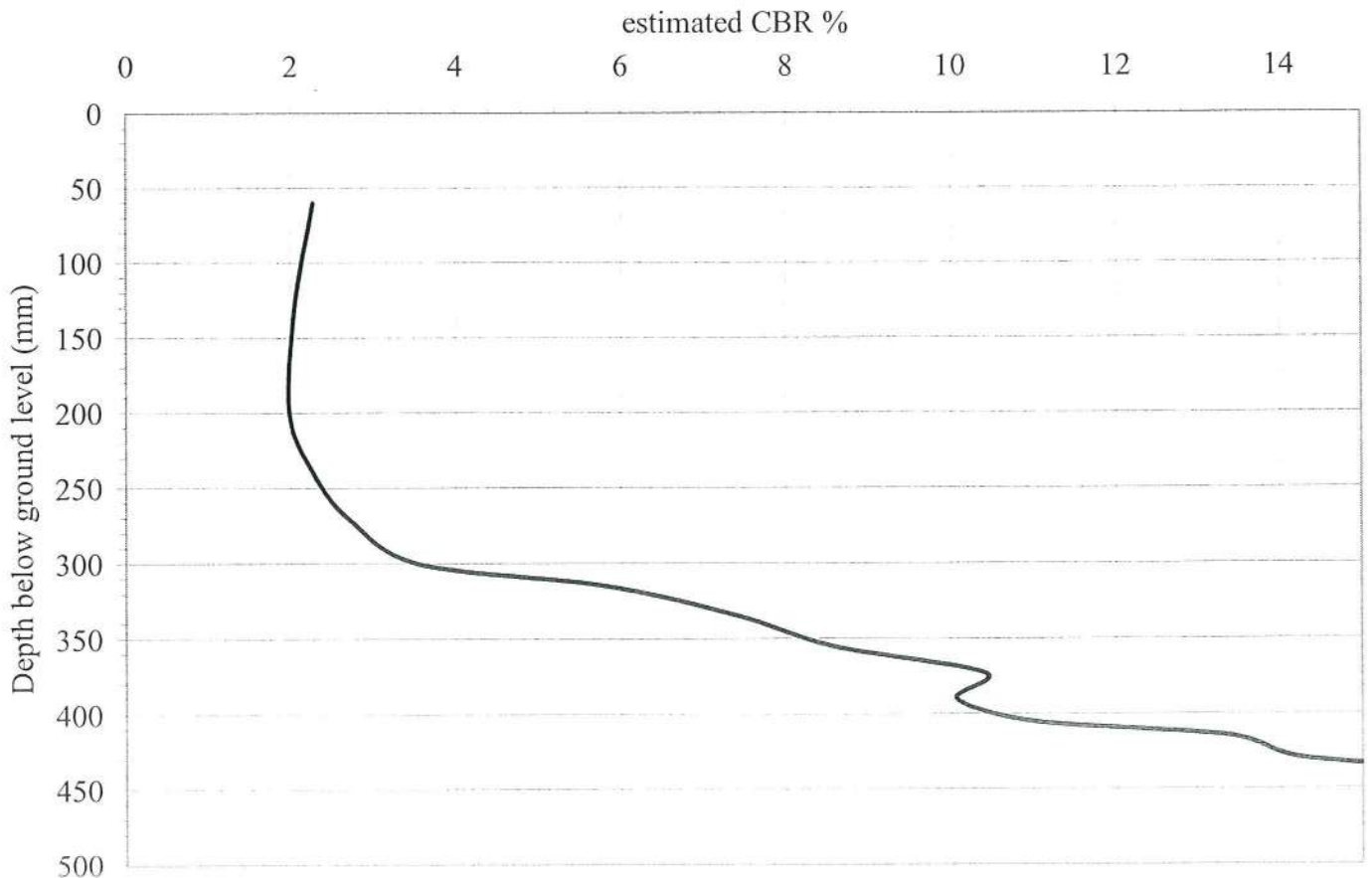
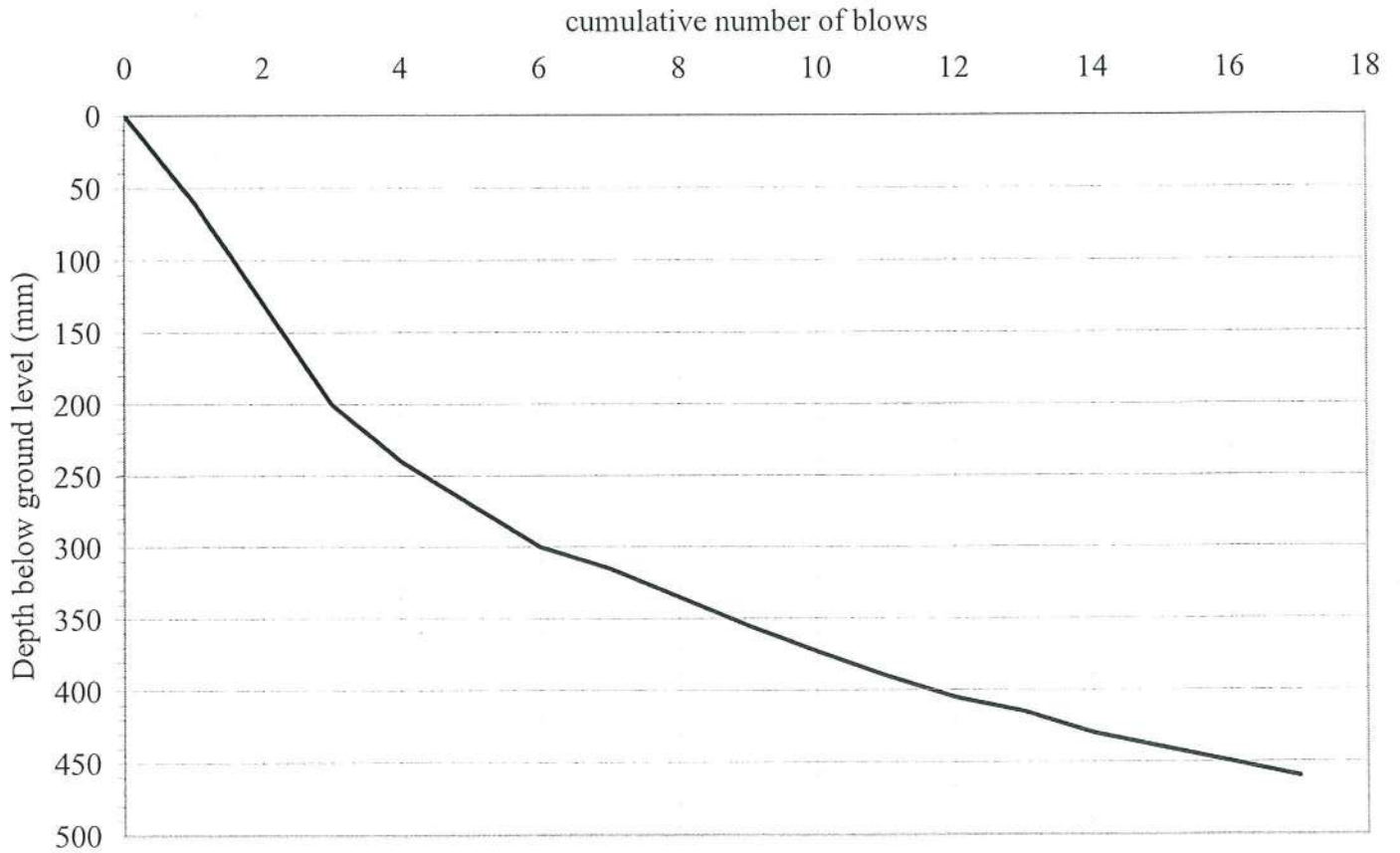
Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Proposed Development at Portmarnock

Report No: 06-693

Test Number: DCP04

Date: 20-Sep-06



Glover Site Investigations Ltd.

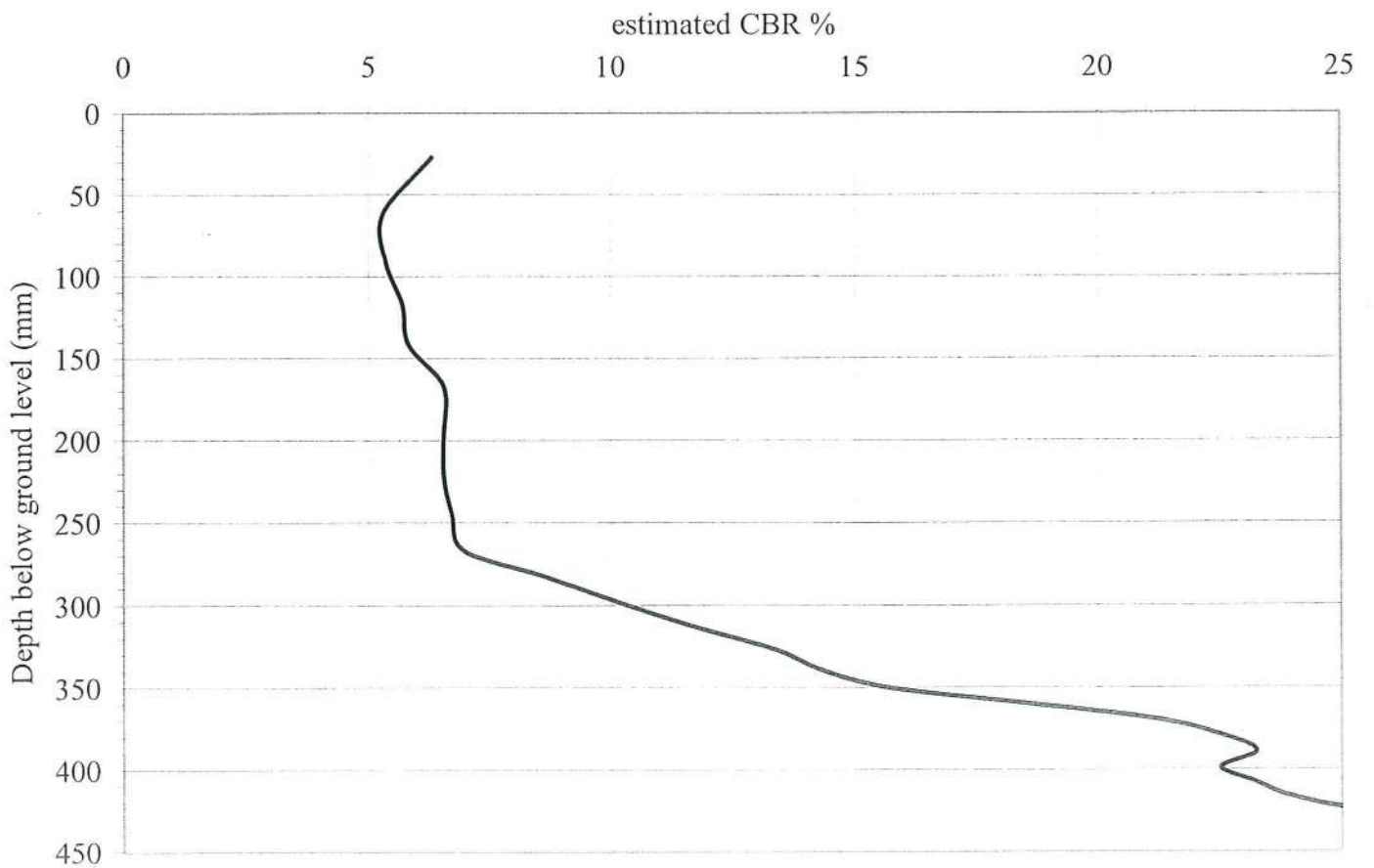
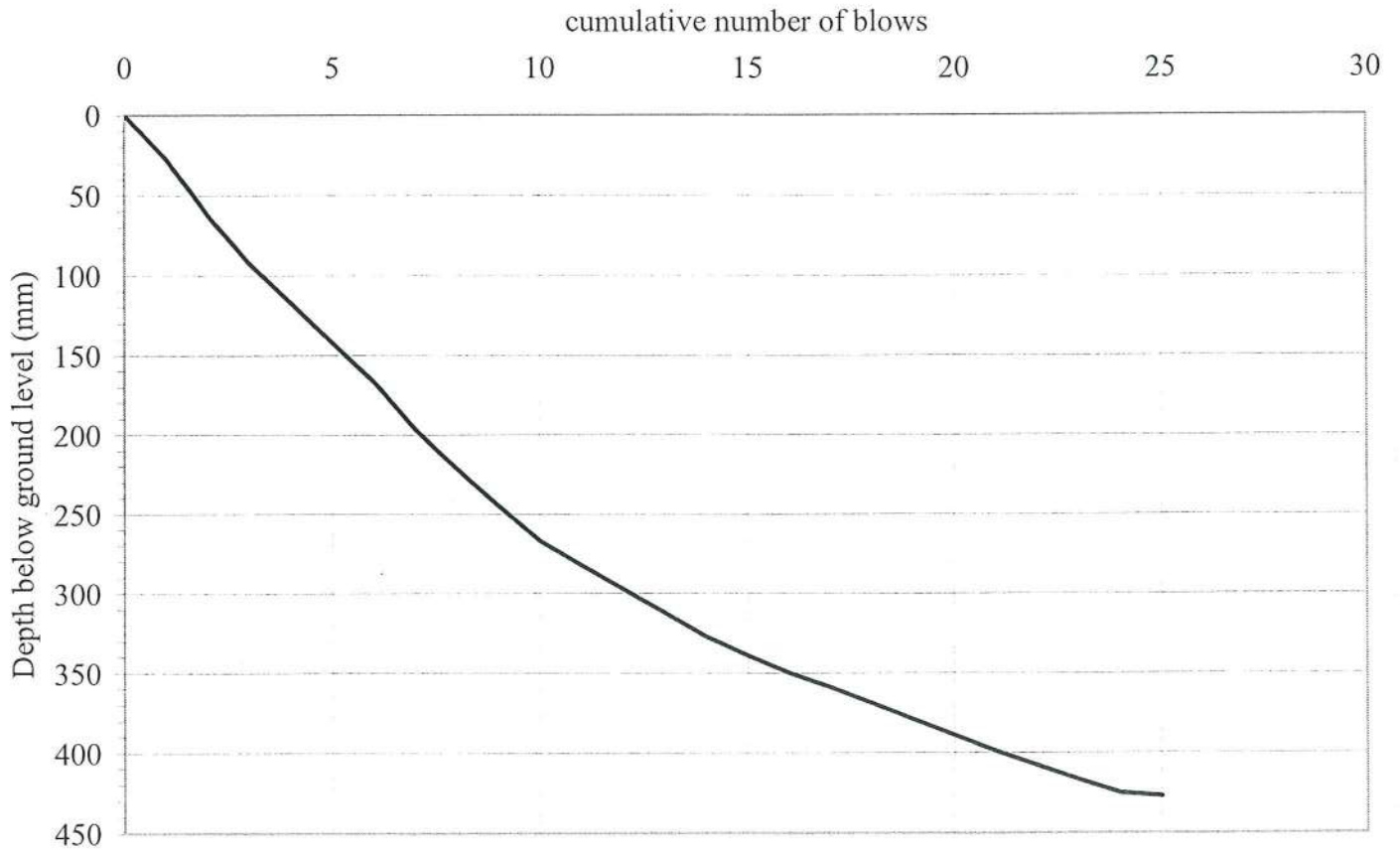
Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Proposed Development at Portmarnock

Report No: 06-693

Test Number: DCP05

Date: 20-Sep-06



Glover Site Investigations Ltd.

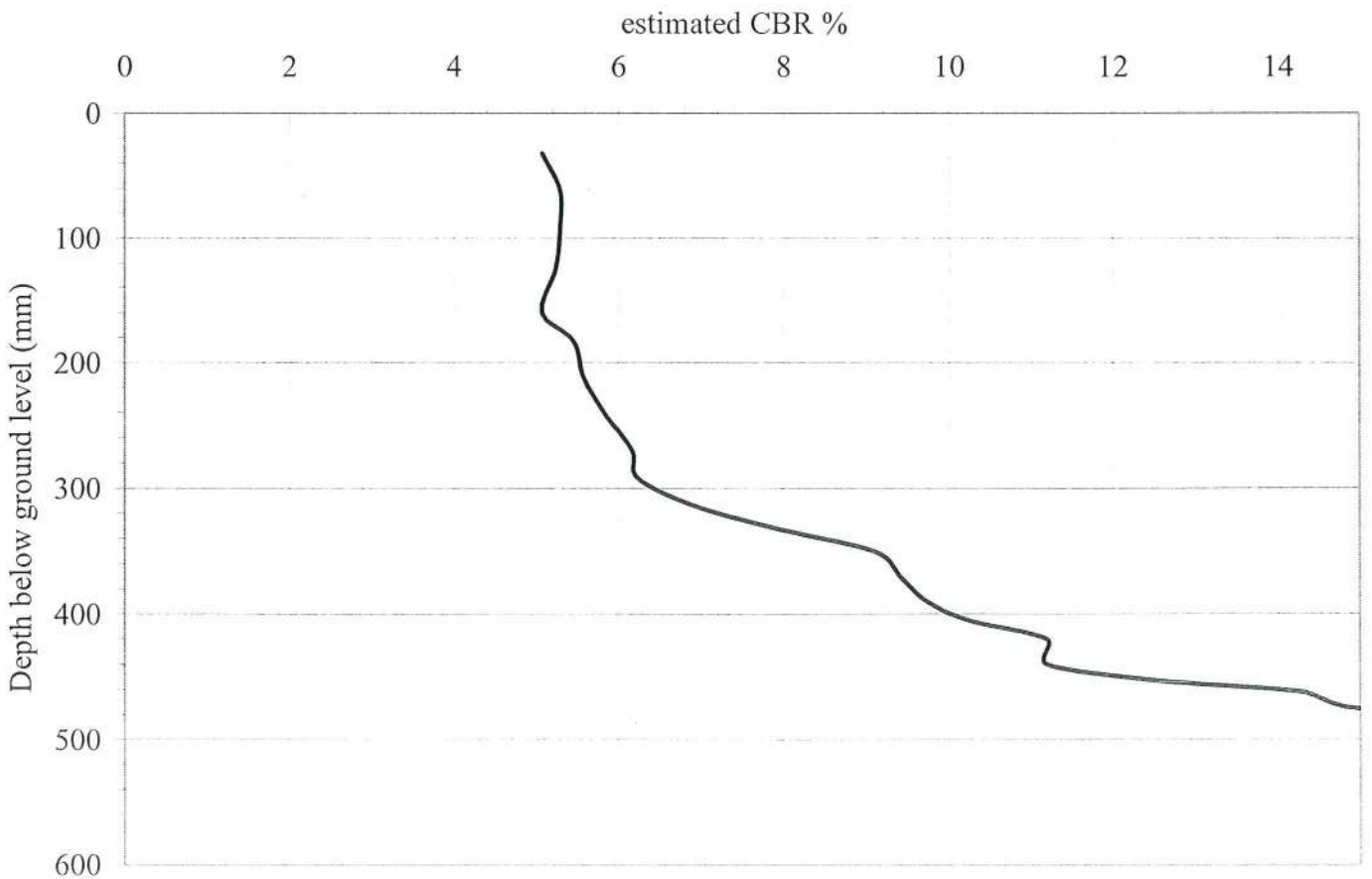
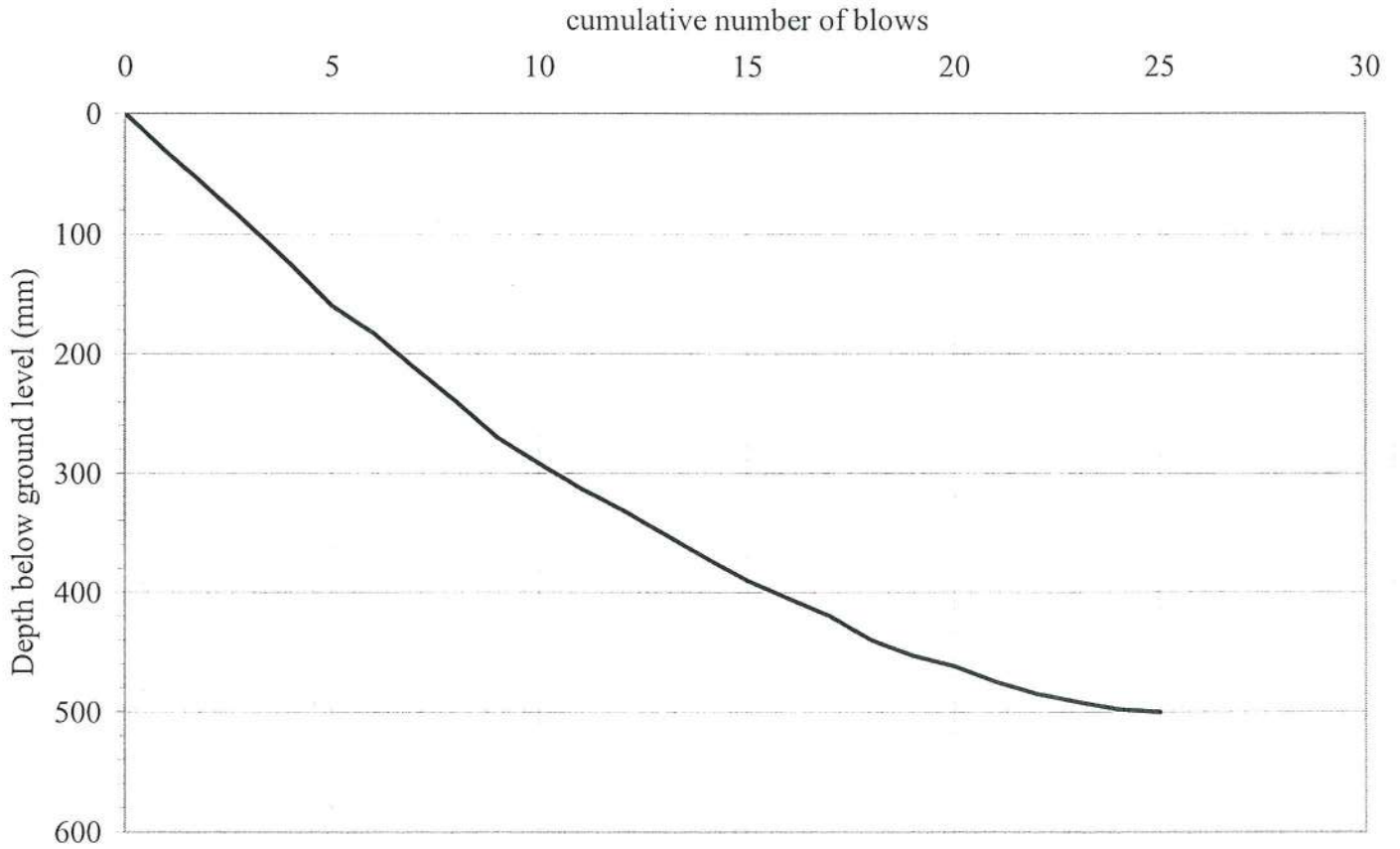
Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project: Proposed Development at Portmarnock

Report No: 06-693

Test Number: DCP06

Date: 20-Sep-06



APPENDIX F
Laboratory Test Results

i) pH and Water Soluble Sulphate Analysis

CHEMICAL TESTS

Tests 3, 4, 5 & 9 of BS 1377 : Part 3 : 1990

EH No.	Sample		Sample Depth		Passing 2mm Sieve (%)	Organic Matter Content * (%)	Mass Loss on Ignition # (%)	Sulphate Content SO ₄		pH Value @
	Type	No.	at (m)	to (m)				Soil/water extract \$ (mg/l)	Groundwater r (mg/l)	
BH01	B	2	0.50	0.95				24		8.0
BH02	B	3	1.50	1.95				60		7.5
BH03	B	3	1.50	1.95				78		8.0
BH04	B	2	0.50	0.95				55		7.5
BH05	B	4	2.50	2.95				42		7
BH06	B	2	1.50	1.95				66		7.5

* Walkley and Black's dichromate method - Clause 3

Average of 3 specimens - Clause 4

\$ Water soluble SO₄ from 2:1 water - soil extract - Clause 5.5

@ Average of 2/3 specimens - Clause 9.5

Clause Nos. of BS 1377 : Part 3 : 1990

**ii) Atterberg Limit Analysis
and Moisture Content**

Moisture content, Atterberg Limits & Particle Density
Tests 3.2, 4.3, 5.3 & 8.3 of BS 1377 : Part 2 : 1990

Sheet 1 of 1

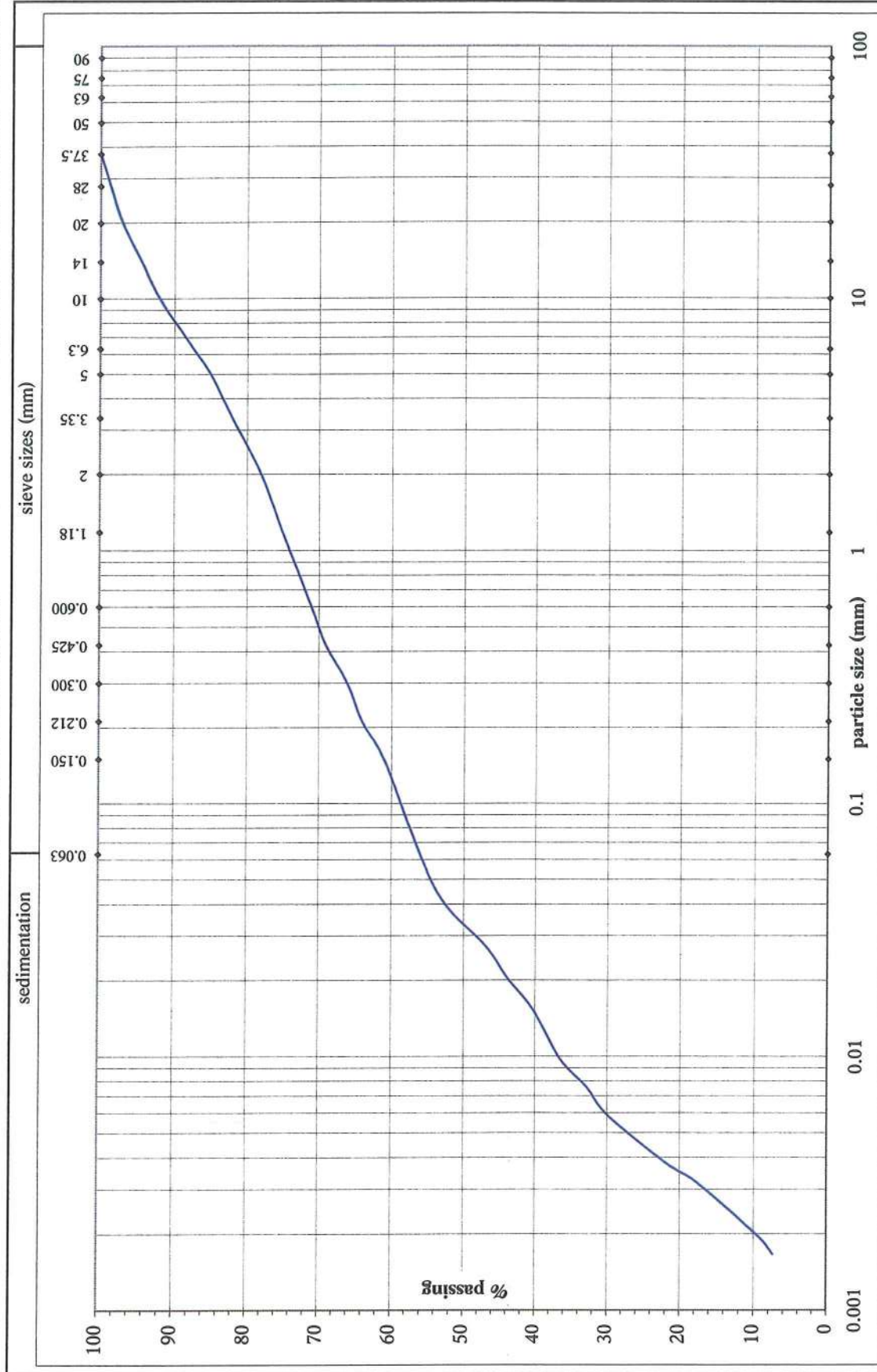
EH No.	Sample		Sample Depth		Moisture Content (%)	Passing 425mm Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Casagrande Classification	Particle Density (Mg/m ³)
	Type	No.	at (m)	to (m)							
TP01	D	2	0.50		16	79	36	19	17	CI	
TP02	D	2	1.00		17	83	34	21	13	CL	
TP03	B	1	0.70		14	83	33	18	15	CL	
TP04	D	2	1.00		18	82	35	20	15	CL	
TP05	D	2	1.00		16	79	37	21	16	CI	
TP06	B	2	1.50		15	72	34	18	16	CL	

NP non-plastic soil

\$ Insufficient material for Limits tests.

iii) Particle Size Distributions

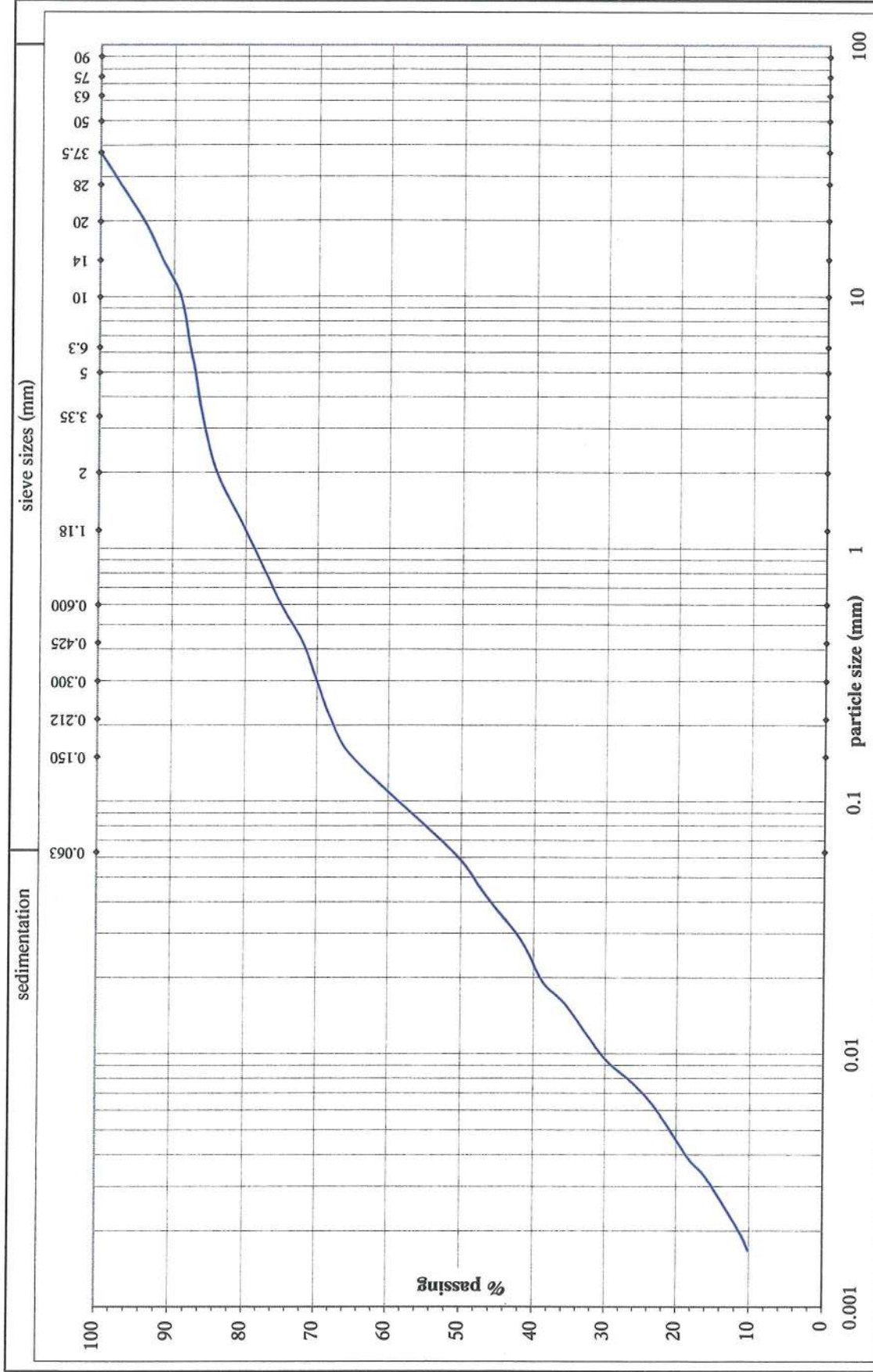
Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	99
20	97
14	94
10	92
6.3	87
5	85
3.35	82
2	78
1.18	75
0.6	71
0.425	69
0.3	66
0.212	64
0.15	61
0.063	56
0.0400	53
0.0274	47
0.0204	44
0.0153	40.3
0.0097	36.5
0.0076	32.8
0.0059	30.0
0.0039	22.1
0.0031	17.3
0.0020	9.4
0.0017	7.3



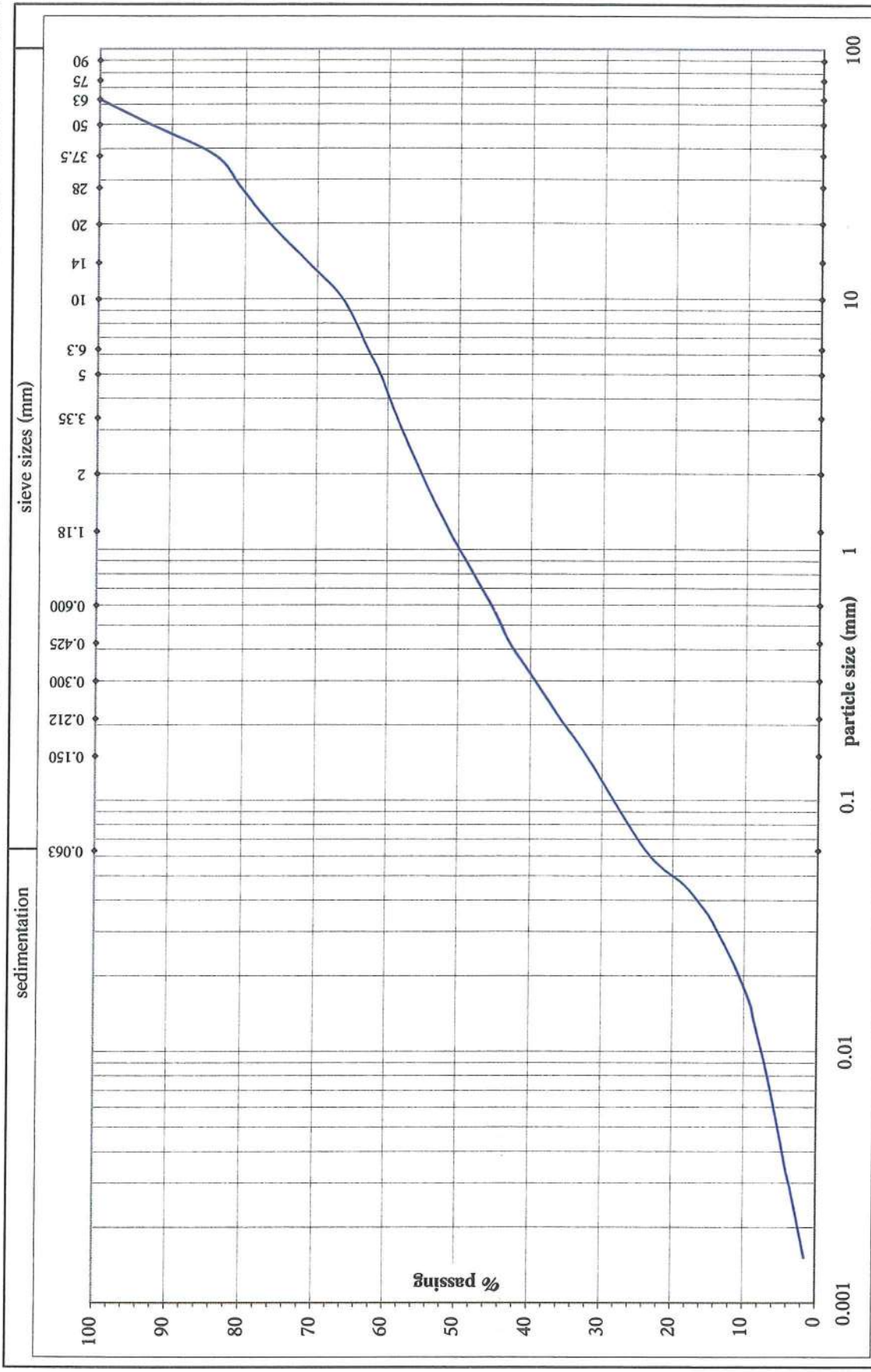
Clay 10%	Silt 46%			Gravel 22%			Cobbles 0%
	fine	medium	coarse	fine	medium	coarse	
				Sample natural moisture content (%) = 18			

Project:	Portmarnock		Exploratory Hole No.:	BH01		Sample	
Job No.:	06-693		Type	No.	at (m)	to (m)	
			B	3	1.50	1.95	

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	97
20	94
14	91
10	89
6.3	88
5	87
3.35	86
2	84
1.18	80
0.6	75
0.425	72
0.3	70
0.212	68
0.15	65
0.063	51
0.0425	47
0.0278	42
0.0192	39
0.0156	35
0.0097	30
0.0076	26
0.0061	23
0.0039	18
0.0032	16
0.0020	11
0.0017	10



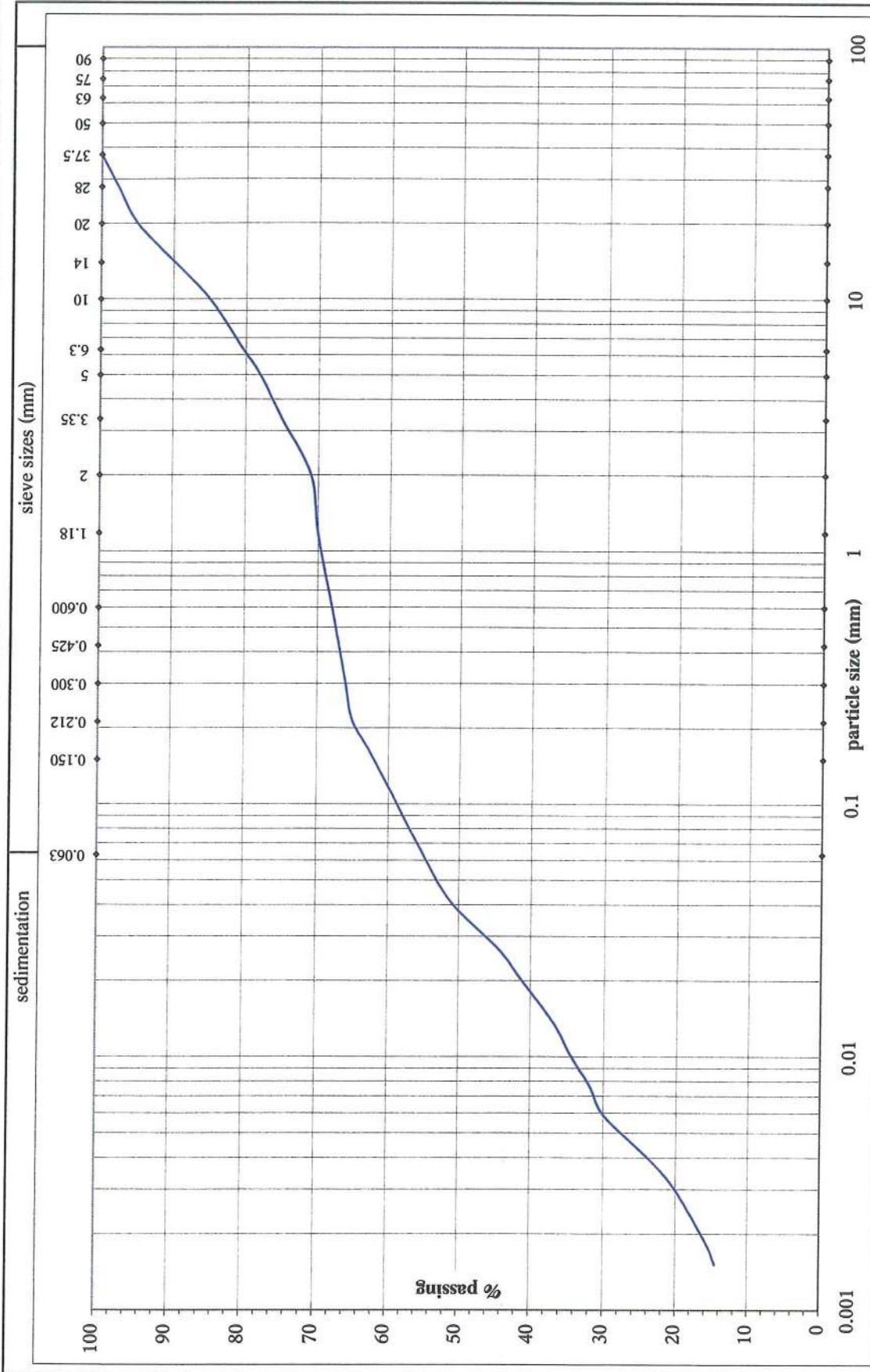
Clay 13%		Silt 38%		Sand 33%		Gravel 16%		Cobbles 0%	
fine		medium		coarse		fine		coarse	
Sample		Sample		Sample		Sample		Sample	
Type B		No. 2		at (m) 0.50		to (m) 0.95		Sample natural moisture content (%) = 16	
Project: Portmarnock		Exploratory Hole No.:		BH02					
Job No.: 06-693									



Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	93
37.5	84
28	81
20	77
14	71
10	66
6.3	63
5	61
3.35	59
2	55
1.18	51
0.6	45
0.425	43
0.3	39
0.212	36
0.15	32
0.063	24
0.0463	18.5
0.0386	16.1
0.0339	14.7
0.0280	13.2
0.0221	11.3
0.0159	9.3
0.0130	8.6
0.0093	7.3
0.0066	6.1
0.0047	5.1
0.0034	4.1
0.0028	3.4
0.0015	1.5

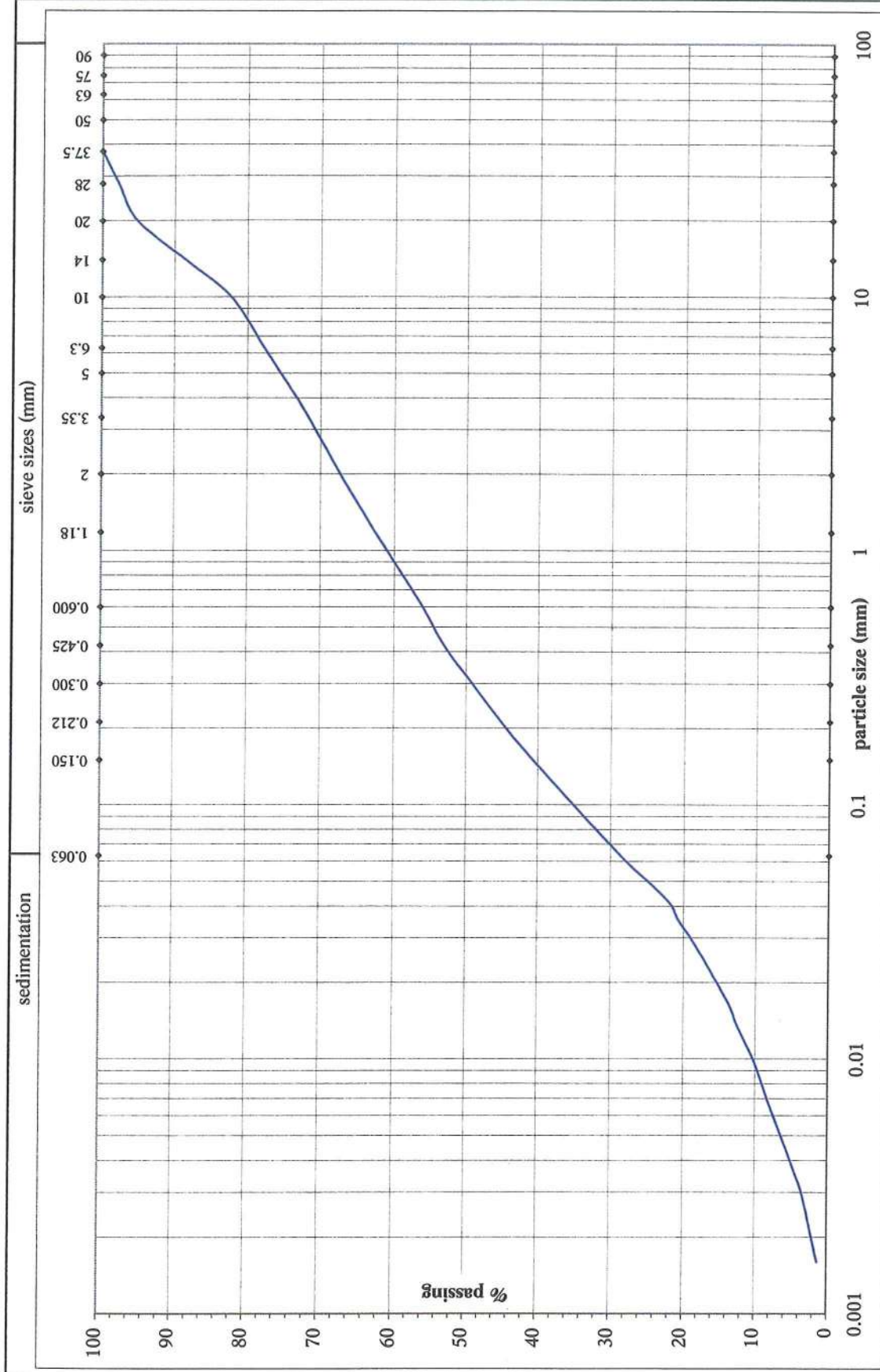
Clay 3%	Silt 21%	fine	medium	coarse	fine	medium	coarse	Cobbles 0%
				Sand 31%		Gravel 45%		
Sample natural moisture content (%) = 11								
Project: Portmarnock			Exploratory Hole No.: BH03			Sample		
Job No.: 06-693			Type	at (m)	to (m)			
			B	4	2.50	2.95		

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	98
20	95
14	90
10	85
6.3	80
5	78
3.35	75
2	71
1.18	70
0.6	68
0.425	67
0.3	66
0.212	65
0.15	62
0.063	55
0.0409	51
0.0266	44
0.0203	41
0.0135	37
0.0102	35
0.0077	32
0.0058	30
0.0040	24
0.0030	20
0.0018	16
0.0015	14



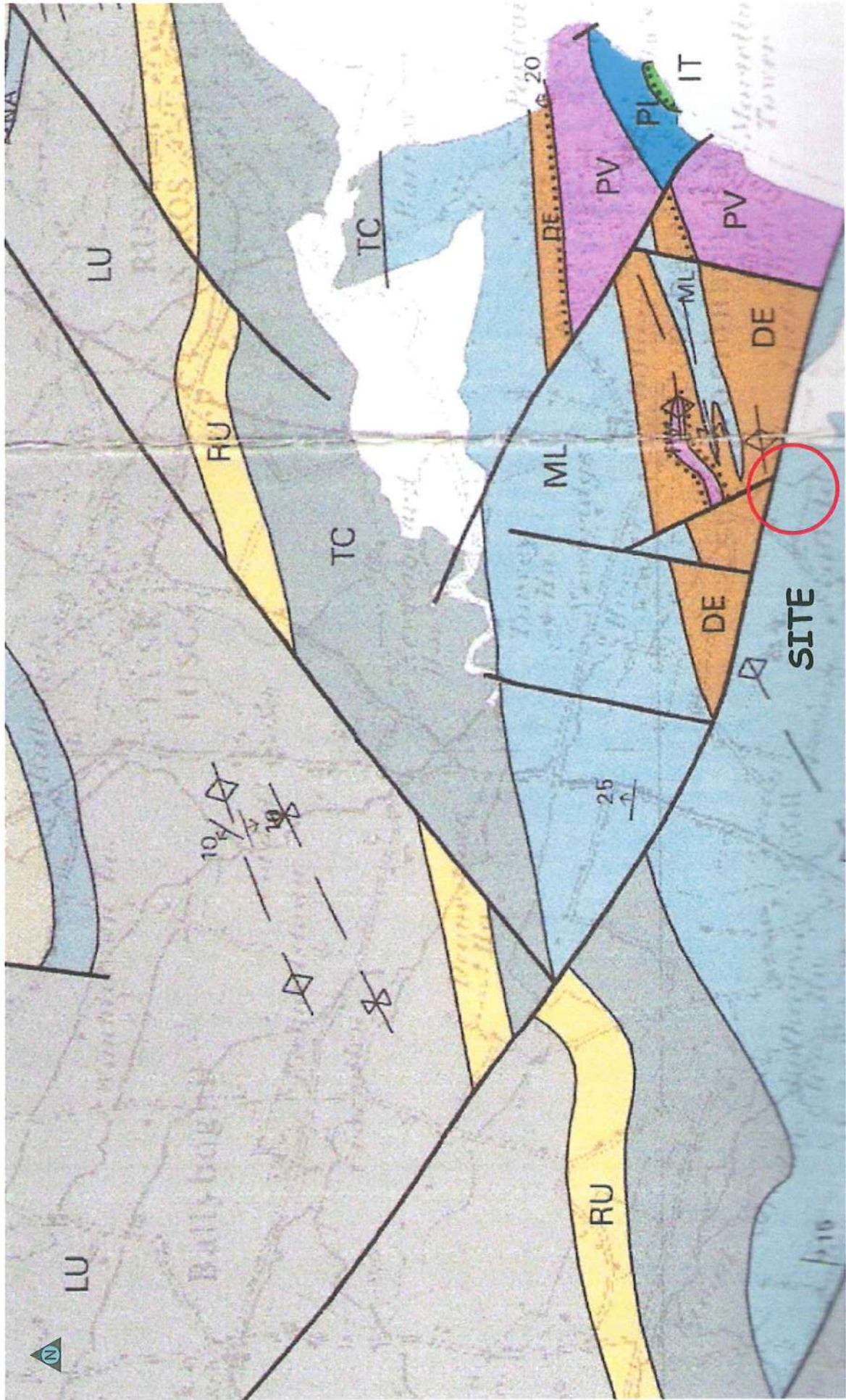
Clay 16%	Silt 39%		Sand 16%		Gravel 29%		Cobbles 0%	
	fine	medium	coarse	fine	medium	coarse		
Sample natural moisture content (%) = 16								
Project: Portmarnock	Exploratory Hole No.:	Sample						
		BH04	Type	No.	at (m)	to (m)		
Job No.: 06-693		B	6	4.50	4.95			

Particle size (mm)	% passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	98
20	95
14	89
10	82
6.3	78
5	75
3.35	72
2	67
1.18	62
0.6	56
0.425	53
0.3	49
0.212	45
0.15	41
0.063	29
0.0487	24.4
0.0405	21.7
0.0353	20.7
0.0292	18.7
0.0230	16.5
0.0165	13.7
0.0136	12.5
0.0097	10.1
0.0070	8.3
0.0050	6.3
0.0036	4.4
0.0029	3.4
0.0016	1.3



Sedimentation		fine		medium		coarse		fine		medium		coarse		Cobbles		
Silt 27%				Sand 39%						Gravel 33%				0%		
Sample natural moisture content (%) = 14																
Project:	Portmarnock		Exploratory Hole No.:		BH05		Sample									
			Type	No.	at (m)	to (m)										
Job No.:	06-693		B	3	1.50	1.95										

APPENDIX G
Geology Maps of the Site



PROJECT:

Proposed Development at Potmarnock, Co. Dublin

CLIENT:

Ballymore Residential Ltd.

ENGINEER:

J B Barry & Partners Ltd.

TITLE:

Geology location plan

KEY:

ML: Malahide Formation
Argillaceous bioclastic limestone, shale



SCALE: NTS

SERIES: 1 of 1

DRWN: OC

CHCK: TR

DATE:

13/10/06

REV. DATE: DETAILS: DRAW. CHK:

DWB NO: 06-693-SLoc-002

REV:

