Appendix 10-5: Dublin Airport Multistorey Office Blocks & Car Parks Ground Investigation Report

Dublin Airport Multistorey Office Blocks & Car Parks

Ground Investigation Report (Factual)

Client: Dublin Airport Authority

Engineer: PM Group

Project No. 18609

September 2015

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FOREWORD
The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards
The ground investigation works for this project have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930:1999 +A2:2010 and BS 1377 (Parts 1 to 9) and the following European Norms:

- EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- EN ISO 14688-1:2002 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- EN ISO 14688-2:2004 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Classification Principles
- EN ISO 14689-1:2004 Geotechnical Investigation and Testing - Identification & Classification of Rock, Part 1: Identification & Description

Reporting
No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations. The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

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Boring Procedures
Unless otherwise stated, 'shell and auger' or cable percussive boring technique has been employed as defined by Section 6.3 of IS EN ISO 22475-1:2006. The boring operations, sampling and in-situ testing complies with the recommendations of IS EN 1997-2:2007 and BS 1377:1990 and EN ISO 22476-3:2005. The shell and auger boring technique allows for continuous sampling in clay and silt above the water table and sand and gravel below the water table (Table 2 of IS EN ISO 22475-1:2006).

It is highlighted that some disturbance and variation is unavoidable in particular ground (e.g. blowing sands, gravel / cobble dominant glacial deposits etc). Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

In-Situ Testing
Standard penetration tests were conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 and the Energy Ratio (E_r). A calibration certificate is available upon request. The E_r is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the

engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

Soil Sampling
Three categories of sampling methods are outlined in EN ISO 22475-1:2006. The categories are referenced A, B and C for any given ground conditions and are shown in Tables 1 and 2 of EN ISO 22475-1:2006. Reference should be made to EN 1997-2:2002 for guidelines on sample class and quality for strength and compressibility testing. Samples of quality classes 1 or 2 can only be obtained by using Category A sampling methods.

Class 1 thin wall undisturbed tube samples (UT100) were obtained in fine grained soils and strictly meet the requirements of EN 1997-2:2002 and EN ISO 22475-1:2006. Soil samples for laboratory tests are divided into five classes with respect to the soil properties that are assumed to remain unchanged during sampling, handling transport and storage. The minimum sample quality required for testing purposes to Eurocode 7 compatibility (EN 1997-2:2002) is shown in Table A.

Table A – Details of Sample Quality Requirements

EN 1997 Clause	Test	Minimum Sample Quality Class
5.5.3	Water Content	3
5.5.4	Bulk Density	2
5.5.5	Particle Density	N/S
5.5.6	Particle Size Analysis	N/S
5.5.7	Consistency Limits	4
5.5.8	Density Index	N/S
5.5.9	Soil Dispersivity	N/S
5.5.10	Frost Susceptibility	N/S
5.6.2	Organic Content	4
5.6.3	Carbonate Content	3
5.6.4	Sulphate Content	3
5.6.5	pH	3
5.6.6	Chloride Content	3
5.7	Strength Index	1
5.8	Strength Tests	1
5.9	Compressibility Tests	1
5.10	Compaction Tests	N/S
5.11	Permeability	2

N/S – not stated. Presume a representative sample of appropriate size.

Samples recovered from trial pits or trenches meet the requirements of IS EN ISO 22475-1. It is highlighted that unforeseen circumstances such as variations in geological strata may lead to lower quality sample classes being obtained.

Groundwater
The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible, drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004. Rock weathering classification conforms to IS EN ISO 14689-1:2003 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2003. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Where peat has been encountered, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 and Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986.

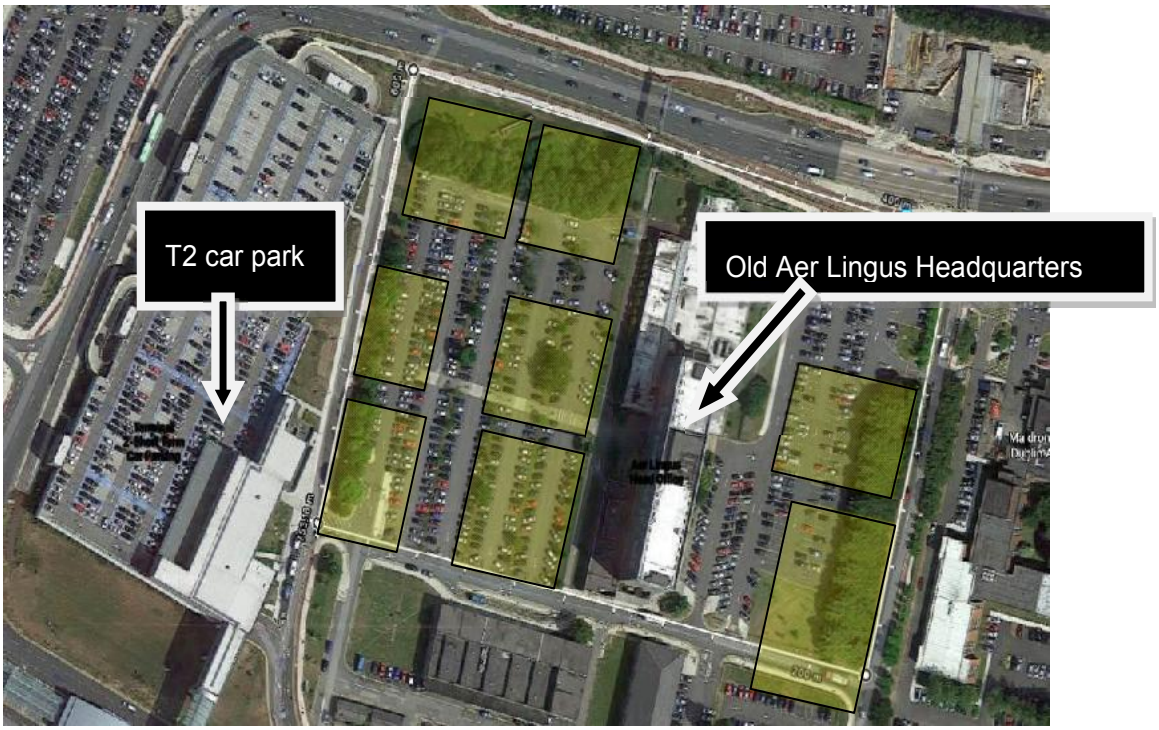
Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

1. INTRODUCTION

At the instruction of PM Group, IGSL has undertaken a programme of geotechnical site investigations at Dublin Airport for new multi-storey office blocks and car parks. The proposed development area (refer to Figure 1) is located to the east of T2 Car Park and west of the old Aer Lingus headquarters. The site encompasses an area of approximately 3.5 Ha and currently serves as tarmacadam surface car parks with grass verges. Ground levels or elevations across the investigation area range from c63.66 to 65.88m OD.

Figure 1 – Site Location Plan (From PM Specification)



The investigations conducted by IGSL included rotary boreholes, trial pits, window sampling, dynamic probing, soakaway tests, slit trenches and a geophysical survey. Geotechnical instrumentation (50mm diameter standpipes) was installed in selected rotary boreholes. The investigations were executed in accordance with BS 5930, Code of Practice for Site Investigations (1999+A2:2010) and EN 1997-2 Eurocode 7 Part 2 Ground Investigation & Testing and supervised by an IGSL geotechnical engineer.

Geotechnical, chemical and environmental laboratory testing was carried out on a range of soil samples and rock cores. The geotechnical testing included particle size distributions, moisture contents, Atterberg Limits, particle size distributions and point load strength index tests. Chemical analyses tests were performed on selected samples to measure sulphur and sulphate contents and derive equivalent pyrite contents. Environmental tests were carried out (WAC suite) on soil samples to characterize the materials in terns of disposal off-site. The 'as-built' co-ordinates and ground levels are shown on the exploratory logs with locations plotted on the exploratory hole plan in Appendix 12.

2. FIELDWORKS

2.1 General

The fieldworks were undertaken during the period mid August to early September 2015 and comprised the following:

- Rotary core boreholes (10 No.)
- Trial pits (5 No.)
- Dynamic probes (10 No.)
- Window sampling (10 No.)
- Slit trenches (2 No.)
- Geophysical surveying
- Groundwater monitoring
- Surveying of '*as-built*' exploratory locations

2.2 Rotary Boreholes

Rotary boreholes (denoted RC 1 to RC 10) was carried out using a Unimog-mounted Knebel HY79 rig. Symmetrex drilling was utilized within the superficial deposits with conventional coring techniques employed in the bedrock. Standard Penetration Tests (SPT's) were performed in some borehole locations to assess strength / stiffness of the superficial deposits. The rotary drilling in bedrock produced 82mm diameter cores using air mist flush.

The cores were placed in 3m capacity timber boxes and logged by an IGSL engineering geologist. This included photography of the cores with a digital camera. Where rock core was recovered, a graphic fracture log is also presented alongside the mechanical indices. This illustrates the fracture state of the rock cores and allows easy identification of highly fractured / non-intact zones and discontinuity spacings. It should be noted that no correction for dip of the joints has been made and that the spacings shown are successive joint / core intersections within the core.

Groundwater monitoring standpipes were installed in three of the ten rotary boreholes, namely RC 1, 5 and 7. The standpipes consisted of 50mm diameter HDPE pipework with proprietary 1mm slots and incorporated a pea gravel filter pack and cement/bentonite grout seal. Flush manhole covers were concreted in place.

The rotary borehole records are presented in Appendix 1 and this includes engineering geological descriptions, details of the bedding / discontinuities and mechanical indices (TCR, SCR and RQD's) for each core run. Core photographs are also presented in Appendix 1 and these illustrate the structure and fracture state of the bedrock.

2.3 Trial Pits

Trial pitting was performed using a JCB 3CX excavator. The trial pits were logged and sampled by an IGSL geotechnical engineer in accordance with BS 5930 (1999+A2:2010). Bulk disturbed samples (typically 30 to 40 kg) were taken as the pits progressed. The bulk samples were placed in heavy-duty polyethylene bags and sealed before being transported to Naas for laboratory testing. The trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site geotechnical engineer and representatives of DAA and PM Group. The trial pit logs and photographs are presented in Appendix 2 and include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls.

2.4 Dynamic Probes

In-situ "Heavy" dynamic probing (DPH) was undertaken at ten locations using a Global Geotech rig. This unit meets the requirements of BS 1377, Part 9 (1990) and IS EN 1997-2:2007. The probing rig utilized a 50kg drop weight and 500mm drop height with a 60° cone. In accordance with the standards, the number of blows required to drive the cone each 100mm increment into the sub-soil was recorded. Probing is generally terminated when blow counts, N_{100} values, exceed 25, in order to

avoid damage to equipment. The probe records are presented in Appendix 3 and include blow-counts in both numerical and graphical format.

2.5 Window Sampling (Driven Percussive Boreholes)
Window sampling or 'driven percussive boreholes' was carried out adjacent to the dynamic probes. Prior to commencing window sampling, hand dug pits were excavated to a depth of 1.20m. The super-heavy hammer (63.5kg weight) was used to drive the window sampler and the material was retrieved in a semi-rigid plastic core liner. Depths were dictated by the level of stiff to very stiff strata or obstructions (cobbles or boulders). The samples were placed in timber boxes and returned to Nass for logging and photography by an IGSL Geotechnical Engineer. The window sample records and photographs are presented in Appendix 4 and include descriptions of the soils encountered and the total recovery per run.

2.6 Infiltration Tests ('Soakaway')
Infiltration tests were undertaken in TP's 1 and 4 ito determine the soakage characteristics of the superficial deposits. The infiltration tests were performed in accordance with BRE Digest 365 'Soakaway Design'. To obtain a measure of the infiltration rate of the sub-soils, water was poured into the test pit, and records taken of the fall in water level against time. This procedure was repeated twice more to ensure saturation of the sub-soils. The infiltration rate (f) is the volume of water dispersed per unit exposed area per unit of time, and is generally expressed as metres/minute or metres/second. Designs are based on the slowest infiltration rate, which is generally calculated from the final cycle. The infiltration test records are enclosed in Appendix 5.

2.7 Slit Trenches
Two slit trenches were excavated at the site as directed by PM Group. To minimize the risk to utility ducts or services, vacuum excavation methods were specified and used with some hand digging where obstructions were present. The slit trenches were backfilled with lean mix concrete as per PM Specification. The slit trenches were logged and surveyed by san IGSL Geotechnical Engineer and details are presented in Appendix 6.

2.8 Groundwater Monitoring
Groundwater monitoring was undertaken in the borehole standpipes to establish equilibrium groundwater levels. Groundwater levels were measured using an electric dipmeter with measurements taken in RC 1, 5 and 7. The levels recorded are shown in Appendix 7.

2.9 Geophysical Surveying
A geophysical survey was carried out by MInerex Geophysics Ltd. The key aim of the survey was to map rockhead depths / elevations and identify any anomalous ground conditions. Following an evaluation of the geophysical survey findings (i.e. anticipated depths to rockhead) the locations of the rotary boreholes were selected. A combination of techniques was utilized Including 2D Electrical Resistivity Tomography (ERT), Seismic Refraction Profiling and Multichannel Analysis of Surface Waves (MASW). The findings of the geophysical survey are incorporated in Appendix 8.

2.10 Surveying of Exploratory Locations
Following completion of the exploratory works, surveying was carried out using GPS techniques. Co-ordinates (x, y) were measured to Irish National Grid and ground levels (z) established to Malin Head. The co-ordinates and ground levels are shown on the exploratory hole logs with "as-built" locations plotted on the exploratory hole plan in Appendix 12.

3. LABORATORY TESTING

Geotechnical laboratory testing was carried out on selected soil samples and rock cores. The soils testing was undertaken in accordance with BS 1377 (1990) and included particle size gradings, moisture contents and Atterberg limits (refer to Appendix 8). Point load strength index (PLSI) tests were performed on the rock cores and results are contained in Appendix 9. The chemical analysis results (i.e. total sulphur, total sulphate, water soluble sulphate & derivation of equivalent pyrite contents) are presented in Appendix 10. A select number of soil samples were chosen for Waste Acceptance Criteria (WAC) analysis. These results are presented in Appendix 11 and can be used to assess or characterize disposal of excavated materials off-site.

REFERENCES

1.0 BS 5930 (1999 + A2:2010) Code of Practice for Site Investigation, British Standards Institution (BSI).

2.0 BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.

3.0 Eurocode 7, Part 2: Ground Investigation & Testing (EN 1997-2:2007)

4.0 Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.

Appendix 1

Rotary Borehole Records & Photographs

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**DRILLHOLE NO**	**RC01**
		SHEET	Sheet 1 of 2
CO-ORDINATES	317,221.91 E 243,493.21 N	**DATE DRILLED**	24/08/2015
GROUND LEVEL (mOD)	65.64	**DATE LOGGED**	24/08/2015
RIG TYPE	Knebel		
FLUSH	Air/Mist		
CLIENT	DAA	**DRILLED BY**	Petersen
ENGINEER	PM Group	**LOGGED BY**	D.O'Shea
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	82		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								Hand-dug inspection pit - observed by driller as returns of brown sandy gravelly clay				
1									1.20	64.44		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay				
2									2.30	63.34		
								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles				
3												
4												
5												
6												
7												
8												
9									9.40	56.24		
								Symmetrix Drilling - No recovery, observed by driller as returns of grey gravels				
									10.00	55.64		

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-14.90m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
12.80					Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
24-08-15	14.50	3.00	14.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC01**
SHEET Sheet 2 of 2

CO-ORDINATES 317,221.91 E
243,493.21 N
GROUND LEVEL (mOD) 65.64

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 24/08/2015
DATE LOGGED 24/08/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles				
11												
12									12.80	52.84		
13								Symmetrix Drilling - No recovery, observed by driller as returns of grey gravels	13.50	52.14		
14								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles	14.10	51.54		
								Symmetrix Drilling - No recovery, observed by driller as returns of possible weathered rock	14.60	51.04		
	14.90							Symmetrix Drilling - No recovery, observed by driller as returns of rock	14.90	50.74		
15		100	91	38				Medium strong, medium to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Predominantely calcareous mudstone with very occasional calci-siltite lenses), fresh to locally slightly weathered.				
16	16.40							Discontinuities are medium to closely spaced, smooth, planar. Apertures are tight to moderately open, locally clay-smeared, locally strongly (penetrative) iron-oxide stained. Dips are subhorizontal & locally 20°.				
17		100	91	63								
	17.90								17.90	47.74		
18								End of Borehole at 17.90 m				
19												

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-14.90m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
12.80					Slow

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
24-08-15	14.50	3.00	14.50	50mm SP

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**DRILLHOLE NO**	**RC02**
		SHEET	Sheet 1 of 2
CO-ORDINATES	317,176.18 E 243,490.83 N	**DATE DRILLED**	04/09/2015
GROUND LEVEL (mOD)	65.88	**DATE LOGGED**	04/09/2015
CLIENT	DAA	**DRILLED BY**	Petersen
ENGINEER	PM Group	**LOGGED BY**	D.O'Shea
RIG TYPE	Knebel		
FLUSH	Air/Mist		
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	82		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
								Hand-dug inspection pit - observed by driller as returns of brown sandy gravelly clay	1.20	64.68		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay	1.40	64.48		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay with occasional cobbles	1.90	63.98		
								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles	4.50	61.38		
								Symmetrix Drilling - No recovery, observed by driller as returns of grey gravel with occasional cobbles	4.80	61.08		
								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles	9.80	56.08		

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-10.60m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
9.70					Slow

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC02**
SHEET Sheet 2 of 2

CO-ORDINATES 317,176.18 E
243,490.83 N
GROUND LEVEL (mOD) 65.88

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 04/09/2015
DATE LOGGED 04/09/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10								Symmetrix Drilling - No recovery, observed by driller as returns of rock *(continued)*				
	10.60								10.60	55.28		
11		100	87	14				Medium strong, medium to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Predominantely calcareous mudstone with very occasional calci-siltite lenses), fresh to locally slightly weathered. Discontinuities are medium to closely spaced, smooth, planar. Apertures are tight to moderately open, locally clay-smeared, locally strongly (penetrative) iron-oxide stained. Dips are subhorizontal & locally 45°.				
12	12.10											
13		100	91	43								
	13.60								13.60	52.28		
14								End of Borehole at 13.60 m				
15												
16												
17												
18												
19												

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-10.60m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
9.70					Slow

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC03**
SHEET Sheet 1 of 2

CO-ORDINATES 317,220.63 E
243,458.85 N
GROUND LEVEL (mOD) 65.47

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 07/09/2015
DATE LOGGED 07/09/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								Hand-dug inspection pit - observed by driller as returns of tarmacadam	0.10	65.37		
								Hand-dug inspection pit - observed by driller as returns of made ground consisting of cobbly gravel	0.30	65.17		
1								Hand-dug inspection pit - observed by driller as returns of brown sandy gravelly clay	1.20	64.27		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay	1.40	64.07		
2								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay with occasional cobbles	2.00	63.47		
3								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles	4.00	61.47		
4								Symmetrix Drilling - No recovery, observed by driller as returns of grey boulder	4.80	60.67		
5								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles				
6												
7												
8									8.80	56.67		
9								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay with occasional cobbles				

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-10.70m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC03**
SHEET Sheet 2 of 2

CO-ORDINATES 317,220.63 E
243,458.85 N
GROUND LEVEL (mOD) 65.47

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 07/09/2015
DATE LOGGED 07/09/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay with occasional cobbles *(continued)*	10.50	54.97		
	10.70							Symmetrix Drilling - No recovery, observed by driller as returns of rock	10.70	54.77		
11		100	85	20				Medium strong, medium to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Predominantely calcareous mudstone with very occasional calci-siltite lenses), fresh to locally highly weathered (at 11.06-11.19m).				
	12.00											
12		100	95	55				Discontinuities are medium to closely spaced, smooth, planar. Apertures are tight to moderately open, locally clay-smeared, locally strongly (penetrative) iron-oxide stained, locally calcite-veined (1-10mm). Dips are subhorizontal & locally 45°.				
13	13.30								13.30	52.17		
								End of Borehole at 13.30 m				
14												
15												
16												
17												
18												
19												

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-10.70m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC04**
SHEET Sheet 1 of 2

CO-ORDINATES 317,250.16 E
243,461.49 N
GROUND LEVEL (mOD) 65.23

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 25/08/2015
DATE LOGGED 25/08/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								Hand-dug inspection pit - observed by driller as returns of tarmacadam	0.10	65.13		
								Hand-dug inspection pit - observed by driller as returns of brown sandy gravel	0.50	64.73		
1								Hand-dug inspection pit - observed by driller as returns of brown sandy gravelly clay	1.20	64.03		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay	1.90	63.33		N = 16 (3, 2, 5, 3, 4, 4)
2								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles				
3												N = 37 (5, 8, 8, 9, 10, 10)
4												
5												N = 50/170 mm (5, 13, 11, 28, 11)
6												N = 43 (5, 9, 10, 10, 11, 12)
7	7.70							Symmetrix Drilling - No recovery, observed by driller as returns of boulder	7.00	58.23		
8		33	0	0				Stiff, brown, slightly sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is angular to subrounded, fine to coarse of varying lithologies. Cobbles are subrounded of limestone.	7.70	57.53		
9	9.20											

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-12.20m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**DRILLHOLE NO**	**RC04**
		SHEET	Sheet 2 of 2
CO-ORDINATES	317,250.16 E 243,461.49 N	**DATE DRILLED**	25/08/2015
GROUND LEVEL (mOD)	65.23	**DATE LOGGED**	25/08/2015
RIG TYPE	Knebel		
FLUSH	Air/Mist		
CLIENT	DAA	**DRILLED BY**	Petersen
ENGINEER	PM Group	**LOGGED BY**	D.O'Shea
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	82		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10		100	0	0				Stiff, brown, slightly sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is angular to subrounded, fine to coarse of varying lithologies. Cobbles are subrounded of limestone. *(continued)*				
	10.70											
11												N = 49 (9, 11, 12, 12, 13, 12)
12	12.20											
									12.50	52.73		N = 50/185 mm (14, 11, 13, 15, 22)
13		100	70	7				Medium strong, medium to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Predominantely calcareous mudstone with very occasional calci-siltite lenses), fresh to locally slightly weathered.				
	13.70							Discontinuities are medium to closely spaced, smooth, planar. Apertures are tight to moderately open, locally clay-smeared, locally strongly (penetrative) iron-oxide stained. Dips are subhorizontal & locally 45°.	13.70	51.53		
14		100	27	0				Highly weathered zone - POSSIBLE FAULT ZONE - recovered as stiff, orange/brown clay with sand, gravel and cobbles.				
	14.40											
		100	13	0								
15	15.10											
									15.40	49.83		
		75	58	58				Strong to very strong, medium bedded, pale grey, fine-grained, LIMESTONE (Plastically sheared in places), slightly (solution) weathered.	15.90	49.33		
	15.90							End of Borehole at 15.90 m				
16												
17												
18												
19												

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-12.20m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
25-08-15	15.90	12.20	3.00	Water level recorded 10 mins after end of drilling

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**DRILLHOLE NO**	**RC05**
		SHEET	Sheet 1 of 2
CO-ORDINATES	317,213.69 E 243,429.06 N	**DATE DRILLED**	27/08/2015
GROUND LEVEL (mOD)	65.02	**DATE LOGGED**	27/08/2015
CLIENT	DAA	**DRILLED BY**	Petersen
ENGINEER	PM Group	**LOGGED BY**	D.O'Shea
RIG TYPE	Knebel		
FLUSH	Air/Mist		
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	82		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
								Hand-dug inspection pit - observed by driller as returns of tarmacadam	0.10	64.92		
								Hand-dug inspection pit - observed by driller as returns of grey gravels	0.30	64.72		
								Hand-dug inspection pit - observed by driller as returns of brown sandy gravelly clay	1.10	63.92		
								Hand-dug inspection pit - observed by driller as returns of brown sandy gravelly clay	1.20	63.82		
								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles	5.20	59.82		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay with occasional cobbles	9.50	55.52		
								Symmetrix Drilling - No recovery, observed by driller as returns of rock				

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-10.70m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
9.50					Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
27-08-15	12.70	2.00	12.70	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC05**
SHEET Sheet 2 of 2

CO-ORDINATES 317,213.69 E
243,429.06 N

GROUND LEVEL (mOD) 65.02

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 27/08/2015
DATE LOGGED 27/08/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10								Symmetrix Drilling - No recovery, observed by driller as returns of rock *(continued)*				
	10.70								10.70	54.32		
11		100	81	48				Medium strong, medium to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Predominantely calcareous mudstone with very occasional calci-siltite lenses), fresh to locally slightly weathered. Discontinuities are medium to closely spaced, smooth, planar. Apertures are tight to moderately open, locally clay-smeared, locally strongly (penetrative) iron-oxide stained. Dips are subhorizontal & locally 45°.				
12	12.20											
13		100	95	54								
	13.70								13.70	51.32		
14								End of Borehole at 13.70 m				
15												
16												
17												
18												
19												

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-10.70m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
9.50					Slow

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
27-08-15	12.70	2.00	12.70	50mm SP

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**DRILLHOLE NO**	**RC06A**
		SHEET	Sheet 1 of 2
CO-ORDINATES	317,206.82 E 243,396.10 N	**DATE DRILLED**	31/08/2015
GROUND LEVEL (mOD)	64.66	**DATE LOGGED**	31/08/2015
CLIENT	DAA	**DRILLED BY**	Petersen
ENGINEER	PM Group	**LOGGED BY**	D.O'Shea
RIG TYPE	Knebel		
FLUSH	Air/Mist		
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	82		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								Hand-dug inspection pit - observed by driller as returns of tarmacadam	0.10	64.56		
								Hand-dug inspection pit - observed by driller as returns of gravels (clause 804 material)	0.20	64.46		
								Hand-dug inspection pit - observed by driller as returns of grey gravels	0.50	64.16		
1								Hand-dug inspection pit - observed by driller as returns of brown sandy gravelly clay	1.20	63.46		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay	1.30	63.36		
2								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles				
3									3.80	60.86		
4								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay with occasional cobbles				
	4.60								4.60	60.06		
5		100	0	0				Stiff, brown, slightly sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is angular to subrounded, fine to coarse of varying lithologies. Cobbles are subrounded of limestone.				N = 50/185 mm (8, 15, 15, 19, 16)
6	6.20											N = 50/115 mm (6, 19, 28, 22)
7		100	0	0								
	7.60											N = 50/165 mm (7, 18, 19, 20, 11)
8		100	56	7					8.15	56.51		
9	9.10											
		100	87	10								

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-4.60m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**DRILLHOLE NO**	**RC06A**
		SHEET	Sheet 2 of 2
CO-ORDINATES	317,206.82 E 243,396.10 N	**DATE DRILLED**	31/08/2015
GROUND LEVEL (mOD)	64.66	**DATE LOGGED**	31/08/2015
CLIENT	DAA	**DRILLED BY**	Petersen
ENGINEER	PM Group	**LOGGED BY**	D.O'Shea
RIG TYPE	Knebel		
FLUSH	Air/Mist		
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	82		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.60							Medium strong, medium to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Predominantely calcareous mudstone with very occasional calci-siltite lenses), fresh to locally slightly weathered. Discontinuities are medium to closely spaced, smooth, planar. Apertures are tight to moderately open, locally clay-smeared, locally strongly (penetrative) iron-oxide stained, locally calcite-veined (1-10mm). Dips are subhorizontal & locally 45°. *(continued)* End of Borehole at 10.60 m	10.60	54.06		
11												
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-4.60m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC07**
SHEET Sheet 1 of 2

CO-ORDINATES 317,153.39 E
243,384.27 N
GROUND LEVEL (mOD) 65.04

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 01/09/2015
DATE LOGGED 01/09/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
								Hand-dug inspection pit - observed by driller as returns of concrete	0.20	64.84		
								Hand-dug inspection pit - observed by driller as returns of gravels (clause 804 material)	0.30	64.74		
								Hand-dug inspection pit - observed by driller as returns of brown silty gravelly clay with occasional cobbles	1.20	63.84		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown silty gravelly clay with occasional cobbles	1.40	63.64		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay with occasional cobbles	2.50	62.54		
								Symmetrix Drilling - No recovery, observed by driller as returns of grey/brown mottled sandy gravelly clay with occasional cobbles				N = 50/165 mm (7, 13, 18, 20, 12)
												N = 50/160 mm (6, 14, 20, 23, 7)
								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles	6.70	58.34		
								Symmetrix Drilling - No recovery, observed by driller as returns of rock	6.90	58.14		
	7.70								7.70	57.34		
		100	94	46				Medium strong, medium to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Predominantely calcareous mudstone with very occasional calci-siltite lenses), fresh to locally slightly weathered. Discontinuities are medium to closely spaced, smooth, planar. Apertures are tight to moderately open, locally clay-smeared, locally strongly (penetrative) iron-oxide stained. Dips are subhorizontal & locally 45°.				
	9.10											
		100	97	43								

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-7.70m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
7.70					Slow

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
01-09-15	10.50	1.00	10.50	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC07**
SHEET Sheet 2 of 2

CO-ORDINATES 317,153.39 E
243,384.27 N

GROUND LEVEL (mOD) 65.04

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 01/09/2015
DATE LOGGED 01/09/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.50							End of Borehole at 10.50 m	10.50	54.54		
11												
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-7.70m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
7.70					Slow

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
01-09-15	10.50	1.00	10.50	50mm SP

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC08**
SHEET Sheet 1 of 2

CO-ORDINATES 317,163.06 E
243,367.11 N
GROUND LEVEL (mOD) 64.35

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 02/09/2015
DATE LOGGED 02/09/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
								Hand-dug inspection pit - observed by driller as returns of tarmacadam	0.10	64.25		
								Hand-dug inspection pit - observed by driller as returns of gravels (clause 804 material)	0.50	63.85		
								Hand-dug inspection pit - observed by driller as returns of brown silty gravelly clay with occasional cobbles	1.20	63.15		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown silty gravelly clay with occasional cobbles	1.40	62.95		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay with occasional cobbles	2.60	61.75		
								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles	4.50	59.85		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown boulder	6.70	57.65		
	7.70							Symmetrix Drilling - No recovery, observed by driller as returns of rock	7.70	56.65		
8	8.10	100	78	33				Medium strong, medium to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Predominantely calcareous mudstone with very occasional calci-siltite lenses), fresh to locally slightly weathered. Discontinuities are medium to closely spaced, smooth, planar. Apertures are tight to moderately open, locally clay-smeared, locally strongly (penetrative) iron-oxide stained. Dips are subhorizontal & locally 45°.				
9	9.10	100	86	43								
	9.65	100	100	27								

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-7.70m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC08**
SHEET Sheet 2 of 2

CO-ORDINATES 317,163.06 E
243,367.11 N

GROUND LEVEL (mOD) 64.35

DATE DRILLED 02/09/2015
DATE LOGGED 02/09/2015

CLIENT DAA
ENGINEER PM Group

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.55	100	96	73				End of Borehole at 10.55 m	10.55	53.80		
11												
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-7.70m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
02-09-15	10.55	7.70	6.50	Water level recorded 10 mins after end of drilling

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC09**
SHEET Sheet 1 of 2

CO-ORDINATES 317,232.63 E
243,374.18 N
GROUND LEVEL (mOD) 64.19

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 28/08/2015
DATE LOGGED 28/08/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								Hand-dug inspection pit - observed by driller as returns of tarmacadam	0.10	64.09		
								Hand-dug inspection pit - observed by driller as returns of gravels (clause 804 material)	0.20	63.99		
1								Hand-dug inspection pit - observed by driller as returns of brown sandy gravelly clay	1.20	62.99		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay	1.40	62.79		
2								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles				
3												
4												
5												
6												
7									7.70	56.49		
	7.90							Symmetrix Drilling - No recovery, observed by driller as returns of rock	7.90	56.29		
8		100	82	22				Medium strong, medium to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Predominantely calcareous mudstone with very occasional calci-siltite lenses), fresh to locally slightly weathered.				
	9.00											
9		100	100	46				Discontinuities are medium to closely spaced, smooth, planar. Apertures are tight to moderately open, locally clay-smeared, locally strongly (penetrative) iron-oxide stained. Dips are subhorizontal & locally 45°.				

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-7.90m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
7.70					Slow

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC09**
SHEET Sheet 2 of 2

CO-ORDINATES 317,232.63 E
243,374.18 N

GROUND LEVEL (mOD) 64.19

DATE DRILLED 28/08/2015
DATE LOGGED 28/08/2015

CLIENT DAA
ENGINEER PM Group

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.40											
	10.80	100	95	38					10.80	53.39		
11								End of Borehole at 10.80 m				
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-7.90m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
7.70					Slow

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC10**
SHEET Sheet 1 of 2

CO-ORDINATES 317,216.51 E
243,349.72 N
GROUND LEVEL (mOD) 64.10

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 03/09/2015
DATE LOGGED 03/09/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								Hand-dug inspection pit - observed by driller as returns of topsoil	0.30	63.80		
								Hand-dug inspection pit - observed by driller as returns of made ground consisting of cobbly gravel	1.00	63.10		
1								Hand-dug inspection pit - observed by driller as returns of brown sandy gravelly clay	1.20	62.90		
								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay	1.50	62.60		
2								Symmetrix Drilling - No recovery, observed by driller as returns of brown sandy gravelly clay with occasional cobbles	2.60	61.50		
3								Symmetrix Drilling - No recovery, observed by driller as returns of grey/brown sandy gravelly clay with occasional cobbles	3.70	60.40		
4								Symmetrix Drilling - No recovery, observed by driller as returns of grey sandy gravelly clay with occasional cobbles	7.60	56.50		
5												
6												
7	7.70							Symmetrix Drilling - No recovery, observed by driller as returns of rock	7.70	56.40		
8		100	74	9				Medium strong, medium to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Predominantely calcareous mudstone with very occasional calci-siltite lenses), fresh to locally slightly weathered.				
9	9.20							Discontinuities are medium to closely spaced, smooth, planar. Apertures are tight to moderately open, locally clay-smeared, locally strongly (penetrative) iron-oxide stained. Dips are subhorizontal & locally 45° & subvertical.				

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-7.70m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

DRILLHOLE NO **RC10**
SHEET Sheet 2 of 2

CO-ORDINATES 317,216.51 E
243,349.72 N
GROUND LEVEL (mOD) 64.10

RIG TYPE Knebel
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 82

DATE DRILLED 03/09/2015
DATE LOGGED 03/09/2015

CLIENT DAA
ENGINEER PM Group

DRILLED BY Petersen
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10		100	84	41								
	10.70							End of Borehole at 10.70 m	10.70	53.40		
11												
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS

Hand-dug inspection pit 0.00-1.20m. Hole cased 0.00-7.70m.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
03-09-15	10.70	7.70	7.50	Water level recorded 10 mins after end of drilling

IGSL RC FI 10M 18609.GPJ IGSL.GDT 15/9/15

RC01 - Box 1 of 1



RC02 - Box 1 of 1



RC03 - Box 1 of 1



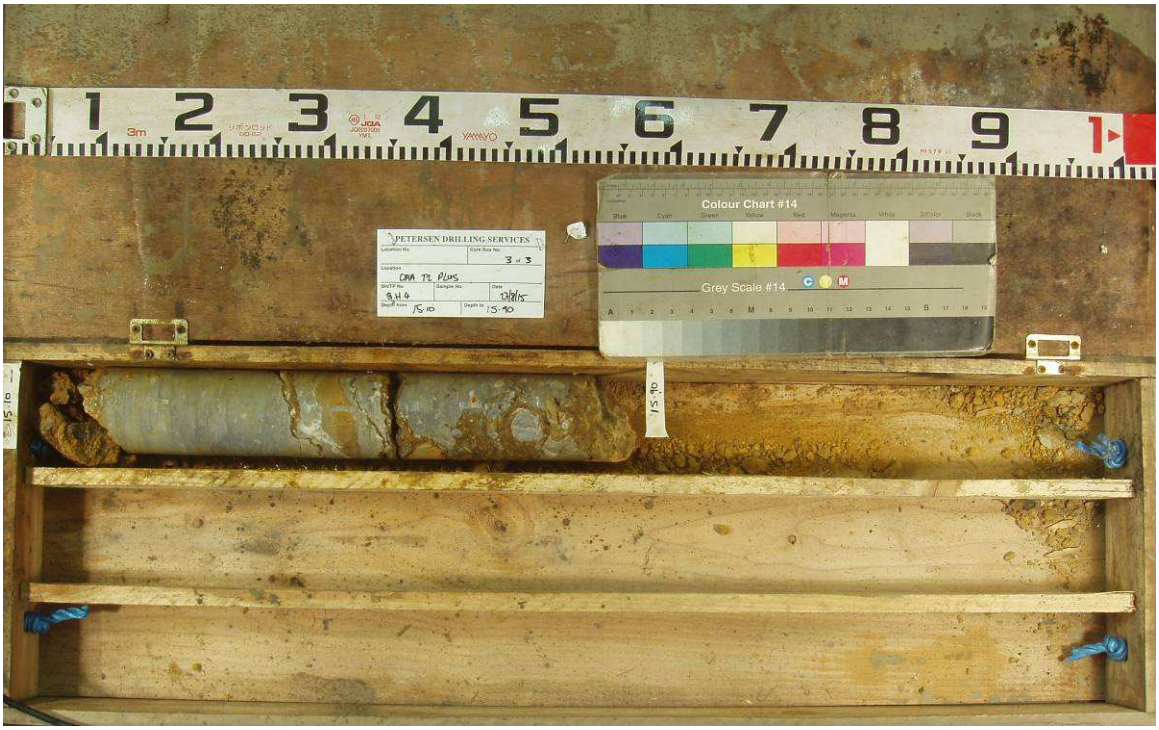
RC04 - Box 1 of 3



RC04 - Box 2 of 3



RC04 - Box 3 of 3



RC05 - Box 1 of 1



RC06A - Box 1 of 2



RC06A - Box 2 of 2



RC07 - Box 1 of 1



RC08 - Box 1 of 1



RC09 - Box 1 of 1



RC10 - Box 1 of 1



Appendix 2

Trial Pit Records & Photographs

TRIAL PIT RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**TRIAL PIT NO.**	**TP01**
		SHEET	Sheet 1 of 1
LOGGED BY	R. Covrig	**CO-ORDINATES**	317,188.12 E 243,487.04 N
		DATE STARTED	28/07/2015
		DATE COMPLETED	28/07/2015
CLIENT	DAA	**GROUND LEVEL (m)**	65.65
ENGINEER	PM Group	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL: Firm light brown slightly sandy silty CLAY with abundant roots and rootlets.		0.30	65.35						
Stiff light brown sandy gravelly CLAY with a high cobble content. (MADE GROUND)		0.40	65.25						
Stiff brown sandy gravelly CLAY with a low cobble content and rare fragments of red brick, concrete. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse. Cobbles are subangular to rounded. (MADE GROUND)					AA37861	B	0.50-0.60		
Stiff brown sandy gravelly CLAY with a low cobble content a. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse. Cobbles are subangular to rounded.		1.20	64.45		AA37862	B	1.30-1.40		
Very stiff dark brown sandy gravelly CLAY with a medium cobble and low boulder content.		1.90	63.75		AA37863	B	2.20-2.30		
End of Trial Pit at 2.50m		2.50	63.15						

Groundwater Conditions
Dry

Stability
Good stability

General Remarks
Pit terminated due to an obstruction, possible large boulder

TRIAL PIT RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**TRIAL PIT NO.**	**TP02**
		SHEET	Sheet 1 of 1
LOGGED BY	R. Covrig	**CO-ORDINATES**	317,228.42 E 243,416.29 N
		DATE STARTED	27/07/2015
		DATE COMPLETED	27/07/2015
CLIENT	DAA	**GROUND LEVEL (m)**	64.71
ENGINEER	PM Group	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TARMAC		0.07	64.64						
Bluish grey sandy GRAVEL. Sand is coarse. Gravel is angular fine. (MADE GROUND)		0.15	64.56						
Brown sandy GRAVEL with a high cobble content. Sand is coarse. Gravel is angular coarse. Cobbles are angular to subangular		0.35	64.36		AA35399	B	0.50-0.60		
Firm to stiff brown occasionally very sandy gravelly CLAY with a medium cobble content. Sand is fine. Gravel is subangular to rounded fine to coarse.									
1.0 Stiff to very stiff dark brown slightly sandy gravelly CLAY with a medium cobble and a low boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		1.20	63.51		AA37851	B	1.50-1.60		
2.0					AA37852	B	2.50-2.60		
End of Trial Pit at 2.90m		2.90	61.81						
3.0									
4.0									

Groundwater Conditions
Dry

Stability
Good stability

General Remarks
Pit terminated due to obstruction, possible large boulder

TRIAL PIT RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**TRIAL PIT NO.**	**TP03**
		SHEET	Sheet 1 of 1
LOGGED BY	R. Covrig	**CO-ORDINATES**	317,159.93 E 243,426.62 N
		DATE STARTED	27/07/2015
		DATE COMPLETED	27/07/2015
CLIENT	DAA	**GROUND LEVEL (m)**	66.22
ENGINEER	PM Group	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown slightly sandy slightly gravelly CLAY with abundant roots and rootlets.		0.10	66.12						
Very stiff light brown sandy gravelly silty CLAY. (MADE GROUND)					AA37856	B	0.40-0.60		
Very stiff brown sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		0.70	65.52						
1.0					AA37857	B	1.50-1.60		
Stiff to very stiff dark brown sandy gravelly CLAY with a low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		1.80	64.42						
2.0					AA37858	B	2.20-2.30		
End of Trial Pit at 2.30m		2.30	63.92						
3.0									
4.0									

Groundwater Conditions
Dry

Stability
Good stability

General Remarks
Pit terminated due to very poor progress through very stiff CLAY

TRIAL PIT RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**TRIAL PIT NO.**	**TP04**
		SHEET	Sheet 1 of 1
LOGGED BY	R. Covrig	**CO-ORDINATES**	317,152.33 E 243,370.39 N
		DATE STARTED	28/07/2015
		DATE COMPLETED	28/07/2015
CLIENT	DAA	**GROUND LEVEL (m)**	64.69
ENGINEER	PM Group	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown slightly sandy slightly gravelly CLAY with abundant roots and rootlets.		0.20	64.49						
Firm brown sandy gravelly CLAY. (MADE GROUND)		0.40	64.29						
Grey sandy GRAVEL. Sand is fine to coarse. Gravel is angular fine to medium. (MADE GROUND)					AA37859	B	0.50-0.60		
Material underlaid by GEOTEXTILE		0.70	63.99						
Stiff brown sandy gravelly CLAY with a medium cobble and a low boulder content. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse. Cobbles are subangular to rounded									
1.0					AA37860	B	1.40-1.50		
2.0 End of Trial Pit at 2.00m		2.00	62.69						
3.0									
4.0									

Groundwater Conditions
Dry

Stability
Good stability

General Remarks
Pit terminated due to an obstruction, possible large boulder

IGSL TP LOG 18609.GPJ IGSL.GDT 31/8/15

TRIAL PIT RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development	**TRIAL PIT NO.**	**TP05**
		SHEET	Sheet 1 of 1
LOGGED BY	R. Covrig	**CO-ORDINATES**	317,220.49 E 243,366.46 N
		DATE STARTED	27/07/2015
		DATE COMPLETED	27/07/2015
CLIENT	DAA	**GROUND LEVEL (m)**	64.29
ENGINEER	PM Group	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0									
TOPSOIL: Soft brown slightly sandy slightly gravelly CLAY with abundant roots and rootlets.		0.15	64.14						
Grey sandy GRAVEL. Sand is fine to coarse. Gravel is angular fine to medium. (MADE GROUND)		0.40	63.89						
Material underlaid by GEOTEXTILE					AA37853	B	0.50-0.70		
Firm brown sandy gravelly CLAY with a medium cobble content. Sand is fine to medium. Gravel is subangular to rounded fine to coarse. Cobbles are subangular to subrounded									
1.0									
		1.50	62.79						
Stiff to very stiff dark brown sandy gravelly CLAY with a medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.					AA37854	B	1.50-1.80		
2.0									
					AA37855	B	2.50-2.70		
		2.70	61.59						
End of Trial Pit at 2.70m									
3.0									
4.0									

Groundwater Conditions
Dry

Stability
Good stability

General Remarks
Pit terminated due to slow progress

TP 01 1 of 2



TP 01 2 of 2



TP 02 1 of 2



TP 02 2 of 2



TP 03 1 of 3



TP 03 2 of 3



TP 03 3 of 3



TP 04 1 of 3



TP 04 2 of 3



TP 04 3 of 3



TP 05 1 of 3



TP 05 2 of 3



TP 05 3 of 3



Appendix 3

Dynamic Probe Records

DYNAMIC PROBE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **DP01**
SHEET Sheet 1 of 1

CO-ORDINATES 317,177.24 E
243,491.09 N
GROUND LEVEL (mOD) 65.93

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 29/07/2015
DATE LOGGED 29/07/2015

CLIENT DAA
ENGINEER PM Group

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	0
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	0
						1.20	3
						1.30	3
						1.40	5
						1.50	6
						1.60	12
						1.70	12
						1.80	8
						1.90	8
2.0						2.00	9
						2.10	9
						2.20	10
						2.30	12
						2.40	11
						2.50	13
						2.60	15
						2.70	15
						2.80	17
						2.90	16
3.0						3.00	16
						3.10	20
						3.20	25
	End of Probe at 3.30 m			62.63			
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 18609.GPJ IGSL.GDT 14/9/15

DYNAMIC PROBE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **DP02**
SHEET Sheet 1 of 1

CO-ORDINATES 317,236.24 E
243,461.97 N
GROUND LEVEL (mOD) 65.54

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 29/07/2015
DATE LOGGED 29/07/2015

CLIENT DAA
ENGINEER PM Group

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	0
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	0
						1.20	4
						1.30	4
						1.40	3
						1.50	3
						1.60	4
						1.70	6
						1.80	5
						1.90	6
2.0						2.00	6
						2.10	6
						2.20	9
						2.30	12
						2.40	11
						2.50	20
						2.60	18
						2.70	17
						2.80	18
						2.90	25
3.0	End of Probe at 3.00 m			62.54			
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 18609.GPJ IGSL.GDT 14/9/15

DYNAMIC PROBE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **DP03**
SHEET Sheet 1 of 1

CO-ORDINATES 317,229.48 E
243,420.64 N
GROUND LEVEL (mOD) 64.76

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 04/08/2015
DATE LOGGED 04/08/2015

CLIENT DAA
ENGINEER PM Group

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	0
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	0
						1.20	10
						1.30	11
						1.40	10
						1.50	13
						1.60	11
						1.70	9
						1.80	15
						1.90	25
2.0	End of Probe at 2.00 m			62.76			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 18609.GPJ IGSL.GDT 14/9/15

DYNAMIC PROBE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **DP04**
SHEET Sheet 1 of 1

CO-ORDINATES 317,211.33 E
243,420.17 N
GROUND LEVEL (mOD) 64.92

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 05/08/2015
DATE LOGGED 05/08/2015

CLIENT DAA
ENGINEER PM Group

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	0
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	0
						1.20	8
						1.30	8
						1.40	9
						1.50	10
						1.60	12
						1.70	12
						1.80	10
						1.90	12
2.0						2.00	9
						2.10	11
						2.20	13
						2.30	15
						2.40	14
						2.50	14
						2.60	16
						2.70	16
						2.80	14
						2.90	13
3.0						3.00	13
						3.10	14
						3.20	13
						3.30	15
						3.40	14
						3.50	16
						3.60	18
						3.70	25
	End of Probe at 3.80 m			61.12			
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 18609.GPJ IGSL.GDT 14/9/15

DYNAMIC PROBE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **DP05**
SHEET Sheet 1 of 1

CO-ORDINATES 317,163.03 E
243,436.39 N
GROUND LEVEL (mOD) 66.41

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

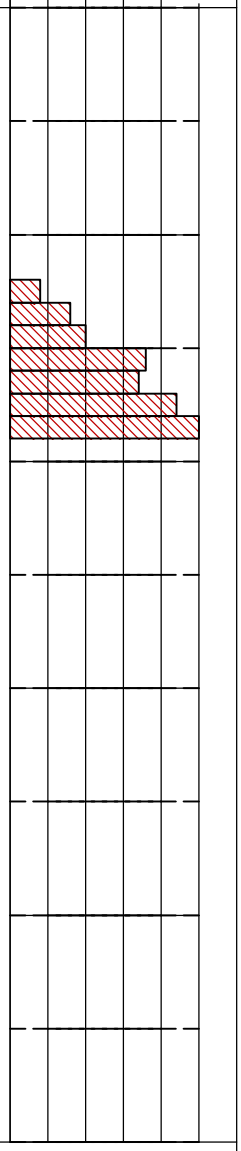
DATE DRILLED 30/07/2015
DATE LOGGED 30/07/2015

CLIENT DAA
ENGINEER PM Group

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	0
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	0
						1.20	4
						1.30	8
						1.40	10
						1.50	18
						1.60	17
						1.70	22
						1.80	25
2.0	End of Probe at 1.90 m			64.51			
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 18609.GPJ IGSL.GDT 14/9/15

DYNAMIC PROBE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **DP06**
SHEET Sheet 1 of 1

CO-ORDINATES 317,155.58 E
243,408.07 N
GROUND LEVEL (mOD) 66.12

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 30/07/2015
DATE LOGGED 30/07/2015

CLIENT DAA
ENGINEER PM Group

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	0
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	0
						1.20	4
						1.30	8
						1.40	11
						1.50	11
						1.60	12
						1.70	11
						1.80	17
						1.90	16
2.0						2.00	15
						2.10	16
						2.20	21
						2.30	25
	End of Probe at 2.40 m			63.72			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 18609.GPJ IGSL.GDT 14/9/15

DYNAMIC PROBE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **DP07**
SHEET Sheet 1 of 1

CO-ORDINATES 317,149.83 E
243,390.98 N
GROUND LEVEL (mOD) 65.61

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 30/07/2015
DATE LOGGED 30/07/2015

CLIENT DAA
ENGINEER PM Group

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	0
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	0
						1.20	14
						1.30	11
						1.40	8
						1.50	10
						1.60	12
						1.70	10
						1.80	10
						1.90	14
2.0						2.00	16
						2.10	19
						2.20	19
						2.30	25
	End of Probe at 2.40 m			63.21			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 18609.GPJ IGSL.GDT 14/9/15

DYNAMIC PROBE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **DP08**
SHEET Sheet 1 of 1

CO-ORDINATES 317,143.65 E
243,363.60 N
GROUND LEVEL (mOD) 65.07

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

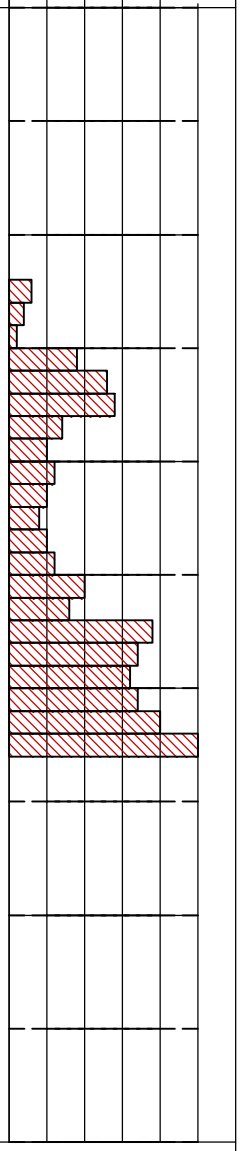
DATE DRILLED 29/07/2015
DATE LOGGED 29/07/2015

CLIENT DAA
ENGINEER PM Group

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	0
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	0
						1.20	3
						1.30	2
						1.40	1
						1.50	9
						1.60	13
						1.70	14
						1.80	7
						1.90	5
2.0						2.00	6
						2.10	5
						2.20	4
						2.30	5
						2.40	6
						2.50	10
						2.60	8
						2.70	19
						2.80	17
						2.90	16
3.0						3.00	17
						3.10	20
						3.20	25
	End of Probe at 3.30 m			61.77			
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 18609.GPJ IGSL.GDT 14/9/15

DYNAMIC PROBE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **DP09**
SHEET Sheet 1 of 1

CO-ORDINATES 317,220.73 E
243,379.25 N
GROUND LEVEL (mOD) 64.25

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

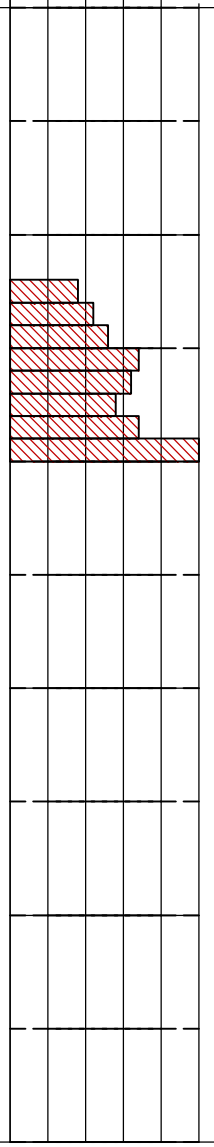
DATE DRILLED 04/08/2015
DATE LOGGED 04/08/2015

CLIENT DAA
ENGINEER PM Group

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	0
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	0
						1.20	9
						1.30	11
						1.40	13
						1.50	17
						1.60	16
						1.70	14
						1.80	17
						1.90	25
2.0	End of Probe at 2.00 m			62.25			
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 18609.GPJ IGSL.GDT 14/9/15

DYNAMIC PROBE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **DP10**
SHEET Sheet 1 of 1

CO-ORDINATES 317,190.39 E
243,353.62 N
GROUND LEVEL (mOD) 64.03

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 05/08/2015
DATE LOGGED 05/08/2015

CLIENT DAA
ENGINEER PM Group

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	0
						0.80	0
						0.90	0
1.0						1.00	0
						1.10	0
						1.20	5
						1.30	7
						1.40	9
						1.50	7
						1.60	13
						1.70	10
						1.80	12
						1.90	12
2.0						2.00	12
						2.10	10
						2.20	10
						2.30	10
						2.40	8
						2.50	10
						2.60	9
						2.70	8
						2.80	11
						2.90	19
3.0						3.00	17
						3.10	17
						3.20	16
						3.30	18
						3.40	25
	End of Probe at 3.50 m			60.53			
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 18609.GPJ IGSL.GDT 14/9/15

Appendix 4

Window Sample Records

WINDOW SAMPLE RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development
PROBE NO.	**WS01**
SHEET	Sheet 1 of 1
CO-ORDINATES	317,177.24 E 243,491.09 N
GROUND LEVEL (mOD)	65.93
DATE DRILLED	29/07/2015
DATE LOGGED	29/07/2015
CLIENT	DAA
ENGINEER	PM Group
SAMPLED BY	E. Lehey
LOGGED BY	R. Covrig

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Hand dug to 1.20m.									
1.0						0.00-1.20				
	Stiff brown sandy gravelly CLAY		1.20	64.73						
2.0	Stiff dark grey sandy gravelly CLAY		2.00	63.93		2.00-3.00	100			
3.0						1.20-3.40	100			
	Final Depth 3.40m		3.40	62.53		3.00-3.40				
4.0										
5.0										

General Remarks
Bag sample taken between 0m and 1.20m BGL

Installations

IGSL WS LOG 18609.GPJ IGSL.GDT 31/8/15

WINDOW SAMPLE RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development
PROBE NO.	**WS02**
SHEET	Sheet 1 of 1
CO-ORDINATES	317,236.24 E 243,461.97 N
GROUND LEVEL (mOD)	65.54
DATE DRILLED	29/07/2015
DATE LOGGED	29/07/2015
CLIENT	DAA
ENGINEER	PM Group
SAMPLED BY	E. Lehey
LOGGED BY	R. Covrig

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Hand dug to 1.20m.									
1.0						0.00-1.20				
	Stiff brown occasionally mottled black sandy gravelly CLAY		1.20	64.34						
2.0										
	Stiff dark grey sandy gravelly CLAY		2.10	63.44						
						1.20-3.00	100			
3.0	Final Depth 3.00m		3.00	62.54		2.00-3.00				
4.0										
5.0										

General Remarks
Bag sample taken between 0m and 1.20m BGL

Installations

WINDOW SAMPLE RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development
PROBE NO.	**WS03**
SHEET	Sheet 1 of 1
CO-ORDINATES	317,229.48 E 243,420.64 N
GROUND LEVEL (mOD)	64.76
DATE DRILLED	04/08/2015
DATE LOGGED	04/08/2015
CLIENT	DAA
ENGINEER	PM Group
SAMPLED BY	E. Lehey
LOGGED BY	R. Covrig

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Hand dug to 1.20m.					0.00-1.20				
1.0	Stiff dark grey sandy gravelly CLAY		1.20	63.56		1.20-2.00	100			
2.0	Final Depth 2.00m		2.00	62.76						
3.0										
4.0										
5.0										

General Remarks
Bag sample taken between 0m and 1.20m BGL

Installations

IGSL WS LOG 18609.GPJ IGSL.GDT 31/8/15

WINDOW SAMPLE RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development
PROBE NO.	**WS04**
SHEET	Sheet 1 of 1
CO-ORDINATES	317,211.33 E 243,420.17 N
GROUND LEVEL (mOD)	64.92
DATE DRILLED	05/08/2015
DATE LOGGED	05/08/2015
CLIENT	DAA
ENGINEER	PM Group
SAMPLED BY	E. Lehey
LOGGED BY	R. Covrig

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Hand dug to 1.20m.									
1.0	Stiff dark grey sandy gravelly CLAY		1.20	63.72		1.20-2.70	100			
2.0	Final Depth 2.70m		2.70	62.22		2.00-2.70				
3.0										
4.0										
5.0										

General Remarks
VAC-EX used to excavate to 1.20m BGL, no sample recovered

Installations

WINDOW SAMPLE RECORD

REPORT NUMBER 18609

CONTRACT DAA T2 Plus Development

PROBE NO. **WS05**
SHEET Sheet 1 of 1

CO-ORDINATES 317,163.03 E
243,436.39 N
GROUND LEVEL (mOD) 66.41

DATE DRILLED 30/07/2015
DATE LOGGED 30/07/2015

CLIENT DAA
ENGINEER PM Group

SAMPLED BY E. Lehey
LOGGED BY R. Covrig

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Hand dug to 1.20m.									
1.0			1.20	65.21		0.00-1.20				
	Stiff light brown sandy gravelly CLAY(Possible MADE GROUND)					1.20-1.60	100			
	Final Depth 1.60m		1.60	64.81						
2.0										
3.0										
4.0										
5.0										

General Remarks
Bag sample taken between 0m and 1.20m BGL

Installations

WINDOW SAMPLE RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development
PROBE NO.	**WS06**
SHEET	Sheet 1 of 1
CO-ORDINATES	317,155.58 E 243,408.07 N
GROUND LEVEL (mOD)	66.12
DATE DRILLED	30/07/2015
DATE LOGGED	30/07/2015
CLIENT	DAA
ENGINEER	PM Group
SAMPLED BY	E. Lehey
LOGGED BY	R. Covrig

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Hand dug to 1.20m.									
1.0						0.00-1.20				
	Stiff brown sandy gravelly CLAY		1.20	64.92						
2.0	Stiff dark grey sandy gravelly CLAY		2.00	64.12		1.20-2.40	100			
	Final Depth 2.40m		2.40	63.72		2.00-2.40				
3.0										
4.0										
5.0										

General Remarks
Bag sample taken between 0m and 1.20m BGL

Installations

IGSL WS LOG 18609.GPJ IGSL.GDT 31/8/15

WINDOW SAMPLE RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development
PROBE NO.	**WS07**
SHEET	Sheet 1 of 1
CO-ORDINATES	317,149.83 E 243,390.98 N
GROUND LEVEL (mOD)	65.61
DATE DRILLED	30/07/2015
DATE LOGGED	30/07/2015
CLIENT	DAA
ENGINEER	PM Group
SAMPLED BY	E. Lehey
LOGGED BY	R. Covrig

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Hand dug to 1.20m.									
1.0			1.20	64.41		0.00-1.20				
	Stiff light brown mottled orange silty sandy gravelly CLAY		1.40	64.21						
	Stiff brown sandy gravelly CLAY with rootlets		1.60	64.01						
	Stiff brown sandy gravelly CLAY		2.00	63.61		1.20-2.20	70			
2.0	Brown coarse GRAVEL		2.20	63.41		2.00-2.20	50			
	Final Depth 2.20m									
3.0										
4.0										
5.0										

General Remarks
Bag sample taken between 0m and 1.20m BGL

Installations

IGSL WS LOG 18609.GPJ IGSL.GDT 31/8/15

WINDOW SAMPLE RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development
PROBE NO.	**WS08**
SHEET	Sheet 1 of 1
CO-ORDINATES	317,143.65 E 243,363.60 N
GROUND LEVEL (mOD)	65.07
DATE DRILLED	29/07/2015
DATE LOGGED	29/07/2015
CLIENT	DAA
ENGINEER	PM Group
SAMPLED BY	E. Lehey
LOGGED BY	R. Covrig

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Hand dug to 1.20m.									
1.0			1.20	63.87		0.00-1.20				
	Stiff light brown silty sandy gravelly CLAY		1.40	63.67						
	Stiff brown sandy gravelly CLAY					1.20-1.70	100			
	Obstruction: Possible concrete boulder Final Depth 1.70m		1.70	63.37						
2.0										
3.0										
4.0										
5.0										

General Remarks
Bag sample taken between 0m and 1.20m BGL

Installations

IGSL WS LOG 18609.GPJ IGSL.GDT 31/8/15

WINDOW SAMPLE RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development
PROBE NO.	**WS09**
SHEET	Sheet 1 of 1
CO-ORDINATES	317,220.73 E 243,379.25 N
GROUND LEVEL (mOD)	64.25
DATE DRILLED	04/08/2015
DATE LOGGED	04/08/2015
CLIENT	DAA
ENGINEER	PM Group
SAMPLED BY	E. Lehey
LOGGED BY	R. Covrig

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Hand dug to 1.20m.					0.00-1.20				
1.0	Stiff dark grey sandy gravelly CLAY		1.20	63.05		1.20-2.00	100			
2.0	Final Depth 2.00m		2.00	62.25						
3.0										
4.0										
5.0										

General Remarks
Bag sample taken between 0m and 1.20m BGL

Installations

WINDOW SAMPLE RECORD

REPORT NUMBER 18609

CONTRACT	DAA T2 Plus Development
PROBE NO.	**WS10**
SHEET	Sheet 1 of 1
CO-ORDINATES	317,190.39 E 243,353.62 N
GROUND LEVEL (mOD)	64.03
DATE DRILLED	05/08/2015
DATE LOGGED	05/08/2015
CLIENT	DAA
ENGINEER	PM Group
SAMPLED BY	E. Lehey
LOGGED BY	R. Covrig

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Hand dug to 1.20m.									
1.0	Stiff brown sandy gravelly CLAY		1.20	62.83						
2.0	Stiff dark grey sandy gravelly CLAY		2.10	61.93		2.00-3.00	100			
3.0						1.20-3.60	100			
	Final Depth 3.60m		3.60	60.43		3.00-3.60				
4.0										
5.0										

General Remarks
VAC-EX used to excavate to 1.20m BGL, no sample recovered

Installations

WS01


18666
DAA T2 Car Park
WS 01
29/07
3.40

WS02


18666
DAA T2 Car Park
WS 02
29/07
3.00

WS03


18666
DAA T2 Car Park
WS 03
04/08
2.00

WS04


18666
DAA T2 Car Park
WS 04
05/08
2.70

WS05


18666
DAA T2 Car Park
WS 05
30/07
1.60

WS06


18666
DAA T2 Car Park
WS 06
03/07
2.40

WS07


18666
DAA T2 Car Park
WS 07
30/07
2.20

WS08


18666
DAA T2 Car Park
WS 08
29/07
1.70

WS09


18666
DAA T2 Car Park
WS 09
04/08
2.00

WS010


18666
DAA T2 Car Park
WS 10
05/08
3.60

Appendix 5

Infiltration Test Records

Soakaway Design f -value from field tests IGSL

Contract: DAA T2 Car Park Contract No. 18609
Test No. SA at TP01
Client PM Group for the DAA
Date: 28-Jul

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	TOPSOIL	Dry
0.30	0.40	Stiff light brown sandy gravelly CLAY with abundant cobbles. (MADE GROUND)	
0.40	1.20	Stiff brown sandy gravelly CLAY with rare fragments of red brick(MADE GROUN	
1.20	1.70	Stiff brown sandy gravelly CLAY with a low cobble content	

Notes: Sampling and soil strata as per TP01 log

Field Data

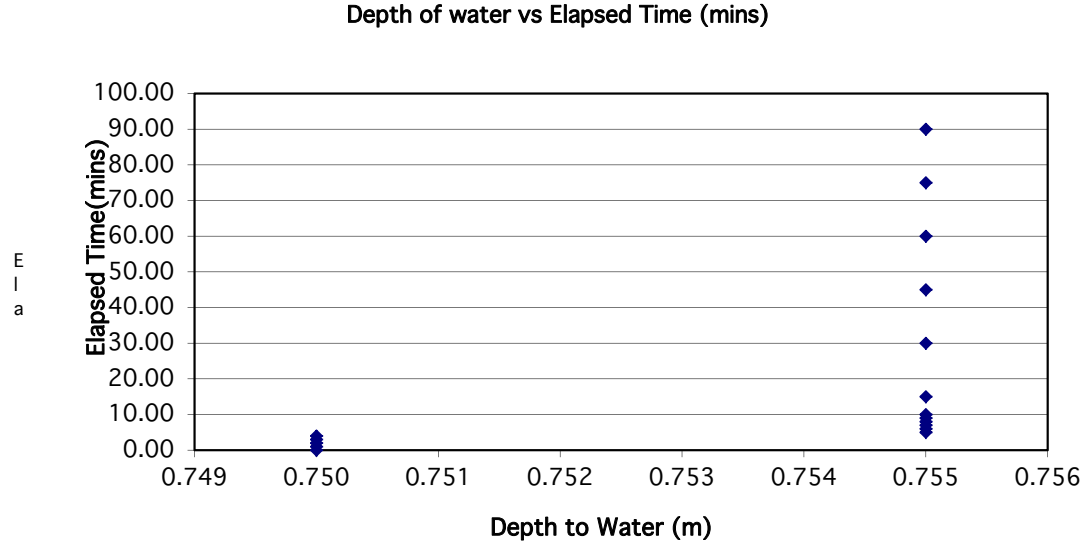
Depth to Water (m)	Elapsed Time (min)
0.750	0.00
0.750	1.00
0.750	2.00
0.750	3.00
0.750	4.00
0.755	5.00
0.755	6.00
0.755	7.00
0.755	8.00
0.755	9.00
0.755	10.00
0.755	15.00
0.755	30.00
0.755	45.00
0.755	60.00
0.755	75.00
0.755	90.00

Field Test

Depth of Pit (D)	1.70	m
Width of Pit (B)	0.45	m
Length of Pit (L)	1.10	m
Initial depth to Water =	0.75	m
Final depth to water =	0.76	m
Elapsed time (mins)=	90.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.495	m2
*Av. side area of permeable stratum over test period=	2.93725	m2
Total Exposed area =	3.43225	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 8E-06 m/min or 1.335E-07 m/sec



Soakaway Design f -value from field tests IGSL

Contract: DAA T2 Car Park Contract No. 18609
Test No. SA at TP04
Client PM Group for the DAA
Date: 28-Jul

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	
0.20	0.40	Firm brown sandy gravelly CLAY. (MADE GROUND)	Dry
0.40	0.70	Grey sandy GRAVEL. Gravel is angular fine to medium. (MADE GROUND)	
0.70	1.55	Stiff brown sandy gravelly CLAY with a medium cobble and a low boulder content	

Notes: Sampling and soil strata as per TP04 log

Field Data

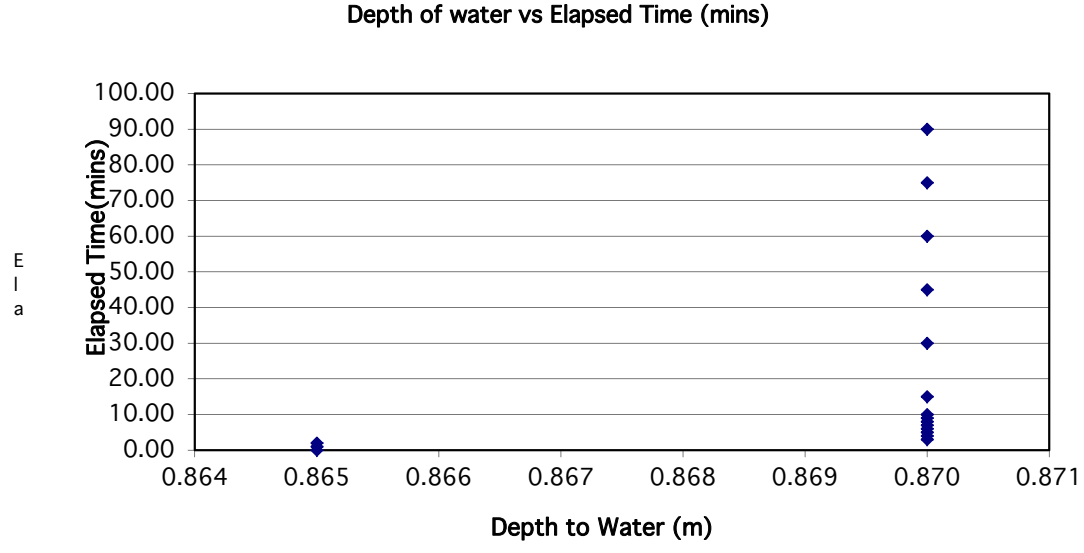
Depth to Water (m)	Elapsed Time (min)
0.865	0.00
0.865	1.00
0.865	2.00
0.870	3.00
0.870	4.00
0.870	5.00
0.870	6.00
0.870	7.00
0.870	8.00
0.870	9.00
0.870	10.00
0.870	15.00
0.870	30.00
0.870	45.00
0.870	60.00
0.870	75.00
0.870	90.00

Field Test

Depth of Pit (D)	1.55	m
Width of Pit (B)	0.45	m
Length of Pit (L)	1.50	m
Initial depth to Water =	0.865	m
Final depth to water =	0.870	m
Elapsed time (mins)=	90.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.675	m2
*Av. side area of permeable stratum over test period=	2.66175	m2
Total Exposed area =	3.33675	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 1.1E-05 m/min or 1.873E-07 m/sec



Appendix 6

Slit Trench Records

Report No. 18609	SLIT TRENCH RECORD	FACING DIRECTION: N / W / E / S

		Survey				
Project: DAA T2Plus Development		Easting (m)	Northing (m)	Elevation (mOD)	Slit Trench No.	ST 01
Engineer: PM Group					Sheet	1 of 1
Crew: Vac-Ex	Start of Trench	317285.843	243473.82	64.625	Date Commenced	05/08/2015
	End of Trench	317287.279	243473.36	64.613	Date Completed	06/08/2015

Ground Conditions

From (m)	To (m)	Soil Description
0	0.3	TOPSOIL
0.3	0.9	Brown sandy gravelly CLAY with abundant fragments of concrete block
		Note: Trench backfilled with leanmix concrete
		Supply from road could not be found nor sized due to bundle of other services and concrete surround.

Photograph



Trench Dimensions

LHS of Trench (m)	0.0
RHS of Trench (m)	3.1
Trench Depth (m)	1.0
Trench Width (m)	0.4



Excavation Quantities

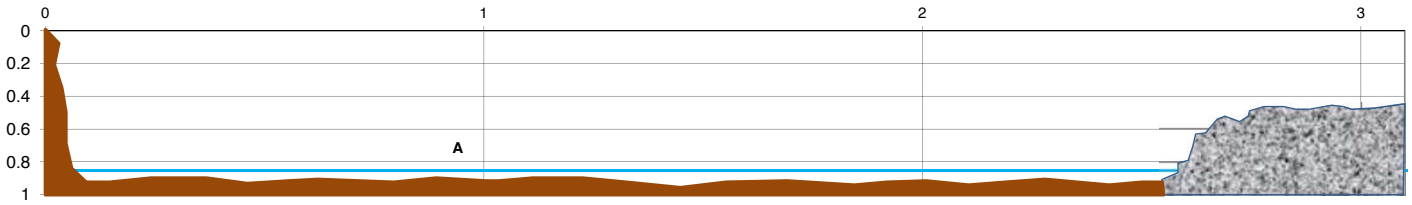
Surface	Length (m)	Material
Road		
Path (LHS)		
Path (RHS)		
Grass Verge (LHS)	3.1	
Grass Verge (RHS)		
Other		
Total Length	3.1	

Facing Direction	North
Facing Features	McDonald's Restaurant
Groundwater	DRY

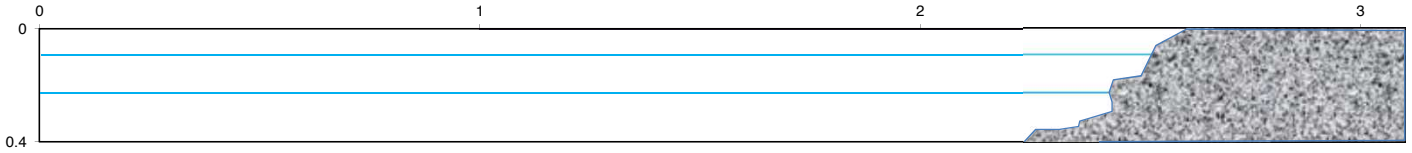
SAMPLES

Zero Metres Taken As: Left hand side of trench, at 1.85m North of podium wall

X-Section



Plan



	Diameter (mm)	Material	Description	Distance (m)	Depth to crown (m)	Angle (deg.)
Service A	100	uPVC	Blue uPVC water main	0.00m	0.85	0
Service B						
Service C						
Service D						
Service E						
Service F						
Service G						
Service H						
Service I						
Service J						
Service K						
Service L						
Service M						

Report No. 18609	SLIT TRENCH RECORD	FACING DIRECTION: N / W / E / S

		Survey				
Project: DAA T2Plus Development		Easting (m)	Northing (m)	Elevation (mOD)	Slit Trench No.	ST 02
Engineer: PM Group					Sheet	1 of 1
Crew: Vac-Ex	Start of Trench	317135.02	243303.51	63.667	Date Commenced	06/08/2015
	End of Trench	317133.829	243303.84	63.949	Date Completed	06/08/2015

Ground Conditions

From (m)	To (m)	Soil Description
0	0.3	TOPSOIL
0.3	0.55	Grey angular medium GRAVEL
0.55	1.1	CONCRETE
1.1	1.15	Brown SAND
		Note: Trench backfilled with leanmix concrete and covered with 300mm of topsoil

Photograph



Trench Dimensions

LHS of Trench (m)	0.0
RHS of Trench (m)	1.3
Trench Depth (m)	1.3
Trench Width (m)	0.4



Excavation Quantities

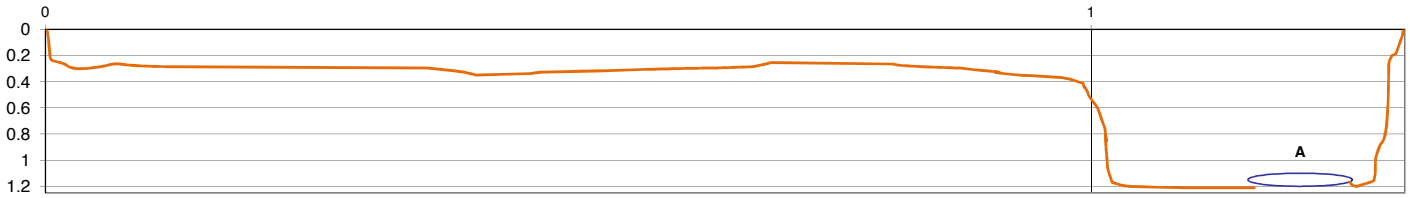
Surface	Length (m)	Material
Road		
Path (LHS)		
Path (RHS)		
Grass Verge (LHS)	1.3	
Grass Verge (RHS)		
Other		
Total Length	1.3	

Facing Direction	West
Facing Features	T2 multi storey car park entrance
Groundwater	DRY

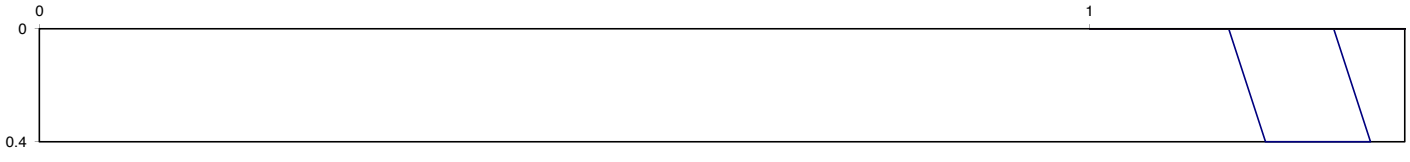
SAMPLES

Zero Metres Taken As: Left hand side of trench

X-Section



Plan



	Diameter (mm)	Material	Description	Distance (m)	Depth to crown (m)	Angle (deg.)
Service A	100	Cast iron	Black cast iron water main	1.2	1.1	95
Service B						
Service C						
Service D						
Service E						
Service F						
Service G						
Service H						
Service I						
Service J						
Service K						
Service L						
Service M						

Appendix 7

Groundwater Monitoring Records

Project No.	18609	**GROUNDWATER MONITORING DATA SHEET**	*IGSL Ltd*

Project: Dublin Airport Multistorey Offices & Car Parks

Engineer: PM Group

Exploratory Hole No.	Hole Depth (m bgl)	Response Zone Top (m bgl)	Response Zone Base (m bgl)	Groundwater End of drilling (m bgl)	Groundwater Level (m bgl) (4.9.15)	Groundwater Level (m bgl) (14.9.15)	Comments
RC 1	17.90	2.50	14.50	12.80 24/08/15	3.50	3.26	24/08 values observed by driller
RC 5	13.70	2.00	12.50	9.50 27/08/15	2.59	2.49	27/08 values observed by driller
RC 7	10.50	1.00	10.50	7.70 01/09/15	2.10	2.06	01/09 values observed by driller

Remarks: Water levels measured using electric dipmeter

Appendix 8

Geophysical Survey Report

DAC Dublin Airport

County Dublin

Geophysical Survey

Report Status: Final

MGX Project Number:5976

MGX File Ref: 5976f-005.doc

16th September 2015

Confidential Report To:

I.G.S.L.
Unit F
M7 Business Park
Naas
Co. Kildare

Report submitted by :
Minerex Geophysics Limited

Unit F4, Maynooth Business Campus
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Issued by:

Ruth Jackson (Senior Geophysicist)

Hartmut Krahn (Senior Geophysicist)

Minerex
Geophysics Limited

Subsurface Geophysical Investigations

EXECUTIVE SUMMARY

1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of 2D-Resistivity and seismic refraction (p-wave) surveying for the ground investigation for a proposed development at Dublin Airport.
2. The main objectives of the survey were to determine the ground conditions, estimate the depth to rock and overburden thickness and to check for lateral change in the layers.
3. The ground has been modelled by four seismic layers ranging from soft or loose topsoil to strong rock.
4. The ground level is relatively flat with elevations between 64 and 66 mOD and the levels of strong rock interpreted from the seismics range between 51 and 59 mOD.
5. The rock is relatively flat under the car park with levels between 55 and 59 mOD. In the northern part of the survey area the strong rock is deeper with levels of 54 mOD on R2 and 51m on R10.
6. The logs of core holes have been used in the final report and the depth to rock was adjusted by approximately 1 m downwards in the final models.

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1.2 Objectives 1
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List of Tables, Maps and Figures:

Title	Pages	Document Reference
Table 1: Data Acquisition Parameters for Geophysical Profiles	In text	In text
Table 2: Summary of Results and Interpretation	In text	In text
Map 1: Geophysical Survey Location Map	1 x A3	5976f_MapsFigs.dwg
Figure 1a: Models of Geophysical Survey	1 x A3	5976f_MapsFigs.dwg
Figure 1b: Models of Geophysical Survey	1 x A3	5976f_MapsFigs.dwg
Figure 2a: Interpretation of Geophysical Survey	1 x A3	5976f_MapsFigs.dwg
Figure 2b: Interpretation of Geophysical Survey	1 x A3	5976f_MapsFigs.dwg

1. INTRODUCTION

1.1 Background

Minerex Geophysics Ltd. (MGX) carried out a geophysical survey for the DAC Dublin Airport project. The survey consisted of 2D-Resistivity and seismic refraction (p-wave) measurements. The survey was commissioned by I.G.S.L.

The survey employed various geophysical methods that complement each other and improve the interpretation. The role of geophysics as a non-destructive fast method is to allow later targeted direct investigations. Those results can be used to improve the initial results and interpretation.

The proposed development are new buildings in an existing car park.

1.2 Objectives

The main objectives of the geophysical survey were:

- To determine the ground conditions under the site
- To determine the depth to rock and overburden thickness
- To estimate the strength/stiffness/compaction of overburden materials and the quality of rock
- To determine the type of overburden and rock
- To detect lateral changes within the geological layers

1.3 Site Description

The site is located at the former Aer Lingus Headquarters in a car park that is currently used as the overflow car park for Terminal 2. The car park is an Asphalt Concrete surface and is surrounded on three sides by a green strip of grass and plants. The ground level varies between 64 and 66 mOD.

1.4 Geology

The bedrock geological map of Meath (GSI, 1999) indicates that the survey area is underlain by Carboniferous lithologies. The Waulsortian limestones are described as massive unbedded fine grained limestone. Immediately to the East is the Tober Colleen formation, described as calcareous shale and limestone conglomerate. A southwest – northeast striking fault is shown near the site (GSI, 1999).

1.5 Report

This report includes the results and interpretation of the geophysical survey. Maps, figures and tables are included to illustrate the results of the survey. More detailed descriptions of geophysical methods and measurements can be found in GSEG (2002), Milsom (1989) and Reynolds (1997).

The client provided maps of the site and the digital version was used as the background map in this report. Elevations were surveyed on site and are used in the vertical sections.

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Minerex Geophysics Limited, while using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface.

2. GEOPHYSICAL SURVEY

2.1 Methodology

The methodology consisted of using 2D-Resistivity (R1 – R3) and Seismic Refraction Profiles (S1 – S10).

The survey locations are indicated on Map 1. The profiles, locations and parameters are tabulated in Table 1.

The site has some constraints and initially proposed EM31 survey could not be done due to the presence of cars and other metal objects. The hardstanding tarmac surfaces make the processing of the seismic data in terms of the depth to rock less accurate. Underground metal pipes can influence the resistivity readings (as happened on R1).

All geophysical surveys are acquired, processed and reported in accordance with British Standards BS 5930:1999 +A2:2010 'Code of Practice for Site Investigations'.

Table 1: Data Acquisition Parameters for Geophysical Profiles

Profile Name	**Electrode/Geophone Spacing/m**	**Number of Electrodes/Geophones**	**Profile Length/m**
R1	3	51	150
R2	3	32	93
R3	3	53	156
S1 to S10	2	24	46

2.2 2D-Resistivity

2D-Resistivity profiles were surveyed with electrode spacing of 3m, up to 53 electrodes per set-up and a maximum length of 156m per profile. The readings were taken with a Tigre Resistivity Meter, Imager Cables, stainless steel electrodes, laptop and ImagerPro acquisition software.

During 2D-Resistivity surveying data is acquired in the form of linear profiles using a suite of metal electrodes. A current is injected into the ground via a pair of electrodes while a potential difference is measured across a second pair of electrodes. This allows for the recording of the apparent resistivity in a two-dimensional arrangement below the profile. The data is inverted after the survey to obtain a model of subsurface resistivities. The generated model resistivity values and their spatial distribution can then be related to typical values for different geological materials.

The penetration depth of a resistivity profile increases towards the centre where it reaches an approx. value of 1/6th of the layout length.

The presence of metal underground services like water or gas pipes may influence the results of the survey. At R1 the readings are so small that there must be a metal pipe along the profile and therefore R1 is not considered in the interpretation.

2D-Resistivity has proven zones of anomalous rock with lateral extents of 5 m and more.

2.3 Seismic Refraction

The seismic survey consisted of p-wave seismic refraction profiling at the locations shown on Map 1. Each of the profiles consisted of 24 geophones with 2 m spacing, resulting in lengths of 46m per profile. The recording equipment consisted of a 24 Channel GEOMETRICS ES-3000 engineering seismograph with 4.5 Hz vertical geophones. The seismic energy source consisted of a hammer and plate. A zero delay trigger was used to start the recording. Generally seven shot points per p-wave profile were used.

In the seismic refraction survey method a p-wave is generated by a source at the surface resulting in energy travelling through surface layers directly and along boundaries between layers of differing seismic wave velocities. Processing of the seismic data allows geological layer thicknesses and boundaries to be established.

Seismic Refraction generally determines the depth to horizontal or near horizontal layers where the compaction/strength/rock quality changes with an accuracy of 10 – 20% of depth to that layer. Where low velocity layers (under tarmac) or shadow zones are present or where layers dip with more than 20 degrees angle the accuracy becomes much less.

In areas with thick concrete or tarmac a low velocity layer exists for the seismic waves below the hard surface layer. This makes it less certain or impossible to pick first breaks from geophones near the source and therefore no velocity determination for the shallow subsurface is possible. This results in larger deviations in the modelling and borehole results are required for a final calibration of the results. During the survey hard standing surfaces were avoided as much as possible but in some locations the survey had to be placed on the car park (S5 – S8). Some portions of other profiles on grass but near kerbs also show some hard layers under the grass.

2.4 Site Work

The data acquisition was carried out on the 29th of July 2015. The weather conditions were good throughout the acquisition period. Health and safety standards were adhered to at all times. While working on the car park the area was clearly highlighted by the use of warning signs and cones.

The locations and elevations were surveyed with a TRIMBLE RTK-GPS to accuracy < 0.02m.

3. RESULTS AND INTERPRETATION

The interpretation of geophysical data was carried out utilising the known response of geophysical measurements, typical physical parameters for subsurface features that may underlay the site, and the experience of the authors.

3.1 2D-Resistivity Profiles

The 2D-Resistivity data was positioned and inverted with the RES2DINV inversion package. The programme uses a smoothness constrained least-squares inversion method to produce a 2D model of the subsurface model resistivities from the recorded apparent resistivity values. Three variations of the least squares method are available and for this project the Jacobian Matrix was recalculated for the first three iterations, then a Quasi-Newton approximation was used for subsequent iterations. Each dataset was inverted using seven iterations resulting in a typical RMS error of < 4.0%. The resulting models were colour contoured with the same resistivity scale for all profiles and they are displayed as cross sections (Figure 1a).

The resistivity readings along R1 (low values < 40 Ohmm) are disturbed by an underground metal pipe and are therefore not considered in the interpretation.

The resistivities on R2 and R3 cover a range typical for materials from boulder clay to bedrock. Medium values (40 – 160 Ohmm, green colours) are typical for gravelly clay and broken rock. A general overburden layer 5 – 7m thick is indicated along R2 and R3. High values (> 160 Ohmm, blue colours) indicate rock and the values suggest a shaly or argillaceous limestone.

At both ends of profiles R3 the medium values at depths larger than 5 – 7 m indicate that the rock may be anomalous and core holes are proposed here to test the rock.

3.2 Seismic Refraction Data

The seismic refraction data was positioned and processed with the SEISIMAGER software package to give a layered model of the subsurface. The numbers of layers has been determined by analysing the seismic traces and 4 layers were used in the models. All seismic profiles were subject to a standardised processing sequence which consisted of a topographic correction which was based on integrated elevation data, first break picking, tomographic inversion, travel-time computation via ray-tracing and velocity modelling. Residual deviations of typically 0.8 to 1.9 msec RMS have been obtained for each profile. Following each processing stage QC procedures were adhered to. The resulting layer boundaries are shown as thick lines overlaid on the cross sections (Figures 1a and 1b). The average seismic velocities obtained within the layers are annotated on the sections as bold black numbers.

Layer 1 has a thickness of 0.5 – 2.0 m and seismic velocities of 250 - 300 m/s. This overburden would be soft or loose topsoil on grass surfaces. On tarmac surfaces this layer is either tarmac or subgrade.

Layer 2 was modelled with a velocity range of 900 – 1300 m/s and reaches a depth between 1.5 and 5 m. The velocity indicates overburden material with firm to stiff or dense stiffness/compaction.

Layer 3 velocities of 1900 – 2300 m/s indicate predominantly overburden with very stiff to hard boulder clay. There can be some broken rock or gravel derived from weathering of rock at the base of this layer. The direct ground investigation has confirmed the high stiffness and compaction of this layer.

Layer 4 velocities of 3500 – 4000 m/s indicate a strong rock with good to very good rock quality.

3.3 Interpretation of Resistivity and Seismic Refraction

Table 2 summarises the interpretation. The stiffness/compaction and the rock strength/quality have been estimated from the seismic velocity. The estimation of the excavatability for the bedrock has been made according to the caterpillar chart published in Reynolds (1997). The geotechnical assessment for rippability will have to take factors like rock type and jointing into account and the estimation in this report is solely based on the seismic velocities. The proposed works may not require the excavation of rock though the assessment for rippability gives a good indication about the strength of the rock.

Interpreted cross sections are shown in Figures 2a and 2b. The interpretation has been made from all available information. For overburden layers and the top of the rock the seismic refraction data has been used as seismic refraction is the best method to delineate layer boundaries. The resistivity models have been used to delineate possible anomalous rock. Resistivity data is better suited to show rock types and features within the rock while seismic refraction velocities are indicating the change of compaction/stiffness/rock quality with depth.

Table 2: Summary of Results and Interpretation

Layer	**General Seismic Velocity Range (m/sec)**	**General Resistivity Range (Ohmm)**	**Stiffness/ Compaction or Rock Strength/ Quality**	**Interpretation**	**Estimated Excavation Method**
1	250 – 300	40 - 160	Soft or loose	Topsoil or Tarmac/Subgrade	Diggable
2	900 – 1300	40 – 160	Firm to stiff or dense	Overburden	Diggable
3	1900 – 2300	40 – 160	Very stiff to hard	Boulder Clay	Diggable
4	3500 – 4000	>160	Good to very good Rock	Strong Rock – Limestone (Shaley or argillaceous)	Breaking & Blasting
5	3500 – 4000	<160	Good Rock	Anomalous Rock	Breaking & Blasting

Abbreviated borehole logs are drawn on the sections where a green vertical bar indicates overburden and a black bar indicates rock. The rock was shown in the boreholes about 1 m lower on average than in the seismic model therefore the rock level was adjusted by 1 m downward in the final models.

3.4 Rock Elevation

The ground level is relatively flat with elevations between 63 and 65 mOD. The levels of strong rock interpreted from the seismic varies between 51 and 59 mOD.

Under most of the car park they vary between 55 and 59 mOD. Only in the northern part the strong rock is deeper with levels of 54 mOD on R2 and 51m on R10. It looks like the rock dips deeper on the northern part of the site.

Under the centre of the car park the strong rock is indicated at elevation from 55 – 58 mOD, around profiles S5-S8. These are located on tarmac that makes the interpretation less accurate.

Corehole locations were proposed after the draft report and this final report has been after receiving the logs.

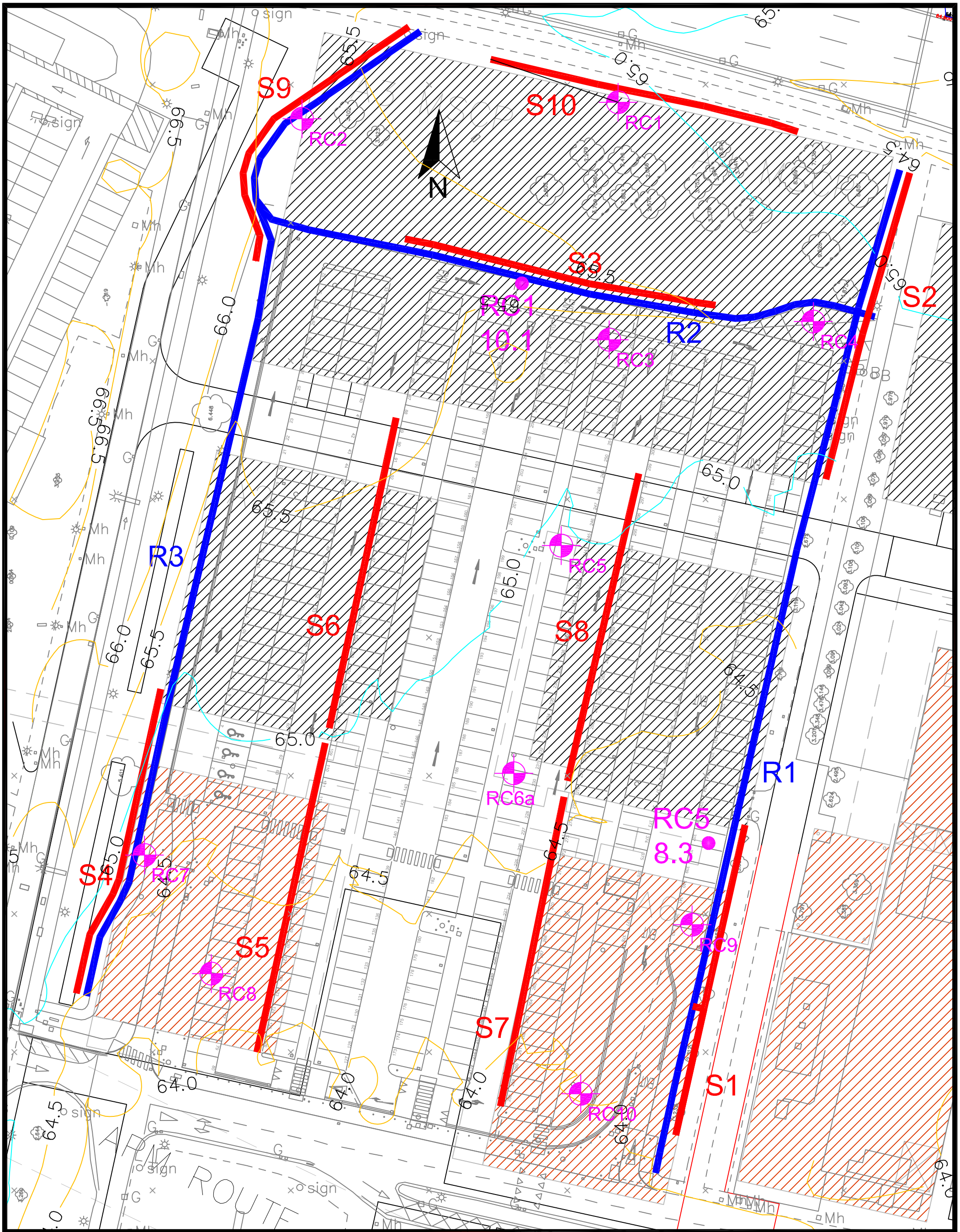
4. REFERENCES

1. **GSEG 2002.** Geophysics in Engineering Investigations. Geological Society Engineering Geology Special Publication 19, London, 2002.

2. **GSI, 1999.** Geology of Meath. Geological Survey of Ireland 1999.

3. **Milsom, 1989.** Field Geophysics. John Wiley and Sons.

4. **Reynolds, 1997.** An Introduction to Applied and Environmental Geophysics. John Wiley and Son.



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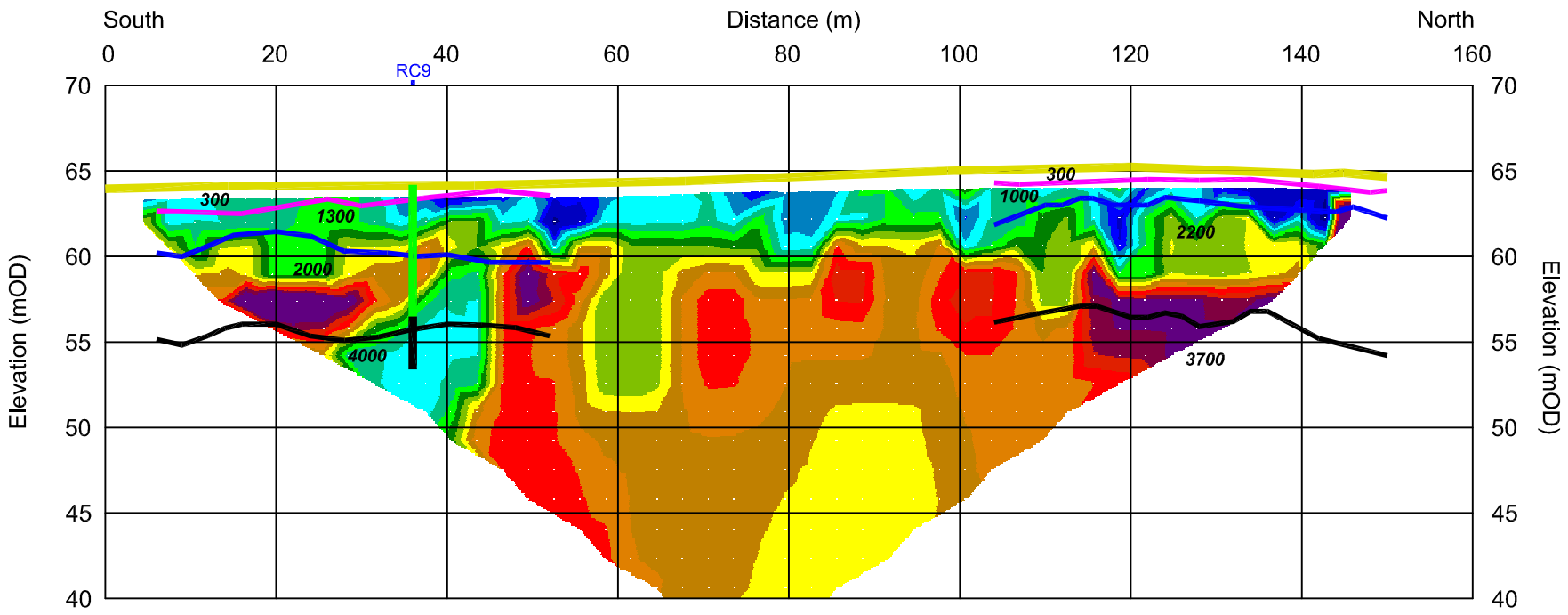
CLIENT	I.G.S.L. PM Group / DAA PLC
PROJECT	DAC Geophysical Survey
TITLE	Map 1: Geophysical Survey Location Map

SCALE:	1:500 @ A3
PROJECT:	5976
DRAWN:	HK
DATE:	04/08/2015
MGX FILE:	5976f_MapsFigs.dwg
STATUS:	Final

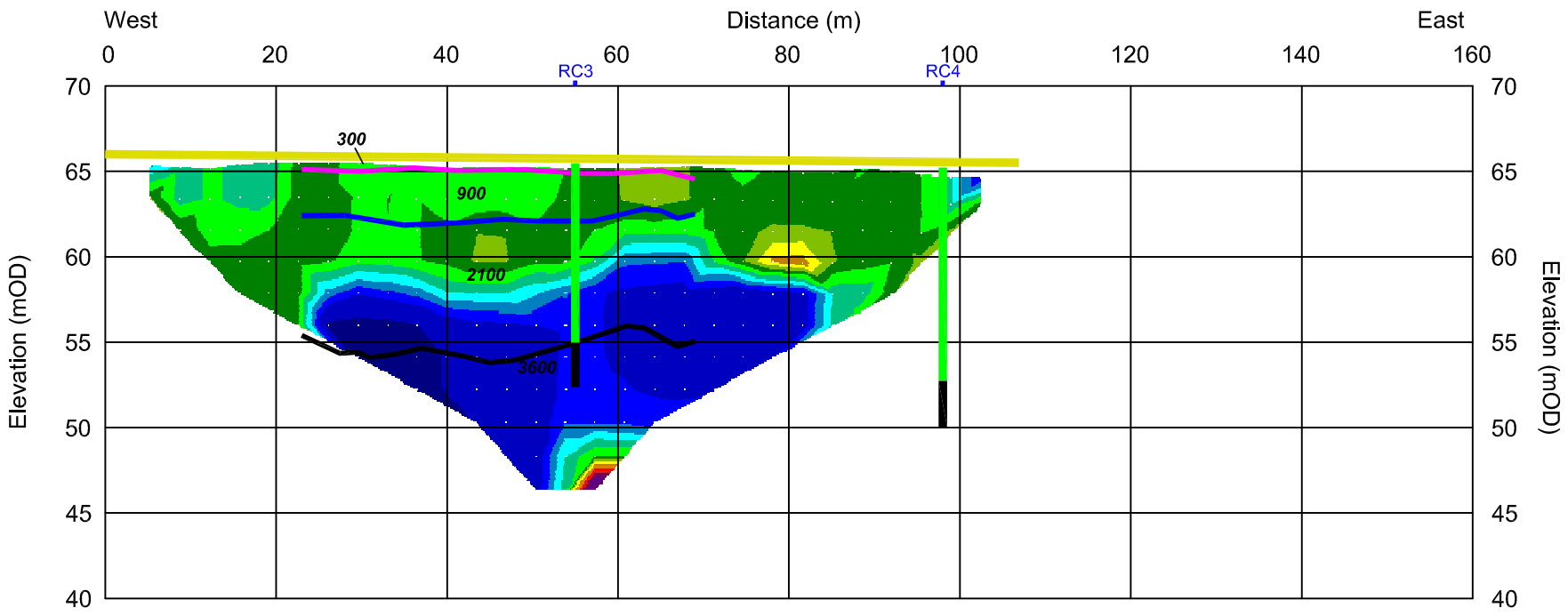
LEGEND:

- Seismic Refraction Profile
- 2D-Resistivity Profile
- RC10 — Rotary Core Hole Location

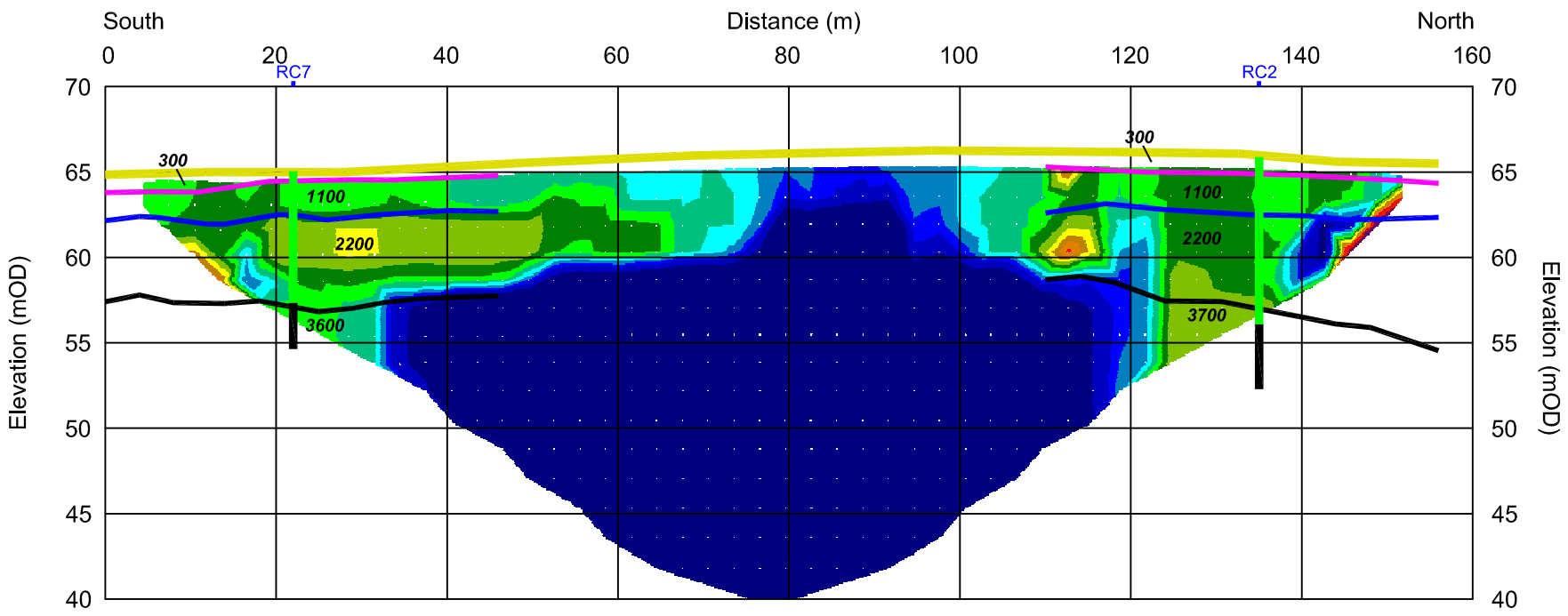
2D-Resistivity Profile R1 and Seismic Refraction Profile S1, S2 Model



2D-Resistivity Profile R2 and Seismic Refraction Profile S3 Model



2D-Resistivity Profile R3 and Seismic Refraction Profile S4, S9 Model



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CLIENT	I.G.S.L. PM Group / DAA PLC
PROJECT	DAC Geophysical Survey
TITLE	Figure 1a: Models of Geophysical Survey

SCALE:	NTS @ A3, VE x 2
PROJECT:	5976
DRAWN:	HK
DATE:	04/08/2015
MGX FILE:	5976f_MapsFigs.dwg
STATUS:	Final

LEGEND:

2200 Seismic Velocity in m/s

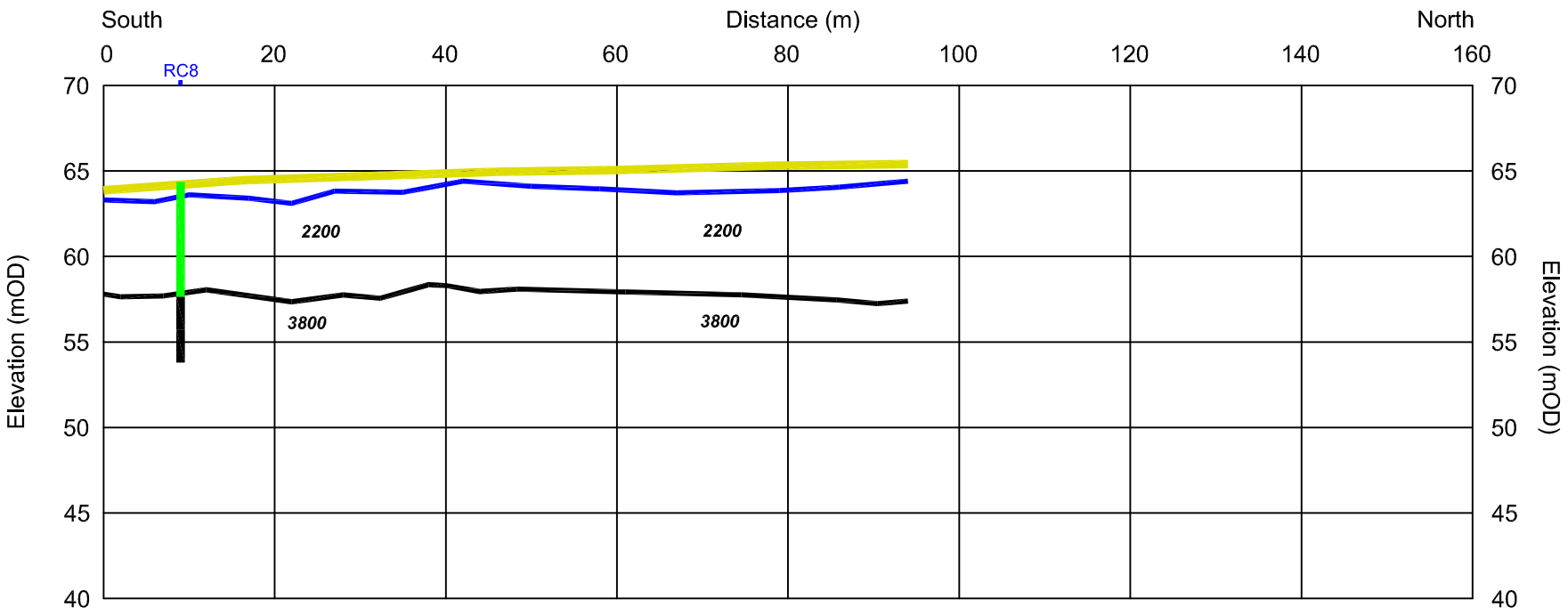
Layers from Seismic Refraction Model:

- Ground Surface/Top of Layer 1 (250 - 300 m/s)
- Top of Layer 2 (900 - 1300 m/s)
- Top of Layer 3 (1900 - 2300 m/s)
- Top of Layer 4 (3500 - 4000 m/s)

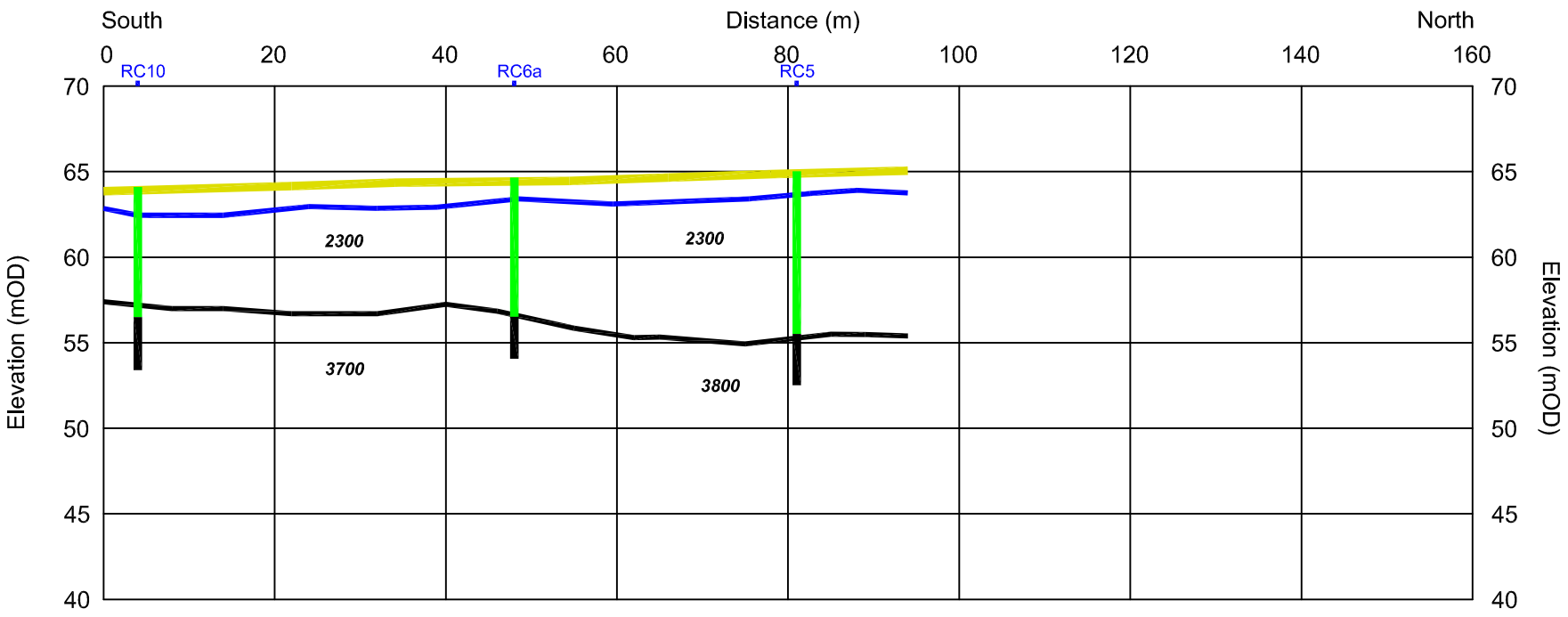
Resistivities (Ohmm) for 2D-Resistivity Model

10.0 15.9 25.2 40.0 63.5 101 160 254

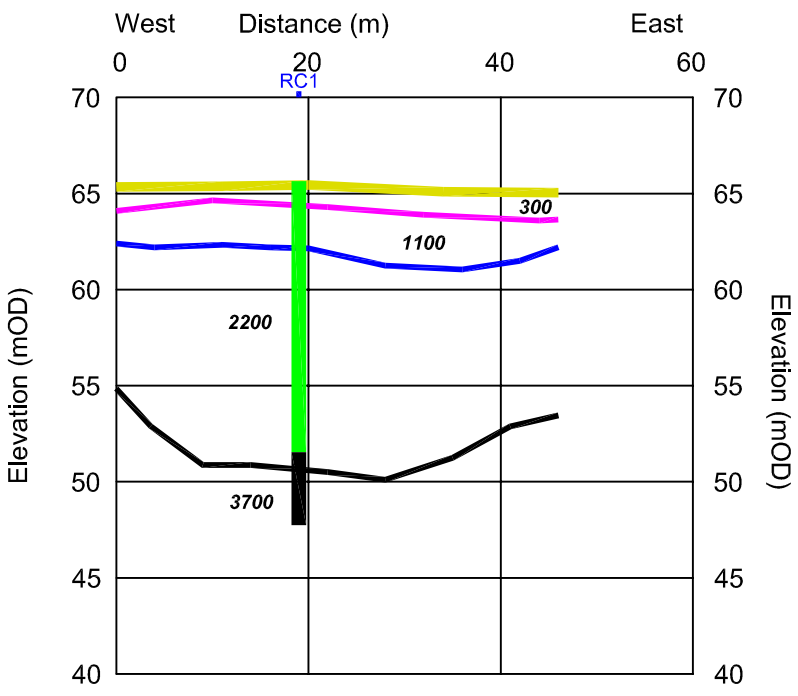
Seismic Refraction Profile S5, S6 Model



Seismic Refraction Profile S7, S8 Model



Seismic Refraction Profile S10 Model



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Web: www.mgx.ie

CLIENT	I.G.S.L. PM Group / DAA PLC
PROJECT	DAC Geophysical Survey
TITLE	Figure 1b: Models of Geophysical Survey

SCALE:	NTS @ A3, VE x 2
PROJECT:	5976
DRAWN:	HK
DATE:	04/08/2015
MGX FILE:	5976f_MapsFigs.dwg
STATUS:	Final

LEGEND:

2200 Seismic Velocity in m/s

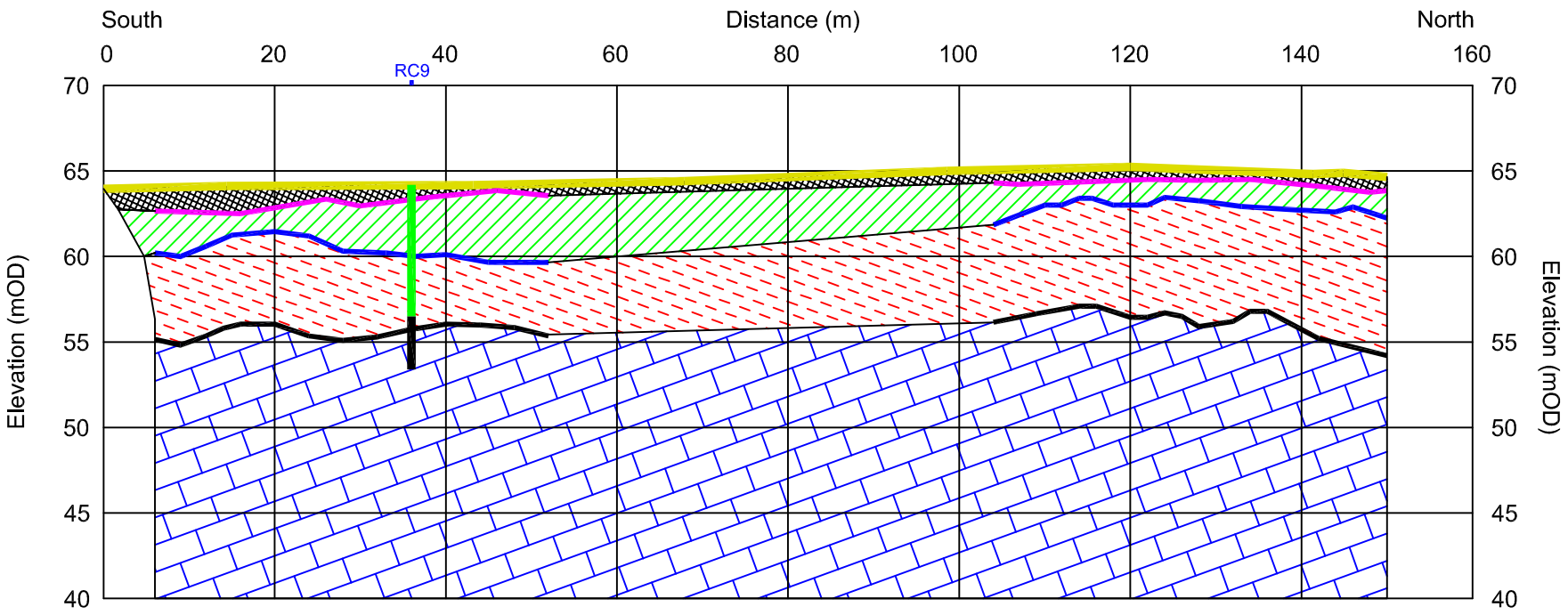
Layers from Seismic Refraction Model:

- Ground Surface/Top of Layer 1 (250 - 300 m/s)
- Top of Layer 2 (900 - 1300 m/s)
- Top of Layer 3 (1900 - 2300 m/s)
- Top of Layer 4 (3500 - 4000 m/s)

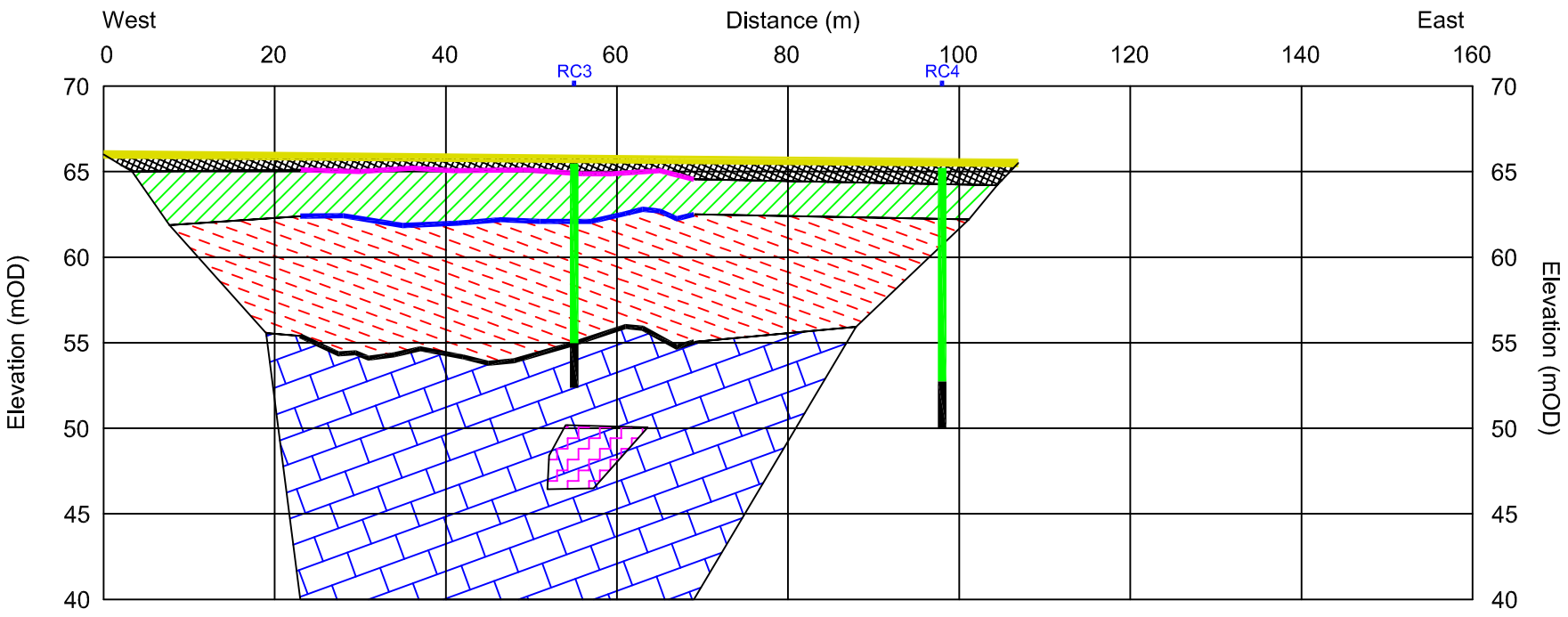
Resistivities (Ohmm) for 2D-Resistivity Model

10.0 15.9 25.2 40.0 63.5 101 160 254

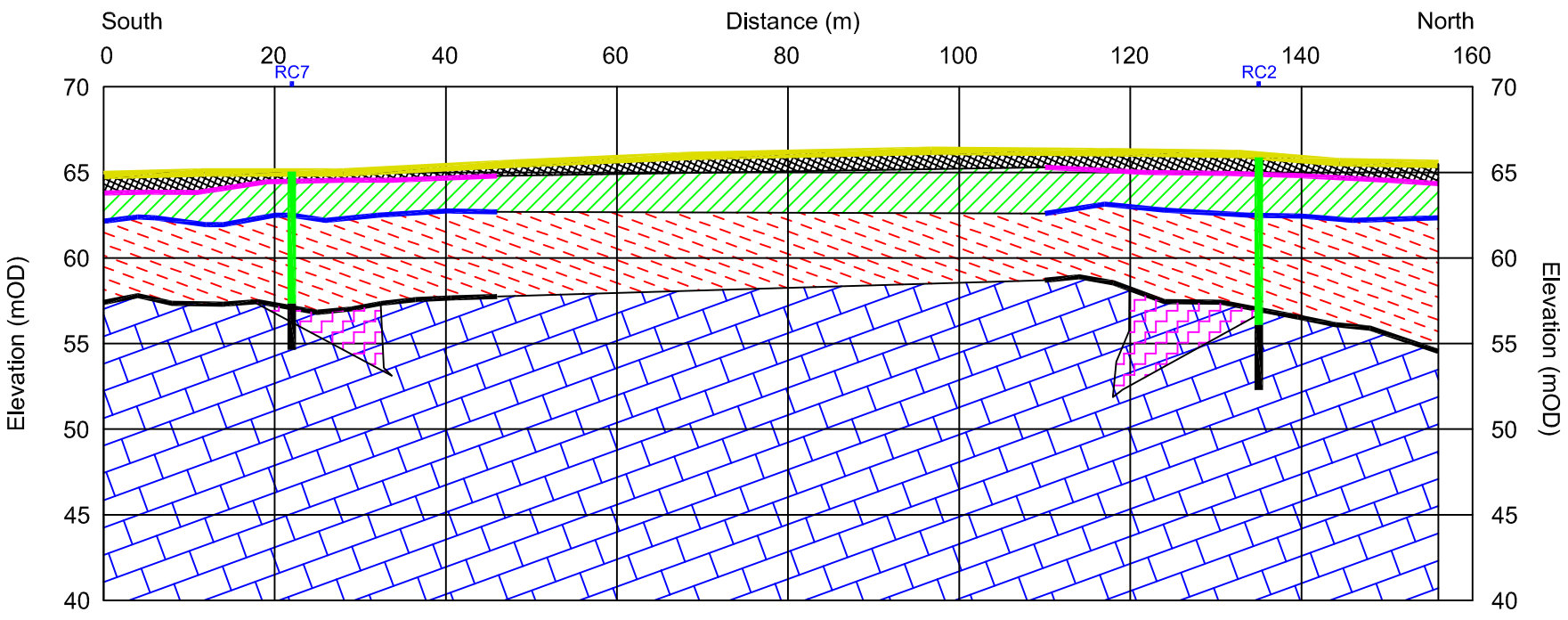
2D-Resistivity Profile R1 and Seismic Refraction Profile S1, S2 Interpretation



2D-Resistivity Profile R2 and Seismic Refraction Profile S3 Interpretation



2D-Resistivity Profile R3 and Seismic Refraction Profile S4, S9 Interpretation



Minerex
Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Fax. (01) 6510033
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	I.G.S.L. PM Group / DAA PLC
PROJECT	DAC Geophysical Survey
TITLE	Figure 2a: Interpretation of Geophysical Survey

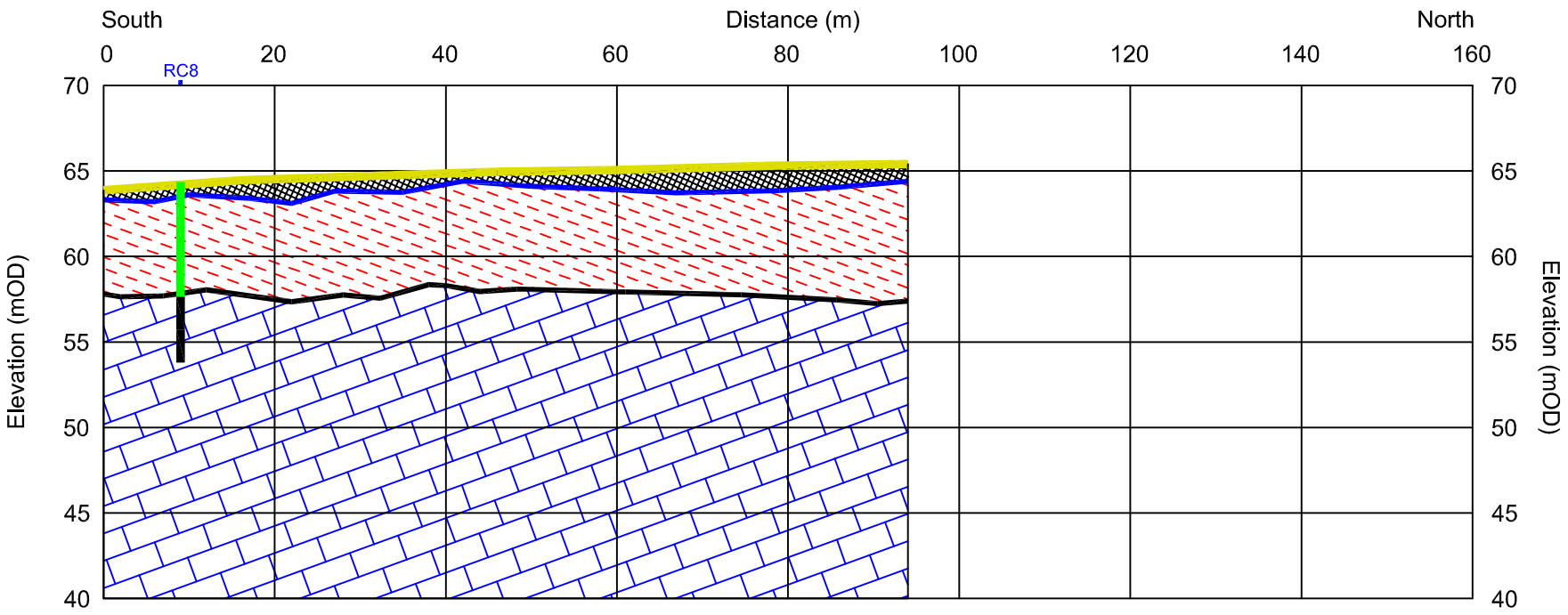
SCALE:	NTS @ A3, VE x 2
PROJECT:	5976
DRAWN:	HK
DATE:	04/08/2015
MGX FILE:	5976f_MapsFigs.dwg
STATUS:	Final

LEGEND:

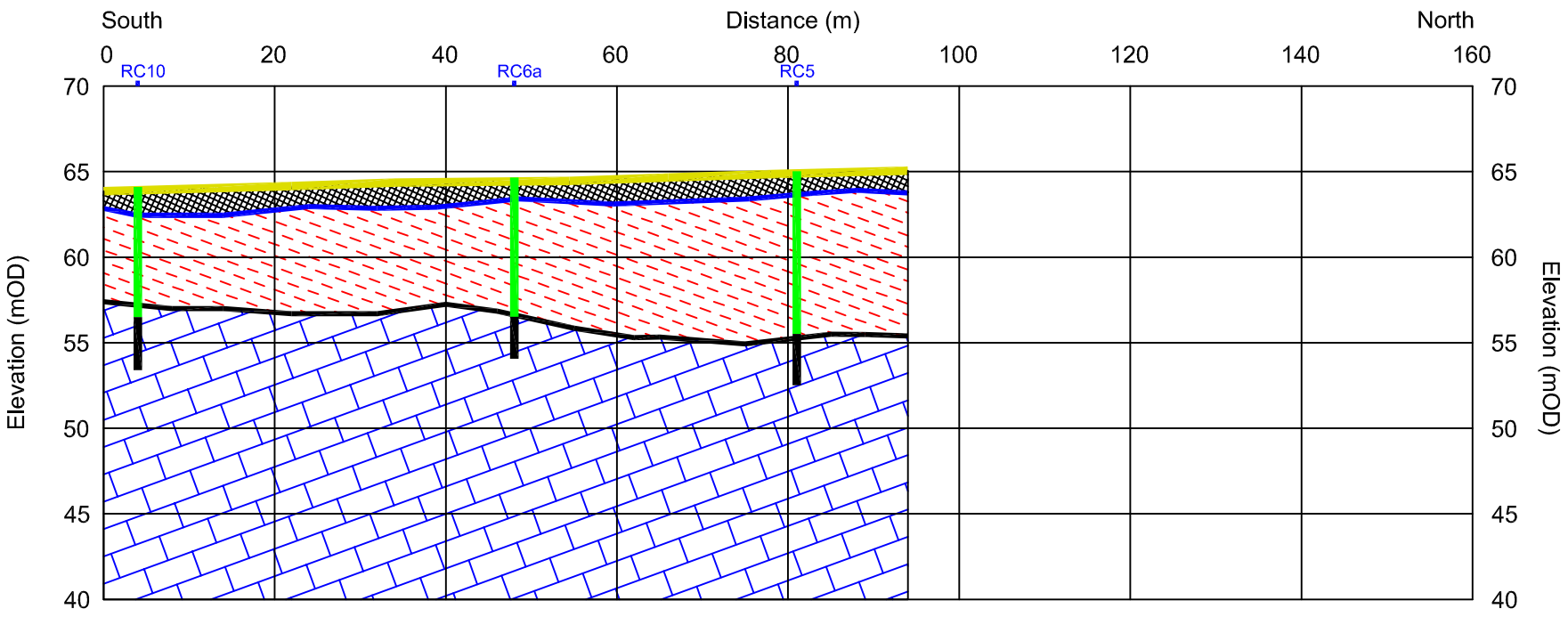
Interpretation:

1 Soft/loose Topsoil or Tarmac/Subgrade
2 Firm to stiff or dense Overburden
3 Very stiff to hard Boulder Clay
4 Strong Rock - Limestone
5 Anomalous Rock - Limestone

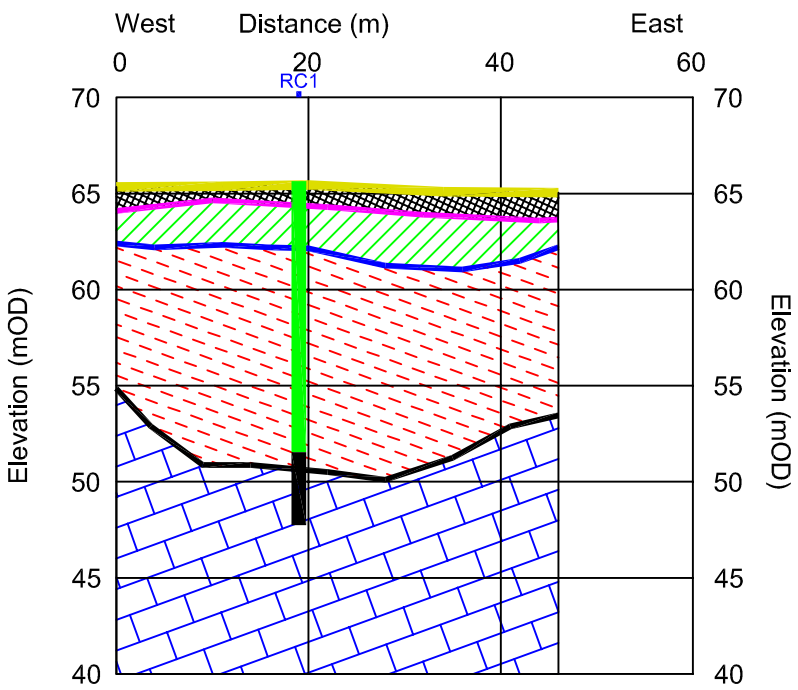
Seismic Refraction Profile S5, S6 Interpretation



Seismic Refraction Profile S7, S8 Interpretation



Seismic Refraction Profile S10 Interpretation



Minerex
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Tel. (01) 6510030
Fax. (01) 6510033
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	I.G.S.L. PM Group / DAA PLC
PROJECT	DAC Geophysical Survey
TITLE	Figure 2b: Interpretation of Geophysical Survey

SCALE:	NTS @ A3, VE x 2
PROJECT:	5976
DRAWN:	HK
DATE:	04/08/2015
MGX FILE:	5976f_MapsFigs.dwg
STATUS:	Final

LEGEND:

Interpretation:

1 Soft/loose Topsoil or Tarmac/Subgrade
2 Firm to stiff or dense Overburden
3 Very stiff to hard Boulder Clay
4 Strong Rock - Limestone
5 Anomalous Rock - Limestone

Appendix 9

Geotechnical Laboratory Test Records

IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 1331

Report No. **R67275** Contract No. 18609 Contract Name: Dublin Airport Office Development

Customer DAA/PM Group

Samples Received: 26/08/15 Date Tested: 27/08/15

BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425μm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
TP01	AA37862	1.3	A15/4861	B	10	31	17	14	52	WS	4.4	C L	Brown slightly sandy, gravelly, CLAY
TP02	AA37851	1.5	A14/4862	B	7.6	30	15	15	48	WS	4.4	C L	Dark brown slightly sandy, slightly gravelly, CLAY with some cobbles
TP03	AA37858	2.2	A15/4864	B	9	33	15	18	55	WS	4.4	C L	Dark brown/grey slightly sandy, slightly gravelly, CLAY with many cobbles
TP04	AA37860	1.4	A15/4866	B	9	33	16	17	58	WS	4.4	C L	Brown slightly sandy, gravelly, CLAY with some cobbles
TP05	AA37854	1.5	A15/4868	B	9.6	32	15	17	48	WS	4.4	C L	Mottled brown/grey slightly sandy, slightly gravelly, CLAY with some cobbles
WS01	N/A	2.00-3.40	A15/4869	B	10	29	14	15	50	WS	4.4	C L	Dark brown sandy gravelly CLAY
WS02	N/A	0.00-1.20	A15/4870	B	9.3	32	18	14	54	WS	4.4	C L	Brown sandy gravelly CLAY
WS04	N/A	1.20-2.70	A15/4871	B	8.5	28	14	14	55	WS	4.4	C L	Dark brown sandy gravelly CLAY
WS06	N/A	0.00-2.40	A15/4872	B	10	34	18	16	58	WS	4.4	C L	Brown sandy gravelly CLAY
WS10	N/A	1.20-3.00	A15/4873	B	11	49	15	44	62	WS	4.4	C I	Mottled brown sandy gravelly CLAY

Notes: Preparation: WS - Wet sieved; AR - As received; NP - Non plastic
Sample Type: B - bulk disturbed; U - Undisturbed
Liquid Limit Clause: 4.3 Cone Penetrometer definitive method; 4.4 Cone Penetrometer one point method

Remarks:

NOTE: *Clause 3.2 of BS1377 is a "withdrawn" standard due to publication of ISO17892-1:2014
Opinions and interpretations are outside the scope of accreditation.
The results relate to the specimens tested. Any remaining material will be retained for one month.

IGSL Ltd Materials Laboratory

Persons authorized to approve reports

H Byrne (Quality Manager)

Approved by: H Byrne

Date: 03/09/15

TEST REPORT
Determination of Particle Size Distribution

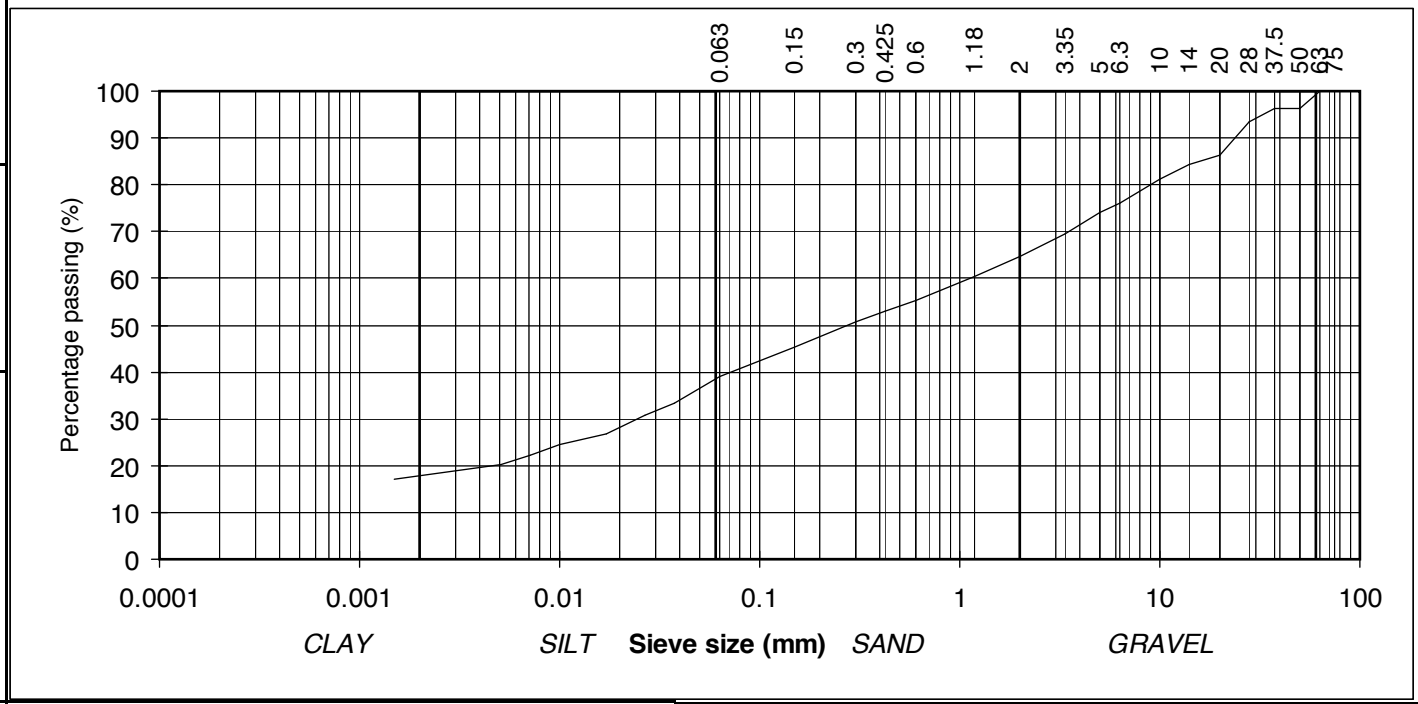
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5

(note: Sedimentation stage not accredited)

particle size	% passing	
75	100	COBBLES
63	100	
50	96	GRAVEL
37.5	96	
28	93	
20	86	
14	84	
10	81	
6.3	76	
5	74	
3.35	70	
2	65	
1.18	60	SAND
0.6	55	
0.425	53	
0.3	51	
0.15	45	
0.063	39	SILT/CLAY
0.037	33	
0.027	31	
0.017	27	
0.010	25	
0.007	22	
0.005	20	
0.001	17	

Contract No:	18609	Report No.	R67437
Contract:	Dublin Airport Office Development		
TP:	TP01		
Sample No.	AA37862	Lab. Sample No.	A15/4861
Sample Type:	B		
Depth (m)	1.30m	Customer:	DAA/PM Group
Date Received	26/08/2015	Date Testing started	27/08/2015
Description:	Brown slightly sandy, gravelly, CLAY		

Remarks



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	15/09/15	1 of 1

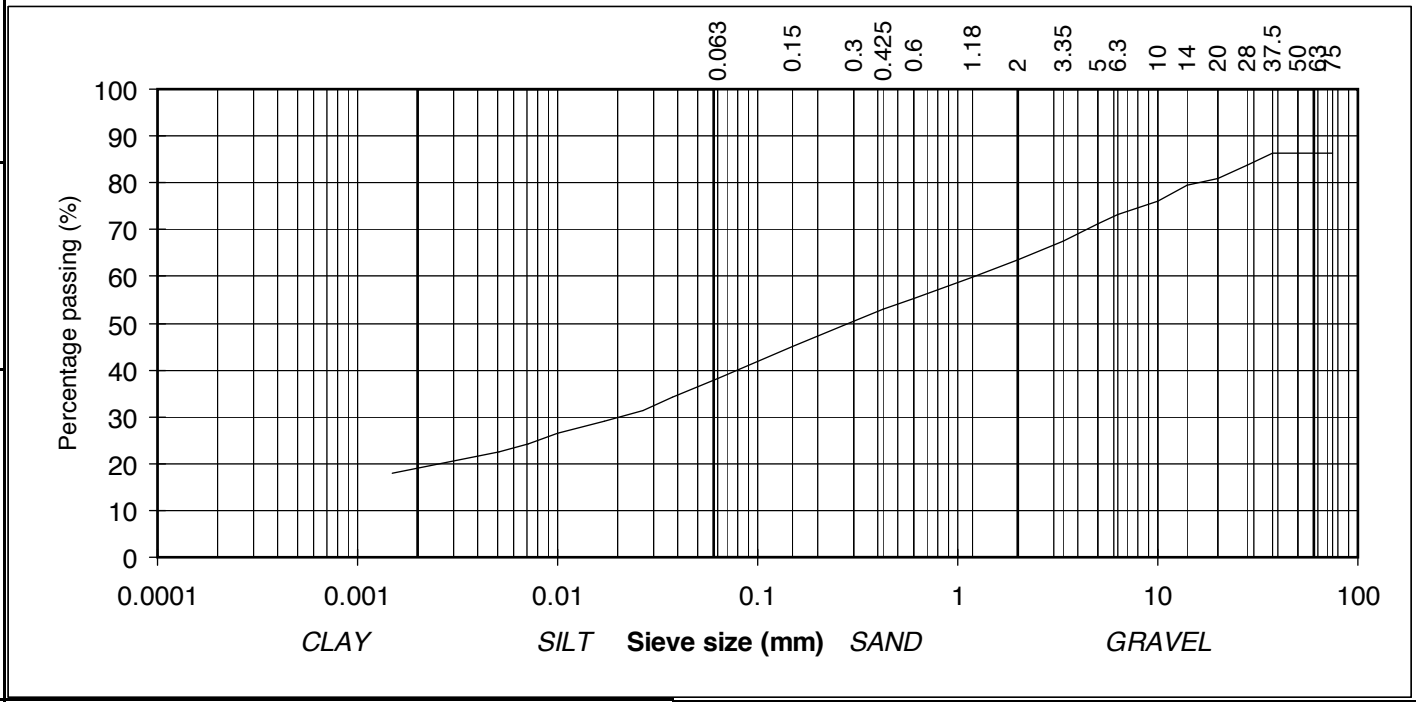
Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5
(note: Sedimentation stage not accredited)

particle size	% passing	
75	86	COBBLES
63	86	
50	86	GRAVEL
37.5	86	
28	84	
20	81	
14	79	
10	76	
6.3	73	
5	71	
3.35	68	
2	63	
1.18	60	SAND
0.6	55	
0.425	53	
0.3	51	
0.15	45	
0.063	38	SILT/CLAY
0.037	34	
0.027	31	
0.017	29	
0.010	26	
0.007	24	
0.005	22	
0.001	18	

Contract No:	18609	Report No.	R67276
Contract:	Dublin Airport Office Development		
TP:	TP02		
Sample No.	AA37851	Lab. Sample No.	A15/4862
Sample Type:	B		
Depth (m)	1.50m	Customer:	DAA/PM Group
Date Received	26/08/2015	Date Testing started	27/08/2015
Description:	Dark brown slightly sandy, slightly gravelly, CLAY with some cobbles		
Remarks	Sample size did not meet the requirements of BS1377		



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	03/09/15	1 of 1

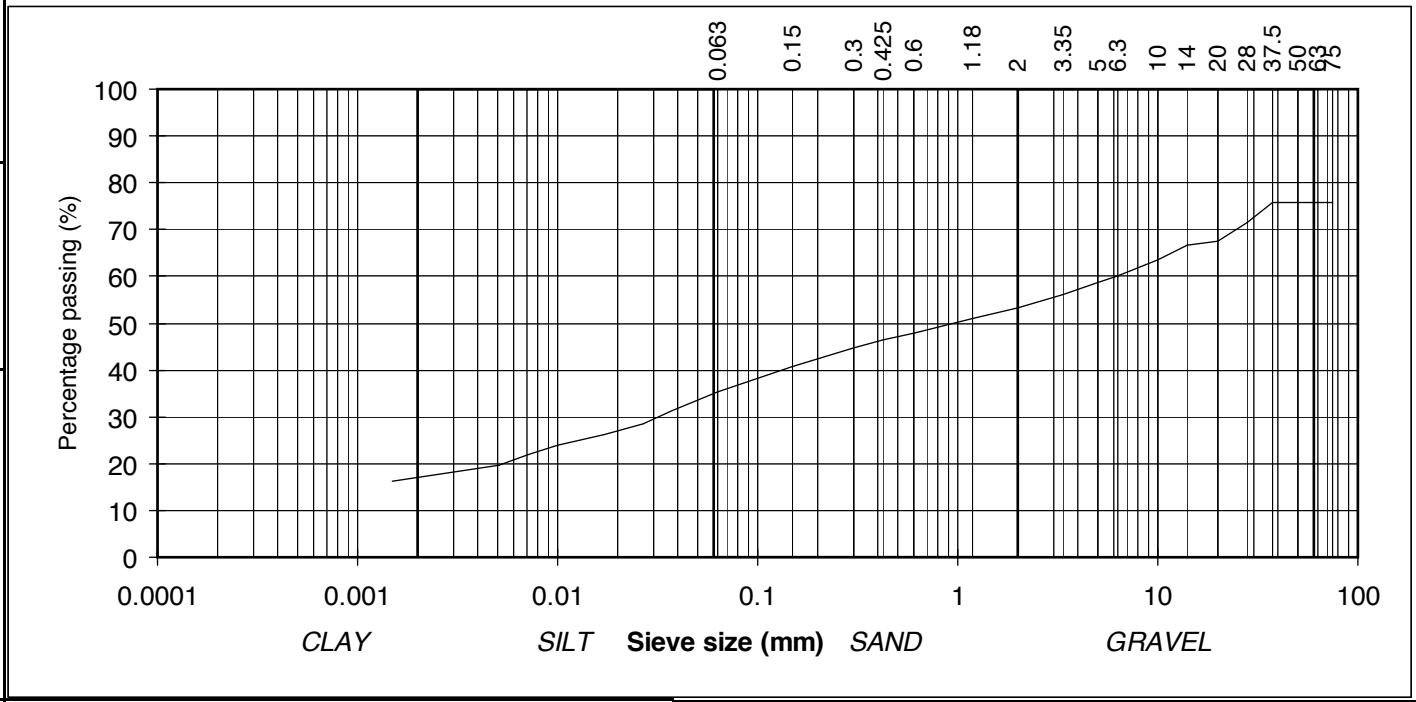
Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5
(note: Sedimentation stage not accredited)

particle size	% passing	
75	76	COBBLES
63	76	
50	76	GRAVEL
37.5	76	
28	72	
20	68	
14	67	
10	63	
6.3	60	
5	59	
3.35	56	
2	53	
1.18	51	SAND
0.6	48	
0.425	46	
0.3	45	
0.15	41	
0.063	35	SILT/CLAY
0.037	31	
0.027	29	
0.017	26	
0.010	24	
0.007	22	
0.005	20	
0.001	16	

Contract No:	18609	Report No.	R67438
Contract:	Dublin Airport Office Development		
TP:	TP03		
Sample No.	AA37858	Lab. Sample No.	A15/4864
Sample Type:	B		
2.20m	2.20m	Customer:	DAA/PM Group
Date Received	26/08/2015	Date Testing started	27/08/2015
Description:	Dark brown/grey slightly sandy, slightly gravelly, CLAY with many cobbles		
Remarks	Sample size did not meet the requirements of BS1377		



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	15/09/15	1 of 1

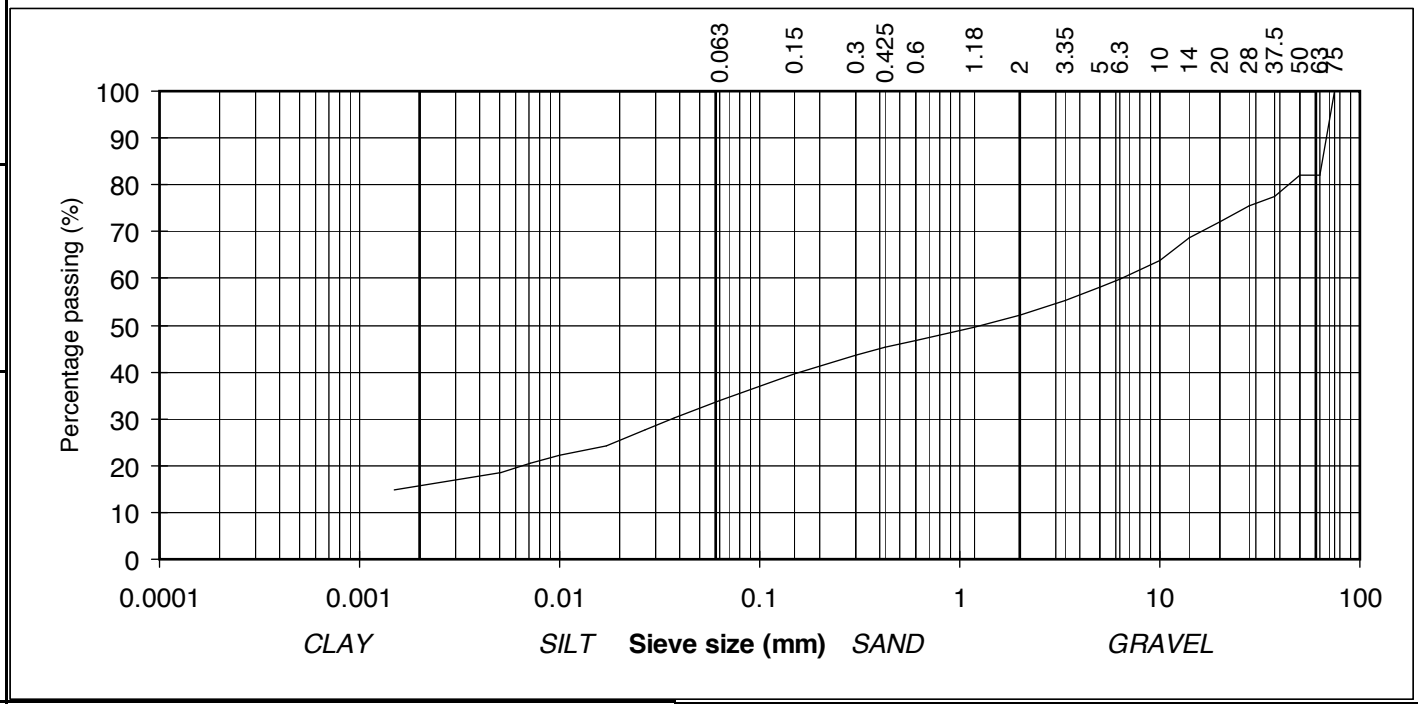
Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5
(note: Sedimentation stage not accredited)

particle size	% passing	
75	100	COBBLES
63	82	
50	82	GRAVEL
37.5	78	
28	76	
20	72	
14	69	
10	64	
6.3	60	
5	58	
3.35	55	
2	52	
1.18	50	SAND
0.6	47	
0.425	45	
0.3	44	
0.15	40	
0.063	34	SILT/CLAY
0.037	30	
0.027	28	
0.017	24	
0.010	22	
0.007	20	
0.005	19	
0.001	15	

Contract No:	18609	Report No.	R67277
Contract:	Dublin Airport Office Development		
TP:	TP04		
Sample No.	AA37860	Lab. Sample No.	A15/4866
Sample Type:	B		
Depth (m)	1.40m	Customer:	DAA/PM Group
Date Received	26/08/2015	Date Testing started	27/08/2015
Description:	Brown slightly sandy, gravelly, CLAY with some cobbles		
Remarks	Sample size did not meet the requirements of BS1377		



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	03/09/15	1 of 1

Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)

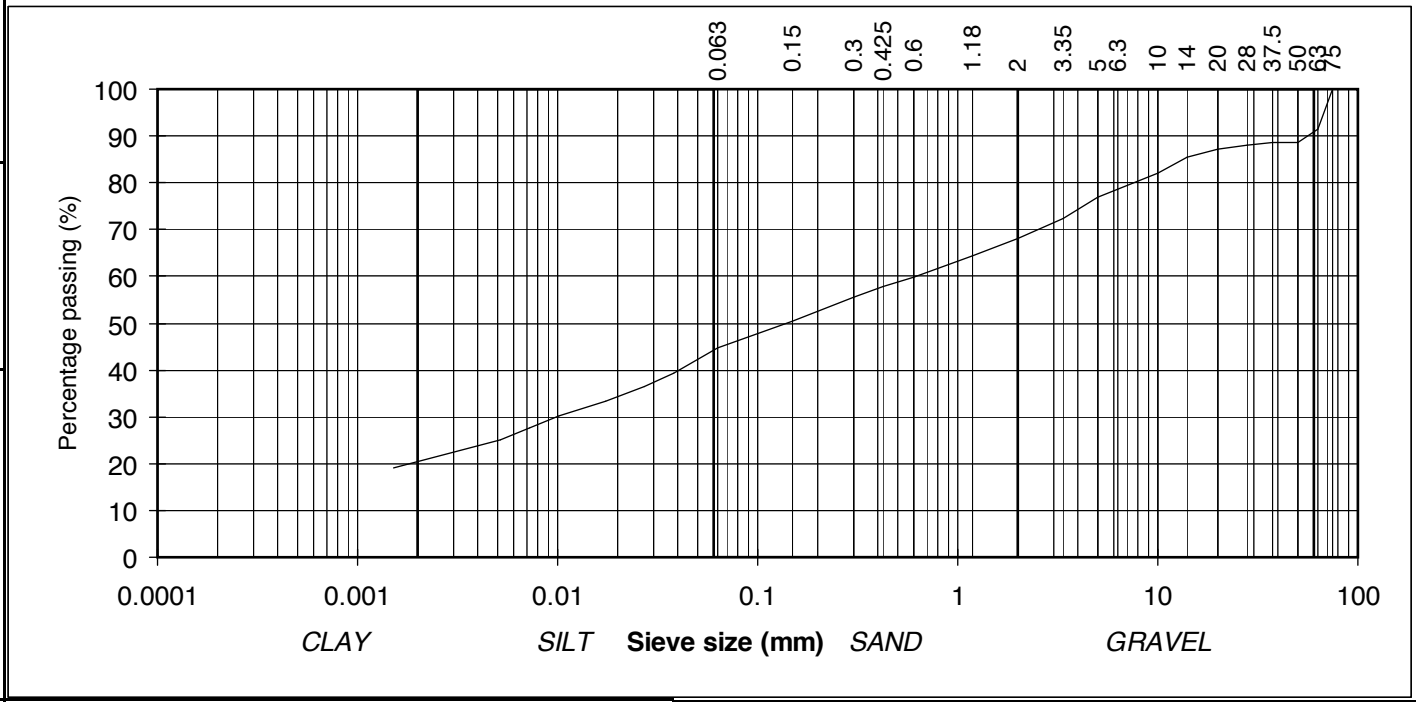
TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5

(note: Sedimentation stage not accredited)

particle size	% passing	
75	100	COBBLES
63	91	
50	89	GRAVEL
37.5	89	
28	88	
20	87	
14	85	
10	82	
6.3	79	
5	77	
3.35	72	
2	68	
1.18	64	SAND
0.6	60	
0.425	58	
0.3	55	
0.15	50	
0.063	45	SILT/CLAY
0.038	39	
0.027	36	
0.017	33	
0.010	30	
0.007	28	
0.005	25	
0.002	19	

Contract No:	18609	Report No.	R67278
Contract:	Dublin Airport Office Development		
TP:	TP05		
Sample No.	AA37554	Lab. Sample No.	A15/4868
Sample Type:	B		
Depth (m)	1.50m	Customer:	DAA/PM Group
Date Received	26/08/2015	Date Testing started	27/08/2015
Description:	Mottled dark brown/grey slightly sandy, slightly gravelly, CLAY with some cobbles		
Remarks			



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	03/09/15	1 of 1

Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)

POINT LOAD STRENGTH INDEX TEST DATA

Contract: DAA T2 Plus Development

Date of test: 9/9/15

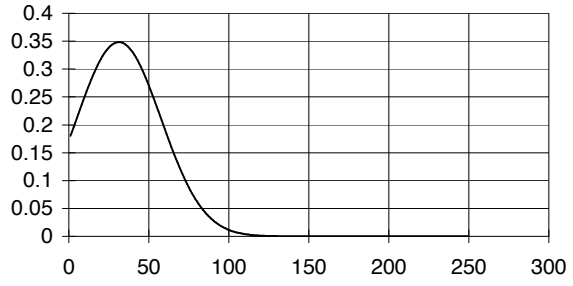
Sample Type: Core
Contract no. 18609

RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	Is (index strength) Mpa	Is(50) (index strength) Mpa	*UCS MPa	Type	Orienation
RC01	15.80	82	3.0	1.249	0.45	0.56	11	PL	90°
	16.50	82	5.0	1.249	0.74	0.93	19	PL	90°
	17.80	82	5.0	1.249	0.74	0.93	19	PL	90°
RC02	11.10	82	9.0	1.249	1.34	1.67	33	PL	90°
	12.55	82	8.0	1.249	1.19	1.49	30	PL	90°
	13.20	82	10.0	1.249	1.49	1.86	37	PL	90°
RC03	11.60	82	3.0	1.249	0.45	0.56	11	PL	90°
	12.50	82	6.0	1.249	0.89	1.11	22	PL	90°
	13.20	82	22.0	1.249	3.27	4.09	82	PL	90°
RC04	13.20	82	2.0	1.249	0.30	0.37	7	PL	90°
	13.25	82	2.0	1.249	0.30	0.37	7	PL	90°
	13.65	82	0.5	1.249	0.07	0.09	2	PL	90°
	15.55	82	28.0	1.249	4.16	5.20	104	PL	90°
	15.70	82	12.0	1.249	1.78	2.23	45	PL	90°
RC05	11.35	82	17.0	1.249	2.53	3.16	63	PL	90°
	12.60	82	10.0	1.249	1.49	1.86	37	PL	90°
	12.95	82	6.0	1.249	0.89	1.11	22	PL	90°
RC06A	9.10	82	4.0	1.249	0.59	0.74	15	PL	90°
	10.15	82	2.0	1.249	0.30	0.37	7	PL	90°
	10.50	82	3.0	1.249	0.45	0.56	11	PL	90°
RC07	8.40	82	10.0	1.249	1.49	1.86	37	PL	90°
	8.90	82	7.0	1.249	1.04	1.30	26	PL	90°
	10.40	82	19.0	1.249	2.83	3.53	71	PL	90°

Statistical Summary Data	Is(50)	UCS*
Number of Samples Tested	23	23
Minimum	0.09	2
Average	1.56	31
Maximum	5.20	104
Standard Dev.	1.32	26
Upper 95% Confidence Limit	4.14	82.89
Lower 95% Confidence Limit	-1.02	-20.36

Comments:
*UCS taken as k x Point Load Is(50): k= 20

*UCS Normal Distribution Curve



Abbreviations	
i	irregular
a	axial
b	block
d	diametral

approx. orientation to planes of weakness/bedding

U	unknown
P	perpendicular
//	parallel

POINT LOAD STRENGTH INDEX TEST DATA

Contract: DAA T2 Plus Development

Sample Type: Core
Contract no. 18609

Date of test: 9/9/15

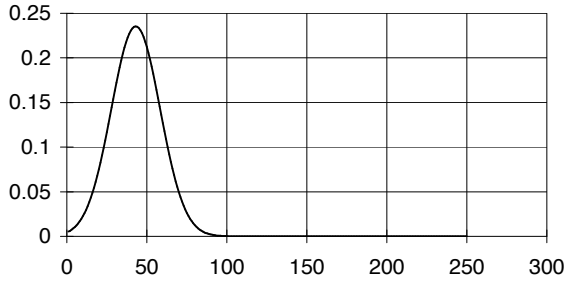
RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	Is (index strength) Mpa	Is(50) (index strength) Mpa	*UCS MPa	Type	Orienation
RC08	8.80	82	11.0	1.249	1.64	2.04	41	PL	90°
	9.00	82	7.0	1.249	1.04	1.30	26	PL	90°
	10.35	82	16.0	1.249	2.38	2.97	59	PL	90°
RC09	8.60	82	19.3	1.249	2.87	3.59	72	PL	90°
	9.20	82	14.0	1.249	2.08	2.60	52	PL	90°
	10.70	82	10.0	1.249	1.49	1.86	37	PL	90°
RC10	9.65	82	10.0	1.249	1.49	1.86	37	PL	90°
	10.10	82	10.0	1.249	1.49	1.86	37	PL	90°
	10.55	82	7.0	1.249	1.04	1.30	26	PL	90°

Statistical Summary Data	Is(50)	UCS*
Number of Samples Tested	9	9
Minimum	1.30	26
Average	2.15	43
Maximum	3.59	72
Standard Dev.	0.76	15
Upper 95% Confidence Limit	3.65	72.96
Lower 95% Confidence Limit	0.66	13.17

Comments:

*UCS taken as k x Point Load Is(50): k= 20

*UCS Normal Distribution Curve



Abbreviations	
i	irregular
a	axial
b	block
d	diametral

approx. orientation to planes of weakness/bedding

U	unknown
P	perpendicular
//	parallel

Appendix 10

Chemical Test Records

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 15-44839

18-Sep-15

Client IGSL Ltd
Unit J5
M7 Business Park
Newhall
Naas
Co. Kildare

Our Reference 15-44839

Client Reference 18609

Contract Title DAA T2 Plus Development

Description 8 Aggregate samples.

Date Received 10-Sep-15

Date Started 10-Sep-15

Date Completed 18-Sep-15

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Aggregate Samples

Our Ref 15-44839
Client Ref 18609
Contract Title DAA T2 Plus Development

	Lab No	866560	866561	866562	866563	866564	866565	866566	866567
	Sample ID	A15/4869	A15/4871	A15/4873	A15/4862	A15/4864	A15/4865	A15/4867	A15/4868
	Depth	2.00-3.40	1.20-3.70	1.20-3.00	2.20	2.20	0.50	0.50	1.50
	Other ID	WS01	WS04	WS10	TP02	TP03	TP04	TP05	TP02
	Sample Type	AGGREGATE	AGGREGATE	AGGREGATE	AGGREGATE	AGGREGATE	AGGREGATE	AGGREGATE	AGGREGATE
	Sampling Date	04/09/15	04/09/15	04/09/15	04/09/15	04/09/15	04/09/15	04/09/15	04/09/15
	Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Inorganics									
pH	DETSC 2008#			7.8	8.4	8.4	8.4	8.4	8.4	8.3	8.4
Carbonate (as CaCO3)	DETSC 2005	1	%	19	18	17	17	13	17	18	18
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	820	59	38	31	21	18	29	10
Total Sulphur as S	DETSC 2320	0.01	%	0.38	0.16	0.04	0.11	0.03	0.05	0.20	0.02
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.16	0.04	0.03	0.04	0.03	0.04	0.02	0.04
Calculated Constituent									
Pyrite Content	*	0.01	%	0.61	0.27	0.06	0.18	0.03	0.08	0.35	0.01

Comments

In calculating the equivalent pyrite present, it has been assumed that all the sulphur, other than that present as sulphate, is present as pyrite. This may not be the case.

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 15-44839
Client Ref 18609
Contract DAA T2 Plus Development

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
866560	A15/4869 2.00-3.40 AGGREGATE	04/09/15	PT 1L		
866561	A15/4871 1.20-3.70 AGGREGATE	04/09/15	PT 1L		
866562	A15/4873 1.20-3.00 AGGREGATE	04/09/15	PT 1L		
866563	A15/4862 2.20 AGGREGATE	04/09/15	PT 1L		
866564	A15/4864 2.20 AGGREGATE	04/09/15	PT 1L		
866565	A15/4865 0.50 AGGREGATE	04/09/15	PT 1L		
866566	A15/4867 0.50 AGGREGATE	04/09/15	PT 1L		
866567	A15/4868 1.50 AGGREGATE	04/09/15	PT 1L		

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix 11

Environmental Test Records

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. UK

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

IGSL
Unit F
M7 Business Park
Naas
Co Kildare
Ireland

4225

Attention :	Darren Keogh
Date :	15th September, 2015
Your reference :	18609
Our reference :	Test Report 15/12367 Batch 1
Location :	Dublin Airport Office Development - DAA
Date samples received :	4th September, 2015
Status :	Final report
Issue :	1

Four samples were received for analysis on 4th September, 2015 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Where Waste Acceptance Criteria Suite (EC Decision of 19 December 2002 (2003/33/EC)) has been requested, all analyses have been performed using the relevant EN methods where they exist.

Compiled By:

Bruce Leslie
Project Co-ordinator

Client Name: IGSL
Reference: 18609
Location: Dublin Airport Office Development - DAA
Contact: Darren Keogh
JE Job No.: 15/12367

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-2	3-4	5-6	7-8							LOD/LOR	Units	Method No.
Sample ID	TP1	TP3	TP4	TP5									
Depth	0.50	0.40	0.50	0.50									
COC No / misc													
Containers	V J	V J	V J	V J									
Sample Date	03/09/2015	03/09/2015	03/09/2015	03/09/2015									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1									
Date of Receipt	04/09/2015	04/09/2015	04/09/2015	04/09/2015									
PAH MS													
Naphthalene #	<0.04	<0.04	<0.04	<0.04							<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03							<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05							<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04							<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	<0.03	<0.03							<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04							<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	0.05	<0.03							<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	0.05	<0.03							<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	0.08	<0.06							<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	0.07	<0.02							<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	0.11	<0.07							<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	0.05	<0.04							<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	0.07	<0.04							<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04							<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	0.08	<0.04							<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04							<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22	0.36	<0.22							<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64							<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	0.08	<0.05							<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	0.03	<0.02							<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	111	108	104	120							<0	%	TM4/PM8
Mineral Oil >C8-C10	<5	<5	<5	<5							<5	mg/kg	TM5/PM16
Mineral Oil >C10-C12	<10	<10	<10	<10							<10	mg/kg	TM5/PM16
Mineral Oil >C12-C16	<10	<10	<10	<10							<10	mg/kg	TM5/PM16
Mineral Oil >C16-C21	<10	<10	<10	<10							<10	mg/kg	TM5/PM16
Mineral Oil >C21-C40	<10	<10	126	<10							<10	mg/kg	TM5/PM16
Mineral Oil >C8-C40	<45	<45	126	<45							<45	mg/kg	TM5/PM16
MTBE #	<5	<5	<5	<5							<5	ug/kg	TM31/PM12
Benzene #	<5	<5	<5	<5							<5	ug/kg	TM31/PM12
Toluene #	<5	<5	<5	<5							<5	ug/kg	TM31/PM12
Ethylbenzene #	<5	<5	<5	<5							<5	ug/kg	TM31/PM12
m/p-Xylene #	<5	<5	<5	<5							<5	ug/kg	TM31/PM12
o-Xylene #	<5	21	<5	<5							<5	ug/kg	TM31/PM12
PCB 28 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8

Client Name: IGSL
Reference: 18609
Location: Dublin Airport Office Development - DAA
Contact: Darren Keogh
JE Job No.: 15/12367

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1-2	3-4	5-6	7-8							LOD/LOR	Units	Method No.
Sample ID	TP1	TP3	TP4	TP5									
Depth	0.50	0.40	0.50	0.50									
COC No / misc													
Containers	V J	V J	V J	V J									
Sample Date	03/09/2015	03/09/2015	03/09/2015	03/09/2015									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1									
Date of Receipt	04/09/2015	04/09/2015	04/09/2015	04/09/2015									
Total 7 PCBs #	<35	<35	<35	<35							<35	ug/kg	TM17/PM8
Natural Moisture Content	9.3	4.8	9.2	11.9							<0.1	%	PM4/PM0
% Dry Matter 105°C	85.2	90.8	86.4	87.4							<0.1	%	NONE/PM4
Total Organic Carbon #	0.31	0.38	1.15	0.29							<0.02	%	TM21/PM24
Loss on Ignition #	2.0	2.0	2.6	2.5							<1.0	%	TM22/PM0
Mass of raw test portion	0.1059	0.0986	0.1039	0.1031								kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09								kg	NONE/PM17

Please see attached notes for all abbreviations and acronyms

Client Name: IGSL
Reference: 18609
Location: Dublin Airport Office Development - DAA
Contact: Darren Keogh
JE Job No.: 15/12367

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-2	3-4	5-6	7-8							LOD/LOR	Units	Method No.
Sample ID	TP1	TP3	TP4	TP5									
Depth	0.50	0.40	0.50	0.50									
COC No / misc													
Containers	V J	V J	V J	V J									
Sample Date	03/09/2015	03/09/2015	03/09/2015	03/09/2015									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1									
Date of Receipt	04/09/2015	04/09/2015	04/09/2015	04/09/2015									
Dissolved Antimony #	<0.002	<0.002	<0.002	<0.002							<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	<0.02							<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025							<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	<0.025							<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	0.005	0.011	0.003							<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	0.05	0.11	0.03							<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005							<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005							<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015							<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015							<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007							<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07							<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005							<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05							<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.005	0.007	0.011	0.005							<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.05	0.07	0.11	0.05							<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002							<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02							<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	<0.003							<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	<0.03							<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	0.004	0.005	0.004	<0.003							<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.04	0.05	0.04	<0.03							<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	0.00002	0.00002	<0.00001							<0.00001	mg/l	TM61/PM38
Mercury Dissolved by CVAF #	<0.0001	0.0002	0.0002	<0.0001							<0.0001	mg/kg	TM61/PM38
Phenol	<0.01	<0.01	<0.01	<0.01							<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1							<0.1	mg/kg	TM26/PM0
Fluoride	0.3	<0.3	<0.3	0.3							<0.3	mg/l	TM27/PM0
Fluoride	<3	<3	<3	3							<3	mg/kg	TM27/PM0
Chloride	1.1	0.6	0.3	1.3							<0.3	mg/l	TM27/PM0
Chloride	11	6	3	13							<3	mg/kg	TM27/PM0
Sulphate	2.61	0.57	30.39	2.79							<0.05	mg/l	TM27/PM0
Sulphate	26.1	5.7	304.0	27.9							<0.5	mg/kg	TM27/PM0
Mass of raw test portion	0.1059	0.0986	0.1039	0.1031								kg	NONE/PM17
Leachant Volume	0.884	0.891	0.886	0.887								l	NONE/PM17
Eluate Volume	0.6	0.67	0.8	0.6								l	NONE/PM17
Dissolved Organic Carbon	3	4	5	<2							<2	mg/l	TM60/PM0
Dissolved Organic Carbon	30	40	50	<20							<20	mg/kg	TM60/PM0
Total Dissolved Solids #	88	92	177	114							<10	mg/l	TM20/PM0
Total Dissolved Solids #	880	920	1770	1140							<100	mg/kg	TM20/PM0

Mass of sample taken (kg)	0.1059	Dry Matter Content Ratio (%) =	85.2
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.884
Particle Size <4mm =	>95%	Eluate Volume (l)	0.6

JEFL Job No	**15/12367**	**Landfill Waste Acceptance Criteria Limits**		
Sample No	**2**			
Client Sample No	**TP1**	**Inert**	**Stable Non-reactive**	**Hazardous**
Depth/Other	**0.50**			
Sample Date	**03/09/2015**			
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.31	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.05	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	0.04	4	50	200
Chloride	11	800	15000	25000
Fluoride	<3	10	150	500
Sulphate as SO4	26.1	1000	20000	50000
Total Dissolved Solids	880	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	30	500	800	1000

Mass of sample taken (kg)	0.0986	Dry Matter Content Ratio (%) =	90.8
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.891
Particle Size <4mm =	>95%	Eluate Volume (l)	0.67

JEFL Job No	**15/12367**	**Landfill Waste Acceptance Criteria Limits**		
Sample No	**4**			
Client Sample No	**TP3**	**Inert**	**Stable Non-reactive**	**Hazardous**
Depth/Other	**0.40**			
Sample Date	**03/09/2015**			
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.38	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.05	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	0.0002	0.01	0.2	2
Molybdenum	0.07	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	0.05	4	50	200
Chloride	6	800	15000	25000
Fluoride	<3	10	150	500
Sulphate as SO4	5.7	1000	20000	50000
Total Dissolved Solids	920	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	40	500	800	1000

Mass of sample taken (kg)	0.1039	Dry Matter Content Ratio (%) =	86.4
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.886
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

JEFL Job No	**15/12367**	**Landfill Waste Acceptance Criteria Limits**		
Sample No	**6**			
Client Sample No	**TP4**	**Inert**	**Stable Non-reactive**	**Hazardous**
Depth/Other	**0.50**			
Sample Date	**03/09/2015**			
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	1.15	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	126	500	-	-
PAH Sum of 6 (mg/kg)	0.36	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.11	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	0.0002	0.01	0.2	2
Molybdenum	0.11	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	0.04	4	50	200
Chloride	3	800	15000	25000
Fluoride	<3	10	150	500
Sulphate as SO4	304.0	1000	20000	50000
Total Dissolved Solids	1770	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	50	500	800	1000

Mass of sample taken (kg)	0.1031	Dry Matter Content Ratio (%) =	87.4
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	0.887
Particle Size <4mm =	>95%	Eluate Volume (l)	0.6

JEFL Job No	**15/12367**	**Landfill Waste Acceptance Criteria Limits**		
Sample No	**8**			
Client Sample No	**TP5**	**Inert**	**Stable Non-reactive**	**Hazardous**
Depth/Other	**0.50**			
Sample Date	**03/09/2015**			
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.29	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<45	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.05	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	13	800	15000	25000
Fluoride	3	10	150	500
Sulphate as SO4	27.9	1000	20000	50000
Total Dissolved Solids	1140	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

Client Name: IGSL

Matrix : Solid

Reference: 18609

Location: Dublin Airport Office Development - DAA

Contact: Darren Keogh

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
15/12367	1	TP1	0.50	1-2	GRO	Solid Samples were received at a temperature above 9°C.
15/12367	1	TP3	0.40	3-4	GRO	Solid Samples were received at a temperature above 9°C.
15/12367	1	TP4	0.50	5-6	GRO	Solid Samples were received at a temperature above 9°C.
15/12367	1	TP5	0.50	7-8	GRO	Solid Samples were received at a temperature above 9°C.

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 15/12367

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (UKAS) accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

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Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM17	Modified US EPA method 8270. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified USEPA 8163. Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified USEPA 160.4. Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (450°C)	PM0	No preparation is required.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM27	Modified US EPA method 9056.Determination of water soluble anions using Dionex (Ion-Chromatography).	PM0	No preparation is required.			AR	Yes

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Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM60	Modified USEPA 9060. Determination of TOC by calculation from Total Carbon and Inorganic Carbon using a TOC analyser, the carbon in the sample is converted to CO2 and then passed through a non-dispersive infrared gas analyser (NDIR).	PM0	No preparation is required.			AR	Yes
TM61	Modified US EPA methods 245.7 and 200.7. Determination of Mercury by Cold Vapour Atomic Fluorescence.	PM38	Samples are brominated to reduce all mercury compounds to Mercury (II) which is analysed using method TM061.	Yes		AR	Yes
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	

Appendix - Methods used for WAC (2003/33/EC)

Leachate tests	
10l/kg; 4mm	I.S. EN 12457-2:2002 Specified particle size; water added to L/S ratio; capped; agitated for 24 ± 0.5 hours; eluate settled and filtered over 0.45 µm membrane filter.
Eluate analysis	
As	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ba	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cd	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cr total	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cu	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Hg	I.S. EN 13370 rec. EN 1483 (CVAAS)
Mo	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ni	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Pb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Sb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Se	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Zn	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Chloride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Fluoride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Sulphate	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Phenol index	I.S. EN 13370 rec. ISO 6439 (4-Aminoantipyrine spectrometic methods after distillation)* (BY HPLC - Jones Env)
DOC	I.S. EN 1484
TDS	I.S. EN 15216
Compositional analysis	
TOC	I.S. EN 13137 Method B: carbonates removed with acid; TOC by combustion.
BTEX	GC-FID
PCB7**	I.S. EN 15308 analysis by GC-ECD.
Mineral oil	I.S. EN 14039 C10 to C40 analysis by GC-FID.
PAH17***	I.S. EN 15527 PAH17 analysis by GC-MS
Metals	I.S. EN 13657 - Aqua regia digestion: EN ISO 11885 (ICP-OES)
Other	
Dry matter	I.S. EN 14346 sample is dried to a constant mass in an oven at 105 ± 3 °C; Method B Water content by direct Karl-Fischer-titration and either volumetric or coulometric detection.
LOI	I.S. EN 15169 Difference in mass after heating in a furnace up to 550 ± 25 °C.
ANC	CEN/TS 15364 Determined by amouns of acid or base needed to cover the pH range

Notes:

*If not suitable due to LOD, precision, etc., any other suitable method can be used, e.g. AFS, ICP-MS

**PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180

***Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)perylene, Benzo(a)pyrene, Chrysene, Coronene, Dibenzo(a,h)anthracene, Fluorene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Phenanthrene and Pyrene.

Appendix 12á

Exploratory Hole Location Plan

DRAFT COPY - UNCHECKED - MAY BE INCOMPLETE

BH1
BH2
WS01
TP1
IT1
PROPOSED MSCP
BH3
WS02
BH4
ST01
GV
EXISTING T2
MULTI STOREY
CAR PARK
WS05
TP3
PROPOSED
BUILDING A2
BH5
WS04
WS03
TP2
PROPOSED
BUILDING A5
WS06
BH6
WS07
BH7
PROPOSED
BUILDING A1
TP4
IT2
BH8
WS08
WS09
BH9
TP5
PROPOSED
BUILDING A6
WS10
BH10
OLD
AER LINGUS
HEADQUARTERS
BUILDING
GV
GV
GV
ST02
GV
Mh
150mm dia STORM
150mm dia STORM
Black Sod Pumping Main
0 5m 10m
THIS DRAWING WAS CREATED USING: AutoCAD
IE0311582_30_SK_0036

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS ARE IN MILLIMETRES.
3. ALL LEVELS ARE IN METRES AND RELATE TO ORDNANCE DATUM : MALIN HEAD.
4. BACKGROUND MAPPING INFORMATION AND EXISTING SERVICES INFORMATION SUPPLIED BY DUBLIN AIRPORT AUTHORITY APRIL 2015.
5. LOCATIONS FOR SITE INVESTIGATION SHOWN AS PER DRAFT IGSL GROUND INVESTIGATION REPORT DATED 15/09/15.

LEGEND

- EX_ S1.0 — EXISTING SURFACE WATER SEWER/MANHOLE
- EX_ F1.0 — EXISTING FOUL SEWER/MANHOLE
- EXISTING FOUL RISING MAIN
- EX_ RG — EXISTING ROAD GULLY
- ExWMS — EXISTING WATERMAIN
- ExFHM — EXISTING FIRE MAIN
- ExGAS — EXISTING GAS MAIN
- ExMV — EXISTING MV DUCT BANK
- LV — EXISTING LV DUCT BANK
- ExTCOM — EXISTING COMMS DUCT BANK
- TP1 — TRIAL PIT (5 NUMBER)
- BH1 — BOREHOLE (10 NUMBER)
- IT1 — INFILTRATION TEST (2 NUMBER)
- WS01 — WINDOW SAMPLE (10 NUMBER)
- BOUNDARY FOR GEOPHYSICAL SURVEY
- ST1 — SLIT TRENCH LOCATIONS FOR WATERMAIN INVESTIGATION
- 64.00 — EXISTING CONTOUR (CONTOUR ACCURACY TO PLUS OR MINUS 200mm)

DRAFT UNCHECKED – MAY BE INCOMPLETE
Issue A Draft No. 1 Date 17/09/15 By DO'LS

ISSUE	DESCRIPTION	DRN	ORG	AUTH CHK	APP	DATE
A	FOR INFORMATION	SD	SD	BK	TK	17/09/15

daa Dublin Airport Authority plc

CLIENT: DUBLIN AIRPORT AUTHORITY PLC

PM GROUP

PROJECT: DAC CONSULTANT SERVICES

TITLE: AS-BUILT SITE INVESTIGATION LOCATIONS CLUSTER A

CLIENT REF.
CLIENT DRG No.
PROJECT No. IE0311582
A0 SCALE 1:250
DRG No. IE0311582-30-SK-0036

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