Appendix 6-3. Hydrogeological Report

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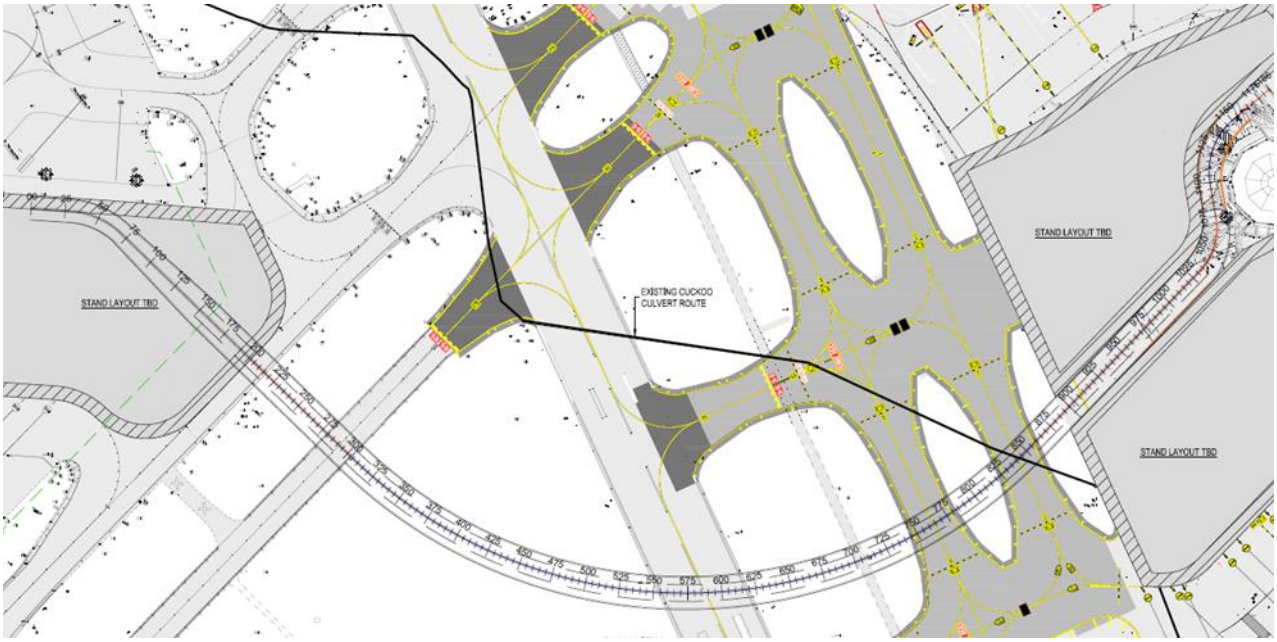
WEST APRON VEHICLE UNDERPASS HYDROGEOLOGICAL REPORT



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WEST APRON VEHICLE UNDERPASS
HYDROGEOLOGICAL REPORT

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Date	**07-08-2020**
Prepared by	**Daniel Porteous, Una Pétursdóttir**
Checked by	**Jes Michaelsen**
Approved by	**Ben North**
Description	**Review of existing hydrogeologic investigations and high-level assessment of required investigations during planning stage.**

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CONTENTS

Glossary

Term	Description
mOD	Metres above Ordinance Datum
mbgl	Metres below ground level
Transmissivity	The rate of flow under a unit hydraulic gradient through a unit width of aquifer of given saturated thickness. Unit: $[L^2/T]$
Screen	A well screen serves as the water intake of a well from an aquifer and prevents sediment from entering the well.
Storativity	The volume of water released from storage per unit surface area of the aquifer per unit decline in hydraulic head. Dimensionless.

1. INTRODUCTION

This note presents a review of the existing hydrogeological information, identifies risks, provides recommendations for site-specific groundwater investigations and proposed groundwater control methodology for the construction phase and the operational phase for the proposed cut and cover Airside Road Tunnel at Dublin Airport.

1.1 Project Overview

As part of the Capital Investment Programme 2020-24 (CIP2020), submitted and approved by the Commission of Aviation Regulation (CAR), a future airside road tunnel ("West Apron Vehicle Underpass") was included in the proposals to be completed by the end of 2024. The airside road tunnel is required to achieve a desired capacity of 40 million passengers per annum (mppa) by the end of 2024, and to safeguard growth to numbers up to 55 mppa, by unlocking the ability of the Airport to use existing stands on the West Apron, future stands to be developed on Apron 5M and subsequent developments of airfield and terminal/pier infrastructure in the west.

The CIP level alignment and general cross section are shown in Figures 1-1 and 1-2. It is noted that the CIP alignment is currently being updated, however the observations and recommendations from this note remain unchanged.

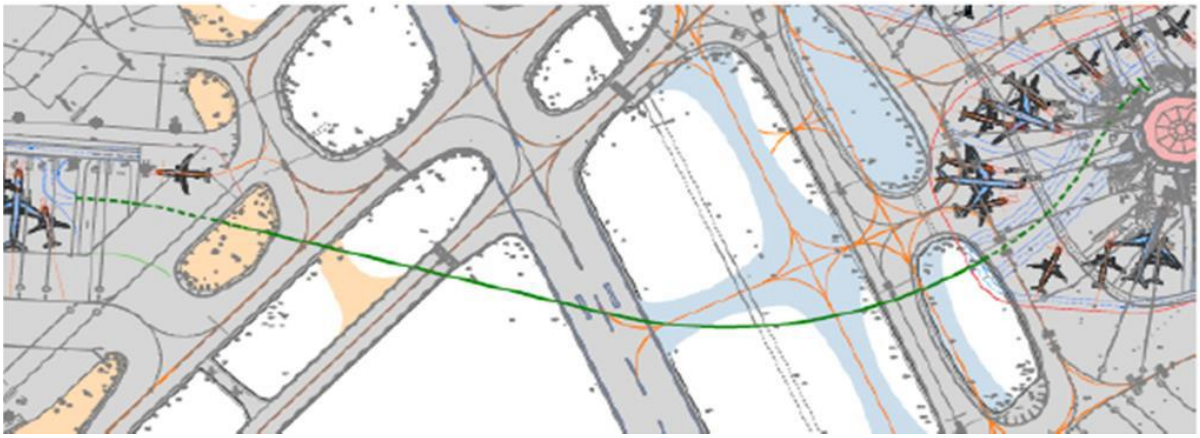

Figure 1-1: Plan view of proposed tunnel alignment to the West Apron (CIP design).

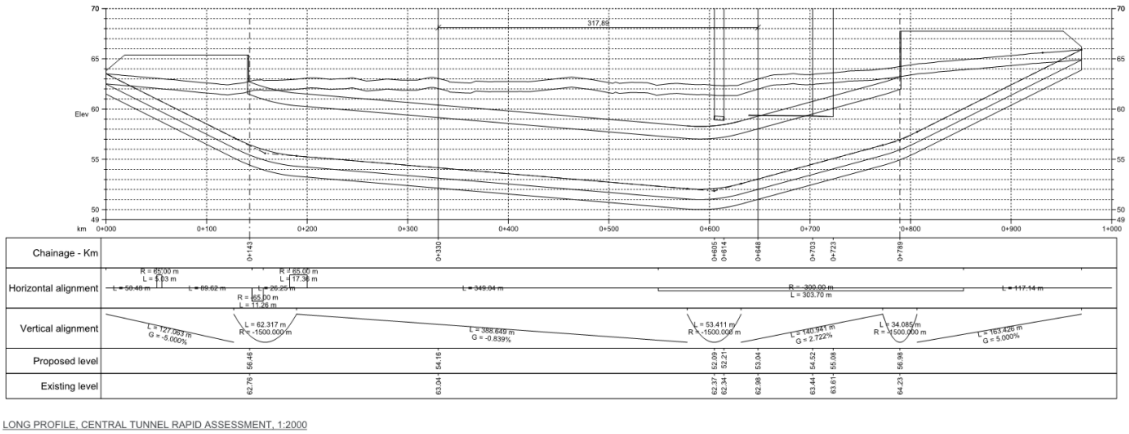

Figure 1-2:Cross section of proposed tunnel (Vehicle underpass, Pier 3 Cut and cover plan and profile, CIP20-03-TUN-CAP-VEH-03-01-0001).

2. SUMMARY OF EXISTING HYDROGEOLOGICAL CONDITIONS

2.1 Introduction

Information regarding the existing hydrogeological conditions has been sourced from various available ground investigation reports provided by daa in February 2020 and online resources. A brief summary of the available sources and hydrogeological information which they contain is included in Table 2-1.

Table 2-1: Summary of available sources.

Ref	Report title	Date	Author(s)	Hydrogeological Information
1	Geological Survey Ireland Spatial Resources (Online map viewer)	Accessed 25/02/2020	Geological Survey of Ireland	Site geology, aquifer characteristics, location of groundwater wells and springs.
2	EPA Maps (Online map viewer)	Accessed 25/02/2020	Environmental Protection Agency (Ireland)	Water features, local geology
3	Additional Airfield Boreholes-GIR	15/05/2018-11/06/2018	Ground Investigations Ireland	Five boreholes (BH01, BH02, BH02A, BH03, BH04) are within close proximity (<100m) to the proposed tunnel route. Borehole log data is included in Appendix A.
4	New Air Traffic Control Tower	03/03/2009-30/05/2009	Glover Site Investigations Ltd	Borehole records identifying groundwater levels off-site (0.5-1.2 km NW of site). Borehole log data is included in Appendix B.

2.2 Geological setting

Geological information is accessible through the Geological Survey of Ireland's (GSI) Spatial Resources viewer[1]. The superficial geology underlying the area of the proposed corridor is anticipated to comprise the Lower Brown Dublin Boulder Clay (LBrBC), which is described as firm to very stiff sandy gravelly clay. Borehole logs from a prior 2018 Ground Investigation noted gravels, cobbles and sandy/gravelly lenses, which are typical of the LBrBC. The natural strata are understood to be overlain by Made Ground.

The underlying bedrock is the Tober Colleen Formation, which is described by the GSI as Calcareous shale, limestone conglomerate. According to the borehole logs, depth to bedrock becomes deeper from north to south (40.9 mOD (24.20 mbgl) to 33.57 mOD (26.70 mbgl)) and shallower from east to west (33.57 mOD (26.70 mbgl) to approximately 45.5 mOD (17.35 mbgl). Based upon these depths, the proposed tunnel is understood to be excavated within the superficial strata only.

[1] https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 [Accessed 25.02.2020]

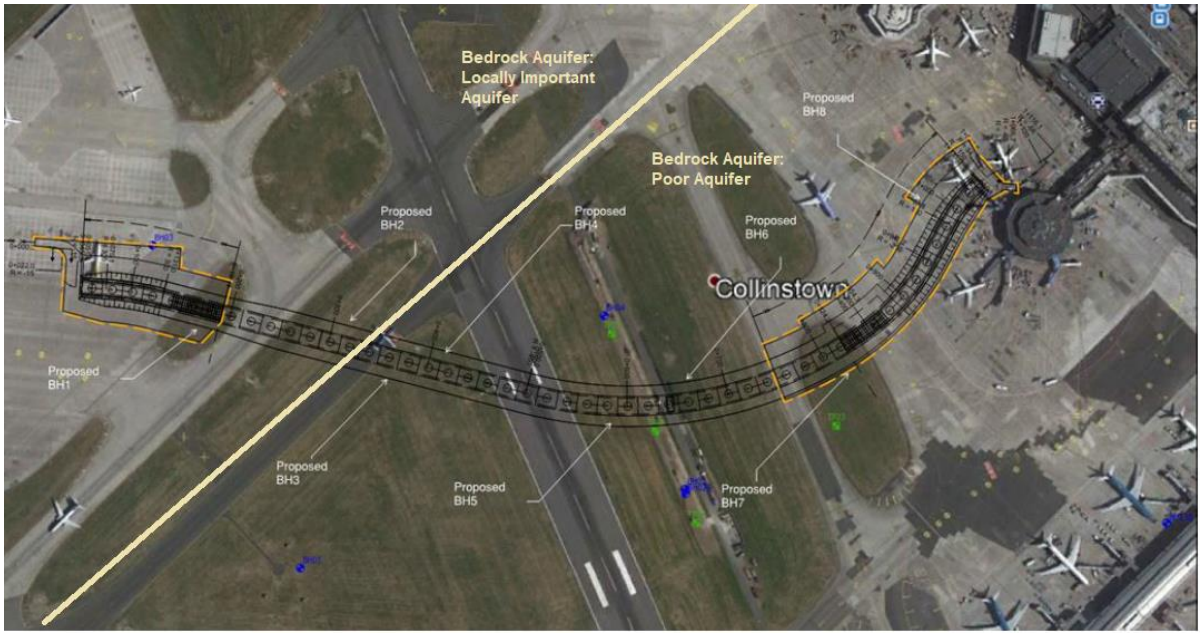

Figure 2-1: Orthophoto of the proposed tunnel route with the approximate aquifer boundary. The markings for proposed borehole locations are from the technical note: 'Review of Existing Geotechnical Information', however an updated borehole location plan can be found in 'Specification for Ground Investigation').

2.3 Hydrogeological setting

Hydrogeological information was accessed through the GSI's Spatial Resources data viewer. The site is situated above the Dublin Urban WFD groundwater waterbody (Chemical status: 'Good', Quantity status: 'Good') which is described as poorly productive bedrock.

According to the GSI Spatial Resources data, the site is underlain by two aquifers separated by a bedrock aquifer fault beneath the approximate centre-west of the proposed tunnel (shown in Figure 2-1). The tunnel is understood to pass through the overlaying strata. The aquifer beneath the western portion is categorised as a Locally Important Aquifer, meaning bedrock which is moderately productive only in local zones. The aquifer beneath the eastern portion is categorised as a Poor Aquifer, meaning bedrock which is generally unproductive except for local zones. No locally or regionally important gravel aquifers, which are superficial and distinct from the bedrock aquifers, are identified as present based upon existing data and there are none within 1 km of the site.

Average groundwater recharge is stated to be 68 mm/yr and Subsoil permeability is believed to be low.

Groundwater levels and seasonal variations at the site are currently unknown. EPA groundwater contours suggest a groundwater level of 60 – 70 mOD in the area, and according to the prior ground investigations, the ground level within 100 m from the proposed tunnel route is approximately 62 – 64 mOD. However, the boreholes within 100 m from the proposed tunnel extended to 33.5 mbgl and did not identify a groundwater strike (see Appendix A for location plan and borehole logs). Six exploratory holes were drilled for the new air traffic control tower in May 2009 (~0.5 km NW of the western end of the proposed tunnel, ~1.2 km NW of eastern end of the tunnel, see Appendix B), where boreholes BH01 and BH02 struck groundwater at 60.1 mOD (5 mbgl) and 60.7 mOD (3.9 mbgl) respectively at the approximate height of the limestone bedrock in both boreholes. However, boreholes BH05 and BH06 encountered groundwater seepage only at 57.42 (7.5 mbgl) and 57.06

mOD (8.0 mbgl) respectively within the clay strata and did not record a groundwater strike within the limestone. This suggests a spatially variable local groundwater level. These boreholes seem, however, to have been constructed mainly for a geotechnical purpose and the reported groundwater strikes in BH01 and BH02 were only measured shortly after completion of the boreholes where it was observed that the groundwater level rose by 0.4-0.8 m during 20 minutes of measurements. It is difficult to assess whether the measured water levels represent the limestone or the clay layer above as there is no information on whether the boreholes were screened. It is also possible that the groundwater levels are in fact higher than those reported, judging from the rising groundwater levels during the measurements. However, the hydraulic conductivity of the clayey soil is expected to be low.

The proposed tunnel is expected to extend down to 48 mOD (Figure 1-2). Importantly, at the three boreholes nearest the proposed tunnel's deepest point (BH01, BH02A and BH04), the limestone basal rock layer is encountered at elevations ranging from 33.6-35.7 mOD (or 27.6-28.3 mbgl), or approximately 15 m beneath the base of the proposed tunnel. This places the limestone bedrock lower than at the air traffic control tower site where the abovementioned groundwater levels were measured. The height of the limestone recorded at BH03, close to the far-western end of the tunnel, was shallower at approximately 45.5 mOD (17.35 mbgl). However, BH03 is further from the deepest proposed excavation, and excavation in the vicinity of BH03 is not planned to exceed 55 mOD. Therefore, a clearance of approximately 10 m at minimum would be expected in this area based upon available data.

Additionally, borehole logs during a previous ground investigation identified sub-horizontal granular lenses within clay strata. These lenses could serve as permeable flow pathways for groundwater and localised areas of higher groundwater discharge. Should groundwater be present within the clay strata, it will most likely exist within these lenses.

A single bored groundwater well (GSI name 2923NEW034) is recorded in the area of the main airport terminal and carparking, within 1 km of the site, approximately 600 m from the proposed tunnel. Location accuracy of the borehole is stated to be within 500 m. Its use is industrial and has a recorded yield of 300 m^3 per day.

2.4 Hydrological setting

The Cuckoo Stream is the only watercourse designated by the EPA within 1 km of the proposed tunnel. The Cuckoo Stream drains into the River Mayne approximately 5.5 km east of its headwaters at the airport. The majority of its channel within the airport is not visible in satellite imagery suggesting it is heavily culverted. There are no other water bodies, hydrologically sensitive or protected areas identified within a 1 km radius of the site. Hydrological information was accessed through the EPA's online data map service.[2]

[2] https://gis.epa.ie/EPAMaps/ [Accessed 25.02.2020]

3. GROUNDWATER ENGINEERING CONSIDERATIONS

3.1 Groundwater Effects in the Operational Phase

Groundwater lowering in the operational phase is not expected. The tunnel shall be designed to withstand worst case uplift pressures, but permanent groundwater control systems are not expected.

Surface water seeping into the granular backfill material around the tunnel will potentially result in a local water level as high as ground level immediately around the tunnel. This risk shall be considered in the design of the tunnel and airfield drainage.

3.2 Temporary Groundwater Control

It is anticipated that the groundwater levels reported 0.5-1.2 km NW from the planned tunnel are representative of the water pressure in the limestone bedrock. Assuming that the water pressure is the same in the limestone at the tunnel site, it is anticipated that depressurisation of groundwater in the limestone will be necessary for the construction of the tunnel to prevent hydraulic failure.

Based on the available information, it is proposed to design the groundwater lowering system with pumping wells established outside the excavation to temporarily reduce the hydraulic pressure of the limestone and prevent uplift. Therefore, it is recommended to investigate the piezometric level of the regional aquifer further to assess the stability of the excavation base. If the layers below the base of the excavation are not stable, and uplift is a concern, then the pumping wells should be drilled to a level where the pressure of the groundwater is in equilibrium with the weight of the deposits below the excavation.

Depending on the hydraulic parameters it may be necessary to establish injection wells to maintain the existing water table level and to prevent settlement of adjacent structures as well as mobilise nearby contaminated sites.

The distance between the pumping wells and the injection wells will be based on the hydrogeological investigations and the groundwater modelling results. The wells established for the groundwater investigations should be located and designed to be able to be used for the temporary groundwater lowering to reduce the cost of the groundwater control associated with the construction phase.

The length of the sections of open excavation will affect the total abstracted and injected volumes and the drawdown effects on the environment. The design should be prepared as part of the tunnel outline design and reviewed as a part of the detailed design, by either a specialist contractor or suitably-qualified consultant. It is recommended to prepare the detailed design of the groundwater lowering system once the design of the tunnel is more developed and the proposed hydrogeological investigations are completed.

The groundwater lowering system will generally consist of the following components;however investigation will be required to confirm these details:

<u>Pumping wells</u>
Pumping wells will be installed as close to the tunnel excavation as possible or inside the excavation if it is practical to a depth of approximately 10 m in the limestone. The wells should be drilled in 10” diameter to allow for the installation of 165 mm diameter PVC screens. Given the expected geological profile the wells should be screened over a large interval covering the underlying

limestone bedrock. The pumping wells should be fitted with submersible pumps and pressure transducers and connected to the SCADA system for remote control of the pumping rates.

Injection wells

If the proposed investigations indicate that injection is required, the injection wells are installed further away from the tunnel excavation between the alignment and existing structures and buildings to reduce the drawdown effects and prevent settlement of existing airfield infrastructure and buildings. The design of the injection wells will be similar to the pumping wells, except potentially with a smaller diameter. The well efficiency of injection wells is generally lower than for pumping wells which is why approximately 25% more injection wells than pumping wells should be expected.

Monitoring wells inside excavation

In order to ensure that the required drawdown inside the excavation is maintained but not exceeded, several monitoring wells will be installed inside the excavation. The monitoring wells will be drilled to accommodate up to two DN50 mm ID PVC piezometers installed to depths below the base of the tunnel. The piezometers should be fitted with pressure transducers and connected to the SCADA system.

Monitoring wells outside excavation

A number of monitoring wells of similar design as the monitoring wells inside the excavation will be installed at the perimeter of the tunnel excavation. The purpose of these monitoring wells is to ensure that minimum water levels under the existing infrastructure is not exceeded.

Supervisory Control And Data Acquisition (SCADA)

The pumping rates will be controlled remotely by a SCADA system based on the water levels recorded in the monitoring wells. All wells will be connected to the SCADA to optimise the pumping regimes and reduce the total abstracted volumes to a minimum.

Piping and manifolds

All pumping wells and injection wells will be connected through manifolds and a piping system. The piping system will primarily be located on the construction site but depending on the location of the injection wells piping is anticipated to extend beyond the construction site. It is proposed to operate the groundwater lowering system as a closed loop system to avoid aeration of the injected groundwater and thereby reduce development activities of the screens in the injection wells. In the case where the drawdown effects on the existing structures can be managed without injecting 100% of the abstracted groundwater, discharge to the nearby stream or sewer system will be required. This will likely require authority permission.

Treatment

It is expected that simple treatment such as sedimentation and aeration will be required before discharging to the nearby stream or sewer system. Treatment of the groundwater injected back to the aquifer is not expected to require treatment. However, the proposed investigations will allow for an assessment of the required treatment.

4. GROUNDWATER BASED RISKS

Due to the proposed tunnel intersecting two distinct aquifers, there is a possibility of creating a pathway for groundwater to travel between the two bodies. However, due to their limited productivity, and particularly that of the Poor Aquifer, the extent of this will likely be minimal during both temporary works and operation. This would not be anticipated to influence the Quantity status of the Dublin Urban WFD groundwater body as both aquifers are combined within the same WFD groundwater water body.

Potential dewatering and effects upon the well identified within the study area should be considered. Both an EPA-designated watercourse (Cuckoo Stream) and abstraction are within 1 km of the proposed tunnel. Due to the estimated distance and known geological factors, at this stage it is considered improbable that the well and watercourse would fall within the zone of dewatering; however, this may need to be demonstrated through analysis/calculation to fulfil regulatory requirements.

A register of the potential risks and risk control measures is shown in Table 4-1.

Table 4-1: Preliminary Groundwater Risk Register

	Groundwater hazard description	Current risk rating	Description of current risk	Risk control measures
1	Groundwater ingress into excavation area (construction phase)	Low	Groundwater intrusion/seepage from the surrounding strata may occur in the tunnel excavation during construction.	Localised site pumping. Discharge to watercourse or disposal via on-site methods (e.g. drying beds, sludge lagoons, tank storage).
2	Groundwater ingress into tunnel (operational phase)	Low	Groundwater intrusion/seepage from the surrounding strata may occur in the tunnel during operation.	Subject to performance criteria (by daa), good quality concreting works and (potentially) a waterproof membrane may be necessary.
3	Groundwater flooding at ground level	Low	Localised groundwater flow may be impeded by permanent works resulting in above ground flooding.	Below-ground flow diversion around tunnel.
4	Dewatering of cutting impacting local abstractions	Low	Abstractions located within the excavation's radius of influence may be adversely affected by dewatering during the temporary construction phase. However, the abstraction is likely drawing from the bedrock, which will not be excavated. The risk is therefore considered very low.	Carry out further investigation to accurately characterise groundwater situation. Ascertain strata being abstracted.
5	Dewatering of cutting impacting local water bodies	Low	Dewatering may adversely affect local water bodies. The EPA-listed Cuckoo Stream is	Carry out further investigation to accurately

	Groundwater hazard description	Current risk rating	Description of current risk	Risk control measures
			within 300m of the proposed tunnel. However, dewatering is expected to occur in the sand/gravel lenses which would need to be hydraulically connected to a surface water body. This is deemed unlikely based upon the proximity of known water bodies.	characterise groundwater situation.
6	Creating a flow pathway through a bedrock aquifer fault	Negligible	Construction activities are expected to occur above the fault but not through it. The risk is considered low due to the depth and scale of the works.	None required.
7	Clay heaving under the tunnel construction (hydraulic failure)	High	Anticipating that the groundwater level, originating from the limestone aquifer, is at approx. 4 mbgl and limestone is encountered at approx. 28 mbgl under the tunnel alignment, there is risk of heave.	Depressurisation of the limestone aquifer (through deep wells) may be required.
8	Uplift/buoyancy of the tunnel (permanent phase)	High	The anticipated high groundwater level presents a buoyancy risk for the proposed tunnel. The large volume of displaced ground will exert a significant upwards hydrostatic net pressure on the base of the tunnel.	Should be counteracted within the tunnel design.

5. HYDROGEOLOGICAL INVESTIGATIONS

It is strongly recommended to conduct hydrogeological investigations for evaluation of the soil hydraulic parameters along the tunnel alignment.

It is proposed to undertake a programme of hydrogeological investigations consisting of a combination of the following activities:

Borehole drilling with a hydrogeological objective

It is proposed to conduct a drilling programme consisting of a combination of 6" and 10" boreholes to install wells and piezometers targeting the permeable zones encountered during the drilling. The wells will be installed with 165 mm dia. PVC screens and the piezometers with 63 mm dia. PVC screens. This will allow for conducting pumping tests with observation wells and slug tests or double packer tests if deemed more suitable.

Furthermore, piezometers to verify the piezometric level of the underlying regional aquifer should be installed to assess the stability of the excavation base.

It should be considered to conduct a scheme of geophysical borehole logging including propeller flow logging in all boreholes to obtain a better understanding of the hydrogeological conditions for establishing the conceptual hydrogeological model.

The installed wells will be fully developed as part of the drilling programme to ensure that reliable results will be obtained from the subsequent hydraulic testing. The wells used for the investigation will be located and designed in order for them to be applied for the temporary groundwater lowering system.

The hydrogeological drilling campaign will be coordinated with the geotechnical investigations to reduce investigations cost and access issues.

Pumping tests

Currently no site-specific hydraulic data exists for the tunnel alignment. Pumping tests and double packer tests will be conducted to obtain a hydrogeological understanding of the conditions in the project and design input for the temporary groundwater lowering system. The hydraulic tests will comprise:

- double packer tests in low yielding strata to obtain values for the hydraulic conductivity of tested sections;
- step-drawdown pumping tests to obtain values such as transmissivity, and formation loss and well loss constants used for assessment of optimal yield of the constructed wells
- constant rate pumping tests with monitoring wells to obtain aquifer parameters such as transmissivity, storativity and potential leakage between aquifers;

During the pumping tests water quality samples will be collected for analysis.

Groundwater monitoring

Groundwater monitoring will be used to operate the temporary groundwater lowering system to maintain a dry excavation and to mitigate settlement of the nearby buildings and structures.

It is recommended to commence groundwater monitoring in the project area at least one year in advance of the temporary groundwater lowering to obtain data on background water levels including

seasonal variations of groundwater levels. During the temporary groundwater lowering, groundwater monitoring will be conducted in monitoring wells inside and outside the excavation.

Groundwater modelling

The results of the hydrogeological investigations described above along with the existing geological information should be used to set up a project specific 3D numerical groundwater model. The groundwater model will be used to design the groundwater control system (coordinated with the tunnel design), to assess the effects on the environment and hence provide suggestions for reduction of settlement effects on existing structures and provide input for liaison with authorities.

6. RECOMMENDATIONS

It is recommended that detailed groundwater monitoring is undertaken as part of a site-specific ground investigation (GI). Further details on the recommended GI are presented in the document: *Specification for Ground Investigation* (Document No.: 1100040489-GEO-NOT-5000).

The GI Specification includes the proposed groundwater investigations that are deemed necessary to properly evaluate groundwater risks associated with the construction and operation of the tunnel as well as for the determination of the necessary mitigation and management measures. This should be undertaken before the completion of outline design and any tendering period for a construction contract.

Groundwater monitoring is recommended to be undertaken in conjunction with GI and other activities to minimise periods of runway closure and maximise time and cost efficiency. Monitoring should occur for the duration of at least one wet season (October to February) or longer. The GI Specification includes an indicative borehole location plan. It is recommended to coordinate location of boreholes with the geotechnical drilling. Long-term monitoring schedules should be designed with wider site context in mind.

Remote recording and download of data is suggested due to the site being within an active airside environment.

It is recommended that groundwater chemical testing is undertaken in addition to this so that both quality and quantity factors can be determined (by the EIAR Consultant). The former is particularly important when considering water disposal.

Table 6-1: Recommendations for tunnel specific groundwater investigations.

Scope	Reason
Determine groundwater levels - It is recommended that there be continuous groundwater monitoring with the use of pressure transducers and dataloggers at 4-8 locations. This should occur over at least one wet season. Several wells should either extend into the clay strata only or have the appropriate screen height to measure groundwater from sandy and gravelly lenses independent of the bedrock aquifer. Specifics and design of installations can be confirmed as part of a detailed GI specification.	Groundwater levels, seasonal variation and groundwater pressure must be determined to properly identify the risks, dewatering requirements, and to inform the design and applicable mitigation measures.
Identify areas of localised high groundwater risk – utilisation of pumping tests or other hydraulic tests to determine hydraulic regime along tunnel route.	Permeable granular horizons may contain groundwater, behave as flow pathways and necessitate increased dewatering during the construction phase.
Determine groundwater quality – chemical testing of groundwater to identify contaminants. Hydrocarbons, de-icers and fire retardants (PFOS/PFOA) are likely possibilities considering current site usage. Details of the chemical testing to be specified by the EIAR Consultant.	Identifying the chemical nature of the groundwater will count towards the determination of discharge consents (if applicable).

Table 6-1: Recommendations for tunnel specific groundwater investigations.

Scope	Reason
Determine groundwater pressure – pressure to be identified within superficial strata and bedrock. This can be calculated during the measurement of groundwater levels.	Higher groundwater pressure increases the risk of groundwater ingress into the tunnel space.
Identify vertical distribution of inflow – it is recommended to undertake geophysical borehole logging including flow logging to determine inflow zones and impermeable zones in the limestone.	Results from the geophysical borehole logging allow to optimise the well design and thus reduce the required number of wells for the groundwater lowering system.

APPENDIX 1

ADDITIONAL AIRFIELD BOREHOLES-GIR BOREHOLE LOGS WITH LOCATION PLAN

General Notes

NOTE:
THE INFORMATION SHOWN ON THIS PLAN IS A GENERAL GUIDE AND THE ACCURACY THEREOF CANNOT BE GUARANTEED.

DRAWINGS ARE AMALGAMATION OF HISTORICAL RECORD DRAWINGS, DESIGN DRAWINGS AND AS BUILT DRAWINGS. REDUNDANT SERVICES MAY BE SHOWN IN SOME INSTANCES.

NO LIABILITY IS ACCEPTED FOR ANY DISCREPANCY, OMISSION OR DEVIATION AND THE ACTUAL POSITIONS OF MAINS AND SERVICES MUST BE VERIFIED AND ESTABLISHED ON SITE BEFORE ANY MECHANICAL EXCAVATING PLANT IS USED.

Legend

BH1 Borehole Location

STATUS

Rev	Description	Issued By	Date
SK	Information	JM	May 18

amd daa Infrastructure Planning & Development

amd
Cloghran House Dublin Airport, Ireland.
T: +353 (1) 814 1676
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PROJECT:
daa
Dublin Airport
CIP2020

TITLE:
Proposed Borehole Locations

Drawn By:		Checked By:		Approved:
CAD	Designer	Discp. Lead	Design Lead	Design Manager
JM	JM			

Date: May 2018 | Scale : NTS | A1 | Stage: Information

Drawing No.: D18011-SK-001 | Rev: 04

Ground Investigations Ireland Ltd
www.gii.ie

Site Additional Airfield Boreholes			**Borehole Number** BH01
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Cable Percussion & Geobore S	**Casing Diameter** 200mm cased to 3.50m 102mm cased to 32.70m	**Ground Level (mOD)** 64.02	**Client** DAA	**Job Number** 7687-04-18
	Location 315950.6 E 242860.5 N	**Dates** 21/05/2018	**Engineer** Balfour Beatty	**Sheet** 1/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(1.20)	Open Hole - Air Excavation		
1.20-1.65 1.20-1.20					1,1/1,2,2,2 SPT(C) N=7 B	62.82	1.20 (0.60)	Stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
2.00-2.45 2.00-2.00					3,6/7,7,7,8 SPT(C) N=29 B	62.22	1.80 (1.20)	Stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
3.00-3.30 3.00-3.00					1,8/13,11,26 SPT(C) 50/150 B	61.02	3.00 (0.50)	Very stiff black slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
3.50	100					60.52	3.50	Very stiff dark grey/brown slightly sandy gravelly CLAY with frequent sub-rounded cobbles and occasional boulders. Gravel is fine to coarse sub-angular to sub-rounded		
4.30 4.30-4.45	100				16,17/50 SPT(C) 50/0					
5.80 5.80-5.95	100				19,25/50 SPT(C) 50/0		(5.90)			
7.30 7.30-7.45	100				20,25/50 SPT(C) 50/0					
8.80 8.80-85.00	100				27,25/50 SPT(C) 50/0	54.62	9.40	Very stiff brown slightly sandy gravelly CLAY with frequent sub-rounded cobbles and occasional boulders. Gravel is fine to coarse sub-angular to sub-rounded		

Remarks
Cable Percussion borehole terminated due to Obstrction - Presumed Boulder
Geobore S techniques carried out from 3.50m to 32.70m BGL
Borehole backfilled upon completion with bentonite grout
Chiselling from 3.30m to 3.50m for 1 hour.

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH01

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Site Additional Airfield Boreholes			**Borehole Number** BH01
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Cable Percussion & Geobore S	**Casing Diameter** 200mm cased to 3.50m 102mm cased to 32.70m	**Ground Level (mOD)** 64.02	**Client** DAA	**Job Number** 7687-04-18
	Location 315950.6 E 242860.5 N	**Dates** 21/05/2018	**Engineer** Balfour Beatty	**Sheet** 2/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.30 10.30-10.45	93				19,25/50 SPT(C) 50/0					
11.80 11.80-11.95	100				22,25/50 SPT(C) 50/0		(6.10)			
13.30 13.30-13.45	100				25,25/50 SPT(C) 50/0					
14.80 14.80-14.95	100				27,25/50 SPT(C) 50/0	48.52	15.50	Very stiff dark grey/brown slightly sandy gravelly CLAY with frequent sub-rounded cobbles and boulders. Gravel is fine to coarse sub-angular to sub-rounded		
16.30 16.30-16.45	100				24,25/50 SPT(C) 50/0					
17.80 17.80-17.95	100				25,25/50 SPT(C) 50/0		(5.30)	.....Lense of brown sandy clayey fine to coarse sub-angular to sub-rounded GRAVEL occurs between 17.85m to 18.35m BGL		
19.30 19.30-19.45					25,25/50 SPT(C) 50/0					

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH01

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Site Additional Airfield Boreholes			**Borehole Number** BH01
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Cable Percussion & Geobore S	**Casing Diameter** 200mm cased to 3.50m 102mm cased to 32.70m	**Ground Level (mOD)** 64.02	**Client** DAA	**Job Number** 7687-04-18
	Location 315950.6 E 242860.5 N	**Dates** 21/05/2018	**Engineer** Balfour Beatty	**Sheet** 3/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	100									
20.80 20.80-20.95	100				25,25/50 SPT(C) 50/0	43.22	20.80	Very stiff dark grey/black slightly sandy gravelly CLAY with frequent sub-rounded cobbles and occasional boulders. Gravel is fine to coarse sub-angular to sub-rounded		
22.30 22.30-22.45	100				25,25/50 SPT(C) 50/0					
23.80 23.80-23.95	100				25,25/50 SPT(C) 50/0		(7.50)			
25.30 25.30-25.45	100				25,25/50 SPT(C) 50/0					
26.80 26.80-26.95	100				25,25/50 SPT(C) 50/0					
28.30	100	87	18	16		35.72	28.30	Medium strong thinly bedded grey fine to medium LIMESTONE partially to distinctly weathered with calcite veins. Interbedded with a weak to medium strong thickly laminated MUDSTONE partially to distinctly weathered Sequence contains one set of fratures. F1 are very close to closely spaced, dipping between 10-30 degrees, planar to stepped rough with some surface staining and clay infilling		
29.80							(3.00)			

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH01

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH01
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Cable Percussion & Geobore S	**Casing Diameter** 200mm cased to 3.50m 102mm cased to 32.70m	**Ground Level (mOD)** 64.02	**Client** DAA	**Job Number** 7687-04-18
	Location 315950.6 E 242860.5 N	**Dates** 21/05/2018	**Engineer** Balfour Beatty	**Sheet** 4/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	100	88	26							
31.30	100	52	7	NI		32.72	31.30 (1.40)	Medium strong thinly bedded grey fine to medium LIMESTONE partially to distinctly weathered with calcite veins. Interbedded with a weak to medium strong thickly laminated MUDSTONE partially to distinctly weathered Non Intact		
32.70						31.32	32.70	Complete at 32.70m		

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH01

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH02
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 5.40m	**Ground Level (mOD)** 62.30	**Client** DAA	**Job Number** 7687-04-18
	Location 316328.6 E 242937.8 N	**Dates** 16/05/2018-21/05/2018	**Engineer** Balfour Beatty	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(1.20)	OPEN HOLE - Air Excavation		
1.50-1.95 1.50	SPT(C) N=5 B			1,1/1,1,1,1,2	61.10	1.20 (0.70)	Soft to firm brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
2.50-2.95 2.50	SPT(C) N=38 B			3,5/5,9,10,14	60.40	1.90 (1.60)	Very stiff brown slightly sandy gravelly CLAY with ocasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
3.50-3.88 3.50	SPT(C) 50/225 B			6,7/9,12,21,8	58.80	3.50 (1.50)	Very stiff brown slightly sandy gravelly CLAY with ocasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
4.50-4.65 4.50	SPT(C) 50/0 B			25,25/50	57.30	5.00 (2.00)	Very stiff black slightly sandy gravelly CLAY with ocasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
5.40-5.85 5.40	SPT(C) N=50 B			25,25/50	55.30	7.00	Complete at 7.00m		

Remarks
Air excavations carried out to 1.20m BGL
Borehole terminated due to Obstrction - Presumed Boulder
Chiselling from 5.20m to 5.40m for 1 hour.

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH02

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH02A
Machine : Beretta T44 **Flush :** Polymer **Core Dia :** 102&64 mm **Method :** Rotary Cored	**Casing Diameter** 102mm cased to 28.70m 64mm cased to 33.50m	**Ground Level (mOD)** 62.27	**Client** DAA	**Job Number** 7687-04-18
	Location 316329 E 242933.5 N	**Dates** 25/05/2018-29/05/2018	**Engineer** Balfour Beatty	**Sheet** 1/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(1.00)	OPEN HOLE		
1.00	40					61.27	1.00 (0.70)	Firm brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
1.70	93					60.57	1.70 (1.50)	Firm brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded .....Lense of brown sandy clayey fine to coarse sub-angular to sub-rounded GRAVEL occurs between 1.70m to 2.40m BGL		
3.20 3.20-3.35	100				19,25/50 SPT(C) 50/0	59.07	3.20 (1.50)	Very stiff dark brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
4.70 5.20-5.35	86				25,25/50 SPT(C) 50/0	57.57	4.70	Very stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
6.20 6.20-6.35	100				25,25/50 SPT(C) 50/0					
7.70 7.70-7.85	100				25,25/50 SPT(C) 50/0		(6.00)			
9.20 9.20-9.35	100				25,25/50 SPT(C) 50/0					

Remarks
Borehole carried out from ground level
Air excavtion carried out to 1.0m BGL to avoid serivces
Geobore S techniques carried out to 28.70m BGL and Conventional HQ Rotary techniques carried out 33.50m BGL
Borehole backfilled upon completion

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH02A

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH02A
Machine : Beretta T44 **Flush :** Polymer **Core Dia :** 102&64 mm **Method :** Rotary Cored	**Casing Diameter** 102mm cased to 28.70m 64mm cased to 33.50m	**Ground Level (mOD)** 62.27	**Client** DAA	**Job Number** 7687-04-18
	Location 316329 E 242933.5 N	**Dates** 25/05/2018-29/05/2018	**Engineer** Balfour Beatty	**Sheet** 2/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						51.57	10.70			
10.70 10.70-10.85	100				25,25/50 SPT(C) 50/0			Very stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
							(3.00)			
12.20 12.20-12.35	70				25,25/50 SPT(C) 50/0			....Brown slightly clayey sandy fine to coarse GRAVEL between 12.95m - 13.25m BGL		
						48.57	13.70			
13.70 13.70-13.85	96				25,25/50 SPT(C) 50/0			Very stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles and boulders. Gravel is fine to coarse sub-angular to sub-rounded		
							(1.48)			
						47.09	15.18			
15.20 15.20-15.35	100				25,25/50 SPT(C) 50/0			Very stiff dark brown/grey sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
16.70 16.70-16.85	100				25,25/50 SPT(C) 50/0					
18.00 18.20-18.35	100				25,25/50 SPT(C) 50/0					
							(6.92)			
19.70 19.70-19.85					25,25/50 SPT(C) 50/0					

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH02A

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Site Additional Airfield Boreholes			**Borehole Number** BH02A
Machine : Beretta T44 **Flush :** Polymer **Core Dia :** 102&64 mm **Method :** Rotary Cored	**Casing Diameter** 102mm cased to 28.70m 64mm cased to 33.50m	**Ground Level (mOD)** 62.27	**Client** DAA	**Job Number** 7687-04-18
	Location 316329 E 242933.5 N	**Dates** 25/05/2018-29/05/2018	**Engineer** Balfour Beatty	**Sheet** 3/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	95									
21.20	95					40.17	22.10	Very stiff thinly laminated dark brown slightly gravelly CLAY interlaiminated with a brown fine SAND		
							(0.60)			
22.70	100					39.57	22.70	Very stiff dark brown/grey sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
24.20	100						(4.00)			
25.70	100					35.57	26.70	Very stiff dark brown/grey sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded		
							(0.50)			
27.20	96					35.07	27.20	Very stiff dark brown/grey sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
							(1.50)			
28.70	100	66	50			33.57	28.70	Medium strong to strong thinly bedded grey fine to medium grained LIMESTONE partially weathered. Interbedded with a black thickly laminated fine grained MUDSTONE		
30.00										

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH02A

Ground Investigations Ireland Ltd
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Site	Borehole Number
Additional Airfield Boreholes	BH02A

Machine	Casing Diameter	Ground Level (mOD)	Client	Job Number
Beretta T44	102mm cased to 28.70m 64mm cased to 33.50m	62.27	DAA	7687-04-18
Flush : Polymer				
Core Dia : 102&64 mm	**Location**	**Dates**	**Engineer**	**Sheet**
Method : Rotary Cored	316329 E 242933.5 N	25/05/2018- 29/05/2018	Balfour Beatty	4/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	93	68	36	7			(2.80)	Sequence contains two sets of fractures. F1 are very close to closely spaced dipping between 10-20 degrees, undulating to planar smooth with some clay infilling. F2 are close to medium spaced, dipping between 60-70 degrees, undulating to stepped rough with some clay smearing. Non Intact Zone between 29.45m - 29.70m BGL		
31.50						30.77	31.50			
31.70	97	71	52	7			(2.00)	Medium strong to strong thinly bedded grey fine to medium grained LIMESTONE partially weathered. Interbedded with a black thickly laminated fine grained MUDSTONE Sequence contains two sets of fractures. F1 are very close to mediumspaced dipping between 10-20 degrees, undulating to planar smooth with some clay infilling. F2 are widely spaced, dipping between 60-70 degrees, undulating to stepped rough with some clay smearing. Non Intact Zone between 31.70m to 31.80m BGL		
33.50						28.77	33.50	Complete at 33.50m		

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH02A

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH03
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Cable Percussion & Geobore S	**Casing Diameter** 200mm cased to 3.10m 102mm cased to 22.50m	**Ground Level (mOD)**	**Client** DAA	**Job Number** 7687-04-18
	Location 315805.4 E 243177.1 N	**Dates** 15/05/2018-19/06/2018	**Engineer** Balfour Beatty	**Sheet** 1/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(1.20)	OPEN HOLE - Air Excavation		
1.20					B		1.20			
1.50-1.95					4,4/3,3,3,3 SPT(C) N=12		(0.90)	Firm brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
1.50					B		2.10			
	100							Very stiff dark brown/grey slightly sandy gravelly CLAY with ocasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
2.50-2.80					7,8/11,12,27 SPT(C) 50/150		(1.00)			
2.50					B		3.10			
								Very stiff dark brown slightly sandy gravelly CLAY with ocasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
4.50										
4.50-4.80					5,7/12,14,24 SPT(C) 50/150					
	100									
							(5.50)			
6.00										
6.20-6.35					21,25/50 SPT(C) 50/0					
	100									
7.50										
7.50-7.65					25,25/50 SPT(C) 50/0					
	88									
							8.60			
								Very dense brown slightly silty fine to coare SAND		
9.00										
9.00-9.45					5,6/7,6,7,8 SPT(C) N=28					
							(1.65)			
	97									

Remarks
Air excavations carried out to 1.20m BGL
Cable percsuuion borehole terminated due to Obstrction - Presumed Boulder
Borehlole backfilled with bentonite upon completion
Chiselling from 3.00m to 3.10m for 1 hour.

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH03

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH03
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Cable Percussion & Geobore S	**Casing Diameter** 200mm cased to 3.10m 102mm cased to 22.50m	**Ground Level (mOD)**	**Client** DAA	**Job Number** 7687-04-18
	Location 315805.4 E 243177.1 N	**Dates** 15/05/2018-19/06/2018	**Engineer** Balfour Beatty	**Sheet** 2/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							10.25			
10.50 10.50-10.88	94				8,11/11,12,14,13 SPT(C) 50/225		(0.65) 10.90	Very stiff brown sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded		
							(0.70) 11.60	Very stiff brown laminated CLAY with lenses of brown fine to medium SAND		
12.00 12.00-12.38	93				10,11/12,14,14,10 SPT(C) 50/225		(0.55) 12.15 (0.35) 12.50	Very dense brown slightly silty fine to coarse SAND Very stiff dark brown gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
							(0.90)	Very stiff dark brown slightly gravelly CLAY with lenses of brown fine SAND		
13.50 13.50-13.65	85				14,21/50 SPT(C) 50/0		13.40 13.50 (0.30) 13.80 13.90	Very dense brown fine to caorse SAND Very stiff brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded Very dense brown fine to medium SAND		
							(1.10)	Very stiff brown very sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded		
15.00 15.00-15.15	100				24,25/50 SPT(C) 50/0		15.00	Very stiff brown sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded		
							(2.35)			
16.50 16.50-16.65					21,25/50 SPT(C) 50/0					
17.35	100	30	17				17.35	Medium strong thinly bedded grey/dark grey fine grained LIMESTONE partially to distinctly weathered		
18.00	97	66	38					Sequnce contains two sets of fractures. F1 are close to medium spaced, dipping between 10-30 degrees, undulating to planar rough with some surface staining and clay infilling. F2 are widely spaced, dipping between 50-70 degress, planar smooth with some surface staining and Clay infilling		
19.50				5						

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH03

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH03
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Cable Percussion & Geobore S	**Casing Diameter** 200mm cased to 3.10m 102mm cased to 22.50m	**Ground Level (mOD)**	**Client** DAA	**Job Number** 7687-04-18
	Location 315805.4 E 243177.1 N	**Dates** 15/05/2018-19/06/2018	**Engineer** Balfour Beatty	**Sheet** 3/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	98	92	6				(5.15)			
21.00	100	81	63							
22.50							22.50	Complete at 22.50m		

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH03

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Site Additional Airfield Boreholes			**Borehole Number** BH04
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102&64 mm **Method :** Cable Percsussion & Geobre S	**Casing Diameter** 200mm cased to 7.00m 102mm cased to 20.00m 64mm cased to 32.70m	**Ground Level (mOD)** 62.73	**Client** DAA	**Job Number** 7687-04-18
	Location 316249 E 243108.1 N	**Dates** 16/05/2018-24/05/2018	**Engineer** Balfour Beatty	**Sheet** 1/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(1.20)	OPEN HOLE - Air Excavation		
1.30-1.75 1.30					1,1/1,2,1,2 SPT(C) N=6 B	61.53	1.20 (0.80)	MADE GROUND consisting of brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
2.50-2.95 2.50					1,3/4,6,6,11 SPT(C) N=27 B	60.73	2.00 (1.50)	Stiff dark brown/grey slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
3.50-3.95 3.50					4,7/8,10,15,18 SPT(C) N=51 B	59.23	3.50 (1.00)	Very stiff dark brown/grey slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
4.50-4.80 4.50					7,10/17,25,8 SPT(C) 50/150 B	58.23	4.50	Very stiff black slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
5.50-5.60 5.50					25,25/50 SPT(C) B		(2.50)			
6.50-6.65 6.50					25,25/50 SPT(C) 50/0 B					
7.00	100					55.73	7.00	Very stiff brown/grey slightly sandy gravelly CLAY with occasional sub-rounded cobbles and boulders. Gravel is fine to coarse sub-angular to sub-rounded		
8.50 8.50-8.65	100				20,25/50 SPT(C) 50/0					
10.00										

Remarks
Air excavations carried out to 1.20m BGL
Cable percussion borehole terminated due to Obstrction - Presumed Boulder
Smaple disturbance from 4.50m to 6.50m BGL due to borehole collapse
Geobore S techniques carried out from 4.50m BGL to 20.0m BGL and Conventionla HQ rotary coring carried out from 20.0m BGL to 32.70m BGL
Borehole backfilled with bentonite upon completion
Chiselling from 6.90m to 7.00m for 1 hour.

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH04

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Site Additional Airfield Boreholes			**Borehole Number** BH04
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102&64 mm **Method :** Cable Percsussion & Geobre S	**Casing Diameter** 200mm cased to 7.00m 102mm cased to 20.00m 64mm cased to 32.70m	**Ground Level (mOD)** 62.73	**Client** DAA	**Job Number** 7687-04-18
	Location 316249 E 243108.1 N	**Dates** 16/05/2018-24/05/2018	**Engineer** Balfour Beatty	**Sheet** 2/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00-10.15	97				22,25/50 SPT(C) 50/0		(6.00)			
11.50 11.50-11.65	100				19,25/50 SPT(C) 50/0			.....Lense of brown sandy clayey sub-angular to sub-rounded fine to coarse GRAVEL occurs between 11.40m - 11.90m BGL		
13.00 13.00-13.15	97				25,25/50 SPT(C) 50/0	49.73	13.00	Very stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles and boulders. Gravel is fine to coarse sub-angular to sub-rounded		
14.50 14.50-14.65	96				22,25/50 SPT(C) 50/0		(3.85)			
16.00 16.00-16.15	60				19,25/50 SPT(C) 50/0	45.88	16.85	Poor Recovery - Driller notes gravelly CLAY. Recovery consists grey fine to coarse angular to sub-angular Gravel with Clay washed away		
17.40 17.40-17.55	100				22,25/50 SPT(C) 50/0		(1.15)			
18.00 18.00-18.15	0				25,25/50 SPT(C) 50/0	44.73	18.00	Core Loss - Driller notes silty sandy CLAY		
19.00 19.00-19.23	0				11,14/15 SPT(C) 15/75		(2.00)			
20.00										

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH04

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Site Additional Airfield Boreholes			**Borehole Number** BH04
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia:** 102&64 mm **Method :** Cable Percsussion & Geobre S	**Casing Diameter** 200mm cased to 7.00m 102mm cased to 20.00m 64mm cased to 32.70m	**Ground Level (mOD)** 62.73	**Client** DAA	**Job Number** 7687-04-18
	Location 316249 E 243108.1 N	**Dates** 16/05/2018-24/05/2018	**Engineer** Balfour Beatty	**Sheet** 3/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.00-20.15	60				22,25/ SPT(C)	42.73	20.00	Very stiff dark brown/grey slightly sandy gravelly CLAY with occasional sub-rounded cobbles and boulders. Gravel is fine to coarse sub-angular to sub-rounded		
21.20	60						(4.20)			
22.70	80									
24.20	100					38.53	24.20	Very stiff grey slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded .....Lense of brown sandy clayey sub-angular to sub-rounded fine to coarse GRAVEL occurs between 24.35m - 24.50m BGL		
25.70	86						(3.35)			
27.20										
27.55	100	75	98			35.18	27.55	Medium strong thinly bedded dark grey fine grained LIMESTONE partially to distinctly weathered interbedded with a dark grey black thickly laminated MUDSTONE		
28.70	100	91	63	7			(4.15)	The sequence contains two sets of fractures. F1 are close to medium spaced, dipping 5-25 degrees, undulating rough with some clay surface staining. F2 are widely spaced, dipping between 45-80 degrees, undulating rough with some surface staining		

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH04

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Site Additional Airfield Boreholes			**Borehole Number** BH04
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102&64 mm **Method :** Cable Percsussion & Geobre S	**Casing Diameter** 200mm cased to 7.00m 102mm cased to 20.00m 64mm cased to 32.70m	**Ground Level (mOD)** 62.73	**Client** DAA
	Location 316249 E 243108.1 N	**Dates** 16/05/2018-24/05/2018	**Engineer** Balfour Beatty
			Job Number 7687-04-18
			Sheet 4/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
30.20	93	86	57							
31.70	95	94	32	5		31.03	31.70 (1.00)	Medium strong thinly bedded dark grey fine grained LIMESTONE partially to distinctly weathered interbedded with a dark grey black thickly laminated MUDSTONE The sequence contains one set of fractures. F1 are close to medium spaced, dipping 5-25 degrees, undulating rough with some clay surface staining		
32.70						30.03	32.70	Complete at 32.70m		

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH04

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH05
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Cable Percussion & Geobore S Rotary Cored	**Casing Diameter** 200mm cased to 4.70m 102mm cased to 28.50m	**Ground Level (mOD)** 65.10	**Client** DAA	**Job Number** 7687-04-18
	Location 316004.1 E 243983.1 N	**Dates** 17/05/2018-01/06/2018	**Engineer** Balfour Beatty	**Sheet** 1/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(1.20)	OPEN HOLE - Air Excavation		
1.20					B	63.90	1.20			
1.50-1.95					4,4/3,3,3,3 SPT(C) N=12		(0.90)	Firm brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
2.00					B	63.00	2.10			
2.50-2.80					7,8/11,12,27 SPT(C) 50/150		(0.90)	Stiff dark brown/grey slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
3.00					B	62.10	3.00			
4.00					B		(1.70)	Very stiff black slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
4.70	100					60.40	4.70			
							(1.50)	Very stiff dark brown/grey slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded .....Lense of brown sandy clayey sub-angular to sub-rounded fine to coarse GRAVEL occurs between 4.70m - 4.90m BGL		
6.20 6.20-6.35	100				19,25/50 SPT(C) 50/0	58.90	6.20	Very stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
7.50 7.50-7.65	96				21,25/50 SPT(C) 50/0		(2.80)			
9.00 9.00-9.15	100				19,25/50 SPT(C) 50/0	56.10	9.00	Very stiff dark brown/grey slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		

Remarks
Air excavations carried out to 1.20m BGL
Cable Percussion borehole terminated at 4.20m BGL due to Obstrction
Geobore S Rotary techniques carried out from 4.20m to 28.50m BGL
Borehole backfilled with bentonite upon completion
Chiselling from 4.10m to 4.20m for 1 hour.

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH05

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH05
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Cable Percussion & Geobore S Rotary Cored	**Casing Diameter** 200mm cased to 4.70m 102mm cased to 28.50m	**Ground Level (mOD)** 65.10	**Client** DAA	**Job Number** 7687-04-18
	Location 316004.1 E 243983.1 N	**Dates** 17/05/2018-01/06/2018	**Engineer** Balfour Beatty	**Sheet** 2/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(2.05)			
10.50 10.50-10.65	100				22,25/50 SPT(C) 50/0	54.05	11.05	Very stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
							(1.30)			
12.00 12.00-12.15	100				22,25/50 SPT(C) 50/0	52.75	12.35	Very stiff dark brown/grey slightly sandy gravelly CLAY with frequent sub-rounded cobbles and occasional boulders. Gravel is fine to coarse sub-angular to sub-rounded		
							(1.15)			
13.50 13.50-13.65	100				25,25/50 SPT(C) 50/0	51.60 51.40	13.50 (0.20) 13.70	Very stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
							(1.30)	Very stiff dark brown/grey slightly sandy gravelly CLAY with frequent sub-rounded cobbles and occasional boulders. Gravel is fine to coarse sub-angular to sub-rounded		
15.00 15.00-15.15	100				22,25/50 SPT(C) 50/0	50.10	15.00	Very dense brown sandy clayey sub-angular to sub-rounded fine to coarse GRAVEL with occasional sub-rounded cobbles		
							(2.30)			
16.50 16.50-16.65	100				25,25/50 SPT(C) 50/0	47.80	17.30	Very stiff black slightly sandy gravelly CLAY with frequent sub-rounded cobbles and occasional boulders. Gravel is fine to coarse sub-angular to sub-rounded		
18.00 18.00-18.15	100				25,25/50 SPT(C) 50/0					
19.50 19.50-19.65					25,25/50 SPT(C) 50/0			.....Lense of brown sandy clayey sub-angular to sub-rounded fine to coarse GRAVEL occurs between 19.50m - 19.90m BGL		

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH05

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH05
Machine : Dando 2000 & Beretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Cable Percussion & Geobore S Rotary Cored	**Casing Diameter** 200mm cased to 4.70m 102mm cased to 28.50m	**Ground Level (mOD)** 65.10	**Client** DAA	**Job Number** 7687-04-18
	Location 316004.1 E 243983.1 N	**Dates** 17/05/2018-01/06/2018	**Engineer** Balfour Beatty	**Sheet** 3/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	100						(6.50)			
21.00 21.00-21.15	100				25,25/50 SPT(C) 50/0					
22.50	100									
						41.30	23.80	Very stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
24.00							(0.40)			
24.20	100	80	53			40.90	24.20	Medium strong thickly laminated to thinly bedded dark grey fine grained LIMESTONE with calcite veins partially to distinctly weathered. Interbedded with a weak thickly laminated brown/black MUDSTONE partially to distinctly weathered Sequence contains one set of fractures. F1 is medium spaced, dipping between 20-30 degrees, planar rough with some Clay smearing		
25.50	100	73	63	5			(2.70)			
26.90 27.00	100	36	16	6		38.20	26.90	Medium strong thickly laminated to thinly bedded dark grey fine grained LIMESTONE with calcite veins partially to distinctly weathered. Interbedded with a weak thickly laminated brown/black MUDSTONE partially to distinctly weathered Sequence contains two sets of fractures. F1 is very close to closely spaced, dipping between 20-30 degrees, undulating rough with clay infilling. F2 are widely spaced , dipping between 75-85 degrees, planar smooth with sme clay smearing ....Residual rock recovered as a brown sandy slightly gravelly CLAY with relic bedding betweeen 28.0 - 28.40m BGL		
28.50						36.60	28.50	Complete at 28.50m		

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH05

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH06
Machine : Dando 2000 Beretta T44 **Flush :** Polymer **Core Dia :** 102&64 mm **Method :** Geobore S & HQ Rotary Coring	**Casing Diameter** 200mm cased to 3.60m 102mm cased to 27.50m 64mm cased to 38.00m **Location** 315504.6 E 244020.6 N	**Ground Level (mOD)** 67.81 **Dates** 18/05/2018-11/06/2018	**Client** DAA **Engineer** Balfour Beatty	**Job Number** 7687-04-18 **Sheet** 1/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(1.20)	OPEN HOLE		
1.20-1.65 1.20					1,1/3,2,2,3 SPT(C) N=10 B	66.61	1.20 (0.80)	Firm brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
2.00-2.45 2.00					3,9/9,10,14,17 SPT(C) N=50 B	65.81	2.00 (0.30)	Stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
						65.51	2.30 (0.70)	Very stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
3.00-3.15 3.00					25,25/50 SPT(C) 50/0 B	64.81	3.00 (0.90)	Very stiff black slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to sub-rounded		
3.60	86					63.91	3.90	Very stiff brown/grey slightly sandy gravelly CLAY with occasional sub-rounded cobbles. Gravel is fine to coarse sub-angular to subrounded .....Lense of brown sandy clayey sub-angular to sub-rounded fine to coarse GRAVEL occurs between 4.60m - 4.90m BGL		
4.70 4.70-4.85	100				14,19/50 SPT(C) 50/0					
6.20 6.20-6.35	100				23,25/50 SPT(C) 50/0		(5.60)			
7.70 7.70-7.85	100				22,25/50 SPT(C) 50/0					
9.20 9.20-9.35	100				25,25/50 SPT(C) 50/0	58.31	9.50 (0.70)	Residual Rock - Recovered as very stiff brown slightly sandy gravelly CLAY with relic bedding fabric throughout and lenses of fine brown Sand		

Remarks
Air excavations carried out to 1.20m BGL
Cable percsussion terminated at 3.60m BGL due to Obstrction - Presumed Boulder
Geobore S techniques carried out from 3.60m to 27.50m BGL
Conventional HQ Rotary Techniques carried out from 27.50m to 31.50m BGL
Borehole backfilled with bentonite upon completion
Chiselling from 3.30m to 3.60m for 1 hour.

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH06

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH06
Machine : Dando 2000 Beretta T44 **Flush :** Polymer **Core Dia :** 102&64 mm **Method :** Geobore S & HQ Rotary Coring	**Casing Diameter** 200mm cased to 3.60m 102mm cased to 27.50m 64mm cased to 38.00m	**Ground Level (mOD)** 67.81	**Client** DAA	**Job Number** 7687-04-18
	Location 315504.6 E 244020.6 N	**Dates** 18/05/2018-11/06/2018	**Engineer** Balfour Beatty	**Sheet** 2/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						57.61	10.20	Residual Rock - Recovered as very stiff brown with orange and black mottling slightly sandy CLAY with relic bedding and occasional angular cobbles		
10.70 10.70-10.85	100				24,25/50 SPT(C) 50/0		(3.50)			
12.20 12.20-12.35	100				25,25/50 SPT(C) 50/0					
13.70 13.70-13.85	100				25,25/50 SPT(C) 50/0	54.11	13.70	Residual Rock - Recovered as angular cobbles and boulders in a brown sandy CLAY matrix		
15.20	100						(4.50)			
16.70	100									
18.20	93					49.61	18.20	Residual Rock - Recovered as brown/grey with orange and black mottling CLAY with relic bedding and lenses of Sand		
19.70							(3.00)			

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH06

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH06
Machine : Dando 2000 Beretta T44 **Flush :** Polymer **Core Dia :** 102&64 mm **Method :** Geobore S & HQ Rotary Coring	**Casing Diameter** 200mm cased to 3.60m 102mm cased to 27.50m 64mm cased to 38.00m	**Ground Level (mOD)** 67.81	**Client** DAA	**Job Number** 7687-04-18
	Location 315504.6 E 244020.6 N	**Dates** 18/05/2018-11/06/2018	**Engineer** Balfour Beatty	**Sheet** 3/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	96									
21.20	100					46.61	21.20 (1.50)	Weathered Rock - Recovered as medium strong laminated grey fine grained LIMESTONE distinctly weathered		
22.70	91.3					45.11	22.70	Residual Rock - Residual Rock - Recovered as angular cobbles and boulders in a brown sandy CLAY matrix with relic bedding		
23.00	100					44.01	(1.10) 23.80	Weathered Rock - Recovered as medium strong laminated grey fine grained LIMESTONE distinctly weathered		
24.50	53					43.31	(0.70) 24.50 (1.50)	Residual Rock - Recovered as angular cobbles and boulders in a brown sandy CLAY matrix with relic bedding		
26.00	100					41.81	26.00 (1.50)	Residual Rock - Recovered as light brown with grey/black mottling CLAY with occasional lenses of Sand		
27.50	56					40.31	27.50 (1.50)	Weathered Rock - Recovered as angular cobbles of Limestone in a brown sandy Clay matrix		
29.00	80	43	43			38.81	29.00	Medium strong to strong laminated grey fine grained LIMESTONE partially to distinctly weatheredwith clay seams		

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH06

Ground Investigations Ireland Ltd
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Site Additional Airfield Boreholes			**Borehole Number** BH06
Machine : Dando 2000 Beretta T44 **Flush :** Polymer **Core Dia :** 102&64 mm **Method :** Geobore S & HQ Rotary Coring	**Casing Diameter** 200mm cased to 3.60m 102mm cased to 27.50m 64mm cased to 38.00m	**Ground Level (mOD)** 67.81	**Client** DAA	**Job Number** 7687-04-18
	Location 315504.6 E 244020.6 N	**Dates** 18/05/2018-11/06/2018	**Engineer** Balfour Beatty	**Sheet** 4/4

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				7			(2.50)	The sequence contains two sets of fractures F(1) are closely spaced, dipping between 10-20 degrees, planar to stepped rough with Clay smearing. F(2) are closely spaced, dipping between 70-90 degrees, planar to stepped rough with some Clay infilling		
30.50	93	59	50							
31.50						36.31	31.50	Medium strong to strong laminated grey fine grained LIMESTONE partially to distinctly weatheredwith clay seams		
32.00	73	73	39							
33.50	83	50	20					The sequence contains two sets of fractures F(1) are closely spaced, dipping between 10-20 degrees, planar to stepped rough with Clay smearing. F(2) are closely spaced, dipping between 60-80 degrees, undulating to stepped rough with some surface staining and clay infilling		
							(6.50)			
35.00	80	40	55					Zones of non-intact between 32.0m to 32.05m BGL and 35.90m and 36.60m BGL		
36.50	22	20	20							
38.00						29.81	38.00	Complete at 38.00m		

Remarks

Scale (approx)	Logged By
1:50	S Kealy

Figure No. 7687-04-18.BH06

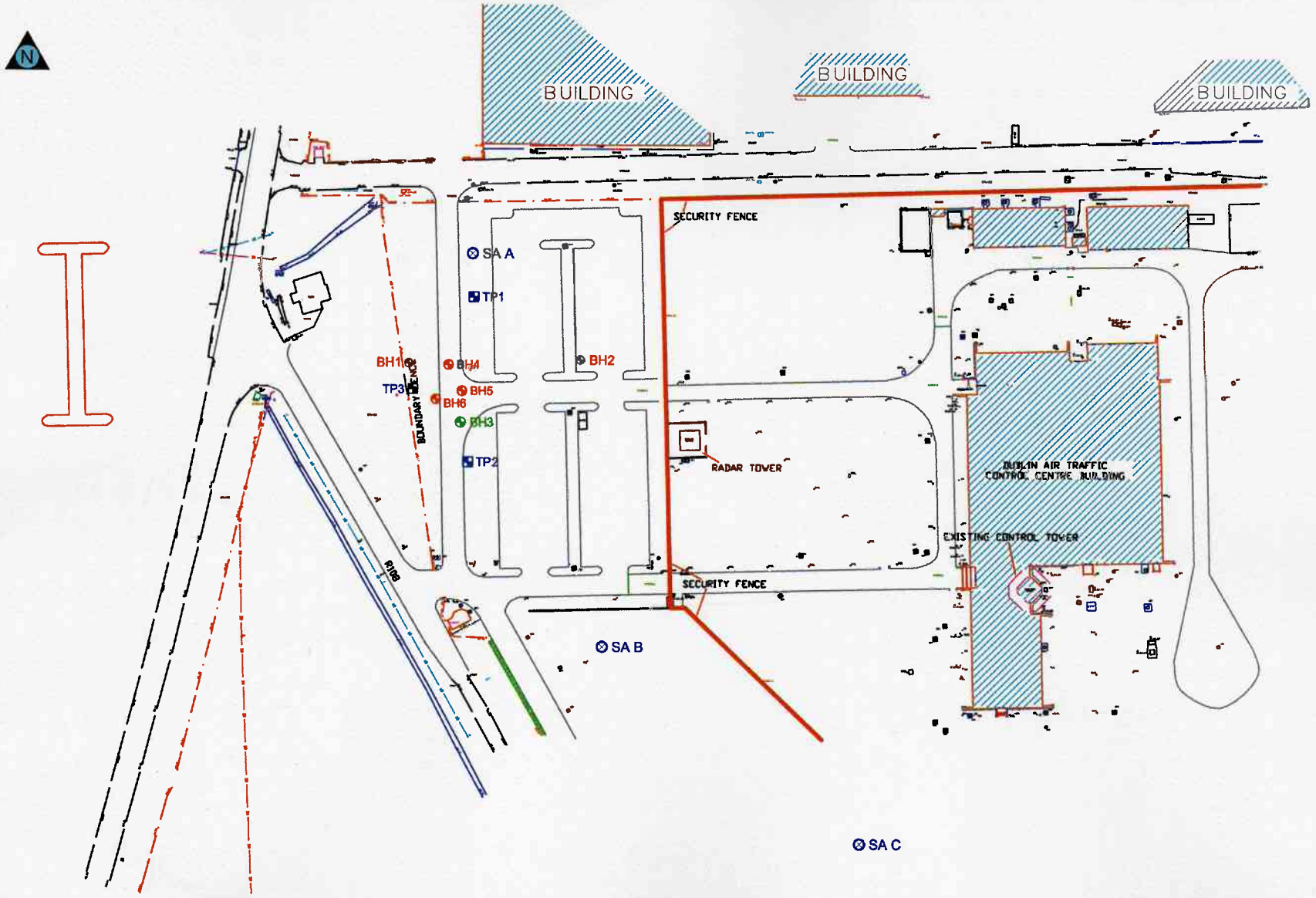
APPENDIX 2

NEW AIR TRAFFIC CONTROL TOWER BOREHOLE LOGS WITH LOCATION PLAN

PROJECT:	Air traffic control tower, North Dublin			TITLE:	Site location plan
CLIENT:	Irish Aviation Authority	SCALE: NTS	SERIES: 01 of 01	KEY:	
ENGINEER:	ARUP	DRWN: MD	DATE: 09/04/09	DWG No:	09-0105-SLoc-001
		CHCK: DC		REV:	

GLOVER SITE INVESTIGATIONS LIMITED

REV:	DATE:	DETAILS:	DRW:	CHK:



PROJECT:	Air traffic control tower, North Dublin			TITLE:	Exploratory hole location plan
CLIENT:	Irish Aviation Authority	SCALE: 1:1000 @ A4	SERIES: 01 of 01	KEY:	BH - Borehole BH- Inclined Borehole TP - Trial Pit
ENGINEER:	ARUP	DRWN: MD	DATE: 07/07/09		
		CHCK: DC			

GLOVER SITE INVESTIGATIONS LIMITED

REV:	DATE:	DETAILS:	DRW:	CHK:

DWG No: 09-0105-EHLoc-001

REV: A

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH01
Boring Method Shell & Auger to 5.13m Rotary Coring to 20.20m	**Casing Diameter** 200mm cased to 5.13m	**Ground Level (mOD)** 65.11	**Client** Irish Aviation Authority	**Job Number** 09-0105
	Location 315412.139 E 243478.653 N	**Dates** 03/03/2009	**Engineer** Arup Consulting Engineers	**Sheet** 1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.30)	TOPSOIL		
					64.81	0.30			
0.50	D1					(0.60)	Firm brown gravelly sandy CLAY with occasional thin seams of fine sand. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse		
					64.21	0.90			
1.00	B1						Stiff brown gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse. Cobbles are subrounded to subangular		
1.00-1.45	U1			12 blows					
1.50	D2								
2.00	D3								
2.00-2.45	SPT N=26			4,5/6,7,6,7					
2.00	B2					(2.60)			
2.50	D4								
3.00	D5								
3.00-3.45	SPT N=44			5,7/9,11,11,13					
3.00	B3								
3.50	D6				61.61	3.50	Very stiff dark brown gravelly sandy CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse. Cobbles and boulders are subrounded to subangular		
4.00	D7								
4.00-4.45	SPT N=33			7,7/6,9,9,9					▼1
4.00	B4					(1.50)			
4.50	D8								
5.00	B5			Water Strike(1) at 5.00m, rose to 4.22m in 20 mins.	60.11	5.00			▽1
5.10-5.26	SPT(C) 25*/60 50/100			25,0/50 03/03/2009:			Strong grey fine grained LIMESTONE		
						(0.80)			

	TCR	SCR	RQD	FI					
5.80					59.31	5.80	Moderately strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veins. Slightly to moderately weathered		
	100	100	57	10			Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 20 degrees, planar smooth to rough, moderately open to very open, clean to orange brown staining to occasional clay infill		
6.70				NI					
6.75							Discontinuity Set 2: widely spaced, dipping 75 degrees to sub-vertical, planar rough to rough undulating, very open to extremely open, clean to clay infill		
	100	94	62			(2.20)			
				8			6.80m - 6.90m: clay infilled discontinuities with aperture 10-20mm		
7.60									
	100	100	88		57.11	8.00			

Remarks
Chiselling from 5.00m to 5.10m for 2 hours.

Scale (approx)	Logged By
1:40	DC/HH

Figure No. 09-0105.BH01

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH01
Machine : Comacchio 405 **Flush :** Air/Mist **Core Dia:** **Method :** Symmetrix & Rotary Coring	**Casing Diameter** 200mm cased to 5.13m	**Ground Level (mOD)** 65.11	**Client** Irish Aviation Authority	**Job Number** 09-0105
	Location 315412.139 E 243478.653 N	**Dates** 03/03/2009	**Engineer** Arup Consulting Engineers	**Sheet** 2/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
8.20								Moderately strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veins. Slightly to moderately weathered		
8.30	100	86	64	NI				Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 20 degrees, planar smooth to rough, moderately open to very open, clean to orange brown staining to occasional clay infill		
8.90	100	100	100	6				Discontinuity Set 2: widely spaced, dipping 75 degrees to sub-vertical, planar rough to rough undulating, very open to extremely open, clean to clay infill		
10.45	100	100	100	7				10.15m - 10.45m: calcite infilled discontinuity with 5-8mm aperture		
10.90	100	100	100	7				11.45m - 11.60m: calcite infilled discontinuity with 5-10mm aperture		
12.00	100	100	100	7			(8.00)	13.25m - 13.55m: calcite infilled discontinuity with 8-12mm aperture		
13.50										
13.55	100	100	100	5						
13.75				16						
14.00				NI				13.95m - 14.36m: zone of weathered limestone with clay. Limestone is strongly discoloured to brown and grey brown, weak to medium strong, becoming very closely spaced		
14.36	88	69	35	6						
14.52				NI						
14.56				10						
15.05										
15.25				NI						
15.35	85	64	45	8		49.11	16.00			

Remarks

Scale (approx)	Logged By
1:40	DC/HH

Figure No. 09-0105.BH01

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH01
Machine : Comacchio 405 **Flush :** Air/Mist **Core Dia:** **Method :** Symmetrix & Rotary Coring	**Casing Diameter** 200mm cased to 5.13m **Location** 315412.139 E 243478.653 N	**Ground Level (mOD)** 65.11 **Dates** 03/03/2009	**Client** Irish Aviation Authority **Engineer** Arup Consulting Engineers	**Job Number** 09-0105 **Sheet** 3/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
16.11				NI				Moderately strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veins. Slightly to moderately weathered Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 20 degrees, planar smooth to rough, moderately open to very open, clean to orange brown staining to occasional clay infill Discontinuity Set 2: widely spaced, dipping 75 degrees to sub-vertical, planar rough to rough undulating, very open to extremely open, clean to clay infill		
16.55	100	100	94	5						
17.05	100	100	79							
17.85	100	100	97	6			(4.20)	16.11m - 16.55m: zone of weathered limestone with occasional clay. Limestone is discoloured to dark grey brown and medium strong		
19.40	100	99	88	5						
19.79				NI						
19.80				5						
20.20						44.91	20.20	Complete at 20.20m		

Remarks

Scale (approx)	Logged By
1:40	DC/HH

Figure No. 09-0105.BH01

Glover Site Investigations Ltd

Site	Borehole Number
New Air Traffic Control Tower, Dublin Airport	BH02

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Shell & Auger to 4.00m Rotary Coring to 21.10m	200mm cased to 4.00m	64.59	Irish Aviation Authority	09-0105
	Location	**Dates**	**Engineer**	**Sheet**
	315453.709 E 243479.445 N	04/03/2009- 20/03/2009	Arup Consulting Engineers	1/3

Depth (m)	Sample / Tests	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
									64.49	(0.10)	BITMAC		
										0.10			
									64.19	(0.30)	HARDCORE		
										0.40			
0.50	ES1										Soft to firm brown gravelly sandy CLAY. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse		
0.50	D1												
1.00	ES2												
1.00-1.45	SPT N=9							2,2/3,2,2,2					
1.00	B1									(1.60)			
1.50	ES2												
1.50	D2												
2.00	B2								62.59	2.00			
2.00-2.45	SPT N=24							4,5/5,6,7,6			Stiff brown gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse. Cobbles are subangular to subrounded		
2.50	D3									(0.90)			
3.00	B3								61.69	2.90			
3.00-3.45	SPT N=44							7,7/10,10,11,13			Very stiff dark brown gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse. Cobbles are subrounded to subangular		
3.50	D4									(1.00)			▼1
													▽1
4.00	D5							Water Strike(1) at 3.90m, rose to 3.50m in 20 mins. 04/03/2009:	60.69	3.90	Strong dark grey fine grained CARBONIFEROUS LIMESTONE		
4.00-4.15	SPT 25*/60 50/90							25,0/50			5.50m - 6.00m: zone of weathered limestone with bands of clay. Limestone is strongly discoloured to brown and grey brown, medium strong		
5.50					NI					(2.10)			
6.00		91	45	45	8				58.59	6.00	Medium strong to strong layered light grey to grey to pale grey brown fine grained LIMESTONE with occasional calcite veining. Moderately weathered Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 20 degrees, planar smooth to rough undulating, open to very open, clean to brown staining and clay infill Discontinuity Set 2: close to widely spaced, dipping 70 degrees to sub-vertical, planar smooth to rough undulating, open to very open, clean to clay infill to calcite infill to occasional orange brown staining		
6.50					NI								
6.60					20								
6.70													
6.80					NI								
6.90		100	78	64	8								
7.50										(2.95)			
		100	100	81	9								
8.30											8.30m - 8.70m: zone of doloritization of the limestone giving a light grey and brown grey discolouration		
		100	100	100	6								
8.90									55.64	8.95	Medium strong to strong layered grey to dark grey and black fine grained fossiliferous LIMESTONE with occasional calcite veins. Slightly weathered (Full description as Sheet 2)		
9.40					NI								
9.50		100	93	86	9					(1.05)	9.90m - 10.00m: calcite infilled discontinuity with a 8-12mm aperture		
									54.59	10.00			

Remarks
Standpipe installed to 6.00m and 12.00m.
Chiselling from 3.90m to 4.00m for 1 hour.

Scale (approx)	Logged By
1:50	DC/HH

Figure No.
09-0105.BH02

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH02
Machine : Comacchio 405 **Flush :** Air/Mist **Core Dia :** **Method :** Symmetrix & Rotary Coring	**Casing Diameter** 200mm cased to 4.00m **Location** 315453.709 E 243479.445 N	**Ground Level (mOD)** 64.59 **Dates** 04/03/2009-20/03/2009	**Client** Irish Aviation Authority **Engineer** Arup Consulting Engineers	**Job Number** 09-0105 **Sheet** 2/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.30								Moderately strong to strong layered grey to dark grey and black fine grained fossiliferous LIMESTONE with occasional calcite veins. Slightly weathered Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 30 degrees, planar smooth to rough undulating, moderately open to very open, clean to brown staining to clay and calcite infill Discontinuity Set 2: medium to widely spaced, dipping 70-85 degrees, planar smooth to smooth undulating, moderately open to very open, clean to brown staining to calcite infill 11.30m - 13.50m: less fossiliferous		
11.09	100	95	86	9 NI 6						
11.14 11.30	100	100	97	8						
11.80 11.86 11.90	100	97	95	33 NI 9						
13.30	100	100	85	8			(6.50)			
14.35 14.40	100	100	90							
14.90	100	100	76	10						
16.50 16.55 16.58	100	95	73	NI 14		48.09	16.50	Moderately strong to strong layered grey to dark grey fine grained slightly fossiliferous LIMESTONE with very occasional calcite veins. Slightly to moderately weathered Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 20 degrees, planar smooth to rough, occasionally rough undulating, moderately open to very open, clean to clay infill to calcite infill Discontinuity Set 2: close to widely spaced, dipping 60 degrees to sub-vertical, planar rough to rough undulating, occasionally stepped, moderately open to very open, clean to clay infill to calcite infill 16.70m - 16.90m: many calcite veins, limestone becoming very closely to closely spaced 17.20m - 19.60m & 20.29m - 20.77m: zones of weathered limestone with occasional clay infilling discontinuities. Limestone is discoloured along discontinuities with more irregular fracture state		
17.41 17.46				NI 12						
18.10 18.24 18.29 18.43 18.48	100	71	53	NI 21 NI 14			(3.50)			
18.98 19.18 19.28 19.42				NI 20 NI						
19.60				14		44.59	20.00			

Remarks

Scale (approx)	Logged By
1:50	DC/HH

Figure No. 09-0105.BH02

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH02
Machine : Comacchio 405 **Flush :** Air/Mist **Core Dia:** **Method :** Symmetrix & Rotary Coring	**Casing Diameter** 200mm cased to 4.00m	**Ground Level (mOD)** 64.59	**Client** Irish Aviation Authority	**Job Number** 09-0105
	Location 315453.709 E 243479.445 N	**Dates** 04/03/2009-20/03/2009	**Engineer** Arup Consulting Engineers	**Sheet** 3/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
								LIMESTONE (Full description as Sheet 2)		
20.29	75	58	37	NI						
20.54				17			(1.10)			
20.72				NI						
21.10						43.49	21.10			
								Complete at 21.10m		

Remarks

Scale (approx)	Logged By
1:50	DC/HH

Figure No. 09-0105.BH02

Glover Site Investigations Ltd

Site	Borehole Number
New Air Traffic Control Tower, Dublin Airport	BH03

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Symmetrix Drilling to 7.00m Rotary Coring to 27.80m		64.96	Irish Aviation Authority	09-0105
Location		**Dates**	**Engineer**	**Sheet**
315424.656 E 243464.265 N		20/03/2009- 25/03/2009	Arup Consulting Engineers	1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					64.76	(0.20)	TARMAC		
					64.56	0.20 (0.20)	MADE GROUND: Hardcore		
						0.40	Stiff brown sandy gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
					63.56	(1.00) 1.40	BOULDER		
					63.06	(0.50) 1.90	Stiff brown sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded		
						(3.50)			
					59.56	5.40	Stiff dark brown sandy gravelly CLAY with low cobble and boulders content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
						(1.10)			
					58.46	6.50	Weathered LIMESTONE		
	TCR / SCR / RQD / FI					(0.50)			
7.00					57.96	7.00	Medium strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veins and bands of clay. Moderately to highly weathered Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 30 degrees, planar smooth to rough undulating, open to extremely open, clean to brown staining to clay infill Discontinuity Set 2: medium to widely spaced, dipping 70 degrees to sub-vertical, planar smooth to rough undulating, open to extremely open, clean to clay infill to calcite infill		
			NI						
7.34	73 / 7	0	20						
7.39			NI						
7.75			9						
8.10			NI						
8.15			10						
8.25			NI						
8.35	89 / 73	59	11			(3.00)			
9.00			NI				7.90m - 7.95m: zone of discolouration to grey brown penetrating in from discontinuity 8.35m - 8.55m, 9.50m - 9.75m: calcite discontinuities with 10-20mm apertures 8.55m - 8.70m: zone of highly weathered limestone. Limestone is weak to medium strong, discoloured grey brown, very closely spaced		
9.25			7						
9.70			NI				9.85m - 9.95m: bands of stiff clay with highly weathered limestone		
9.75			NI						
9.95			13		54.96	10.00			

Remarks
Borehole inclined 30 degrees from vertical.
Depth column relates to actual length at 30 degrees from vertical.

Scale (approx)	Logged By
1:50	DC/HH

Figure No.
09-0105.BH03

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH03
Machine : Comacchio 405 **Flush :** Air/Mist **Core Dia:** **Method :** Symmetrix & Rotary Coring	**Casing Diameter**	**Ground Level (mOD)** 64.96	**Client** Irish Aviation Authority	**Job Number** 09-0105
	Location 315424.656 E 243464.265 N	**Dates** 20/03/2009-25/03/2009	**Engineer** Arup Consulting Engineers	**Sheet** 2/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
9.95	100	72	47	NI				Medium strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veins and bands of clay. Moderately to highly weathered		
10.03				10						
10.16				NI				Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 30 degrees, planar smooth to rough undulating, open to extremely open, clean to brown staining to clay infill		
10.45				13						
10.59								Discontinuity Set 2: medium to widely spaced, dipping 70 degrees to sub-vertical, planar smooth to rough undulating, open to extremely open, clean to clay infill to calcite infill		
10.75				12						
11.09				NI						
11.14				5						
11.35	83	60	48	NI						
11.64				11						
12.00				NI			(4.00)	10.03m - 10.16m, 10.25m - 10.35m, 11.35m - 11.64m, 12.70m - 12.90m: bands of stiff clay with highly weathered limestone		
12.25				NI						
12.90	90	40	22	10				10.16m - 10.25m, 10.45m - 10.59m, 11.95m - 12.00m, 13.10m - 14.00m: zone of highly weathered limestone. Limestone is weak to medium strong, discoloured brown to grey brown, very closely spaced		
13.10				NI						
13.20				13						
13.60				NI						
13.75				NI						
14.00	100	83	78	6		50.96	14.00	Medium strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veining. Slightly weathered		
15.25	100	100	98	5				Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 30 degrees, planar smooth to rough, occasionally rough undulating, moderately open to very open, clean to brown staining to occasional calcite infill to occasional clay infill		
16.75	100	100	84	9			(6.00)	Discontinuity Set 2: widely spaced, dipping 50-70 degrees, planar smooth to rough undulating, moderately open to very open, clean to orange brown staining to occasional clay infill		
18.25	93	93	85	6						
19.65				NI						
19.75						44.96	20.00			

Remarks

Scale (approx)	Logged By
1:50	DC/HH

Figure No. 09-0105.BH03

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH03
Machine : Comacchio 405 **Flush :** Air/Mist **Core Dia:** **Method :** Symmetrix & Rotary Coring	**Casing Diameter**	**Ground Level (mOD)** 64.96	**Client** Irish Aviation Authority	**Job Number** 09-0105
	Location 315424.656 E 243464.265 N	**Dates** 20/03/2009-25/03/2009	**Engineer** Arup Consulting Engineers	**Sheet** 3/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	100	100	89	7				Medium strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veining. Slightly weathered Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 30 degrees, planar smooth to rough, occasionally rough undulating, moderately open to very open, clean to brown staining to occasional calcite infill to occasional clay infill Discontinuity Set 2: widely spaced, dipping 50-70 degrees, planar smooth to rough undulating, moderately open to very open, clean to orange brown staining to occasional clay infill		
21.25	96	89	89	5						
22.11				NI						
22.15				5						
22.52				NI						
22.56				10						
22.66				NI				22.25m - 23.05m: zone of moderately weathered limestone. Limestone is discoloured orange brown in areas with discolouration penetrating in from the discontinuities. Discontinuities more irregular in state		
22.75	100	99	99	3						
24.05				NI			(7.80)			
24.09				8				24.10m - 24.60m: zone of slightly dolomitization		
24.25	70	70	64	5				24.90m - 27.80m: slightly less fossiliferous		
25.75	95	95	90	6						
27.18				NI						
27.25	100	100	82	9						
27.80						37.16	27.80	Complete at 27.80m		

Remarks

Scale (approx)	Logged By
1:50	DC/HH

Figure No. 09-0105.BH03

Glover Site Investigations Ltd

Site: New Air Traffic Control Tower, Dublin Airport				Borehole Number: BH04
Machine : Commachio 405 Flush : Air / Water Core Dia: 100 Method : Symmetrix / Coring	Casing Diameter: 125mm cased to 8.00m Location: 315421.778 E 243478.271 N	Ground Level (mOD): 64.86 Dates: 26/05/2009-27/05/2009	Client: Irish Aviation Authority Engineer: Arup Consulting Engineers	Job Number: 09-0105 Sheet: 1/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(0.30)	TARMAC		
						64.55	0.30			
							(0.40)	MADE GROUND: Firm brown sandy gravelly CLAY with low cobble and boulder content and pieces of fill.		
						64.16	0.70			
							(6.80)	Firm brown sandy gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded.		
						57.36	7.50			
							(0.50)	Weathered LIMESTONE		
8.00				17		56.86	8.00			
8.06				NI						
8.17				11				Medium strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veining. Slightly to moderately weathered.		
8.55				NI						
8.58	97	88	67	3			(1.92)	Discontinuity Set 1: close to widely spaced, dipping subhorizontal to 30 degrees, rough planar to rough undulating, moderately open to very open, clean to brown staining.		
9.46				NI				8.06-8.17m Highly weathered limestone showing a brown discolouration and becoming weak to very weak.		
9.50	100	60	43	11						
9.68				NI						
9.80				10		54.93	9.92			

Remarks
Hand dug pit to 1.20m.

Scale (approx)	Logged By
1:50	RM

Figure No. 09-0105.BH04

Glover Site Investigations Ltd

Site: New Air Traffic Control Tower, Dublin Airport				Borehole Number: BH04
Machine: Commachio 405 Flush: Air / Water Core Dia: 100 Method: Symmetrix / Coring	Casing Diameter: 125mm cased to 8.00m	Ground Level (mOD): 64.86	Client: Irish Aviation Authority	Job Number: 09-0105
	Location: 315421.778 E 243478.271 N	Dates: 26/05/2009-27/05/2009	Engineer: Arup Consulting Engineers	Sheet: 2/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	75	75	45	NI				Medium strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veining. Slightly weathered. Discontinuity Set 1: close to widely spaced, dipping subhorizontal to 30 degrees, smooth planar to rough undulating, tight to open, clean to black carbonate infill. Discontinuities at 11.40, 14.15, 14.90, 15.49, 15.68, 15.75, 16.90-17.00, have a brown discolouration which occasionally penetrates into the surrounding limestone. The limestone appears weak, showing increased weathering.		
10.10 10.20	100	100	92	6						
11.60	99	99	99	3						
13.08 13.10	97	97	92	NI 6			(7.98)			
14.60 14.65 14.72	95	95	94	NI 6						
16.05	100	100	80							
16.35	100	100	86	6						
17.90 18.02 18.07	91	86	75	NI 7		46.96	17.90 (1.85)	Medium strong to strong grey to dark grey and black fine to medium grained fossiliferous LIMESTONE. Slightly weathered. Discontinuity Set 1: close to widely spaced, dipping subhorizontal to 30 degrees, smooth planar to rough undulating, tight to open, clean to black carbonate rich infill. 18.02-18.07 Highly weathered limestone recovered as dark grey very weak to weak limestone with very closely spaced discontinuities.		
19.00	100	100	85							
19.65 19.75				NI		45.11	19.75	Complete at 19.75m		

Remarks

Scale (approx)	Logged By
1:50	RM

Figure No. 09-0105.BH04

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH05
Boring Method Symmetrix Drilling to 11.20m Rotary Coring to 20.55m	**Casing Diameter** 125mm cased to 11.20m	**Ground Level (mOD)** 64.92	**Client** Irish Aviation Authority	**Job Number** 09-0105
	Location 315425.012 E 243471.877 N	**Dates** 28/05/2009	**Engineer** Arup Consulting Engineers	**Sheet** 1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.30)	TARMAC		
					64.62	0.30			
						(0.50)	MADE GROUND: Firm brown sandy gravelly CLAY with low cobble and boulder content and pieces of fill. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
					64.12	0.80			
							Firm brown sandy gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
						(9.20)			
				Seepage(1) at 7.50m.					▽1
					54.92	10.00			

Remarks
Hand dug pit excavated to 1.20m.

Scale (approx)	Logged By
1:50	RM/HH

Figure No. 09-0105.BH05

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH05
Boring Method Symmetrix Drilling to 11.20m Rotary Coring to 20.55m	**Casing Diameter** 125mm cased to 11.20m	**Ground Level (mOD)** 64.92	**Client** Irish Aviation Authority	**Job Number** 09-0105
	Location 315425.012 E 243471.877 N	**Dates** 28/05/2009	**Engineer** Arup Consulting Engineers	**Sheet** 2/3

Depth (m)	Sample / Tests	TCR	SCR	Casing Depth (m)	RQD	Water Depth (m)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
										(0.80)	Firm brown sandy gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
									54.12	10.80			
										(0.40)	Weathered LIMESTONE		
		TCR	SCR	RQD			FI		53.72	11.20			
11.20		100	95	46			9				Medium strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veining and bands of dark grey to black shale. Slightly to moderately weathered Discontinuity Set 1: close to widely spaced, dipping sub-horizontal to 30 degrees, smooth planar to rough undulating, moderately open to open, clean to brown staining to clay infill Discontinuity Set 2: extremely widely spaced, dipping 80 degrees to sub-vertical smooth planar to rough undulating, moderately open to very open, clean		
12.00							NI						
12.05													
12.20							NI						
12.23							14						
12.43		81	28	0									
12.57							NI						
12.95													
13.00		100	100	100			2						
13.40													
							6						
		84	75	69									
14.12							NI						
14.18							4						
14.43							NI						
14.70													
		100	97	86			5				12.57m - 12.95m and 17.25m - 17.35m: bands of clay		
15.57							NI			(8.80)			
15.60													
15.66		100	93	86			5						
16.50							NI						
16.58													
		100	84	76			4						
17.25							NI						
17.35													
17.60							5						
17.90		97	97	59			NI						
18.07							22						
18.30													
		100	100	100			6						
19.20													
		94	94	69			10		44.92	20.00			

Remarks

Scale (approx)	Logged By
1:50	RM/HH

Figure No. 09-0105.BH05

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH05
Machine : Commachio 405 **Flush :** Air/Water **Core Dia:** 100 **Method :** Symmetrix & Rotary Coring	**Casing Diameter** 125mm cased to 11.20m	**Ground Level (mOD)** 64.92	**Client** Irish Aviation Authority	**Job Number** 09-0105
	Location 315425.012 E 243471.877 N	**Dates** 28/05/2009	**Engineer** Arup Consulting Engineers	**Sheet** 3/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(0.55)	Medium strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veining and bands of dark grey to black shale. Slightly to moderately weathered		
20.55						44.37	20.55	Discontinuity Set 1: close to widely spaced, dipping sub-horizontal to 30 degrees, smooth planar to rough undulating, moderately open to open, clean to brown staining to clay infill Discontinuity Set 2: extremely widely spaced, dipping 80 degrees to sub-vertical smooth planar to rough undulating, moderately open to very open, clean		
								Complete at 20.55m		

Remarks

Scale (approx)	Logged By
1:50	RM/HH

Figure No. 09-0105.BH05

Glover Site Investigations Ltd

Site	Borehole Number
New Air Traffic Control Tower, Dublin Airport	BH06

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Symmetrix Drilling to 12.60m Rotary Coring to 20.20m	125mm cased to 12.60m	65.06	Irish Aviation Authority	09-0105
	Location	**Dates**	**Engineer**	**Sheet**
	315418.543 E 243469.875 N	29/05/2009 30/05/2009	Arup Consulting Engineers	1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					64.86	(0.20)	CONCRETE		
						0.20	MADE GROUND: Firm brown sandy gravelly CLAY with low cobble and boulder content and pieces of fill. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
					64.46	(0.40) 0.60	Firm brown sandy gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
						(7.70)			
				Seepage(1) at 8.00m.					▽1
					56.76	8.30	Very stiff black sandy gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
						(1.70)			
					55.06	10.00			

Remarks
Hand dug pit excavated to 1.20m.

Scale (approx)	Logged By
1:50	RM/HH/DC

Figure No.
09-0105.BH06

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH06
Boring Method Symmetrix Drilling to 12.60m Rotary Coring to 20.20m	**Casing Diameter** 125mm cased to 12.60m	**Ground Level (mOD)** 65.06	**Client** Irish Aviation Authority	**Job Number** 09-0105
	Location 315418.543 E 243469.875 N	**Dates** 29/05/2009-30/05/2009	**Engineer** Arup Consulting Engineers	**Sheet** 2/3

Depth (m)	Sample / Tests	TCR	SCR	RQD	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
										Very stiff black sandy gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
									(2.20)			
								52.86	12.20			
									(0.40)	Weathered LIMESTONE		
		TCR	SCR	RQD	FI			52.46	12.60			
12.60					6					Medium strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veining and bands of dark grey to black shale. Slightly weathered Discontinuity Set 1: close to widely spaced, dipping sub-horizontal to 30 degrees, smooth planar to rough undulating, moderately open to very open, clean to occasional clay infill Discontinuity Set 2: extremely widely spaced, dipping 80 degrees to sub-vertical, smooth planar to rough undulating, moderately open to very open, clean		
12.78					NI							
12.84		100	96	96	6							
14.10		100	100	96	5							
									(5.15)			
15.60		100	100	94	6							
17.20		97	97	57	12			47.31	17.75			
									(0.25)	Medium weak to medium strong grey to dark grey and black fine grained SHALE. Slightly to moderately weathered Discontinuity Set 1: very closely to closely spaced, dipping sub-horizontal to 10 degrees, smooth to rough planar, tight to open, clean to clay infill		
								47.06	18.00			
18.66					NI				(1.37)			
18.70					4					Medium strong to strong grey to dark grey fine grained fossiliferous LIMESTONE with occasional calcite veining and bands of dark grey to black shale. Slightly weathered Discontinuity Set 1: close to medium spaced, dipping sub-horizontal to 30 degrees, smooth planar to rough undulating, moderately open to very open, clean to occasional clay infill Discontinuity Set 2: extremely widely spaced, dipping 80 degrees to sub-vertical, smooth planar to rough undulating, moderately open to very open, clean		
19.37		100	100	88	6			45.69	19.37			

Remarks

Scale (approx)	Logged By
1:50	RM/HH/DC

Figure No. 09-0105.BH06

Glover Site Investigations Ltd

Site New Air Traffic Control Tower, Dublin Airport			**Borehole Number** BH06
Machine : Commachio 405 **Flush :** Air/Water **Core Dia :** 100 **Method :** Symmetrix & Rotary Coring	**Casing Diameter** 125mm cased to 12.60m	**Ground Level (mOD)** 65.06	**Client** Irish Aviation Authority	**Job Number** 09-0105
	Location 315418.543 E 243469.875 N	**Dates** 29/05/2009-30/05/2009	**Engineer** Arup Consulting Engineers	**Sheet** 3/3

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						44.86	(0.83)	Medium strong to strong light grey to cream medium grained bioclastic LIMESTONE with occasional calcite veining. Slightly weathered		
20.20							20.20	Discontinuity Set 1: close to widely spaced, dipping sub-horizontal to 30 degrees, rough planar to rough undulating, moderately open to very open, clean to clay infill		
								Complete at 20.20m		

Remarks

Scale (approx)	Logged By
1:50	RM/HH/DC

Figure No. 09-0105.BH06