

Project

**Swords Road, Santry Phase 2**

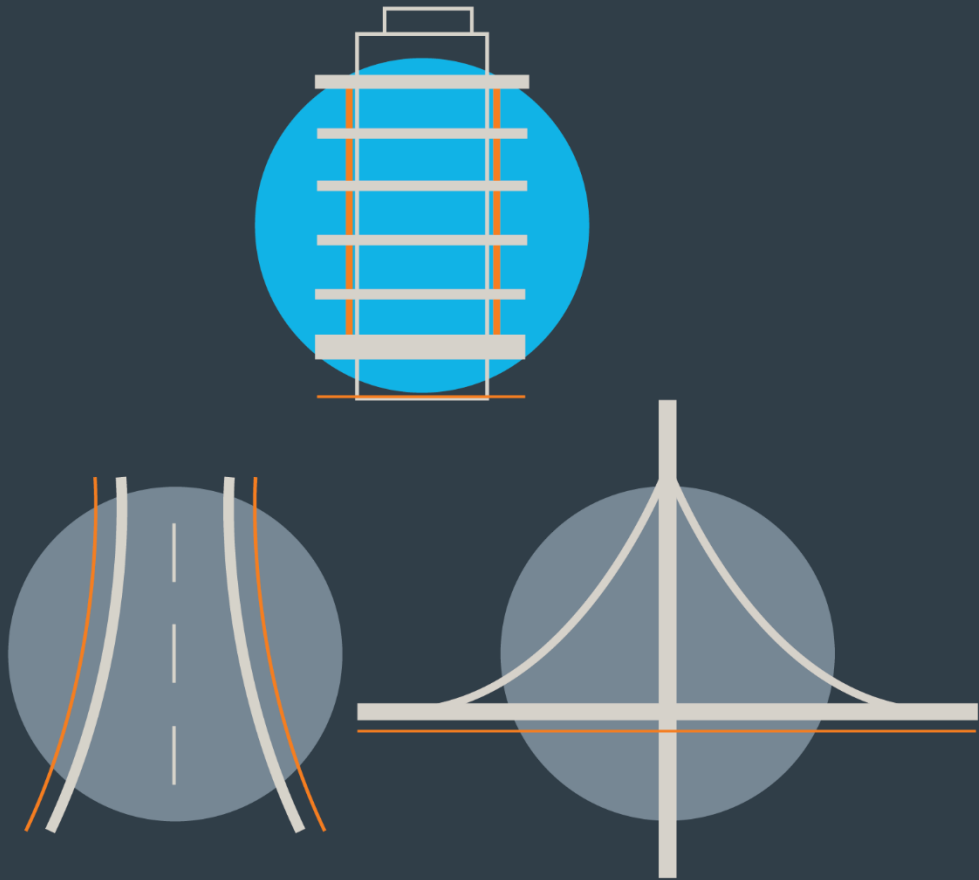
Report Title

**Foundation Appraisal**

Client

**Dwyer Nolan Developments**

STRUCTURES



DBFL CONSULTING ENGINEERS

May 2021

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**Date:** 20<sup>th</sup> May 2021

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Revision	Issue Date	Description	Prepared	Reviewed	Approved
P01	31.05.2021	First Issue	KDC	CFD	CFD
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## **1.0 INTRODUCTION**

### **1.1 Summary**

This report is intended to accompany the DBFL structural layouts of basement and ground floor level of the proposed mixed-use development, on the Swords Road, Santry. These drawings are presented in Appendix A of this report. The choice of conventional strip footings and pad foundations is presented and the reason for the selection of this foundation configuration.

### **1.2 Proposed Development**

Permission is sought for the demolition of the existing buildings on site (4,196.8m<sup>2</sup>). Vehicular access to the proposed development will be via two proposed access points: (i) on Santry Avenue and (ii) off Swords Road, and as permitted under the adjoining development at Santry Place.

The total proposed development consists of 113 no. 1 bed units, 218 no. 2 bed units & 19 no. 3 bed units, all in 7 no. blocks. The proposed development also provides for 5 no. commercial / retail units at ground floor level facing onto Santry Avenue and Swords Road. The development provides a community use unit on the ground floor of Block E, and a residential amenity unit at ground floor level located between Blocks A and D.

Car parking is to be provided in the form of ground parking and basement car parks. Blocks A, B, C, D, E & F are located above the proposed basements, accommodating 173 no. car parking spaces and 719 no. cycle parking spaces. 36 no. surface level car parking spaces also catered for (including 4 no. car club spaces & 5 set down spaces) along with 86 no. surface level bicycle parking spaces, including 42 visitor spaces.

### 1.3 Site Location

The proposed development is located on lands at the junction of Santry Avenue and Swords Road, Santry, Dublin 9 on a site area of 1.5ha, as shown in Figure 1.1. The site is bounded to the north by Santry Avenue, to the east by Swords Road, to the south by the permitted Santry Place development (Ref.s 2713/17 & 2737/19) and to the west by the Santry Avenue Industrial Estate. The site is relatively flat.

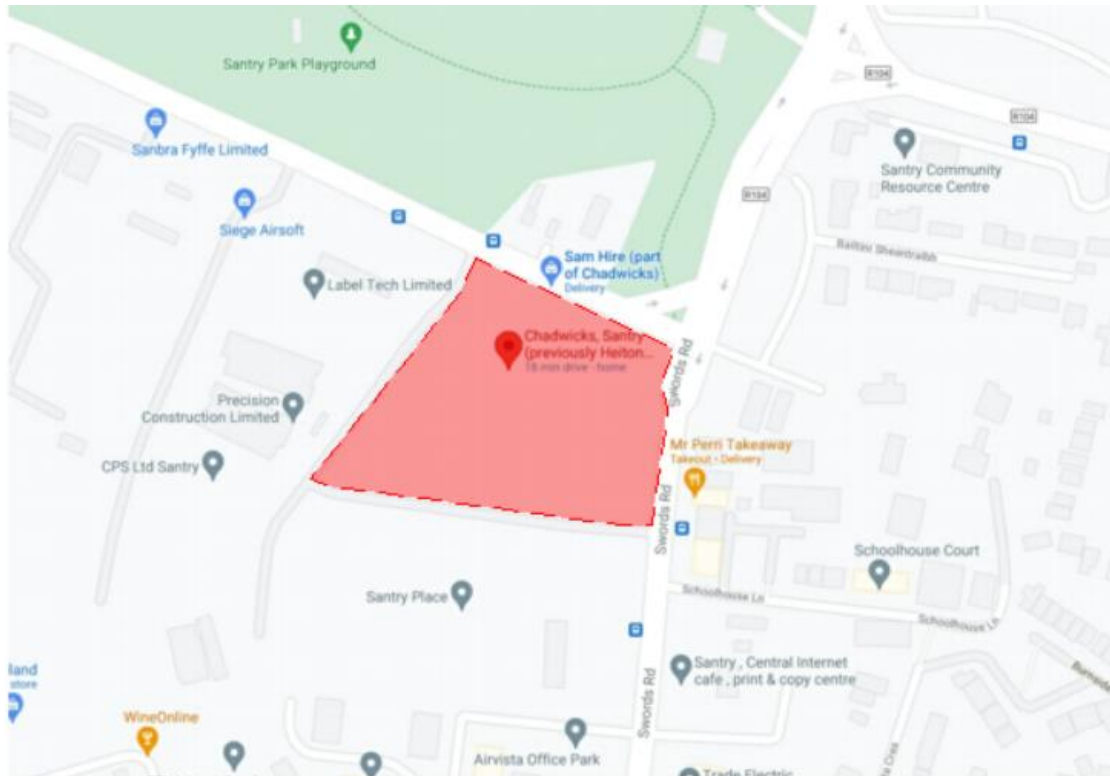


Figure 1.1 Site location

## 2.0 Information Gathering

### 2.1 Scope of Information

A desk study of the geotechnical conditions was carried out using information available of investigations carried out on nearby and adjacent sites. Information was collated from the following sources:

- Ground Investigations Ireland (GII) site investigation carried out on the adjacent Santry Place site. The investigation was carried out on the request of DBFL, who were appointed by Dwyer Nolan as Structural Engineers for the development.
- IGSL site investigation carried out on the nearby Coolock Lane Development, Santry. The investigation was carried out on behalf of Barry & Partners Consulting Engineers. This report is publicly available via the Geological Survey Ireland (GSI) online map portal;  
<https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228>.

No ground investigations have been carried out on the proposed site at the time of writing this report. However, the proposed development is located between the sites, where these investigations were carried out, as shown in Figure 2.1 below. Due to the uniformity of ground conditions described in the 2 No. reports, it is envisaged that the ground conditions on the proposed site will be consistent with Santry Place and Coolock Lane. However, it is recommended that extensive ground investigations are carried out to confirm the ground conditions prior to carrying out any detailed design. This ground investigation should include a combination of trial pits, boreholes, and dynamic probes.



Figure 2.1 Location of ground investigations

## 2.2 Geotechnical Site Investigation – Santry Place Development

A ground investigation was carried out for the adjoining development at Santry Place by GII, in January 2019. The findings of this investigation are summarised below. Please refer to GII report presented in Appendix B at the back of this report for the detailed findings.

### 2.2.1 Ground Conditions Encountered

The following is an extract from the GII report describing the ground conditions encountered on the Santry Place site:

*“The sequence of strata encountered were consistent across the site and are generally comprised;*

- *Surfacing*
- *Fill*
- *Made Ground*
- *Cohesive Deposits*

**SURFACING:** Reinforced concrete surfacing was encountered in all the exploratory holes and was present to a maximum depth of 0.3m BGL.

**FILL:** Granular fill deposits were encountered beneath the concrete surfacing and was present to a relatively consistent depth of between 0.4m and 1.0m BGL. These deposits were described generally as Grey brown slightly clayey slightly sandy angular Gravel with rare angular cobbles.

**MADE GROUND:** Made Ground deposits were encountered beneath the Fill material and was present to a relatively variable depths of between 0.70m and 3.40m BGL. These deposits were described generally as dark brown grey slightly sandy gravelly Clay with occasional cobbles and contained rare fragments of plastic and plywood.

**COHESIVE DEPOSITS:** Cohesive deposits were encountered beneath the Made Ground and were described typically as brown slightly sandy slightly gravelly CLAY with occasional cobbles and boulders overlying a stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and boulders. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits typically increased with depth and was firm to stiff or stiff below 1.50m BGL in the majority of the exploratory holes. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.”

### 2.2.2 Foundations

GII recommended an allowable bearing capacity of 150kN/m<sup>2</sup> for conventional strip or pad footings founded on the stiff cohesive deposits at a depth of 2.0m below ground level (BGL).

As the basement in the proposed development will be founded at a formation level of approx. 4.5m BGL, DBFL requested GII to review the allowable bearing capacity at the lower formation. On further correspondence between DBFL and GII, dated 19<sup>th</sup> April 2021, GII recommended an allowable bearing capacity of 250-300kN/m<sup>2</sup> for conventional strip footings at 4.5m BGL.



### 2.2.3 Excavations

GII noted that temporary excavations in the cohesive deposits will only remain stable for a limited time only and will need temporary propping or appropriate battering if the excavation is to permit man entry. Excavations in the made ground or the soft cohesive deposits will also require appropriate battering.

### 2.2.4 Groundwater

No standpipes were installed during the GII investigation, however water strikes were noted on the borehole log of BH3 at a depth of 5.5m, rising to 4.2m BGL in 20mins. There is no further groundwater information available.

## 2.3 Geotechnical Site Investigation – Coolock Lane Development

IGSL carried out a site investigation of nearby lands as part of a proposed residential / community centre development at Coolock Lane, Santry, in August 2002. The site is located within 150m of the proposed development. The IGSL report is appended to the back of this report. Refer to Appendix C.

### 2.3.1 Ground Conditions Encountered

The following is an extract from the IGSL report describing the ground conditions encountered on the Santry Place site:

*“The boreholes have revealed similar ground conditions with deposits of topsoil and made ground extending to depths of between 1.00 and 2.20m underlain by a firm to stiff brown gravelly clay. This stratum was in turn underlain by a hard black gravelly clay and the boreholes were all terminated on obstructions within these gravelly clays at depths of between 5.50 and 6.50m.”*

### 2.3.2 Foundations

The following is an extract from the IGSL report in which the recommended allowable bearing capacities are presented:

---

*“Where conventional foundations are placed on the firm to stiff brown gravelly clays at depths of approx. 1.00m an allowable bearing pressure of the order of 100 - 125 kN /M2 can be utilised. Where greater loads than these are required then foundations will have to be transferred to the underlying black gravelly clays where an allowable bearing pressure of the order 275 - 300 kN /M2 can be utilised.”*

### 2.3.3 Groundwater

No information on groundwater was presented in the IGSL report.

## **3.0 Discussion of Results**

### **3.1 Choice of Foundations**

Given the stiff cohesive deposits and allowable bearing capacity of 150kN/m<sup>2</sup> noted in the GII report along with the increased allowable bearing capacity of 250-300kN/m<sup>2</sup> noted in the correspondence between DBFL and GII in April 2021, conventional strip and pad foundations are considered suitable for walls and columns for all blocks up to 14 storeys in height. Circulation cores are proposed to be founded on raft foundations as these cores provide stability to the overall scheme and as a result will attract higher load.

The ground conditions and allowable bearing capacity was verified using the ground investigation report carried out by IGSL on the nearby Coolock lane development, accessed via the GSI online map portal.

Although a piling solution was considered for the taller blocks, it was not considered necessary due to the relatively shallow depth of the stiff cohesive deposits.

### **3.2 Stability of Excavations**

Given the location of the basement within the site and the space between the basement perimeter and the site boundary, a 45 degree batter is achievable to form the basement excavation. Alternative retention systems, such as sheet piles or contiguous piling were also considered but deemed unnecessary. A keyplan of the proposed development and proximity to the boundary line is presented in Appendix D, at the back of this report.

### **3.3 Further Investigations**

The findings and recommendations expressed in this report are solely based on information available to DBFL at the time of writing this report. No responsibility can be held by DBFL for conditions which have not been identified. Recommendations made in this report are indicative only and liability cannot be accepted for their accuracy.

It is also recommended that extensive ground investigations are carried out on the proposed site (including a combination of trial pits, boreholes and dynamic probes), before more detailed project design takes place.

**APPENDIX A**

General Layout Drawings

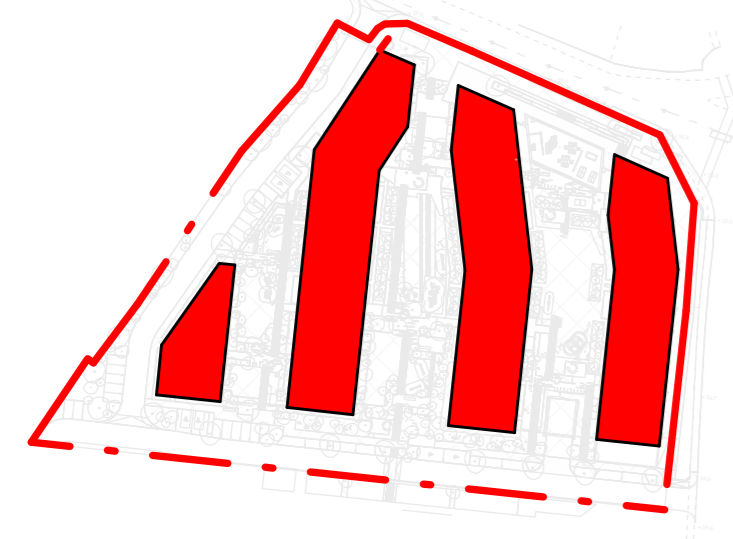
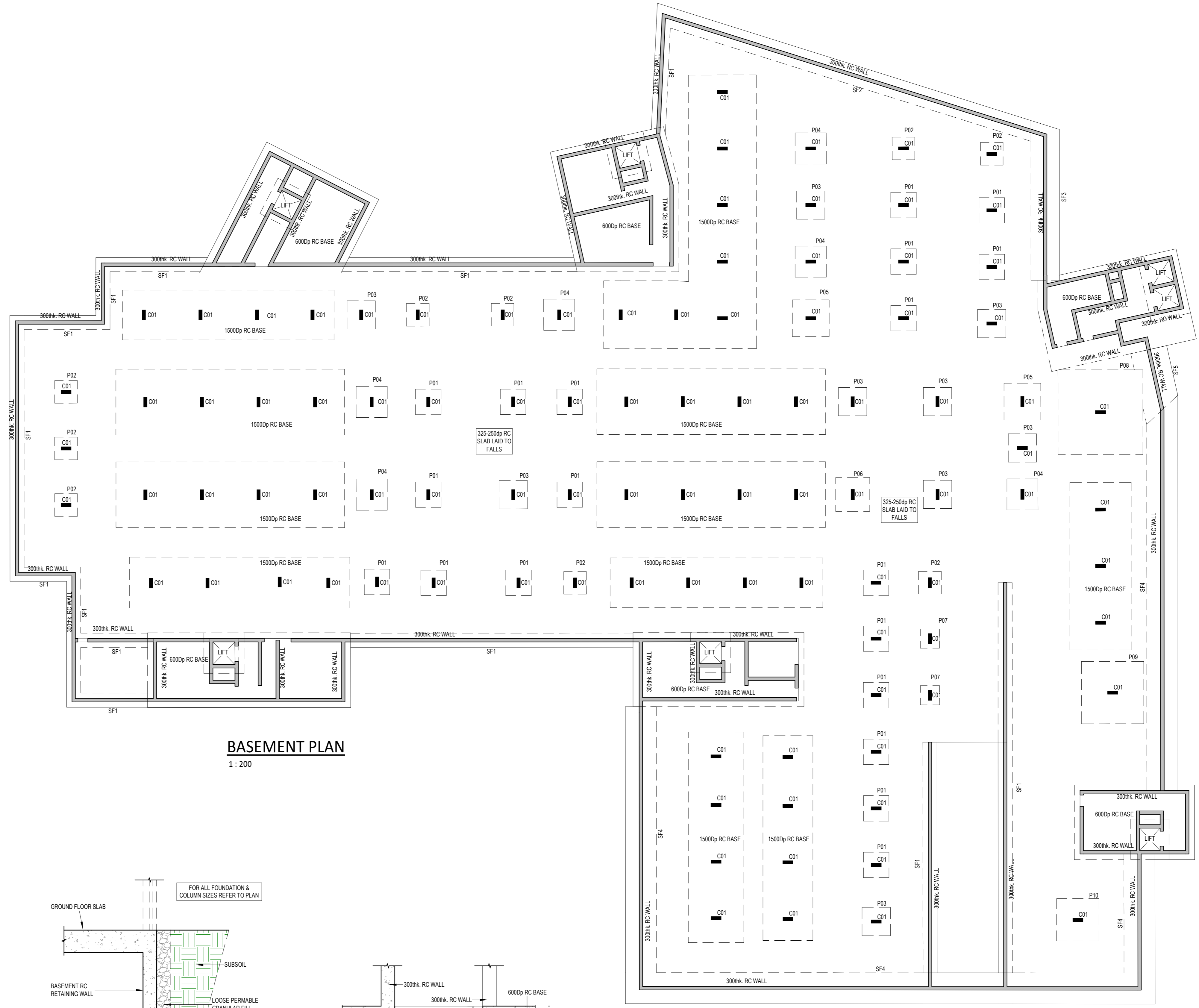
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 Figured dimension only to be taken from this drawing. All dimensions to be checked on site. Consultants to be informed immediately of any discrepancies before work proceeds.

**NOTE:**  
 SIZING/POSITIONING OF STRUCTURAL ELEMENT SHOWN, INCLUDING FOUNDATIONS, ARE PRELIMINARY ONLY AND ARE SUBJECT TO CHANGE BASED ON FURTHER GEOTECHNICAL IN-SITU TESTING AND AT DETAILED DESIGN PHASE

PAD FOUNDATION SCHEDULE	
Type Mark	Description
P01	2250x2250x600Dp RC PAD
P02	2000x2000x500dp RC PAD
P03	2500x2500x600dp RC PAD
P04	2750x2750x750Dp RC PAD
P05	3250x3250x750dp RC PAD
P06	3000x3000x750dp RC PAD
P07	1700x1700x450dp RC PAD
P08	7500x7500x1875dp RC PAD
P09	5500x5500x1450dp RC PAD
P10	3750x3750x950dp RC PAD

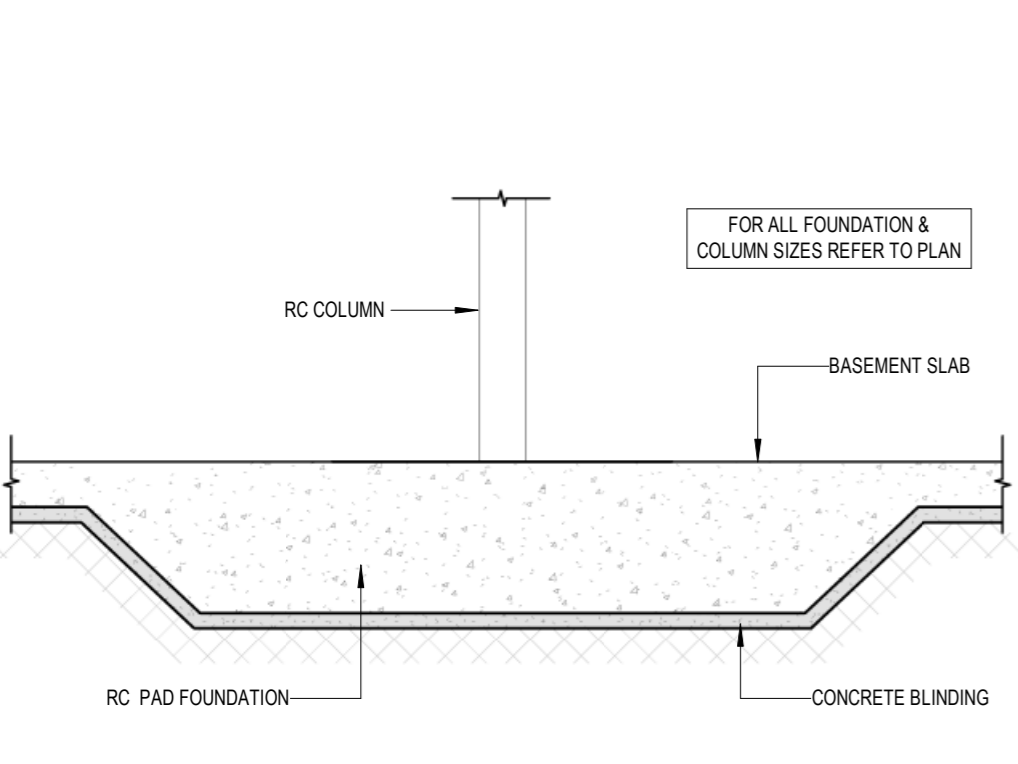
STRIP FOUNDATION SCHEDULE	
Type Mark	Description
SF1	1250x450 Dp RC STRIP FOOTING
SF2	1750x450 Dp RC STRIP FOOTING
SF3	2500x650 Dp RC STRIP FOOTING
SF4	2750x750 Dp RC STRIP FOOTING
SF5	3250x850 Dp RC STRIP FOOTING
SF6	3000x450 Dp RC STRIP FOOTING
SF7	3600x450 Dp RC STRIP FOOTING
SF8	2250x450 Dp RC STRIP FOOTING
SF9	4250x450 Dp RC STRIP FOOTING
SF10	1500x450 Dp RC STRIP FOOTING
SF11	2000x450 Dp RC STRIP FOOTING
SF12	2700x450 Dp RC STRIP FOOTING
SF14	3450x450 Dp RC STRIP FOOTING

COLUMN SCHEDULE	
REF	DESCRIPTION
C01	300x900 RC COLUMN
C02	450sq RC COLUMN

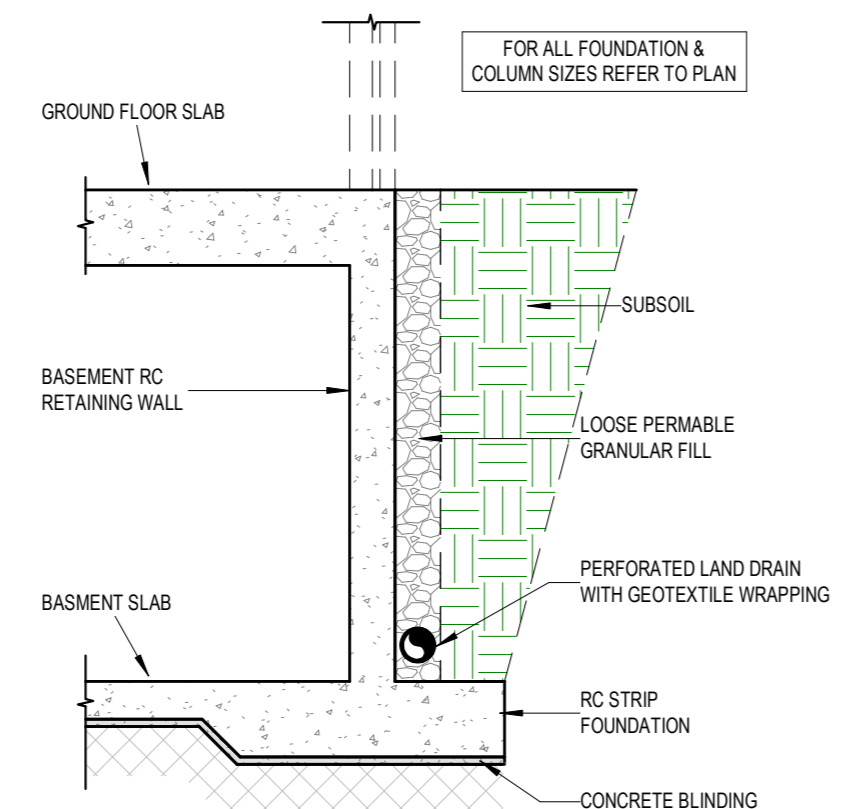


keyplan  
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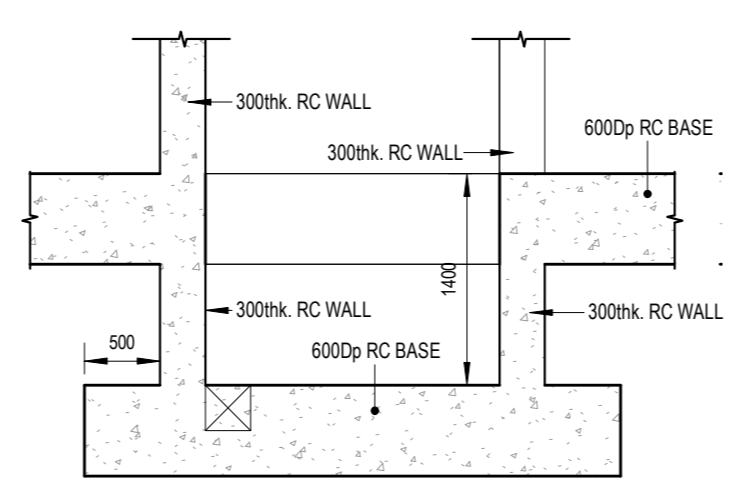
BASEMENT PLAN  
1 : 200



TYP. PAD FOUNDATION SECTION  
1 : 50



TYP. BASEMENT SECTION  
1 : 50



TYP. LIFTPIT SECTION  
1 : 50

REV	date	description	by	chkd.
P01	24-05-2021	ISSUED FOR INFORMATION	GD	KDC

client approval	A - Approved	
	B - Approved with comments	
	C - Do not use	

FOR INFORMATION PLANNING

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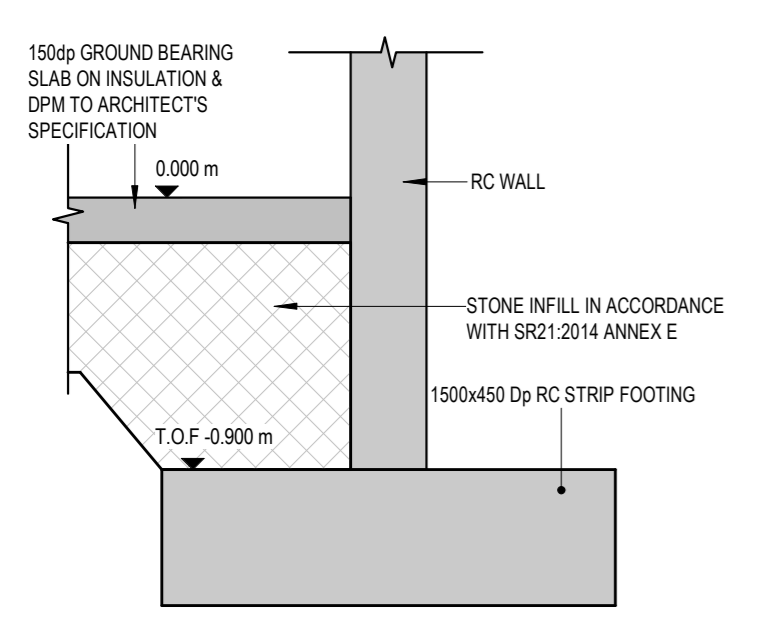
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project ref: **PROPOSED RESIDENTIAL DEVELOPMENT AT SWORDS RD, SANTRY, PHASE 2**

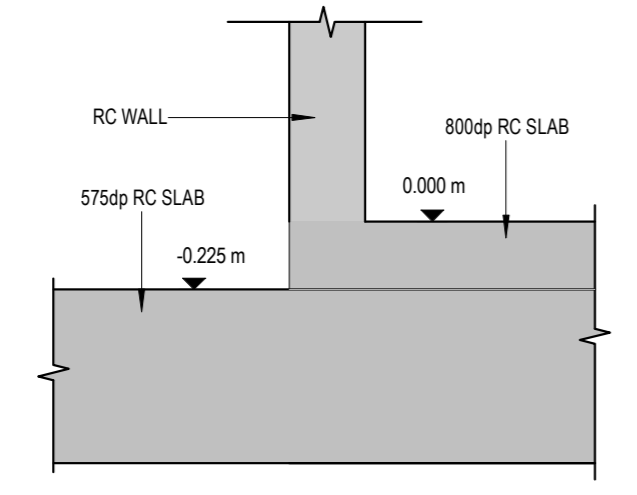
client: **DWYER NOLAN DEVELOPMENTS**

designed by	author	scale	sheet size
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drawing no.	revision:		
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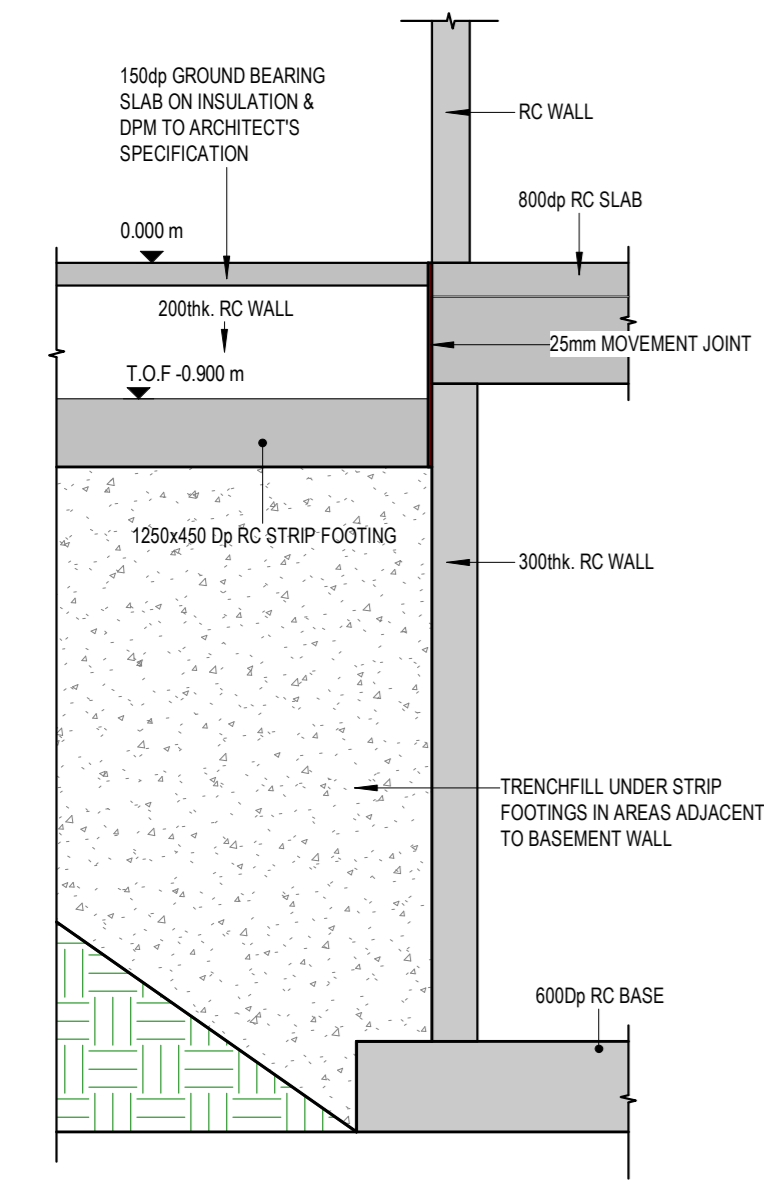
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**SECTION 1-1**  
1 : 25



**SECTION 2-2**  
1 : 25



**SECTION 3-3**  
1 : 50

**SLAB LEGEND**

- DENOTES EXTENT OF TRENCH FILL REQUIRED UNDER STRIP FOOTINGS REFER TO DETAIL
- DENOTES 800dp RC TRANSFER SLAB
- DENOTES 575-500dp RC TRANSFER SLAB SCREED SET TO FALLS
- DENOTES 150dp GROUND BEARING SLAB ON INSULATION & DPM TO ARCHITECT'S SPECIFICATION

**Legend 1**  
1 : 50

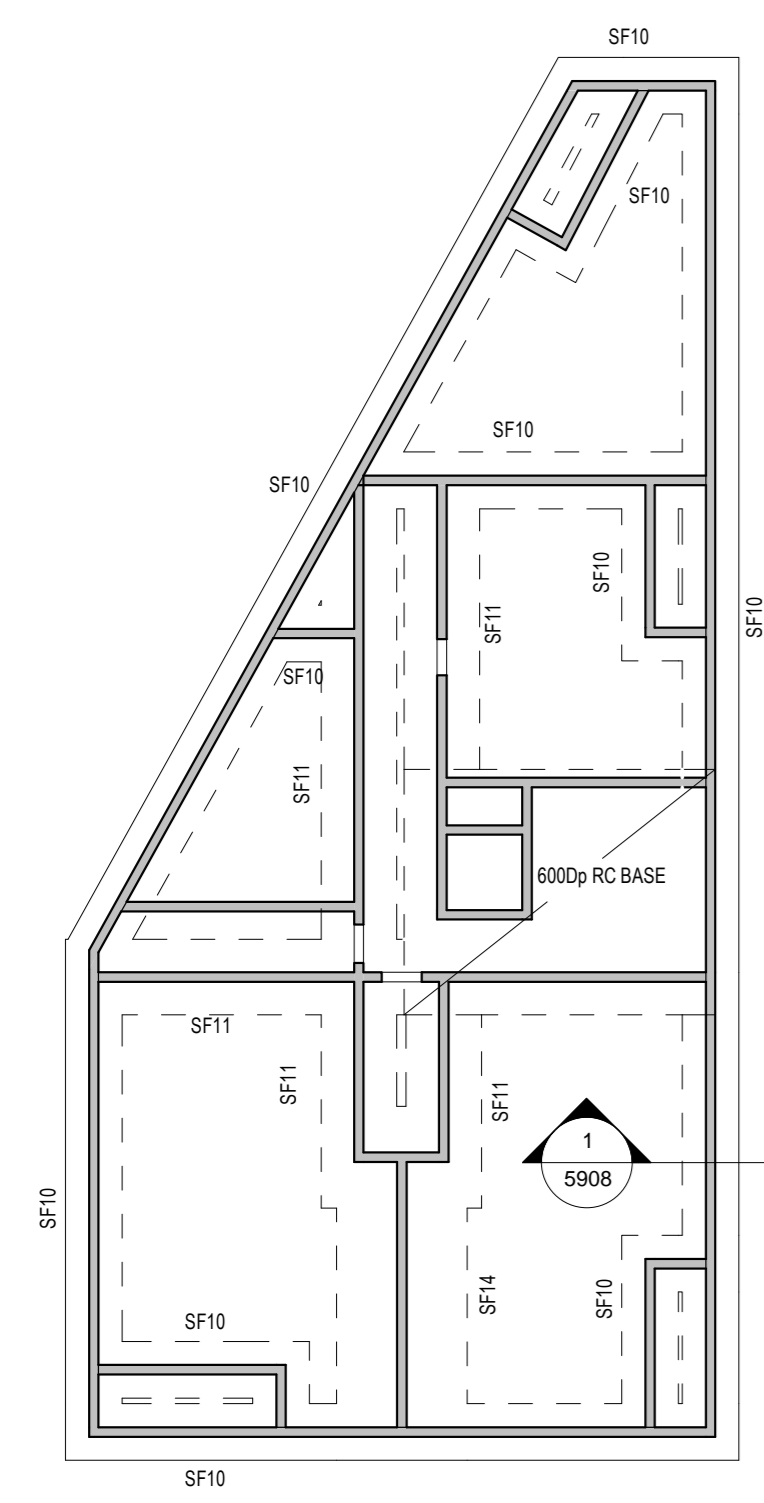
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Type Mark	Description
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SF11	2000x450 Dp RC STRIP FOOTING
SF12	2700x450 Dp RC STRIP FOOTING
SF14	3450x450 Dp RC STRIP FOOTING

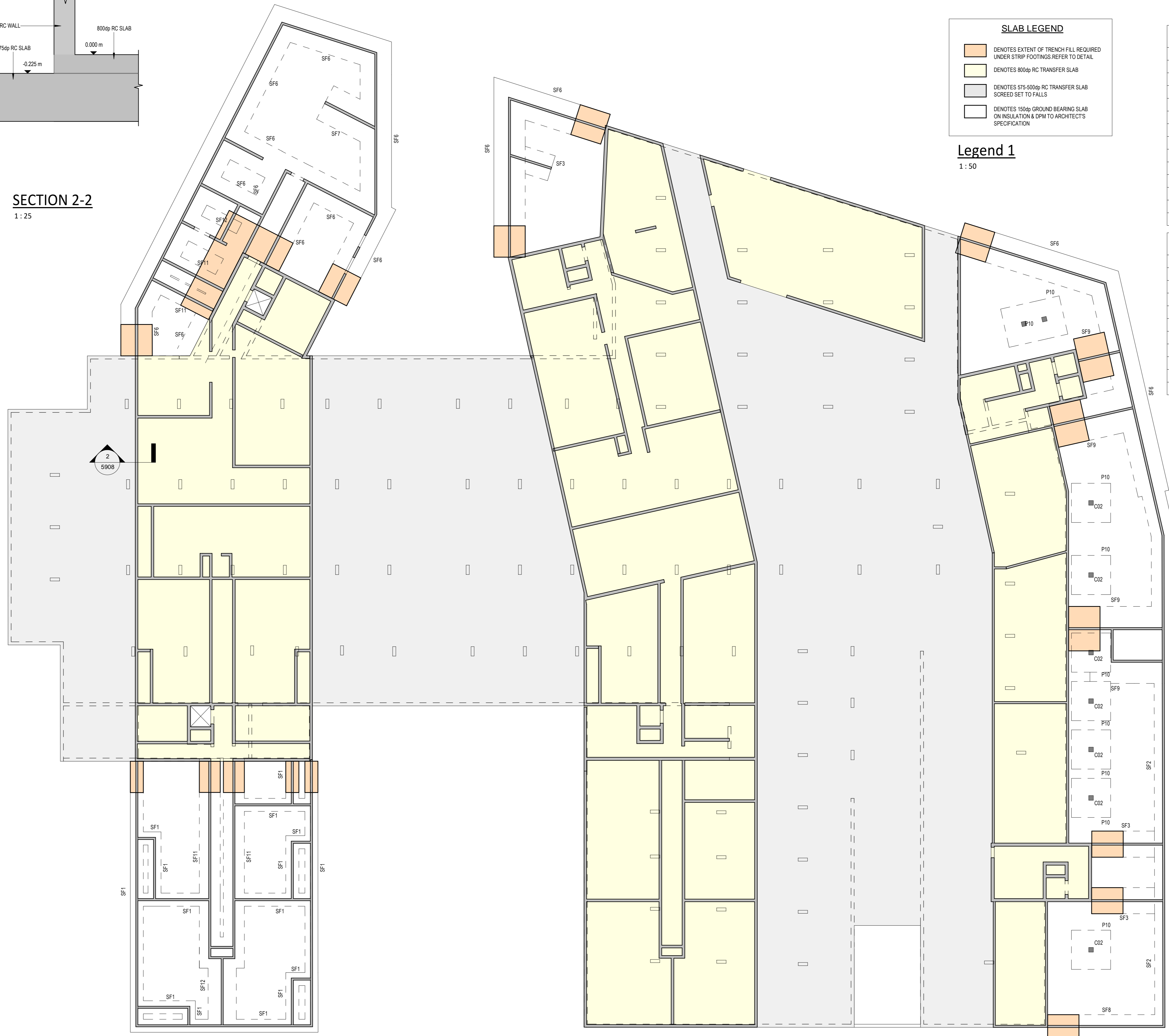
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Type Mark	Description
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P02	2000x2000x500dp RC PAD
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P07	1700x1700x450dp RC PAD
P08	7500x7500x1875dp RC PAD
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P10	3750x3750x950dp RC PAD

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**GROUND FLOOR PLAN**  
1 : 200



REV	date	ISSUED FOR INFORMATION	description	GD	KDC
P01	31-08-2021	ISSUED FOR INFORMATION		GD	KDC

client approval	A - Approved	
	B - Approved with comments	
	C - Do not use	

FOR INFORMATION  
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project ref. **PROPOSED RESIDENTIAL DEVELOPMENT AT SWORDS RD, SANTRY, PHASE 2**  
 drawing title **GROUND FLOOR PLAN**

client **DWYER NOLAN DEVELOPMENTS**

designed by	author	scale	sheet size
KDC	GD	AS SHOWN	A1
drawing no.	200060-DBFL-XX-00-DR-S-1002		revision:
			<b>P01</b>

**APPENDIX B**

Ground Investigations Ireland Report

Santry Place





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# Ground Investigations Ireland

## Development in Santry

### Ground Investigation Report

#### ***DOCUMENT CONTROL SHEET***

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Client	DBFL
Project No	8347-01-19
Document Title	Ground Investigation Report

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## APPENDICES

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Appendix 2	Trial Pit Records
Appendix 3	Borehole Records
Appendix 4	Laboratory Testing

## 1.0 Preamble

On the instructions of DBFL Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., between January and February 2019 at the site of the proposed residential development in Santry, Co. Dublin.

## 2.0 Overview

### 2.1. Background

It is proposed to construct a new residential development with associated services, access roads and car parking at the proposed site. The site is currently occupied by existing warehouses and is situated approximately 6km south of Dublin city centre adjacent to the Swords Road. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant.

### 2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 3 No. Trial Pits to a maximum depth of 3.1m BGL
- Carry out 3 No. Cable Percussion boreholes to a maximum depth of 10m BGL
- Carry out 1 No. Rotary Core Boreholes to a maximum depth of 9.7m BGL
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

## 3.0 Subsurface Exploration

### 3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.

The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

### **3.2. Trial Pits**

The trial pits were excavated using a JCB 3CX excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

### **3.3. Cable Percussion Boreholes**

The Cable Percussion Boreholes were drilled using a Dando 2000 drilling rig with regular in-situ testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.

The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata. Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60° cone. The Standard Penetration Test number referred to as the 'N' value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil. The cable percussion borehole logs are provided in Appendix 3 of this Report.

### **3.4. Rotary Boreholes**

The rotary coring was carried out by a track mounted T44 Beretta rig at the locations shown on the location plan in Appendix 1. The rotary boreholes were completed from the ground surface or alternatively, where noted on the individual borehole log, from the base of the cable percussion borehole where a temporary liner was installed to facilitate follow-on rotary coring.

The T44 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T44 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the “overshoot” recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit, and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids. It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 3 of this Report.

### **3.5. Laboratory Testing**

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.

Environmental testing, including Waste Acceptance Criteria (WAC), pH and sulphate testing was carried out by Jones Environmental Laboratory in the UK.

Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD), hydrometer tests were carried out in NMTL’s Geotechnical Laboratory in Carlow.

The results of the laboratory testing are included in Appendix 4 of this Report

## **4.0 Ground Conditions**

### **4.1. General**

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and are generally comprised;

- Surfacing
- Fill
- Made Ground
- Cohesive Deposits

**SURFACING:** Reinforced concrete surfacing was encountered in all the exploratory holes and was present to a maximum depth of 0.3m BGL.

**FILL:** Granular fill deposits were encountered beneath the concrete surfacing and was present to a relatively consistent depth of between 0.4m and 1.0m BGL. These deposits were described generally as *Grey brown slightly clayey slightly sandy angular Gravel with rare angular cobbles*.

**MADE GROUND:** Made Ground deposits were encountered beneath the Fill material and was present to a relatively variable depths of between 0.70m and 3.40m BGL. These deposits were described generally as *dark brown grey slightly sandy gravelly Clay with occasional cobbles and contained rare fragments of plastic and plywood*.

**COHESIVE DEPOSITS:** Cohesive deposits were encountered beneath the Made Ground and were described typically as *brown slightly sandy slightly gravelly CLAY with occasional cobbles and boulders* overlying a *stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits typically increased with depth and was firm to stiff or stiff below 1.50m BGL in the majority of the exploratory holes. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

#### 4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors.

#### 4.3. Laboratory Testing

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of low to high plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging from 39.2% to 61% generally with fines contents of 31% to 71.7%.

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

The results of the Waste Acceptance Criterial Test Suite are presented with the individual parameter limits for “Inert” “Non Hazardous” and “Hazardous” as outlined within European Council Directive 1999 131/EC Article 16 Annex II, “Criteria and procedures for the acceptance of waste at landfills”. The intended disposal site should be consulted to ensure compliance with their specific requirements.

The results indicate that Asbestos has been detected at 0.4m BGL in TP1. Consultation is advised with a specialist environmental consultant or local landfill operators regarding the disposal of this material. The results from the completed laboratory testing is included in Appendix 4 of this report.

## **5.0 Recommendations & Conclusions**

### **5.1. General**

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

### **5.2. Foundations**

An allowable bearing capacity of 150 kN/m<sup>2</sup> is recommended for conventional strip or pad foundations on the stiff cohesive deposits at a depth of 2.00m BGL in all areas except where the BH03, which had made ground down to 3.00m BGL. At BH03, lean mix trench fill to a depth of 3.00m BGL is recommended to achieve the recommended allowable bearing capacity.

The possibility for variation in the depth of the made ground in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete.

A ground bearing floor slab is recommended to be based on the firm to stiff cohesive deposits with an appropriate depth of compacted hardcore specified by the consulting engineer and in accordance with the limits and guidelines in SR21:2014 +A1:2016 and/or NRA SRW CL808 Type E granular stone fill.

The pH and sulphate testing completed on samples recovered from the trial pits indicates the pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. No special precautions are required for concrete foundations to prevent sulphate attack.

### **5.3. Excavations**

Short term temporary excavations in the cohesive deposits will remain stable for a limited time only and will require to be appropriately battered or the sides supported if the excavation is below 1.25m BGL or is required to permit man entry.

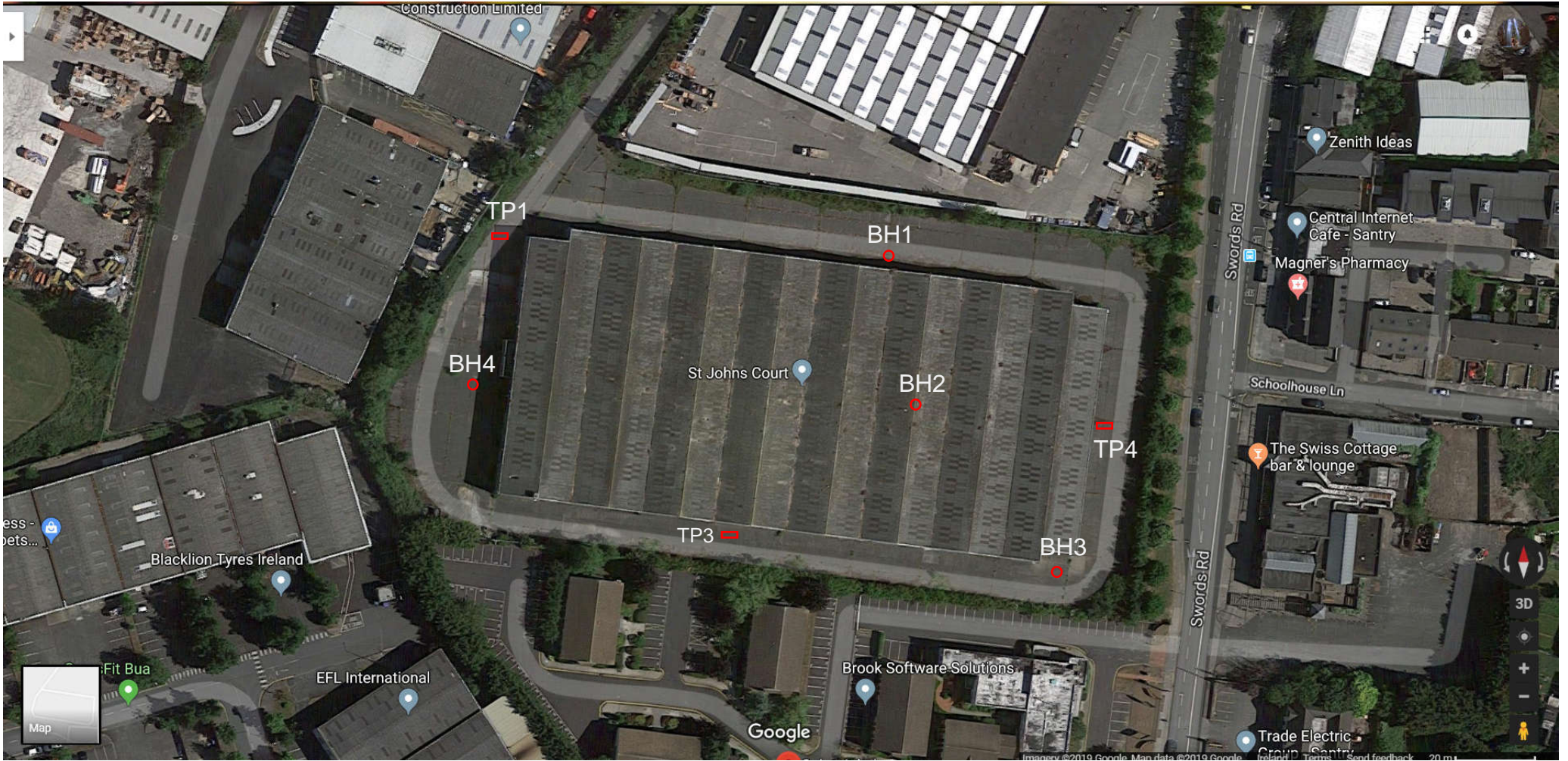
Excavations in the Made Ground or soft Cohesive Deposits will require to be appropriately battered or the sides supported due to the low strength of these deposits.

The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.



# **APPENDIX 1 - Site Location Plan**



## **APPENDIX 2 – Trial Pit Records**



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**Site**  
Development in Santry

**Trial Pit Number**  
**TP01**

<b>Machine</b> : JCB 3CX		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> DBFL		<b>Job Number</b> 8347-01-19	
<b>Method</b> : Trial Pit		<b>Location</b>		<b>Dates</b> 21/01/2019		<b>Engineer</b>		<b>Sheet</b> 1/1	

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40	B				(0.22)	REINFORCED CONCRETE		
					0.22 (0.18)	FILL: Grey sandy angular Gravel wit rare cobble.		
1.00	B				0.40 (0.30)	MADE GROUND: Grey brown slightly sandy slightly gravelly with occasional cobbles and rare fragments of plastic.		
					0.70 (0.50)	Firm grey brown slightly sandy slightly gravelly CLAY with occasional cobbles.		
2.40	B				1.20 (1.20)	Firm to stiff grey brown slightly sandy slightly gravelly CLAY with occasional cobbles.		
					2.40 (0.40)	Stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and rare boulders.		
					2.80	Refusal at 2.8m due to boulder. Complete at 2.80m		

**Remarks**

Groundwater encountered at 2.6m BGL in Trial Pit.  
Trial Pit sidewalls are stable.  
Trial Pit backfilled upon completion.

No image available

<b>Scale (approx)</b> 1:25	<b>Logged By</b> CCostigan	<b>Figure No.</b> 8347-01-19.TP01
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**Site**  
Development in Santry

**Trial Pit Number**  
**TP03**

<b>Machine</b> : JCB 3CX		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> DBFL		<b>Job Number</b> 8347-01-19	
<b>Method</b> : Trial Pit		<b>Location</b>		<b>Dates</b> 21/01/2019		<b>Engineer</b>		<b>Sheet</b> 1/1	

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B				(0.24)	REINFORCED CONCRETE		
					0.24	FILL: Grey sandy angular Gravel wit rare cobble.		
1.50	B				(0.36)			
					0.60	Firm grey brown slightly sandy slightly gravelly CLAY with occasional cobbles.		
					(0.40)	Firm to stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles.		
					1.00			
					(0.80)			
					1.80	Stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and rare boulders.		
					(0.70)			
					2.50	Refusal at 2.5m due to boulder.		
						Complete at 2.50m		

**Remarks**

No groundwater encountered in Trial Pit.  
Trial Pit sidewalls are stable.  
Trial Pit backfilled upon completion.

No image available

<b>Scale (approx)</b> 1:25	<b>Logged By</b> CCostigan	<b>Figure No.</b> 8347-01-19.TP03
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**Site**  
Development in Santry

**Trial Pit Number**  
**TP04**

<b>Machine</b> : JCB 3CX		<b>Dimensions</b>		<b>Ground Level (mOD)</b>		<b>Client</b> DBFL		<b>Job Number</b> 8347-01-19	
<b>Method</b> : Trial Pit		<b>Location</b>		<b>Dates</b> 21/01/2019		<b>Engineer</b>		<b>Sheet</b> 1/1	

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B				(0.21)	REINFORCED CONCRETE		
					0.21	FILL: Grey sandy angular Gravel.		
1.00	B				(0.29)			
					0.50	MADE GROUND: Grey reddish brown slightly clayey sandy Gravel with occasional cobbles and rare fragments of plywood.		
2.00	B				(0.50)			
					1.00	Soft to firm grey brown mottled slightly sandy slightly gravelly CLAY with rare cobbles and fragments of shell.		
3.00	B				(0.80)			
					1.80	Firm grey brown slightly sandy slightly gravelly CLAY with occasional cobbles and fragments of shell.		
					(1.00)			
					2.80	Firm to stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and rare boulders.		
					(0.30)			
					3.10	Refusal at 3.1m due to boulder.		
						Complete at 3.10m		

No image available

**Remarks**

No groundwater encountered in Trial Pit.  
Trial Pit sidewalls are stable.  
Trial Pit backfilled upon completion.

<b>Scale (approx)</b> 1:25	<b>Logged By</b> CCostigan	<b>Figure No.</b> 8347-01-19.TP04
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## Development in Santry – Trial Pit Photos

TP01



TP01



TP01



TP01





TP03



TP03



**TP02**



**TP02**



TP04



TP04



TP04



TP04



## **APPENDIX 3 – Cable Percussion Borehole Records**



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**Site**  
Development in Santry

**Borehole Number**  
**BH1**

<b>Machine</b> : Dando 2000	<b>Casing Diameter</b> 200 mm to 10.0 m	<b>Ground Level (mOD)</b>	<b>Client</b> DBFL	<b>Job Number</b> 8347-01-19
<b>Method</b> : Cable Percussion	<b>Location</b>	<b>Dates</b> 16/02/2019	<b>Engineer</b>	<b>Sheet</b> 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45 1.00	SPT(C) N=10 B			1,2/3,2,3,2		(0.20)	REINFORCED CONCRETE		
						(0.20)	FILL: Grey brown slightly sandy clayey angular to subangular Gravel.		
2.00-2.45 2.00	SPT(C) N=34 B			6,7/8,8,8,10		(0.20)	POSSIBLE MADE GROUND: Brown grey slightly sandy gravelly Clay with occasional angular cobbles.		
						(0.60)	Firm to stiff brown grey slightly sandy slightly gravelly CLAY with occasional subangular to rounded cobbles.		
3.00-3.45 3.00	SPT(C) N=35 B			8,8/7,6,11,11		1.00			
4.00-4.45 4.00	SPT(C) N=55 B			8,12/13,13,14,15		(0.60)			
5.00-5.45 5.00	SPT(C) N=50 B			9,10/14,14,18,4		1.60	Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and rare boulders.		
6.00-6.30 6.00	SPT(C) 50/145 B			18,24/24,26		(8.40)			
7.00-7.23 7.00	SPT(C) 50/75 B			27,27/50					
8.00-8.30 8.00	SPT(C) 50/145 B			23,25/24,26					
9.00-9.18 9.00	SPT(C) 50/25 B			25,25/50					
10.00-10.00	50/0 SPT(C) 50*/0			25,25/50		10.00			

<b>Remarks</b> No groundwater encountered in Borehole. Borehole backfilled upon completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:50	CCostigan
	<b>Figure No.</b> 8347-01-19.BH1	



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**Site**  
Development in Santry

**Borehole Number**  
**BH1**

<b>Machine</b> : Dando 2000 <b>Method</b> : Cable Percussion	<b>Casing Diameter</b> 200 mm to 10.0 m	<b>Ground Level (mOD)</b>	<b>Client</b> DBFL	<b>Job Number</b> 8347-01-19
	<b>Location</b>	<b>Dates</b> 16/02/2019	<b>Engineer</b>	<b>Sheet</b> 2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00	B								

<b>Remarks</b>	<b>Scale (approx)</b> 1:50	<b>Logged By</b> CCostigan
	<b>Figure No.</b> 8347-01-19.BH1	



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**Site**  
Development in Santry

**Borehole Number**  
**BH2**

<b>Machine</b> : Dando 2000	<b>Casing Diameter</b> 200 mm to 8.5 m	<b>Ground Level (mOD)</b>	<b>Client</b> DBFL	<b>Job Number</b> 8347-01-19
<b>Method</b> : Cable Percussion	<b>Location</b>	<b>Dates</b> 23/02/2019	<b>Engineer</b>	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45 1.00	SPT(C) N=9 B			2,2/2,2,2,3		0.20 0.20 0.40 0.60 0.80	REINFORCED CONCRETE FILL: Grey brown slightly sandy clayey angular to subangular Gravel. MADE GROUND: Brown grey slightly sandy gravelly Clay with occasional angular cobbles. (Fill)		
2.00-2.45 2.00	SPT(C) N=15 B			3,4/4,3,4,4		1.40 2.00	Firm to stiff brown grey slightly sandy slightly gravelly CLAY with occasional subangular to rounded cobbles. Stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and rare boulders.		
3.00-3.45 3.00	SPT(C) N=43 B			6,7/8,11,11,13		3.00	Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and rare boulders.		
4.00-4.45 4.00	SPT(C) N=49 B			7,10/10,11,14,14					
5.00-5.38 5.00	SPT(C) 50/225 B			8,15/13,17,20					
6.00-6.30 6.00	SPT(C) 50/150 B			13,19/31,19		(5.50)			
7.00-7.30 7.00	SPT(C) 50/150 B			28,24/27,23					
8.00-8.23 8.00	SPT(C) 50/75 B			28,41/50		8.50	Complete at 8.50m		

<b>Remarks</b> No groundwater encountered in Borehole. Borehole backfilled upon completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:50	CCostigan
	<b>Figure No.</b> 8347-01-19.BH2	





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**Site**  
Development in Santry

**Borehole Number**  
**BH3**

<b>Machine</b> : Dando 2000	<b>Casing Diameter</b> 200 mm to 10.0 m	<b>Ground Level (mOD)</b>	<b>Client</b> DBFL	<b>Job Number</b> 8347-01-19
<b>Method</b> : Cable Percussion	<b>Location</b>	<b>Dates</b> 18/02/2019- 19/02/2019	<b>Engineer</b>	<b>Sheet</b> 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45 1.00	SPT(C) N=11 B			1,2/2,3,3,3		(0.20) 0.20	REINFORCED CONCRETE		
						(0.60)	FILL: Grey brown sandy angular Gravel.		
						0.80	MADE GROUND: Dark brown grey slightly sandy gravelly Clay with occasional angular cobbles and fragments of brick and scrap metal		
2.00-2.45 2.00	SPT(C) N=9 B			1,2/2,3,2,2		(2.20)			
3.00-3.45 3.00	SPT(C) N=19 B			2,3/4,4,5,6		3.00	Stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and rare boulders.		
4.00-4.45 4.00	SPT(C) N=26 B			4,4/6,6,7,7		(2.00)			▽1
5.00-5.45 5.00	SPT(C) N=37 B			7,8/8,9,9,11		5.00	Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and rare boulders.		▽1
6.00-6.45 6.00	SPT(C) N=48 B			10,10/11,13,13,11					
7.00-7.38 7.00	SPT(C) 50/225 B			8,15/15,18,17		(5.00)			
8.00-8.30 8.00	SPT(C) 50/145 B			21,24/28,22					
9.00-9.22 9.00	SPT(C) 50/70 B			27,25/50					
10.00-10.00	50/0 SPT(C) 50*/0			25,25/50		10.00			

<b>Remarks</b> Groundwater encountered at 5.5m BGL in Borehole. Borehole backfilled upon completion.	<b>Scale (approx)</b> 1:50	<b>Logged By</b> CCostigan
<b>Figure No.</b> 8347-01-19.BH3		



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**Site**  
Development in Santry

**Borehole Number**  
**BH3**

<b>Machine</b> : Dando 2000	<b>Casing Diameter</b> 200 mm to 10.0 m	<b>Ground Level (mOD)</b>	<b>Client</b> DBFL	<b>Job Number</b> 8347-01-19
<b>Method</b> : Cable Percussion	<b>Location</b>	<b>Dates</b> 18/02/2019- 19/02/2019	<b>Engineer</b>	<b>Sheet</b> 2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00	B								

<b>Remarks</b>	<b>Scale (approx)</b> 1:50	<b>Logged By</b> CCostigan
	<b>Figure No.</b> 8347-01-19.BH3	



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**Site**  
Development in Santry

**Borehole Number**  
**BH4**

<b>Machine</b> : Dando 2000	<b>Casing Diameter</b> 200 mm to 1.0 m	<b>Ground Level (mOD)</b>	<b>Client</b> DBFL	<b>Job Number</b> 8347-01-19
<b>Method</b> : Cable Percussion	<b>Location</b>	<b>Dates</b> 18/02/2019	<b>Engineer</b>	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						0.30	REINFORCED CONCRETE		
						0.30	FILL: Grey brown slightly sandy clayey angular to subangular Gravel with occasional angular cobbles.		
						0.70			
						1.00	OBSTRUCTION: Possible Concrete Slab		
							Complete at 1.00m		

<b>Remarks</b> No groundwater encountered in Borehole. Obstruction at 1.0m BGL. Moved rig 10m and commenced BH4A. Borehole backfilled upon completion. Chiselling from 1.00m to 1.00m for 1.0 hour.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:50	CCostigan
	<b>Figure No.</b> 8347-01-19.BH4	



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**Site**  
Development in Santry

**Borehole Number**  
**BH4A**

<b>Machine</b> : Dando 2000	<b>Casing Diameter</b> 200 mm to 1.0 m	<b>Ground Level (mOD)</b>	<b>Client</b> DBFL	<b>Job Number</b> 8347-01-19
<b>Method</b> : Cable Percussion	<b>Location</b>	<b>Dates</b> 19/02/2019	<b>Engineer</b>	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						0.20 0.20	REINFORCED CONCRETE		
						0.80	FILL: Grey brown slightly sandy clayey angular to subangular Gravel with occasional angular cobbles.		
						1.00	OBSTRUCTION: Possible Concrete Slab		
							Complete at 1.00m		

<b>Remarks</b> No groundwater encountered in Borehole. Obstruction at 1.0m BGL. Moved rig 10m and commenced BH4B. Borehole backfilled upon completion. Chiselling from 1.00m to 1.00m for 1.0 hour.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:50	CCostigan
	<b>Figure No.</b> 8347-01-19.BH4A	



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**Site**  
Development in Santry

**Borehole Number**  
**BH4B**

<b>Machine</b> : Dando 2000	<b>Casing Diameter</b> 200 mm to 1.0 m	<b>Ground Level (mOD)</b>	<b>Client</b> DBFL	<b>Job Number</b> 8347-01-19
<b>Method</b> : Cable Percussion	<b>Location</b>	<b>Dates</b> 19/02/2019	<b>Engineer</b>	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						0.30	REINFORCED CONCRETE		
						0.30	FILL: Grey brown slightly sandy angular to subangular gravelly Clay with occasional angular cobbles.		
						0.70			
						1.00	OBSTRUCTION: Possible Concrete Slab		
							Complete at 1.00m		

<b>Remarks</b> No groundwater encountered in Borehole. Obstruction at 1.0m BGL. Moved rig 10m and commenced BH4C. Borehole backfilled upon completion. Chiselling from 1.00m to 1.00m for 1.0 hour.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:50	CCostigan
	<b>Figure No.</b> 8347-01-19.BH4B	



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**Site**  
Development in Santry

**Borehole Number**  
**BH4C**

**Machine** : Dando 2000

**Casing Diameter**  
200 mm to 0.4 m

**Ground Level (mOD)**

**Client**  
DBFL

**Job Number**  
8347-01-19

**Method** : Cable Percussion

**Location**

**Dates**  
20/02/2019

**Engineer**

**Sheet**  
1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.20) 0.20 (0.20) 0.40	REINFORCED CONCRETE FILL: Grey brown slightly sandy clayey angular to subangular Gravel with occasional angular cobbles. OBSTRUCTION: Possible Concrete Slab Complete at 0.40m		

**Remarks**

No groundwater encountered in Borehole.  
Obstruction at 0.4m BGL.  
Borehole backfilled upon completion.

**Scale (approx)**

1:50

**Logged By**

CCostigan

**Figure No.**

8347-01-19.BH4C



**Ground Investigations Ireland Ltd**  
www.gii.ie

**Site**  
Development in Santry

**Borehole Number**  
**RC04**

<b>Machine</b> : Beretta T44	<b>Casing Diameter</b> 98mm to 9.70m	<b>Ground Level (mOD)</b>	<b>Client</b> DBFL	<b>Job Number</b> 8347-01-19
<b>Flush</b> : Water			<b>Engineer</b>	<b>Sheet</b> 1/1
<b>Core Dia</b> : 68 mm	<b>Location</b>	<b>Dates</b> 07/03/2019- 08/03/2019		
<b>Method</b> : Rotary Cored				

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
2.20 2.20-2.65	16				5,3/4,4,6,5 SPT(C) N=19		(2.60)	OVERBURDEN: Poor recovery - recovery consists of MADE GROUND grey subangular to subrounded Gravel and cobble fragments. Drillers notes: MADE GROUND			
3.70 3.70-4.15	23				5,7/6,8,7,9 SPT(C) N=30		2.60	OVERBURDEN: Poor recovery - recovery consists of grey clayey subangular to subrounded GRAVEL with cobble fragments. Drillers notes: Brown CLAY (Stiff)			
5.20 5.20-5.65	23				5,7/9,9,6,8 SPT(C) N=32		(3.80)				
6.70 6.70-6.70	25				0/0 SPT(C) 0*0		6.40	OVERBURDEN: Poor recovery - recovery consists of grey silty predominately fine SAND. Drillers notes: Blowing SAND (SPT FAILED)			
8.20 8.20-8.25	29				13/50 SPT(C) 13*/45 50/0		(1.50)	OVERBURDEN: Recovery consists of dark brown slightly sandy gravelly CLAY. Gravel is angular to subrounded. Drillers notes: Hard boulder CLAY (Very stiff)			
9.70	99						7.90				
							(1.80)				
							9.70	Complete at 9.70m			

<b>Remarks</b> Slotted standpipe installed from 9.70m to 1.00m BGL with a pea gravel surround and sock, and a plain standpipe installed from 1.00m BGL to GL with a bentonite seal and a flush cover Rotary Coring completed adjacent to BH04	<b>Scale (approx)</b>	<b>Logged By</b>
	1:50	EB
	<b>Figure No.</b> 8347-01-19.RC04	

## **APPENDIX 4 - Laboratory Testing**



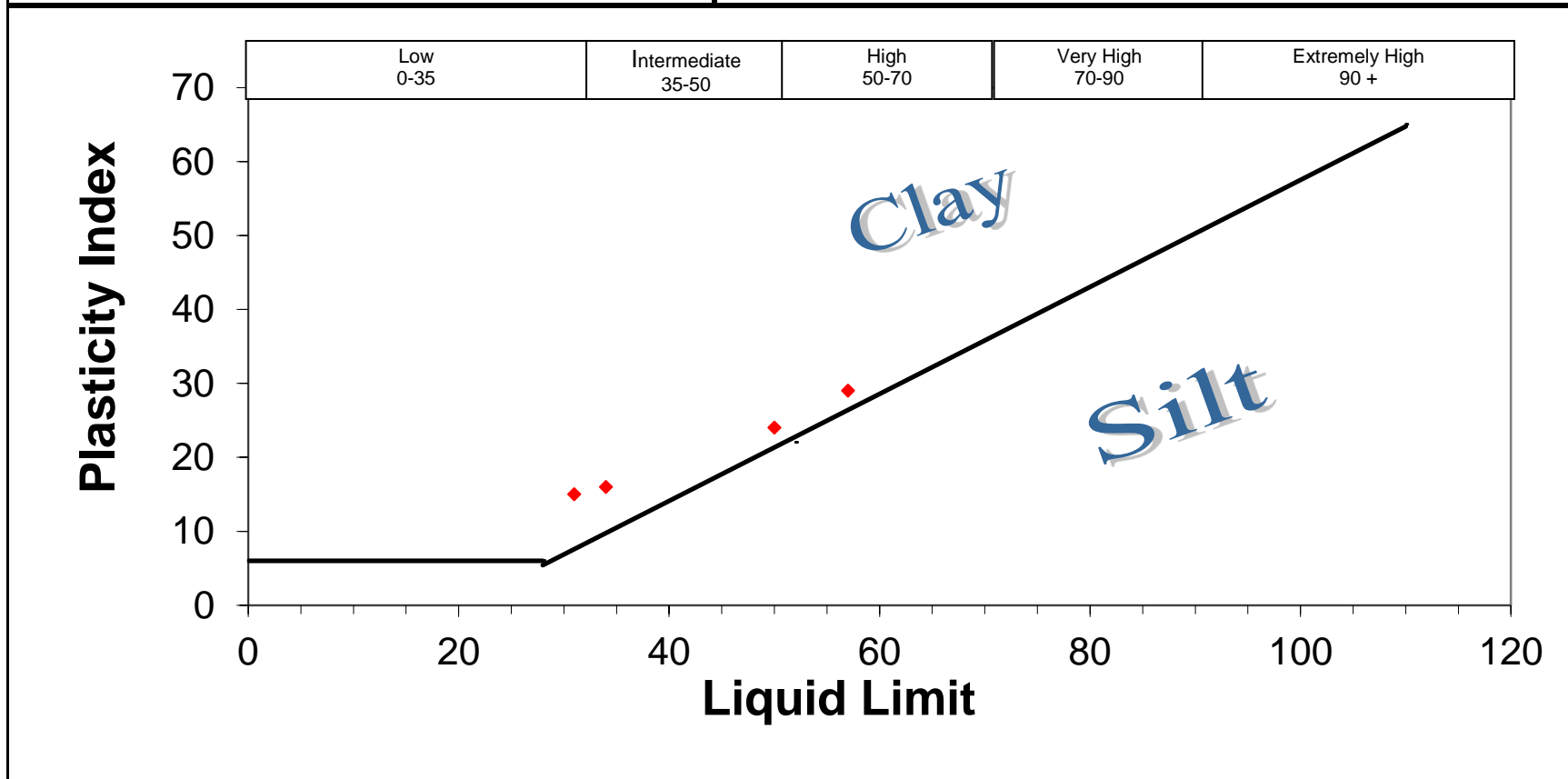
**National Materials Testing Laboratory Ltd.**

**SUMMARY OF TEST RESULTS**

BH/TP	Depth	sample	Moisture	Particle			Index Properties			Bulk	Cell	Undrained Triaxial Tests		Lab	Remarks	
No	m	No.	%	Density Mg/m3	<425um %	LL %	PL %	PI %	Density Mg/m3	Presssure kPa	Compressive Stress kPa	Strain at Failure %	Vane kPa			
TP01	1.00	B	15.0		41.8	34	18	16								
TP03	1.50	B	10.8		59.4	31	16	15								
TP04	2.00	B	29.2		82.5	50	26	24								
TP04	3.00	B	23.6		76.5	57	28	29								
NMTL		Notes :										Job ref No.	NMTL 2807	GII Project ID:	8367-01-19	
		1. All BS tests carried out using preferred (definitive) method unless otherwise stated.										Location	Development in Santry			

**NMTL LTD**  
**Unit 18c, Tullow Industrial Estate**  
**Tullow**  
**County Carlow**  
Tel: 00353 59 9180822  
Mob: 00353 872575508  
[billachana@eircom.net](mailto:billachana@eircom.net)

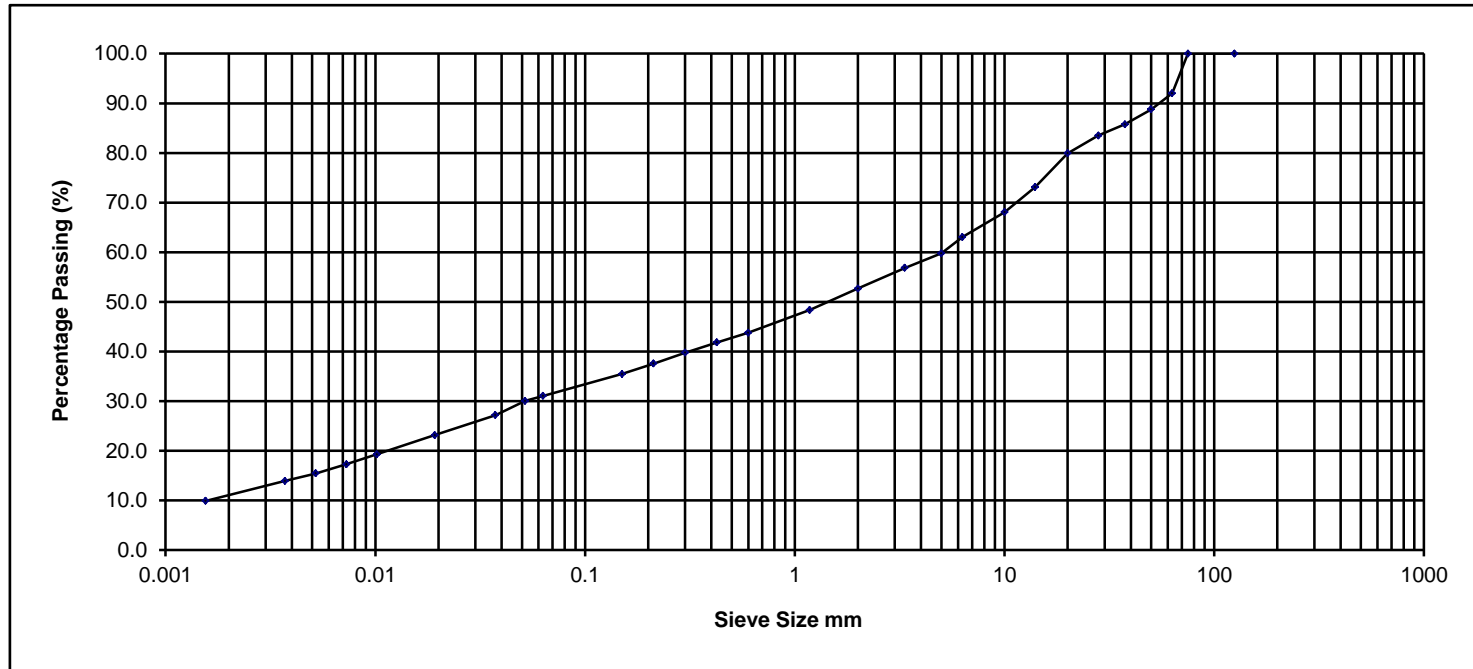
**Contract:** Development in Santry  
**Client:** Ground Investigations Ireland Ltd  
**Engineer:** N/A  
**GII Project ID** 8367-01-19  
**Date:** 08/02/2019  
**Tested By:** Tzr **Checked:** Bc  
**Job ref No.** NMTL 2807



**NMTL Ltd**

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	92.0
50.000	88.8
37.500	85.8
28.000	83.5
20.000	79.9
14.000	73.1
10.000	68.1
6.300	63.1
5.000	59.8
3.350	56.9
2.000	52.7
1.180	48.4
0.600	43.8
0.425	41.8
0.300	39.8
0.212	37.6
0.150	35.5
0.063	31.0
0.052	30.0
0.037	27.2
0.019	23.2
0.010	19.3
0.007	17.3
0.005	15.4
0.004	13.9
0.002	9.9

### Determination of Particle Size Distribution BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Fine			Medium			Coarse			Cobbles	Boulder
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
9.9	Silt			Sand			Gravel			8.0	0.0

Sample Description: Brown slightly sandy gravelly silty CLAY with some cobbles.

Project No. NMTL 2823

BH/TP No. TP01

Project Development in Santry

GII Project ID: 8367-01-19

Sample No. B

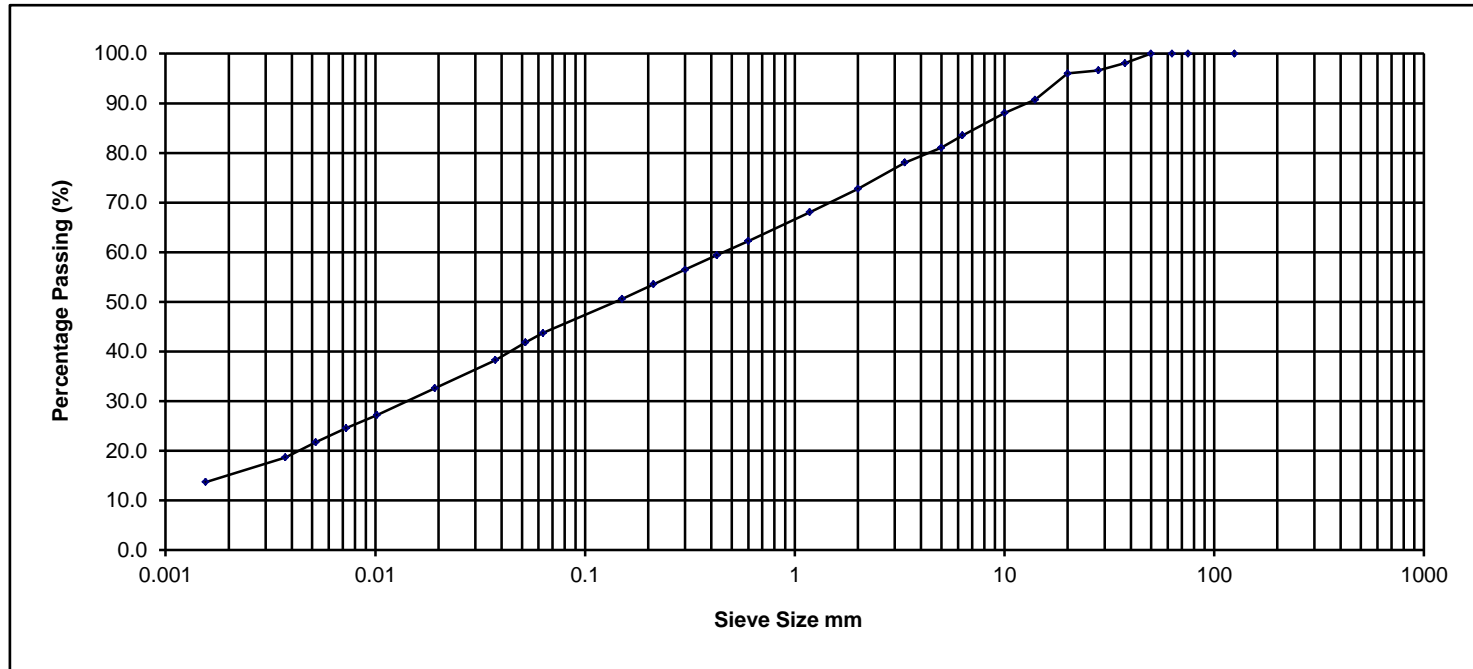
**NM**  
**TL**  
**Ltd**

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	01/02/2019	Depth	1.0m
----------	-----	---------	----	----------	----	--------------------	------------	-------	------

**NMTL Ltd**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	98.1
28.000	96.6
20.000	96.0
14.000	90.7
10.000	88.0
6.300	83.5
5.000	81.0
3.350	78.1
2.000	72.8
1.180	68.0
0.600	62.2
0.425	59.4
0.300	56.5
0.212	53.6
0.150	50.6
0.063	43.7
0.052	41.8
0.037	38.3
0.019	32.6
0.010	27.2
0.007	24.6
0.005	21.7
0.004	18.7
0.002	13.7

### Determination of Particle Size Distribution BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size											
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
13.7	30.0			29.1			27.2			0.0	0.0

Sample Description Brown slightly sandy slightly gravelly silty CLAY.

Project No. NMTL 2823

BH/TP No. TP03

Project Development in Santry

GII Project ID: 8367-01-19

Sample No. B

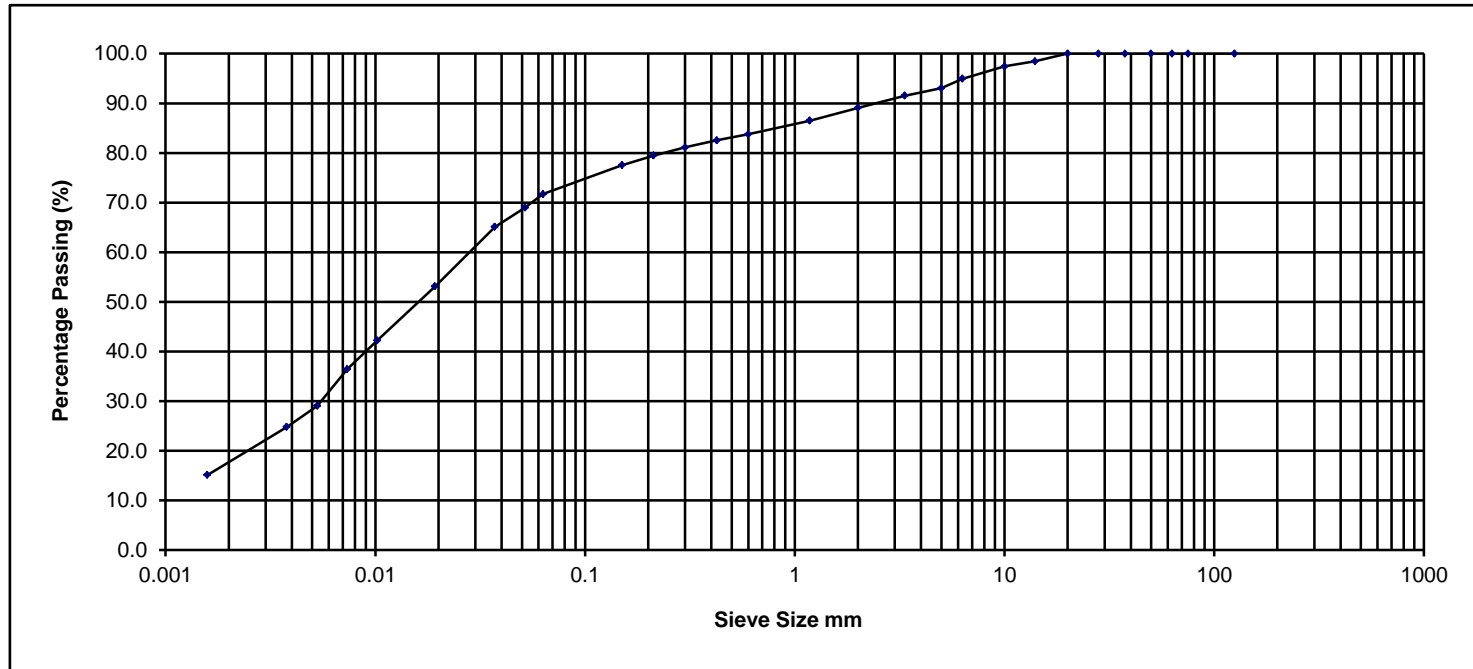
**NM**  
**TL**  
**Ltd**

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	01/02/2019	Depth	1.50m
----------	-----	---------	----	----------	----	--------------------	------------	-------	-------

**NMTL Ltd**

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	98.5
10.000	97.4
6.300	94.9
5.000	93.0
3.350	91.5
2.000	89.1
1.180	86.5
0.600	83.8
0.425	82.5
0.300	81.1
0.212	79.5
0.150	77.6
0.063	71.7
0.052	69.0
0.037	65.1
0.019	53.1
0.010	42.2
0.007	36.4
0.005	29.1
0.004	24.8
0.002	15.1

### Determination of Particle Size Distribution BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Clay	Percentage Particle Size						Cobbles	Boulder
	Fine	Medium	Coarse	Fine	Medium	Coarse		
	Silt		Sand		Gravel			
15.1	56.6		17.4		10.9		0.0	0.0

Sample Description: Brown slightly gravelly slightly sandy silty CLAY.

Project No. NMTL 2823

BH/TP No. TP04

Project: Development in Santry

GII Project ID: 8367-01-19

Sample No. B

**NM**  
**TL**  
**Ltd**

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	01/02/2019	Depth	2.00m
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# Exova Jones Environmental

Registered Office: Exova Environmental UK Limited, 10 Lower Grosvenor Place, London, SW1W 0EN. Reg No. 11371415

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Catherinestown House  
Hazelhatch Road  
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Ireland

Tel: +44 (0) 1244 833780

Fax: +44 (0) 1244 833781



4225

**Attention :** Aisling McDonnell  
**Date :** 4th February, 2019  
**Your reference :** 8347-01-19  
**Our reference :** Test Report 19/1177 Batch 1  
**Location :** Santry  
**Date samples received :** 24th January, 2019  
**Status :** Final report  
**Issue :** 1

Six samples were received for analysis on 24th January, 2019 of which six were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

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

## Compiled By:

**Bruce Leslie**  
Project Co-ordinator

**Client Name:** Ground Investigations Ireland  
**Reference:** 8347-01-19  
**Location:** Santry  
**Contact:** Aisling McDonnell  
**JE Job No.:** 19/1177

**Report :** Solid

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

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18						
<b>Sample ID</b>	TP1	TP1	TP3	TP4	TP4	TP4						
<b>Depth</b>	0.40	1.00	1.50	1.00	2.00	3.00						
<b>COC No / misc</b>												
<b>Containers</b>	V J T	V J T	V J T	V J T	V J T	V J T						
<b>Sample Date</b>	23/01/2019	23/01/2019	23/01/2019	23/01/2019	23/01/2019	23/01/2019						
<b>Sample Type</b>	Soil	Soil	Soil	Soil	Soil	Soil						
<b>Batch Number</b>	1	1	1	1	1	1						
<b>Date of Receipt</b>	24/01/2019	24/01/2019	24/01/2019	24/01/2019	24/01/2019	24/01/2019						
										LOD/LOR	Units	Method No.
Antimony	-	-	-	<1	-	-				<1	mg/kg	TM30/PM15
Arsenic #	-	-	-	6.9	-	-				<0.5	mg/kg	TM30/PM15
Barium #	-	-	-	50	-	-				<1	mg/kg	TM30/PM15
Cadmium #	-	-	-	0.8	-	-				<0.1	mg/kg	TM30/PM15
Chromium #	-	-	-	42.9	-	-				<0.5	mg/kg	TM30/PM15
Copper #	-	-	-	17	-	-				<1	mg/kg	TM30/PM15
Lead #	-	-	-	12	-	-				<5	mg/kg	TM30/PM15
Mercury #	-	-	-	<0.1	-	-				<0.1	mg/kg	TM30/PM15
Molybdenum #	-	-	-	1.7	-	-				<0.1	mg/kg	TM30/PM15
Nickel #	-	-	-	23.0	-	-				<0.7	mg/kg	TM30/PM15
Selenium #	-	-	-	<1	-	-				<1	mg/kg	TM30/PM15
Zinc #	-	-	-	79	-	-				<5	mg/kg	TM30/PM15
Antimony	2	-	-	-	-	-				<1	mg/kg	TM30/PM62
Arsenic	11.9	-	-	-	-	-				<0.5	mg/kg	TM30/PM62
Barium	71	-	-	-	-	-				<1	mg/kg	TM30/PM62
Cadmium	3.4	-	-	-	-	-				<0.1	mg/kg	TM30/PM62
Chromium	16.0	-	-	-	-	-				<0.5	mg/kg	TM30/PM62
Copper	23	-	-	-	-	-				<1	mg/kg	TM30/PM62
Lead	18	-	-	-	-	-				<5	mg/kg	TM30/PM62
Mercury	<0.1	-	-	-	-	-				<0.1	mg/kg	TM30/PM62
Molybdenum	2.5	-	-	-	-	-				<0.1	mg/kg	TM30/PM62
Nickel	31.2	-	-	-	-	-				<0.7	mg/kg	TM30/PM62
Selenium	1	-	-	-	-	-				<1	mg/kg	TM30/PM62
Zinc	134	-	-	-	-	-				<5	mg/kg	TM30/PM62

Please see attached notes for all abbreviations and acronyms

**Client Name:** Ground Investigations Ireland  
**Reference:** 8347-01-19  
**Location:** Santry  
**Contact:** Aisling McDonnell  
**JE Job No.:** 19/1177

**Report :** Solid

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

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18									
<b>Sample ID</b>	TP1	TP1	TP3	TP4	TP4	TP4									
<b>Depth</b>	0.40	1.00	1.50	1.00	2.00	3.00									
<b>COC No / misc</b>															
<b>Containers</b>	V J T	V J T	V J T	V J T	V J T	V J T									
<b>Sample Date</b>	23/01/2019	23/01/2019	23/01/2019	23/01/2019	23/01/2019	23/01/2019									
<b>Sample Type</b>	Soil	Soil	Soil	Soil	Soil	Soil									
<b>Batch Number</b>	1	1	1	1	1	1									
<b>Date of Receipt</b>	24/01/2019	24/01/2019	24/01/2019	24/01/2019	24/01/2019	24/01/2019									
PAH MS															
Naphthalene #	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	TM4/PM8						
Acenaphthylene	<0.03	-	-	<0.03	-	-	<0.03	mg/kg	TM4/PM8						
Acenaphthene #	<0.05	-	-	<0.05	-	-	<0.05	mg/kg	TM4/PM8						
Fluorene #	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	TM4/PM8						
Phenanthrene #	0.04	-	-	<0.03	-	-	<0.03	mg/kg	TM4/PM8						
Anthracene #	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	TM4/PM8						
Fluoranthene #	0.04	-	-	<0.03	-	-	<0.03	mg/kg	TM4/PM8						
Pyrene #	0.03	-	-	<0.03	-	-	<0.03	mg/kg	TM4/PM8						
Benzo(a)anthracene #	<0.06	-	-	<0.06	-	-	<0.06	mg/kg	TM4/PM8						
Chrysene #	<0.02	-	-	<0.02	-	-	<0.02	mg/kg	TM4/PM8						
Benzo(bk)fluoranthene #	<0.07	-	-	<0.07	-	-	<0.07	mg/kg	TM4/PM8						
Benzo(a)pyrene #	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	TM4/PM8						
Indeno(123cd)pyrene #	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	TM4/PM8						
Dibenzo(ah)anthracene #	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	TM4/PM8						
Benzo(ghi)perylene #	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	TM4/PM8						
Coronene	<0.04	-	-	<0.04	-	-	<0.04	mg/kg	TM4/PM8						
PAH 6 Total #	<0.22	-	-	<0.22	-	-	<0.22	mg/kg	TM4/PM8						
PAH 17 Total	<0.64	-	-	<0.64	-	-	<0.64	mg/kg	TM4/PM8						
Benzo(b)fluoranthene	<0.05	-	-	<0.05	-	-	<0.05	mg/kg	TM4/PM8						
Benzo(k)fluoranthene	<0.02	-	-	<0.02	-	-	<0.02	mg/kg	TM4/PM8						
Benzo(j)fluoranthene	<1	-	-	<1	-	-	<1	mg/kg	TM4/PM8						
PAH Surrogate % Recovery	99	-	-	99	-	-	<0	%	TM4/PM8						
Mineral Oil (C10-C40)	32	-	-	<30	-	-	<30	mg/kg	TM5/PM8/PM16						
TPH CWG															
Aliphatics															
>C5-C6 #	<0.1	-	-	<0.1	-	-	<0.1	mg/kg	TM36/PM12						
>C6-C8 #	<0.1	-	-	<0.1	-	-	<0.1	mg/kg	TM36/PM12						
>C8-C10	<0.1	-	-	<0.1	-	-	<0.1	mg/kg	TM36/PM12						
>C10-C12 #	<0.2	-	-	<0.2	-	-	<0.2	mg/kg	TM5/PM8/PM16						
>C12-C16 #	<4	-	-	<4	-	-	<4	mg/kg	TM5/PM8/PM16						
>C16-C21 #	<7	-	-	<7	-	-	<7	mg/kg	TM5/PM8/PM16						
>C21-C35 #	32	-	-	25	-	-	<7	mg/kg	TM5/PM8/PM16						
>C35-C40	<7	-	-	<7	-	-	<7	mg/kg	TM5/PM8/PM16						
Total aliphatics C5-40	32	-	-	<26	-	-	<26	mg/kg	TM5/PM8/PM16						
>C6-C10	<0.1	-	-	<0.1	-	-	<0.1	mg/kg	TM36/PM12						
>C10-C25	<10	-	-	<10	-	-	<10	mg/kg	TM5/PM8/PM16						
>C25-C35	25	-	-	24	-	-	<10	mg/kg	TM5/PM8/PM16						

Please see attached notes for all abbreviations and acronyms





**Client Name:** Ground Investigations Ireland  
**Reference:** 8347-01-19  
**Location:** Santry  
**Contact:** Aisling McDonnell  
**JE Job No.:** 19/1177

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

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18					Please see attached notes for all abbreviations and acronyms		
Sample ID	TP1	TP1	TP3	TP4	TP4	TP4							
Depth	0.40	1.00	1.50	1.00	2.00	3.00							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	23/01/2019	23/01/2019	23/01/2019	23/01/2019	23/01/2019	23/01/2019							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1							
Date of Receipt	24/01/2019	24/01/2019	24/01/2019	24/01/2019	24/01/2019	24/01/2019							
Mass of raw test portion	0.1009	-	-	0.0982	-	-						kg	NONE/PM17
Mass of dried test portion	0.09	-	-	0.09	-	-						kg	NONE/PM17



**Client Name:** Ground Investigations Ireland  
**Reference:** 8347-01-19  
**Location:** Santry  
**Contact:** Aisling McDonnell  
**JE Job No.:** 19/1177

**Report :** EN12457\_2  
**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1-3	10-12																			
Sample ID	TP1	TP4																			
Depth	0.40	1.00																			
COC No / misc																					
Containers	V J T	V J T																			
Sample Date	23/01/2019	23/01/2019																			
Sample Type	Soil	Soil																			
Batch Number	1	1																			
Date of Receipt	24/01/2019	24/01/2019																			
												Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.				
<b>Solid Waste Analysis</b>																					
Total Organic Carbon #	NDP	0.23										3	5	6	<0.02	%	TM21/PM24				
Sum of BTEX	<0.025	<0.025										6	-	-	<0.025	mg/kg	TM31/PM12				
Sum of 7 PCBs #	<0.035*	<0.035*										1	-	-	<0.035	mg/kg	TM17/PM8				
Mineral Oil	32	<30										500	-	-	<30	mg/kg	TM5/PM8/PM16				
PAH Sum of 6 #	<0.22	<0.22										-	-	-	<0.22	mg/kg	TM4/PM8				
PAH Sum of 17	<0.64	<0.64										100	-	-	<0.64	mg/kg	TM4/PM8				
<b>CEN 10:1 Leachate</b>																					
Arsenic #	<0.025	<0.025										0.5	2	25	<0.025	mg/kg	TM30/PM17				
Barium #	0.77	0.19										20	100	300	<0.03	mg/kg	TM30/PM17				
Cadmium #	<0.005	<0.005										0.04	1	5	<0.005	mg/kg	TM30/PM17				
Chromium #	0.381	0.080										0.5	10	70	<0.015	mg/kg	TM30/PM17				
Copper #	<0.07	<0.07										2	50	100	<0.07	mg/kg	TM30/PM17				
Mercury #	<0.0001	<0.0001										0.01	0.2	2	<0.0001	mg/kg	TM61/PM0				
Molybdenum #	0.02	0.06										0.5	10	30	<0.02	mg/kg	TM30/PM17				
Nickel #	<0.02	<0.02										0.4	10	40	<0.02	mg/kg	TM30/PM17				
Lead #	<0.05	<0.05										0.5	10	50	<0.05	mg/kg	TM30/PM17				
Antimony #	<0.02	0.02										0.06	0.7	5	<0.02	mg/kg	TM30/PM17				
Selenium #	<0.03	<0.03										0.1	0.5	7	<0.03	mg/kg	TM30/PM17				
Zinc #	<0.03	<0.03										4	50	200	<0.03	mg/kg	TM30/PM17				
Total Dissolved Solids #	3751	1920										4000	60000	100000	<350	mg/kg	TM20/PM0				
Dissolved Organic Carbon	60	20										500	800	1000	<20	mg/kg	TM60/PM0				
Mass of raw test portion	0.1009	0.0982										-	-	-		kg	NONE/PM17				
Dry Matter Content Ratio	89.0	91.8										-	-	-	<0.1	%	NONE/PM4				
Leachant Volume	0.889	0.892										-	-	-		l	NONE/PM17				
Eluate Volume	0.85	0.79										-	-	-		l	NONE/PM17				
pH #	12.15	10.99										-	-	-	<0.01	pH units	TM73/PM11				
Phenol	<0.1	<0.1										1	-	-	<0.1	mg/kg	TM26/PM0				
Fluoride	<3	<3										-	-	-	<3	mg/kg	TM173/PM0				
Sulphate as SO4 #	80	47										1000	20000	50000	<5	mg/kg	TM38/PM0				
Chloride #	12	10										800	15000	25000	<3	mg/kg	TM38/PM0				

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland  
 Reference: 8347-01-19  
 Location: Santry  
 Contact: Aisling McDonnell

Matrix : Solid

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	EPH Interpretation
19/1177	1	TP1	0.40	1-3	No interpretation possible
19/1177	1	TP4	1.00	10-12	No interpretation possible

**Client Name:** Ground Investigations Ireland  
**Reference:** 19/01/8347  
**Location:** Santry  
**Contact:** Aisling McDonnell

**Note:**

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Jones Environmental Laboratory:



Ryan Butterworth  
 Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
19/1177	1	TP1	0.40	2	25/01/2019	<b>General Description (Bulk Analysis)</b>	soil-stones
					25/01/2019	<b>Asbestos Fibres</b>	Fibre Bundles
					25/01/2019	<b>Asbestos ACM</b>	NAD
					25/01/2019	<b>Asbestos Type</b>	Chrysotile
					25/01/2019	<b>Asbestos Level Screen</b>	less than 0.1%
19/1177	1	TP4	1.00	11	25/01/2019	<b>General Description (Bulk Analysis)</b>	soil-stones
					25/01/2019	<b>Asbestos Fibres</b>	NAD
					25/01/2019	<b>Asbestos ACM</b>	NAD
					25/01/2019	<b>Asbestos Type</b>	NAD
					25/01/2019	<b>Asbestos Level Screen</b>	NAD







## NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 19/1177

### SOILS

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

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

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

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

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

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

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

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

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

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

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

### WATERS

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

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

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

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

### DEVIATING SAMPLES

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

### SURROGATES

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

### DILUTIONS

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

### BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

### NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

### REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Please include all sections of this report if it is reproduced

All solid results are expressed on a dry weight basis unless stated otherwise.

**ABBREVIATIONS and ACRONYMS USED**

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Exova Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

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

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Leachate tests	
10l/kg; 4mm	I.S. EN 12457-2:2002 Specified particle size; water added to L/S ratio; capped; agitated for 24 ± 0.5 hours; eluate settled and filtered over 0.45 µm membrane filter.
Eluate analysis	
As	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ba	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cd	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cr total	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cu	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Hg	I.S. EN 13370 rec. EN 1483 (CVAAS)
Mo	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ni	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Pb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Sb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Se	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Zn	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Chloride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Fluoride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Sulphate	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Phenol index	I.S. EN 13370 rec. ISO 6439 (4-Aminoantipyrine spectrometric methods after distillation)* ( BY HPLC - Jones Env)
DOC	I.S. EN 1484
TDS	I.S. EN 15216
Compositional analysis	
TOC	I.S. EN 13137 Method B: carbonates removed with acid; TOC by combustion.
BTEX	GC-FID
PCB7**	I.S. EN 15308 analysis by GC-ECD.
Mineral oil	I.S. EN 14039 C10 to C40 analysis by GC-FID.
PAH17***	I.S. EN 15527 PAH17 analysis by GC-MS
Metals	I.S. EN 13657 - Aqua regia digestion: EN ISO 11885 ( ICP-OES)
Other	
Dry matter	I.S. EN 14346 sample is dried to a constant mass in an oven at 105 ± 3 °C; Method B Water content by direct Karl-Fischer-titration and either volumetric or coulometric detection.
LOI	I.S. EN 15169 Difference in mass after heating in a furnace up to 550 ± 25 °C.
ANC	CEN/TS 15364 Determined by amounts of acid or base needed to cover the pH range
<p><b>Notes:</b></p> <p>*If not suitable due to LOD, precision, etc., any other suitable method can be used, e.g. AFS, ICP-MS</p> <p>**PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180</p> <p>***Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)perylene, Benzo(a)pyrene, Chrysene, Coronene, Dibenzo(a,h)anthracene, Fluorene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Phenanthrene and Pyrene.</p>	

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Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3: 1990/USEPA 160.3 Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

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Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM62	Acid digestion of as received solid samples using Aqua Regia refluxed at 112.5 °C.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methylterbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methylterbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM0	No preparation is required.	Yes		AR	Yes

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Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060, APHA Standard Methods for Examination of Water and Wastewater 5310B, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Modified US EPA methods 245.7 and 200.7. Determination of Mercury by Cold Vapour Atomic Fluorescence.	PM0	No preparation is required.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 340.2	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AR	Yes
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				

JE Job No: 19/1177

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	

**APPENDIX C**

IGSL Report

Proposed Development at Coolock Lane



**Ground Investigation  
IGSL Report No. 8208  
Coolock Lane Dev., Santry, Dublin 9  
On Behalf Of  
Barry & Partners  
Consulting Engineers**

## **FOREWORD**

### **Notes on Site Investigation Procedure**

The following notes should be read in conjunction with the report. Any modifications to the procedures outlined below are indicated in the main text.

#### **GENERAL**

The recommendations made and opinions expressed in the Report are based on the "Boring Records, an examination of samples and results of the site and laboratory tests. No responsibility can be held for conditions which have not been revealed by the boreholes, for example, between borehole positions. Whilst the report may express an opinion on a possible configuration of strata both between borehole positions and below the maximum depth of the investigation, this is for guidance only and no liability can be accepted for its accuracy.

#### **BORING TECHNIQUE**

Unless otherwise stated the 'Shell and Auger' technique of soft ground boring has been employed. Whilst this technique allows the maximum data to be obtained on strata conditions, a degree of mixing of some layered soils, (e.g. thin layers of coarse and fine granular material) is inevitable. Specific attention is drawn to this factor where evidence of such a condition is available.

#### **GROUND WATER**

The ground water conditions entered on the Boring Records are those appertaining at the time of the investigation. The normal rate of boring does not usually permit the recording of an equilibrium water level for any one water strike. Moreover, ground water levels are subject to variations caused by seasonal effects or changes in local drainage conditions. The table of each Boring Record shows the ground water level at the quoted borehole and casing depths, usually at the start of the day's work. The word "none" indicates that ground water was sealed off by the borehole casing.

#### **GAS MONITORING**

Unless otherwise stated gas monitoring is carried out using a GA90 infra red gas detector. The gases monitored for and levels noted are recorded and plotted on the relevant test data sheets. Unless stated otherwise no monitoring is carried out for gas pressure or to calculate gas flow rates.

#### **ROUTINE SAMPLING**

Undisturbed samples of predominantly cohesive soils are obtained in a 102mm diameter open-drive sampler, complying with the requirements of the British Standard Code of Practice B.S. 5930. Large disturbed samples of granular soils, or of soils in which undisturbed sampling is not possible or appropriate, are taken from the boring tools and sealed into polythene bags. Small disturbed samples are taken at frequent intervals and sealed into 0.5 kg glass jars or polythene bags for subsequent visual classification. Where encountered in sufficient quantity, samples of groundwater are taken.

Unless otherwise stated in the main text, disturbed soil samples may not be at their natural water content.

**REPORT ON A SITE INVESTIGATION  
FOR  
PROPOSED RESIDENTIAL / COMMUNITY CENTRE  
DEVELOPMENT  
AT  
COOLOCK LANE, SANTRY, DUBLIN 9  
ON BEHALF OF  
BARRY & PARTNERS  
CONSULTING ENGINEERS**

**REPORT NO. 8208**

**OCTOBER 2002**

**INTRODUCTION**

The site is located off Coolock Lane in Santry, Dublin 9 and it is proposed to construct a new Community Centre and residential development on this site

The ground investigation was carried out at the request of the projects engineers , Barry & Partners, on behalf of their clients Dublin City Council.

The programme of the investigation included,

- The construction of six cable tool boreholes to establish stratification. During the course of boring in-situ tests were performed at regular intervals and representative soil samples were recovered for visual examination and laboratory analysis.
- The excavation of four trial pits using a CAT 4280 back hoe excavator. All pits were logged and sampled by an IGSL geotechnical engineer.
- The carrying out of laboratory soils testing ( Geotechnical ).
- The carrying out of laboratory soils testing ( Environmental ).

This report details the findings of the investigation.

## **II. FIELDWORK**

The locations of all of the investigation points are shown on the detailed site plan enclosed in Appendix IV to this report. Site works were supervised by an IGSL geotechnical engineer.

The site investigation work was carried out using a DANDO 150 cable tool boring rig equipped with 200 diameter equipment and CAT 4280 excavator. The methods utilised during the course of the field investigations are outlined in the following sections.

### *Cable Tool Boreholes.*

Conventional cable tool techniques ( shell and auger ) were employed at five locations across the site. All field work was carried out in accordance with BS5930. At each location a Cable Tool Detector was used to scan for services and a 1.20m trial pit was excavated by hand to confirm the absence of services.

Disturbed soil samples were taken at regular intervals or at changes in stratification while standard penetration tests ( SPT's ) were also carried out to establish relative in - situ soil strength. Full details of stratification, testing, sampling, comments on groundwater and notes on any obstructions to normal boring encountered are given in the detailed borehole records enclosed in Appendix I to this report.

The boreholes have revealed similar ground conditions with deposits of topsoil and made ground extending to depths of between 1.00 and 2.20m underlain by a firm to stiff brown gravelly clay. This stratum was in turn underlain by a hard black gravelly clay and the boreholes were all terminated on obstructions within these gravelly clays at depths of between 5.50 and 6.50m.

### *Trial Pits.*

A total of four pits were excavated using a four wheel drive CAT 4280 back hoe excavator. All pits were logged by an IGSL geotechnical engineer.

Full details of stratification, testing, sampling, comments on groundwater and notes on any obstructions to normal boring encountered are given in the detailed trial pit records enclosed in Appendix II to this report.

### **III. TESTING**

During the course of the investigation in - situ tests were carried out in the boreholes and samples of the sub soils were taken at 1.00m intervals in each of the cable tool boreholes.

#### **(a) Standard Penetration Tests ( CPT ).**

The relative in-situ strength of the sub-soils was established at intervals by cone penetration test . A solid conical point is hammered into the soil and the blow count for 300mm of penetration is recorded in four 75mm increments.

Results are presented in the right - hand column of the boring records. SPT tests were carried out at intervals specified by the projects engineers.

#### **(b) Laboratory Testing**

The recovered soil samples were returned to IGSL's laboratory. All of the test data is included in Appendix III to this report. Geotechnical tests were carried out in IGSL's soils laboratories while environmental analyses was carried out at Alcontrol Geochem laboratory in Dublin.

Specified tests carried out included,

##### *Geotechnical Tests*

- ✓ Moisture Content Tests
- ✓ Atterburg Limits ( Classification tests ).
- ✓ pH and SO<sup>3</sup> Tests
- ✓ Particle Size Distribution Tests ( Wet Sieve )
- ✓ Sedimentation by hydrometer
- ✓ CBR Analysis

##### *Environmental Tests*

- ✓ ICRCCL Suite of Tests ( In Accordance With Guidance Note 53 / 83 of the UK DOE publication redevelopment of contaminated land.)

### **III. DISCUSSION.**

It is proposed to construct a new residential and community centre development at a site located off Coolock Lane in Santry, Dublin. At the request of the projects engineers, Barry & Partners, carried out a site investigation which comprised the drilling of five cable tool boreholes, the excavation of trial pits and the carrying out of tests, both environmental and geotechnical, on the recovered soil samples.

The site investigation has revealed generally similar ground conditions with top soils and made ground deposits extending from ground level to depths of between 1.00 and 2.20m. This was underlain by a firm to stiff brown gravelly clay which extended to depths of between 2.00 and 3.00m where it overlay a very stiff to hard black gravelly clay deposit ( boulder clay ). The boreholes extended to depths up to 6.50m where they were terminated on obstructions.

It should be noted however that final borehole depth does not necessarily represent rock horizon and that the gravelly clay stratum may continue for some distance. Rock proving or coring to establish bedrock was not part of this investigation.

Foundations for the proposed developments will have to be transferred beneath the upper topsoil and made ground and placed on the more competent glacial till deposits.

Where conventional foundations are placed on the firm to stiff brown gravelly clays at depths of approx. 1.00m an allowable bearing pressure of the order of 100 – 125 kN/M<sup>2</sup> can be utilised. Where greater loads than these are required then foundations will have to be transferred to the underlying black gravelly clays where an allowable bearing pressure of the order 275 - 300 kN/M<sup>2</sup> can be utilised.

Careful inspection of all foundations is recommended, any made ground or obviously loose or water softened material should be removed and replaced by low-grade concrete. Foundations placed on the gravelly clays should be rapidly blinded to avoid any deterioration of subsoil due to water ingress. Should foundations encounter any granular deposits then steel reinforcement should be incorporated top and bottom to minimise the potential for differential settlements.

Chemical analysis have shown low sulphates in the soils and a near neutral pH and no precautions need be taken to protect buried concrete.

**REPORT ON A SITE INVESTIGATION  
FOR  
PROPOSED RESIDENTIAL / COMMUNITY CENTRE  
DEVELOPMENT  
AT  
COOLOCK LANE, SANTRY, DUBLIN 9  
ON BEHALF OF  
BARRY & PARTNERS  
CONSULTING ENGINEERS**

**REPORT NO. 8208**

**OCTOBER 2002**

**INTRODUCTION**

The site is located off Coolock Lane in Santry, Dublin 9 and it is proposed to construct a new Community Centre and residential development on this site

The ground investigation was carried out at the request of the projects engineers , Barry & Partners, on behalf of their clients Dublin City Council.

The programme of the investigation included,

- The construction of six cable tool boreholes to establish stratification. During the course of boring in-situ tests were performed at regular intervals and representative soil samples were recovered for visual examination and laboratory analysis.
- The excavation of four trial pits using a CAT 4280 back hoe excavator. All pits were logged and sampled by an IGSL geotechnical engineer.
- The carrying out of laboratory soils testing ( Geotechnical ).
- The carrying out of laboratory soils testing ( Environmental ).

This report details the findings of the investigation.

## **II.FIELDWORK**

The locations of all of the investigation points are shown on the detailed site plan enclosed in Appendix IV to this report. Site works were supervised by an IGSL geotechnical engineer.

The site investigation work was carried out using a DANDO 150 cable tool boring rig equipped with 200 diameter equipment and CAT 4280 excavator. The methods utilised during the course of the field investigations are outlined in the following sections.

### *Cable Tool Boreholes.*

Conventional cable tool techniques ( shell and auger ) were employed at five locations across the site. All field work was carried out in accordance with BS5930. At each location a Cable Tool Detector was used to scan for services and a 1.20m trial pit was excavated by hand to confirm the absence of services.

Disturbed soil samples were taken at regular intervals or at changes in stratification while standard penetration tests ( SPT's ) were also carried out to establish relative in - situ soil strength. Full details of stratification, testing, sampling, comments on groundwater and notes on any obstructions to normal boring encountered are given in the detailed borehole records enclosed in Appendix I to this report.

The boreholes have revealed similar ground conditions with deposits of topsoil and made ground extending to depths of between 1.00 and 2.20m underlain by a firm to stiff brown gravelly clay. This stratum was in turn underlain by a hard black gravelly clay and the boreholes were all terminated on obstructions within these gravelly clays at depths of between 5.50 and 6.50m.

### *Trial Pits.*

A total of four pits were excavated using a four wheel drive CAT 4280 back hoe excavator. All pits were logged by an IGSL geotechnical engineer.

Full details of stratification, testing, sampling, comments on groundwater and notes on any obstructions to normal boring encountered are given in the detailed trial pit records enclosed in Appendix II to this report.



### **III. TESTING**

During the course of the investigation in - situ tests were carried out in the boreholes and samples of the sub soils were taken at 1.00m intervals in each of the cable tool boreholes.

#### **(a) Standard Penetration Tests ( CPT ).**

The relative in-situ strength of the sub-soils was established at intervals by cone penetration test . A solid conical point is hammered into the soil and the blow count for 300mm of penetration is recorded in four 75mm increments.

Results are presented in the right - hand column of the boring records. SPT tests were carried out at intervals specified by the projects engineers.

#### **(b) Laboratory Testing**

The recovered soil samples were returned to IGSL's laboratory. All of the test data is included in Appendix III to this report. Geotechnical tests were carried out in IGSL's soils laboratories while environmental analyses was carried out at Alcontrol Geochem laboratory in Dublin.

Specified tests carried out included,

##### *Geotechnical Tests*

- ✓ Moisture Content Tests
- ✓ Atterburg Limits ( Classification tests ).
- ✓ pH and SO<sup>3</sup> Tests
- ✓ Particle Size Distribution Tests ( Wet Sieve )
- ✓ Sedimentation by hydrometer
- ✓ CBR Analysis

##### *Environmental Tests*

- ✓ ICRCL Suite of Tests ( In Accordance With Guidance Note 53 / 83 of the UK DOE publication redevelopment of contaminated land.)

### III. DISCUSSION.

It is proposed to construct a new residential and community centre development at a site located off Coolock Lane in Santry, Dublin. At the request of the projects engineers, Barry & Partners, carried out a site investigation which comprised the drilling of five cable tool boreholes, the excavation of trial pits and the carrying out of tests, both environmental and geotechnical, on the recovered soil samples.

The site investigation has revealed generally similar ground conditions with top soils and made ground deposits extending from ground level to depths of between 1.00 and 2.20m. This was underlain by a firm to stiff brown gravelly clay which extended to depths of between 2.00 and 3.00m where it overlay a very stiff to hard black gravelly clay deposit ( boulder clay ). The boreholes extended to depths up to 6.50m where they were terminated on obstructions.

It should be noted however that final borehole depth does not necessarily represent rock horizon and that the gravelly clay stratum may continue for some distance. Rock proving or coring to establish bedrock was not part of this investigation.

Foundations for the proposed developments will have to be transferred beneath the upper topsoil and made ground and placed on the more competent glacial till deposits.

Where conventional foundations are placed on the firm to stiff brown gravelly clays at depths of approx. 1.00m an allowable bearing pressure of the order of 100 – 125 kN/M<sup>2</sup> can be utilised. Where greater loads than these are required then foundations will have to be transferred to the underlying black gravelly clays where an allowable bearing pressure of the order 275 - 300 kN/M<sup>2</sup> can be utilised.

Careful inspection of all foundations is recommended, any made ground or obviously loose or water softened material should be removed and replaced by low-grade concrete. Foundations placed on the gravelly clays should be rapidly blinded to avoid any deterioration of subsoil due to water ingress. Should foundations encounter any granular deposits then steel reinforcement should be incorporated top and bottom to minimise the potential for differential settlements.

Chemical analysis have shown low sulphates in the soils and a near neutral pH and no precautions need be taken to protect buried concrete.

**APPENDIX I**  
**CABLE TOOL BOREHOLES RECORDS**

REPORT NO. 8208

GEOTECHNICAL BORING RECORD

IGSL

CONTRACT: Coolock Lane

BOREHOLE NO: BH1

CLIENT:  
ENGINEER: Barry & Partners

GROUND LEVEL (mOD) 0.00  
BOREHOLE DIAMETER (mm) 200  
BOREHOLE DEPTH (m) 5.80  
CASING DEPTH (m) 5.80

Sheet 1 of 1  
DATE STARTED: 28/08/2002  
DATE COMPLETED: 28/08/2002

CO-ORDINATES: E 0.00  
N 0.00

BORED BY: M. Collins

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES			FIELD TEST RESULTS	STAND PIPE DETAILS
					REF. NUMBER	SAMPLE TYPE	DEPTH (m)		
1	MADE GROUND (comprised of brown sandy clay and red brick)	[Cross-hatch pattern]			3696		1.00	11/300mm	
2	Stiff brown sandy gravelly CLAY with cobbles	[Stippled pattern]		1.70	3697		2.00	39/300mm	
3	Hard black gravelly CLAY with cobbles and boulders	[Dotted pattern]		2.20	3698		3.00	62/300mm	
4					3699		4.00	84/300mm	
5					3700		5.00	69/225mm	
6	Boulders	[Large circles]		5.50	3601		5.60		
6	End of Borehole at 5.80 m			5.80					
7									
8									
9									

Hard Strata Boring / Chiselling			
From (m)	To (m)	Hours	Comments
4.50	5.00	1.00	
5.50	5.80	2.00	

Water Strike Details					
Water Strike	Casing Depth	Sealed at	Rise to	Time	Comments

Standpipe Installation Details				
Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations				
Date	Hole Depth	Casing Depth	Depth to Water	Comments

Remarks: Casing hard to divide from 3.5 to 5.8

REPORT NO. 8208

GEOTECHNICAL BORING RECORD

IGSL

CONTRACT: Coolock Lane

BOREHOLE NO: BH2

CLIENT:

Sheet 1 of 1

ENGINEER: Barry & Partners

GROUND LEVEL (mOD) 0.00

DATE STARTED: 29/08/2002

BOREHOLE DIAMETER (mm) 200

DATE COMPLETED: 29/08/2002

CO-ORDINATES: E 0.00  
N 0.00

BOREHOLE DEPTH (m) 5.50

BORED BY: M. Collins

CASING DEPTH (m) 5.50

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES			FIELD TEST RESULTS	STAND PIPE DETAILS
					REF. NUMBER	SAMPLE TYPE	DEPTH (m)		
0.00	MADE GROUND (comprised of brown sandy clay with glass and roots)	[Cross-hatched pattern]							
1.50	Stiff brown sandy gravelly CLAY	[Dotted pattern]		1.50	3602		1.20	12/300mm	
2.30	Hard black sandy gravelly CLAY with cobbles	[Stippled pattern]		2.30	3603		2.00	30/300mm	
2.80					3604		2.80	58/300mm	
4.00	Hard black sandy gravelly CLAY with cobbles	[Stippled pattern]		4.00	3605		4.00	26/75mm	
5.00					3606		5.00	26/0mm	
5.50	End of Borehole at 5.50 m			5.50					

From (m)	To (m)	Hours	Comments
4.10	4.30	1.50	
5.10	5.50	2.00	

Water Strike	Casing Depth	Sealed at	Rise to	Time	Comments

Date	Tip Depth	RZ Top	RZ Base	Type

Date	Hole Depth	Casing Depth	Depth to Water	Comments

Remarks:

REPORT NO. 8208

GEOTECHNICAL BORING RECORD

IGSL

CONTRACT: Coolock Lane

BOREHOLE NO: BH3

Sheet 1 of 1

CLIENT:  
ENGINEER: Barry & Partners

GROUND LEVEL (mOD) 0.00  
BOREHOLE DIAMETER (mm) 200  
BOREHOLE DEPTH (m) 5.60  
CASING DEPTH (m) 5.80

DATE STARTED: 27/08/2002  
DATE COMPLETED: 27/08/2002

CO-ORDINATES: E 0.00  
N 0.00

BORED BY: M. Collins

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES			FIELD TEST RESULTS	STAND PIPE DETAILS
					REF. NUMBER	SAMPLE TYPE	DEPTH (m)		
	MADE GROUND (comprised of brown sandy gravelly clay)			0.50					
1	Firm brown sandy gravelly CLAY bands of grey (possible fill material)				3683		1.00	15/300mm	
2				2.20	3684		2.00	34/300mm	
3	Hard black gravelly CLAY with frequent cobbles and some boulders				3685		2.60		
4					3686		3.50	62/300mm	
5					3687		4.60	86/300mm	
6					3688		5.40	25/75mm	
6	End of Borehole at 5.60 m			5.60					

Hard Strata Boring / Chiselling			
From (m)	To (m)	Hours	Comments
4.00	4.20	0.50	
5.20	5.60	2.00	

Water Strike Details					
Water Strike	Casing Depth	Sealed at	Rise to	Time	Comments

Standpipe Installation Details				
Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations				
Date	Hole Depth	Casing Depth	Depth to Water	Comments

Remarks: Casing hard to divide from 4 to 5.6, refused at 5.6

REPORT NO. 8208

GEOTECHNICAL BORING RECORD

IGSL

CONTRACT: Coolock Lane

BOREHOLE NO: BH4

Sheet 1 of 1

CLIENT:  
ENGINEER: Barry & Partners

GROUND LEVEL (mOD) 0.00

BOREHOLE DIAMETER (mm) 200

DATE STARTED: 28/08/2002

DATE COMPLETED: 28/08/2002

CO-ORDINATES: E 0.00  
N 0.00

BOREHOLE DEPTH (m) 5.80

CASING DEPTH (m) 5.80

BORED BY: M. Collins

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES			FIELD TEST RESULTS	STAND PIPE DETAILS
					REF. NUMBER	SAMPLE TYPE	DEPTH (m)		
0	MADE GROUND (comprised of brown sandy clay and red brick)	[Pattern]							
1	Firm brown sandy gravelly CLAY with layers of grey sandy clay	[Pattern]		1.00	3689		1.10-2.00	8/300mm	
2		[Pattern]			3690		2.00	12/300mm	
3	Hard black sandy gravelly CLAY with cobbles and boulders	[Pattern]		2.60	3691		2.50		
		[Pattern]			3692		2.90	63/300mm	
4		[Pattern]			3693		4.00	96/300mm	
5		[Pattern]			3694		5.00	78/225mm	
6	End of Borehole at 5.80 m	[Pattern]		5.80	3695		5.50	26/0mm	

From (m)	To (m)	Hours	Comments
4.50	4.70	1.00	
5.40	5.80	2.00	

Water Strike	Casing Depth	Sealed at	Rise to	Time	Comments

Date	Tip Depth	RZ Top	RZ Base	Type

Date	Hole Depth	Casing Depth	Depth to Water	Comments

Remarks: Casing hard to divide from 4 to 5.8. refused at 5.8

REPORT NO. 8208

GEOTECHNICAL BORING RECORD

IGSL

CONTRACT: Coolock Lane

BOREHOLE NO: BH5

Sheet 1 of 1

CLIENT:  
ENGINEER: Barry & Partners

GROUND LEVEL (mOD) 0.00  
BOREHOLE DIAMETER (mm) 200  
BOREHOLE DEPTH (m) 6.50  
CASING DEPTH (m) 6.50

DATE STARTED: 26/08/2002  
DATE COMPLETED: 26/08/2002

CO-ORDINATES: E 0.00  
N 0.00

BORED BY: M. Collins

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES			FIELD TEST RESULTS	STAND PIPE DETAILS
					REF. NUMBER	SAMPLE TYPE	DEPTH (m)		
0.10	MADE GROUND consisting of fill hard case MADE GROUND (imported stone)	[Cross-hatch pattern]		0.10					
0.60	MADE GROUND (comprised of dark brown sandy gravelly clay)	[Cross-hatch pattern]		0.60					
1.30	Firm brown sandy gravelly CLAY	[Dotted pattern]		1.30	3670	DB	1.00	17/300mm	
1.80	Stiff brown sandy gravelly CLAY	[Dotted pattern]		1.80	3671	DB	2.00	15/300mm	
2.80	Hard black sandy gravelly CLAY with boulders	[Dotted pattern]		2.80	3672	DB	3.00	66/300mm	
4.00		[Dotted pattern]		4.00	3673	DB	4.00	64/300mm	
5.00		[Dotted pattern]		5.00	3674	DB	5.00	62/225mm	
6.40		[Dotted pattern]		6.40	3675	DB	6.40	25/75mm	
6.50	End of Borehole at 6.50 m			6.50					

From (m)	To (m)	Hours	Comments
3.40	3.70	1.25	
4.30	4.60	1.50	
6.00	6.50	2.00	

Water Strike	Casing Depth	Sealed at	Rise to	Time	Comments

Date	Tip Depth	RZ Top	RZ Base	Type

Date	Hole Depth	Casing Depth	Depth to Water	Comments

Remarks: 2 hrs moving rig to BH5 due to large boulders  
Casing hard to divide from 5 to 6.5



REPORT NO. 8208

GEOTECHNICAL BORING RECORD

IGSL

CONTRACT: Coolock Lane

BOREHOLE NO: BH6

Sheet 1 of 1

CLIENT:  
ENGINEER: Barry & Partners

GROUND LEVEL (mOD) 0.00  
BOREHOLE DIAMETER (mm) 200  
BOREHOLE DEPTH (m) 6.00  
CASING DEPTH (m) 6.00

DATE STARTED: 27/08/2002  
DATE COMPLETED: 27/08/2002

CO-ORDINATES: E 0.00  
N 0.00

BORED BY: M. Collins

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES			FIELD TEST RESULTS	STAND PIPE DETAILS
					REF. NUMBER	SAMPLE TYPE	DEPTH (m)		
	MADE GROUND consisting of fill hard case								
	Fill brown sandy gravelly CLAY			0.50					
1	MADE GROUND (comprised of black gravelly clay with bands of grey)			0.70					
	Brown sandy gravelly CLAY bands of grey (possible fill)			1.10	3676	OB	0.90	12/300mm	
2	Stiff brown sandy gravelly CLAY			2.00	3677	OB	1.50		
					3678	OB	2.00	18/300mm	
3	Hard black sandy gravelly CLAY with cobbles			3.00					
					3679	OB	3.20	65/300mm	
4									
					3680	OB	4.30	84/300mm	
5									
					3681	OB	5.30	25/75mm	
6	End of Borehole at 6.00 m			6.00	3682	OB	6.00	28/0mm	
7									
8									
9									

From (m)	To (m)	Hours	Comments
3.50	3.70	1.25	
4.50	5.00	2.00	
5.30	6.00	0.70	



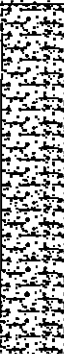

Water Strike	Casing Depth	Sealed at	Rise to	Time	Comments

Date	Tip Depth	RZ Top	RZ Base	Type

Date	Hole Depth	Casing Depth	Depth to Water	Comments

Remarks: Casing hard to divide 4.5 to 6, refused at 6

**APPENDIX II**  
**TRIAL PIT RECORDS**

REPORT NO. 8208		TRIAL PIT RECORD					IGSL			
CONTRACT: Coolock Lane					Trial Pit No.: TP1		Sheet: Sheet 1 of 1			
CLIENT:					Excavation Method: CAT 4280					
ENGINEER: Barry & Partners					Date Started: 21/08/2002					
CO-ORDINATES: E 0.00 N 0.00					Date Completed: 21/08/2002					
					Ground Level (mOD): 0.00					
Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Ref. No.	Type	Depth (m)		
1.0	MADE GROUND (soil, glass, steel, red brick & some clay)		1.10			2328	DB	1.10		
	Firm brown - grey gravelly CLAY		1.70							
2.0	Stiff to firm black gravelly sandy CLAY with occasional cobbles		2.00			2329	DB	2.00		
3.0	End of Trial Pit at 3.00 m		3.00			2330	DB	3.00		
4.0										
Groundwater Conditions: No groundwater encountered										
Stability: Stable										
Remarks:										

REPORT NO. 8208

TRIAL PIT RECORD

IGSL

CONTRACT: Coolock Lane

Trial Pit No.: TP2  
 Sheet: Sheet 1 of 1

CLIENT:

Excavation Method: CAT 4280





ENGINEER: Barry & Partners

Date Started: 21/08/2002

CO-ORDINATES: E 0.00  
 N 0.00

Date Completed: 21/08/2002

Ground Level (mOD): 0.00

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Ref. No.	Type	Depth (m)		
	MADE GROUND (comprised of organics, bricky glass & paper in a gravelly clay matrix)									
1.0	Light brown gravelly CLAY		0.80			2331	DB	1.00		
	Stiff brown - grey gravelly CLAY		1.20							
	Very stiff black gravelly sandy CLAY		1.70			2332	DB	1.60		
2.0										
3.0	End of Trial Pit at 3.00 m		3.00			2333	DB	3.00		
4.0										

Groundwater Conditions: Water seepage at 1.7m

Stability: Stable

Remarks:

REPORT NO. 8208

TRIAL PIT RECORD

IGSL

CONTRACT: Coolock Lane

Trial Pit No.: TP3

Sheet: Sheet 1 of 1

CLIENT:

Excavation Method: CAT 4280




ENGINEER: Barry & Partners

Date Started: 21/08/2002

CO-ORDINATES: E 0.00  
N 0.00

Date Completed: 21/08/2002

Ground Level (mOD): 0.00

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Ref. No.	Type	Depth (m)		
1.0	MADE GROUND (comprised of soil, roots, brick, glass & clay with some gravel)		1.10							
2.0	Stiff brown - grey gravelly CLAY		2.70			2334	DB	1.50		
3.0	Very stiff black gravelly sandy CLAY with cobbles		3.00			2335	DB	3.00		
4.0	End of Trial Pit at 3.00 m									

Groundwater Conditions: Water seepage at 1.5m

Stability:

Remarks:

REPORT NO.	8208	TRIAL PIT RECORD				IGSL
CONTRACT:	Coolock Lane	Trial Pit No.:	TP4			
CLIENT:		Sheet:	Sheet 1 of 1			
ENGINEER:	Barry & Partners	Excavation Method:	CAT 4280			
CO-ORDINATES:	E 0.00 N 0.00	Date Started:	21/08/2002			
		Date Completed:	21/08/2002			
		Ground Level (mOD):	0.00			

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Ref. No.	Type	Depth (m)		
	MADE GROUND (comprised of gravelly clay with some roots & red brick fragments)									
1.0	Firm brown gravelly CLAY		1.00			2325	DB	1.00		
	Stiff black gravelly sandy CLAY		1.50			2326	DB	1.60		
2.0	Hard black gravelly sandy CLAY with cobbles		2.30							
3.0	End of Trial Pit at 3.00 m		3.00			2327	DB	3.00		
4.0										

Groundwater Conditions:	No groundwater encountered
Stability:	
Remarks:	

**APPENDIX III**  
**LABORATORY TEST RESULTS**

**Plasticity Chart - Summary of Liquid & Plastic Limit Tests**

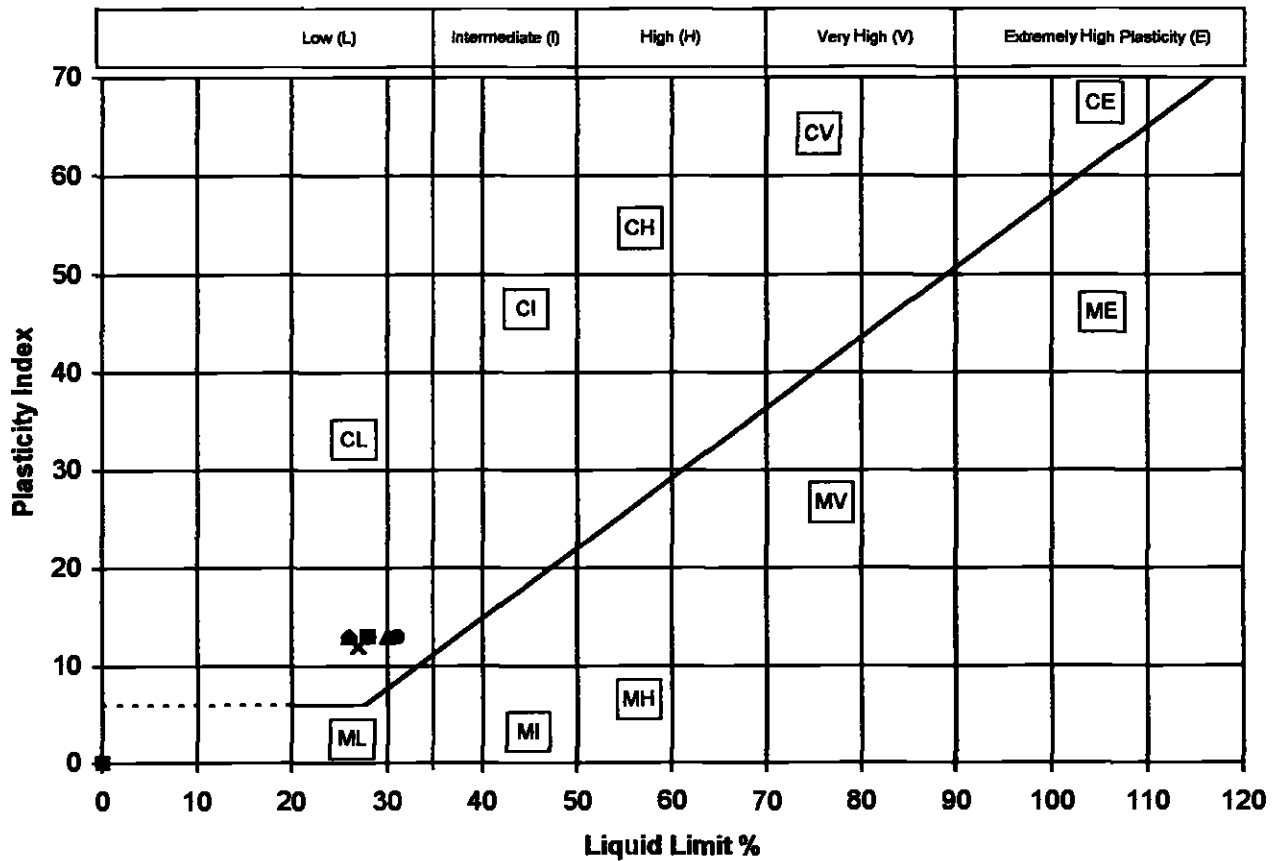
BS1377:Part 2:1990, clauses 3.2, 4 & 5

Chart in accordance with BS5930:1999, fig.18

Contract No. 8208

Contract:

COOLOCK LANE



Code	BH/TP	Sample	Depth (m)	MC%	LL%	PL%	PI%	%<425µm	Description
▲	BH 1	3697	2.00	6.2	30	17	13	63.4	Grey brown slightly sandy slightly gravelly CLAY
■	BH 2	3604	2.80	7.9	28	15	13	56.4	Dark grey slightly sandy slightly gravelly CLAY
●	BH 3	3683	1.00	13.2	31	18	13	62	Grey brown slightly sandy slightly gravelly CLAY
◆	BH 4	3690	2.00	9.3	26	13	13	59.1	Dark grey slightly sandy slightly gravelly CLAY
×	BH 4	3692	2.90	11.4	27	15	12	58.5	Grey brown slightly sandy slightly gravelly CLAY
+	BH 5	3671	2.00	12.3	28	15	13	61	Grey brown slightly sandy slightly gravelly CLAY
△	BH 5	3673	4.00	12.7	26	13	13	60.1	Dark grey slightly sandy slightly gravelly CLAY
□									
○									
◇									
▲									
■									
●									
◆									
×									
+									
△									

NP denotes specimen is non-plastic.

<b>IGSL</b>	Compiled by	Date	Checked by	Date	Page
	D CONNOLLY	24/09/02			



### Summary of Classification Tests

BS1377:Part 2:1990, clauses 3.2, 4.3, 5.3 & 5.4

BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	<425 $\mu$ m %	Preparation	Description	Classification
BH 1	3697	2.00	D	6.2	30	17	13	63.4	WS	Grey brown slightly sandy slightly gravelly CLAY	C L
BH 2	3604	2.80	D	7.9	26	15	13	56.4	WS	Dark grey slightly sandy slightly gravelly CLAY	C L
BH 3	3683	1.00	D	13.2	31	18	13	62	WS	Grey brown slightly sandy slightly gravelly CLAY	C L
BH 4	3690	2.00	D	9.3	26	13	13	59.1	WS	Dark grey slightly sandy slightly gravelly CLAY	C L
BH 4	3692	2.90	D	11.4	27	15	12	58.5	WS	Grey brown slightly sandy slightly gravelly CLAY	C L
BH 5	3671	2.00	D	12.3	28	15	13	61	WS	Grey brown slightly sandy slightly gravelly CLAY	C L
BH 5	3673	4.00	D	12.7	26	13	13	60.1	WS	Dark grey slightly sandy slightly gravelly CLAY	C L

Notes: NAT - tested as received WS - Wet sieved (425  $\mu$ m) NP - Non Plastic

<b>IGSL</b>	Contract <b>COOLOCK LANE</b>					Contract No. <b>8206</b>	
	Compiled By		Date	Checked By		Date	Page
	D CONNOLLY		24/09/02				of

REPORT NO.		<b>SULPHATE ANALYSIS</b>					IGSL	
CONTRACT: COOLOCK LANE								
BH/TP NO.	DEPTH (M)	SAMPLE NO.	SAMPLE TYPE	TEST CODE	SULPHUR TRIOXIDE		pH VALUE	
					WATER SO3 g/L	TOTAL SOIL SO3 %		
BH 1	1.00	3696	D	S		0.006	6.9	
BH 3	1.00	3683	D	S		0.004	7.6	
BH 5	2.00	3671	D	S		0.006	7.7	

TEST CODE:      W = WATER                      S = SOIL    A = AQUEOUS SOIL EXTRACT(2:1)

Report No		CALIFORNIA BEARING RATIO						I.G.S.L.		
Contract: COOLOCK LANE		DATE: 15.9.02								
Location	Sample No.	Depth of Sample	Sample Description	Water Content %	Test Code	Water Content		C.B.R.		
						Top %	Bottom %	Top %	Base %	Average %
TP 1	F2328	1.10	Grey brown slightly sandy slightly gravelly CLAY	11.0	L	11.0	11.0	12.1	14.5	13.3
TP 2	F2331	1.00	Mottled brown slightly sandy slightly gravelly CLAY	22.5	L	21.5	23.5	3.5	3.3	3.4
TP 3	E1004	F.L	Mottled grey brown slightly sandy slightly gravelly CLAY	14.1	L	14.1	14.1	0.8	0.9	0.9
TP 4	F2325	1.00	Fill of grey slightly sandy slightly gravelly CLAY with shell & red brick	14.5	L	14.3	14.7	5.0	5.3	5.2

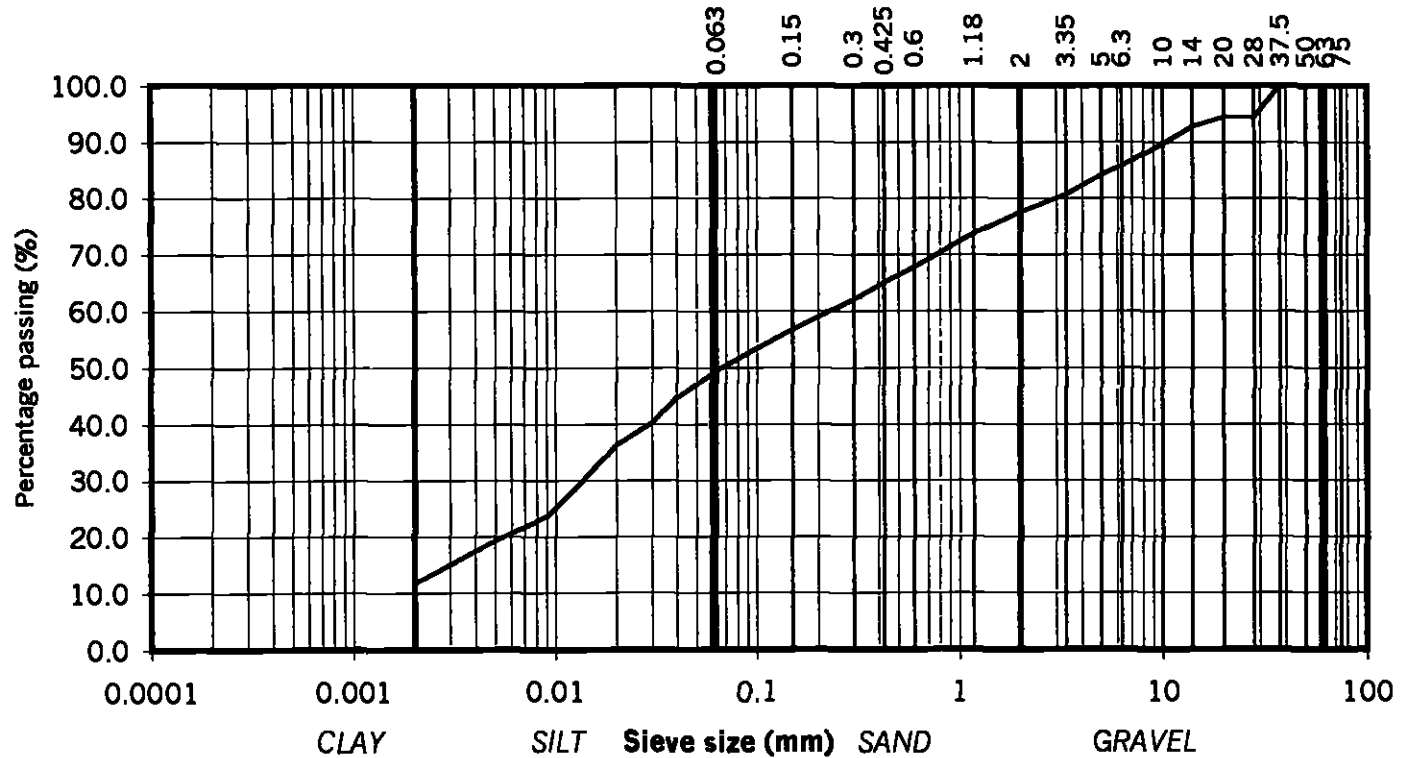
Test Code: U.-Undisturbed Sample    L.-2.5Kg. Rammer    A/5.-5% Air Voids Ratio    V.- Vibrating Hammer  
 D.-Dynamic Compaction    H.-4.5Kg. Rammer    A10.-10% Air Voids Ratio    M.- Method Number  
 St.-Static compaction    RN29.- Road Note 29 (St. 95% H.)

# Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	
50	100.0	GRAVEL
37.5	100.0	
28	94.4	
20	94.4	
14	92.7	
10	89.7	
6.3	85.8	
5	84.2	SAND
3.35	80.7	
2	77.5	
1.18	73.6	
0.6	67.7	
0.425	65.0	SILT/CLAY
0.3	62.0	
0.15	56.6	
0.063	49.5	
0.04	44.6	
0.03	40.2	
0.02	36.3	
0.013	29.2	
0.009	23.6	
0.005	19.3	
0.002	11.8	

Contract No: 8208  
 Contract: COOLOCK LANE  
 BH/TP No: BH 4  
 SAMPLE No.: 3694  
 DEPTH (m): 4.50  
 TEST METHOD: Wet sieve and hydrometer  
 DESCRIPTION: Brown slightly sandy, slightly gravelly, CLAY



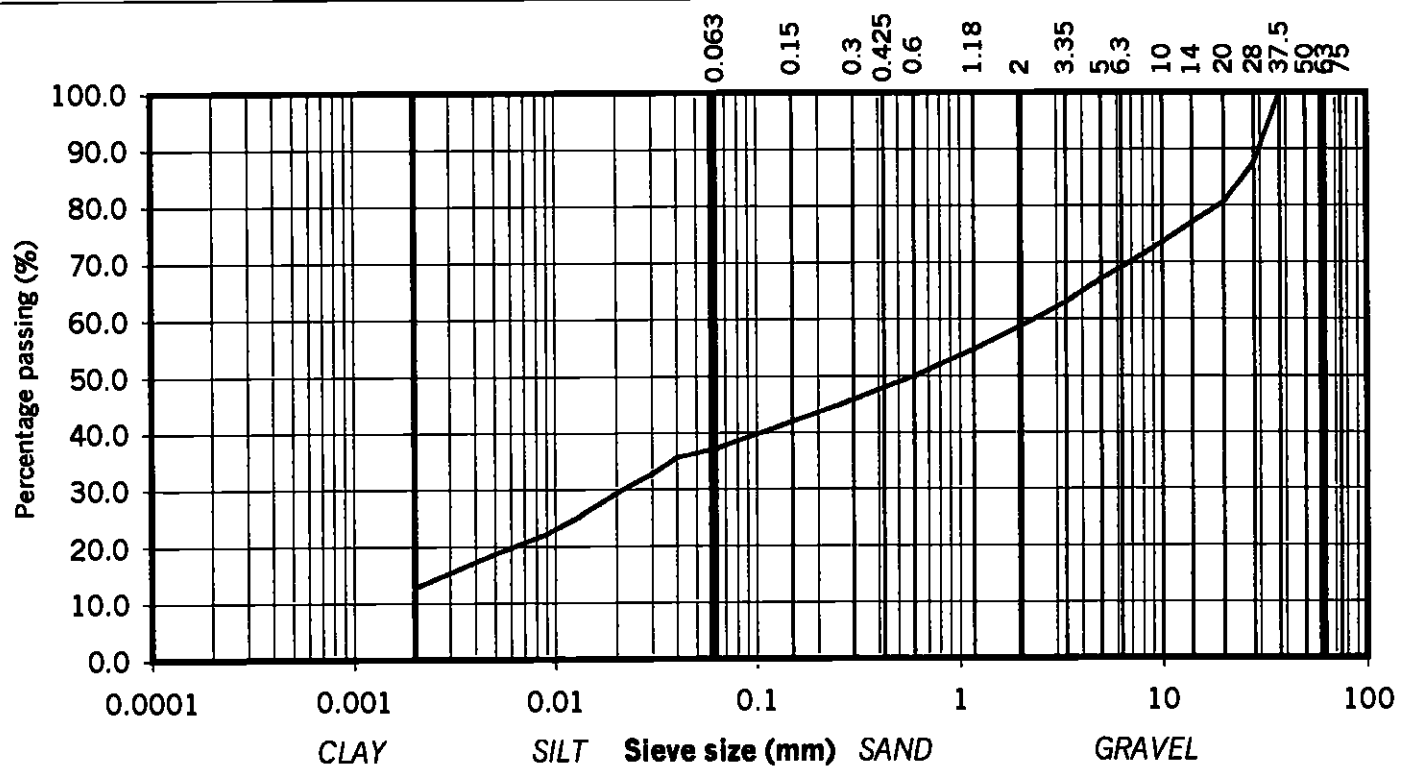
<b>IGSL</b>	Compiled by:	Date:	Checked by:	Date:	Page no:
	D CONNOLLY	24/09/02			

# Determination of Particle Size Distribution

BS1377:Part2:1990, clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	
50	100.0	
37.5	100.0	
28	87.6	
20	80.5	GRAVEL
14	76.9	
10	73.5	
6.3	69.0	
5	67.0	
3.35	62.9	SAND
2	58.5	
1.18	54.6	
0.6	49.9	
0.425	47.8	
0.3	45.8	SILT/CLAY
0.15	42.0	
0.063	37.2	
0.04	35.6	
0.03	32.6	
0.02	29.4	
0.013	25.2	
0.009	22.2	
0.005	18.6	
0.002	12.7	

Contract No: 8208  
 Contract: COOLOCK LANE  
 BH/TP No: BH 3  
 SAMPLE No.: 3686  
 DEPTH (m): 3.50  
 TEST METHOD: Wet sieve and hydrometer  
 DESCRIPTION: Dark grey slightly sandy, gravelly, CLAY



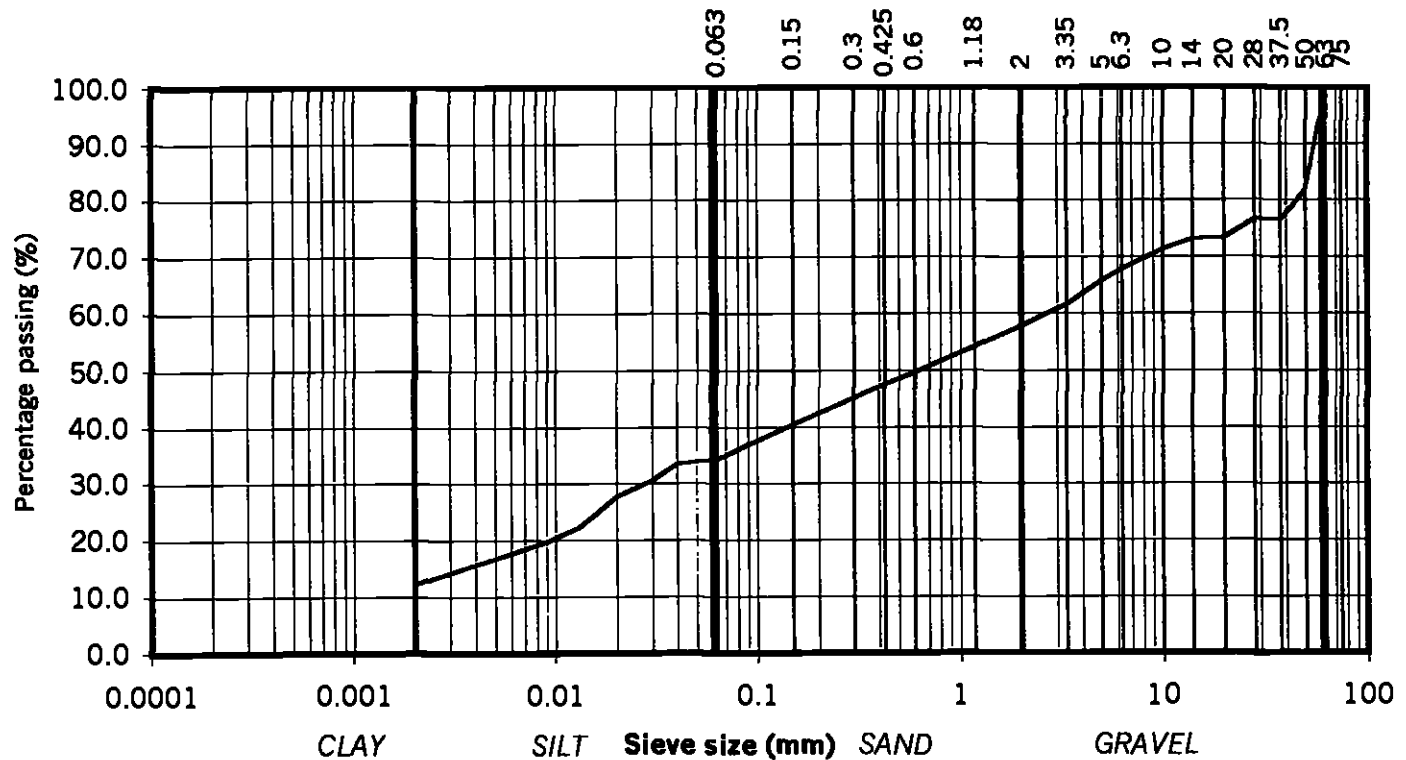
<b>IGSL</b>	Compiled by:	Date:	Checked by:	Date:	Page no:
	D CONNOLLY	24/09/02			

# Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	
50	81.8	GRAVEL
37.5	76.4	
28	76.4	
20	73.3	
14	73.1	
10	71.2	
6.3	67.8	
5	65.8	SAND
3.35	61.6	
2	57.8	
1.18	54.1	
0.6	49.6	
0.425	47.6	SILT/CLAY
0.3	45.2	
0.15	40.5	
0.063	34.4	
0.04	33.5	
0.03	30.4	
0.02	27.7	
0.013	22.2	
0.009	19.7	
0.005	16.7	
0.002	12.3	

Contract No: 8208  
 Contract: COOLOCK LANE  
 BH/TP No: BH 1  
 SAMPLE No.: 3699  
 DEPTH (m): 4.00  
 TEST METHOD: Wet sieve and hydrometer  
 DESCRIPTION: Dark grey slightly sandy, gravelly, CLAY



<b>IGSL</b>	Compiled by:	Date:	Checked by:	Date:	Page no:
	D CONNOLLY	24/09/02			

Irish Geotechnical Services Ltd., Industrial Estate, Newbridge, Co kildare PSD V3.1 12.01



**CERTIFICATE OF ANALYSIS**

---

**Client:** Irish Geotechnical Services Ltd (Newbridge)  
Industrial Estate  
Newbridge  
Co. Kildare  
Ireland

**Attention:** Stephen Franey

**Date:** 1 October, 2002

**Our Reference:** 02-B01335

**Your Reference:** Coolock lane

**Location:**

A total of 4 samples was received for analysis on Monday, 16 September 2002. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Signed

**Ken Scally**  
Site Manager

**Compiled By**

.....  
Marie Dolan

# ALcontrol Laboratories Ireland

## Test Schedule

**Ref Number: 02-B01335**

**Sample Type: SOIL**

Client: Irish Geotechnical Services Ltd (Newbridge)

Location:

Date of Receipt: 16/09/2002

Client Contact: Stephen Franey

Turnaround: 10 days

Client Ref: Coolock lane

Detection Method				DR LANGE	GCMS	GRAVIMETRIC	HPLC	ICP	ICP	KONE	LECO	METER	SPECTRO	SPECTRO	SPECTRO	SPECTRO
ALcontrol Reference	Sample Identity	Other ID	P / V	Chromium VI	PAH EPA (16)	Moisture Content	Total Phenols by HPLC	ICRCL Metals (9)	Water Soluble Boron	Soluble Sulphate	Total Sulphur**	pH (Solid)	Acid Soluble Sulphide**	Free Cyanide	Thiocyanate	Total Cyanide
02-B01335-50011-A01	BH3	UNKNOWN	Plastic tub	X	X	X	X	X	X	X	X	X	X	X	X	X
02-B01335-50012-A01	BH4	UNKNOWN	Plastic Bag	X	X	X	X	X	X	X	X	X	X	X	X	X
02-B01335-50013-A01	BH6	UNKNOWN	Plastic Bag	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

Checked By David Clarke



Interim  
 Validated

# ALcontrol Laboratories Ireland

## Table Of Results

Ref Number: 02-B01335

Client: Irish Geotechnical Services Ltd (Newbridge)

Date of Receipt: 16/09/02  
 (of first sample)

Sample Type: SOIL

Location:

Client Contact: Stephen Franey

Client Ref: Coolock lane

Alcontrol Reference	Sample Identity	Other ID	Detection Method	DR LANGE	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	
			Method Detection Limit	<0.1mg/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg
			Chromium VI	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(123cd)pyrene
			mg/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
02-B01335-S0010	BH1	UNKNOWN	<0.1	33	3	2	3	21	7	22	22	3B	22	12	12	11	13
02-B01335-S0011	BH3	UNKNOWN	<0.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
02-B01335-S0012	BH4	UNKNOWN	<0.1	16	2	3	14	40	10	4	B	14	41	<1	<1	<1	<1
02-B01335-S0013	BH6	UNKNOWN	<0.1	<1	<1	<1	3	12	4	21	21	25	21	17	10	14	<1

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

NFP = NO FIBRES PRESENT

Checked By Marie Dolan Marie Dolan

Interim  
 Validated

# ALcontrol Laboratories Ireland

## Table Of Results

Ref Number: 02-B01335

Sample Type: SOIL

Client: Irish Geotechnical Services Ltd (Newbridge)

Location:

Date of Receipt: 16/09/02

Client Contact: Stephen Franey

(of first sample)

Client Ref: Coolock lane

ALcontrol Reference	Sample Identity	Other ID	Detection Method	GCMS	GCMS	GCMS	GRAVIMETRIC	HPLC	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	
			Method Detection Limit	<1ug/kg	<1ug/kg	<1ug/kg	<0.1%	<0.01mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg
			Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Total 16 EPA PAHs	Moisture Content	Total Phenols	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Water Soluble Boron	Zinc
			ug/kg	ug/kg	ug/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
02-B01335-S0010	BH1	UNKNOWN	4	8	235	18.7	0.02	3	2	10	43	40	<1	25	<1	1	144
02-B01335-S0011	BH3	UNKNOWN	>1	>1	>1	11.1	<0.01	>1	2	13	27	32	>1	25	>1	1	81
02-B01335-S0012	BH4	UNKNOWN	>1	>1	149	10.0	>0.01	>1	1	10	21	15	>1	25	>1	>1	81
02-B01335-S0013	BH6	UNKNOWN	>1	>1	148	12.7	>0.01	4	1	7	18	21	<1	14	<1	>1	82

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

NFP = NO FIBRES PRESENT

Checked By Marie Dolan Marie Dolan

Interim  
 Validated

# ALcontrol Laboratories Ireland

## Table Of Results

Ref Number: 02-B01335

Client: Irish Geotechnical Services Ltd (Newbridge)

Date of Receipt: 16/09/02  
 (of first sample)

Sample Type: SOIL

Location:

Client Contact: Stephen Franey

Client Ref: Coolock lane

Detection Method		KONE	LECO	METER	SPECTRO	SPECTRO	SPECTRO	SPECTRO							
Method Detection Limit		<0.003g/l	<0.01%	napH Units	<10mg/kg	<0.5mg/kg	<1mg/kg	<2.5mg/kg							
Alcontrol Reference	Sample Identity	Other ID	Soluble Sulphate	Total Sulphur**	pH	Acid Soluble Sulphide**	Free Cyanide**	Thiocyanate	Total Cyanide						
			g/l	%	pH Units	mg/kg	mg/kg	mg/kg	mg/kg						
02-B01335-S0010	BH1	UNKNOWN	0.028	0.03	7.88	<10	<0.5	<1	<2.5						
02-B01335-S0011	BH3	UNKNOWN	0.048	0.03	8.21	10	>0.5	>1	>2.5						
02-B01335-S0012	BH4	UNKNOWN	0.638	0.49	8.03	>10	>0.5	>1	>2.5						
02-B01335-S0013	BH6	UNKNOWN	0.116	0.04	8.20	<10	<0.5	<1	<2.5						

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

NFP = NO FIBRES PRESENT

Checked By Marie Dolan Marie Dolan

# ALcontrol Geochem

## 19 PAH Analysis

Sample Identity - DUB-02-B01335-S0010 BH1  
Client / Sample matrix - Irish Geotechnical Services Ltd /Soil  
Units - µg/kg

CAS Number	Compound	Concentration
91-20-3	Naphthalene	33
208-96-8	Acenaphthylene	3
83-32-9	Acenaphthene	2
86-73-7	Fluorene	3
85-01-8	Phenanthrene	21
120-12-7	Anthracene	7
206-44-0	Fluoranthene	22
129-00-0	Pyrene	22
27208-37-3	Cyclopenta(cd)pyrene	<1
56-55-3	Benz(a)anthracene	38
218-01-9	Chrysene	22
205-99-2	Benzo(b)fluoranthene	12
207-08-9	Benzo(k)fluoranthene	12
192-97-2	Benzo(e)pyrene	<1
50-32-8	Benzo(a)pyrene	11
193-39-5	Indeno(123cd)pyrene	13
53-70-3	Dibenzo(ah)anthracene	4
191-24-2	Benzo(ghi)perylene	8
191-26-4	Anthanthrene	<1
Total of 16 PAH's		235

# ALcontrol Geochem

## 19 PAH Analysis

Sample Identity - DUB-02-B01335-S0011 BH3  
Client / Sample matrix - Irish Geotechnical Services Ltd /Soil  
Units - µg/kg

CAS Number	Compound	Concentration
91-20-3	Naphthalene	<1
208-96-8	Acenaphthylene	<1
83-32-9	Acenaphthene	<1
86-73-7	Fluorene	<1
85-01-8	Phenanthrene	<1
120-12-7	Anthracene	<1
206-44-0	Fluoranthene	<1
129-00-0	Pyrene	<1
27208-37-3	Cyclopenta(cd)pyrene	<1
56-55-3	Benz(a)anthracene	<1
218-01-9	Chrysene	<1
205-99-2	Benzo(b)fluoranthene	<1
207-08-9	Benzo(k)fluoranthene	<1
192-97-2	Benzo(e)pyrene	<1
50-32-8	Benzo(a)pyrene	<1
193-39-5	Indeno(123cd)pyrene	<1
53-70-3	Dibenzo(ah)anthracene	<1
191-24-2	Benzo(ghi)perylene	<1
191-26-4	Anthanthrene	<1
Total of 16 PAH's		<1

# ALcontrol Geochem

## 19 PAH Analysis

Sample Identity - DUB-02-B01335-S0012 BH4  
Client / Sample matrix - Irish Geotechnical Services Ltd /Soil  
Units - µg/kg

CAS Number	Compound	Concentration
91-20-3	Naphthalene	16
208-96-8	Acenaphthylene	2
83-32-9	Acenaphthene	3
86-73-7	Fluorene	14
85-01-8	Phenanthrene	40
120-12-7	Anthracene	6
206-44-0	Fluoranthene	4
129-00-0	Pyrene	8
27208-37-3	Cyclopenta(cd)pyrene	<1
56-55-3	Benz(a)anthracene	14
218-01-9	Chrysene	41
205-99-2	Benzo(b)fluoranthene	<1
207-08-9	Benzo(k)fluoranthene	<1
192-97-2	Benzo(e)pyrene	<1
50-32-8	Benzo(a)pyrene	<1
193-39-5	Indeno(123cd)pyrene	<1
53-70-3	Dibenzo(ah)anthracene	<1
191-24-2	Benzo(ghi)perylene	<1
191-26-4	Anthanthrene	<1
Total of 16 PAH's		149

# ALcontrol Geochem

## 19 PAH Analysis

Sample Identity - DUB-02-B01335-S0013 BH6  
Client / Sample matrix - Irish Geotechnical Services Ltd /Soil  
Units - µg/kg

CAS Number	Compound	Concentration
91-20-3	Naphthalene	<1
208-96-8	Acenaphthylene	<1
83-32-9	Acenaphthene	<1
86-73-7	Fluorene	3
85-01-8	Phenanthrene	12
120-12-7	Anthracene	4
206-44-0	Fluoranthene	21
129-00-0	Pyrene	21
27208-37-3	Cyclopenta(cd)pyrene	<1
56-55-3	Benz(a)anthracene	25
218-01-9	Chrysene	21
205-99-2	Benzo(b)fluoranthene	17
207-08-9	Benzo(k)fluoranthene	10
192-97-2	Benzo(e)pyrene	<1
50-32-8	Benzo(a)pyrene	14
193-39-5	Indeno(123cd)pyrene	<1
53-70-3	Dibenzo(ah)anthracene	<1
191-24-2	Benzo(ghi)perylene	<1
191-26-4	Anthanthrene	<1
Total of 16 PAH's		148

**APPENDIX**



## **APPENDIX**

1. Results are expressed as mg/kg dry weight unless otherwise stated, excluding analyses in (2) below.
2. Leach tests, cyanide, phenols by MS, hexavalent chrome, flash point, acid soluble sulphides, TPH by IR and volatiles are performed on wet soil as received, and results are expressed as mg/Kg of wet soil or mg/l of leachate of specified leach test. Ammoniacal nitrogen and total phenols by HPLC are performed on wet sample but are then re-calculated and expressed as mg/kg of dry soil.
3. ICP metals results are analysed using a screening program and the data is accurate to within 20%.
4. The majority of analyses are run to an accuracy of 10%, but this may be improved upon if legally defensible data is required.
5. A sub sample of all samples received will be retained free of charge for two months for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.
6. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.
7. Please note that we take no responsibility for any test performed by sub-contractors (marked with an asterisk).
8. Asbestos screen is done in-house on soils and if no fibres are found will be reported as NFP-no fibres present. If asbestos is detected then identification & quantification is carried out by a sub-contractor. If a sample is suspected of containing asbestos then drying & crushing will be suspended on that sample until the asbestos result is known. If asbestos is present then no analysis requiring dry sample will be undertaken.
9. NDP-No determination possible due to insufficient/unsuitable sample.

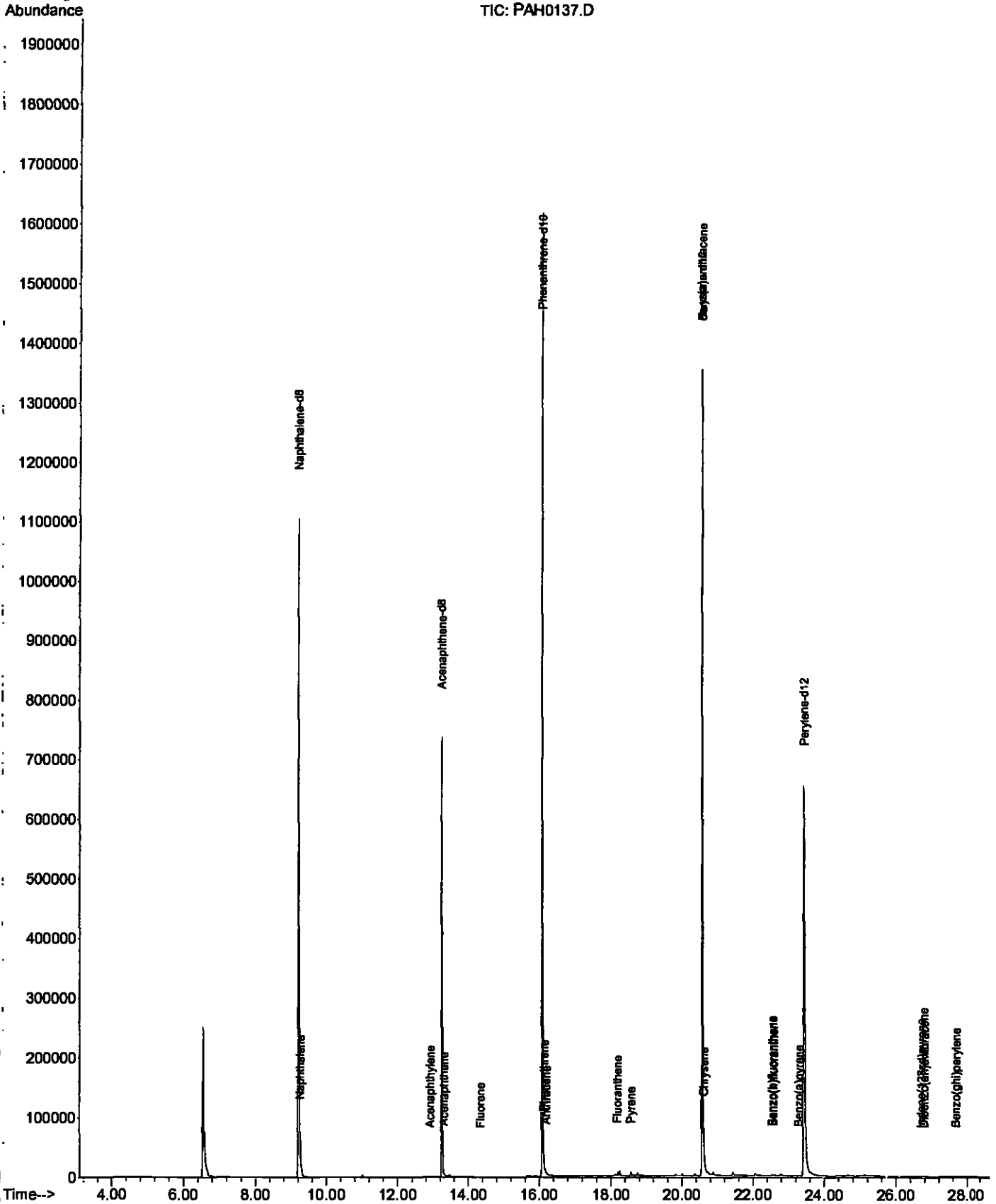
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 Sample : DUB-02-B01335-S0010 BH1  
 Misc : Irish Geotechnical Services Ltd /Soil

vial: 75  
 Operator: Mathilde Ernoult  
 Inst : GCMS1  
 Multiplr: 1.64  
 Sample Amount: 0.00

MS Integration Params: AUTOINT1.E  
 Quant Time: Sep 23 12:17 2002

Quant Results File: DPAH19.RES

Method : C:\MSDCHEM\1\METHODS\DPAH19.M (Chemstation Integrator)  
 Title : 19 PAH Analysis  
 Last Update : Mon Sep 23 09:09:21 2002  
 Response via : Initial Calibration



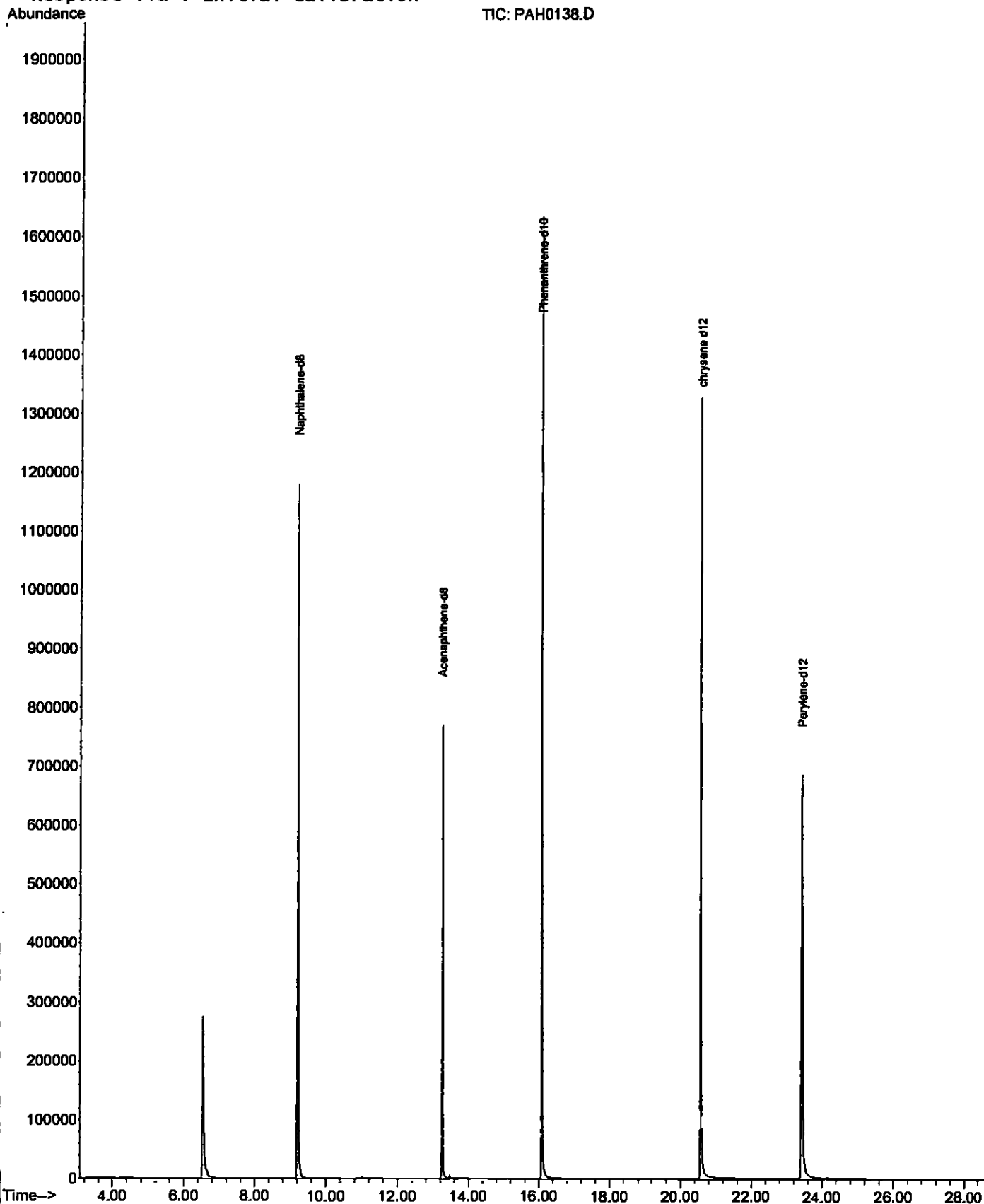
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 Sample : DUB-02-B01335-S0011 BH3  
 Misc : Irish Geotechnical Services Ltd /Soil

Vial: 76  
 Operator: Mathilde Ernoult  
 Inst : GCMS1  
 Multiplr: 1.50  
 Sample Amount: 0.00

MS Integration Params: AUTOINT1.E  
 Quant Time: Sep 23 12:18 2002

Quant Results File: DPAH19.RES

Method : C:\MSDCHEM\1\METHODS\DPAH19.M (Chemstation Integrator)  
 Title : 19 PAH Analysis  
 Last Update : Mon Sep 23 09:09:21 2002  
 Response via : Initial Calibration



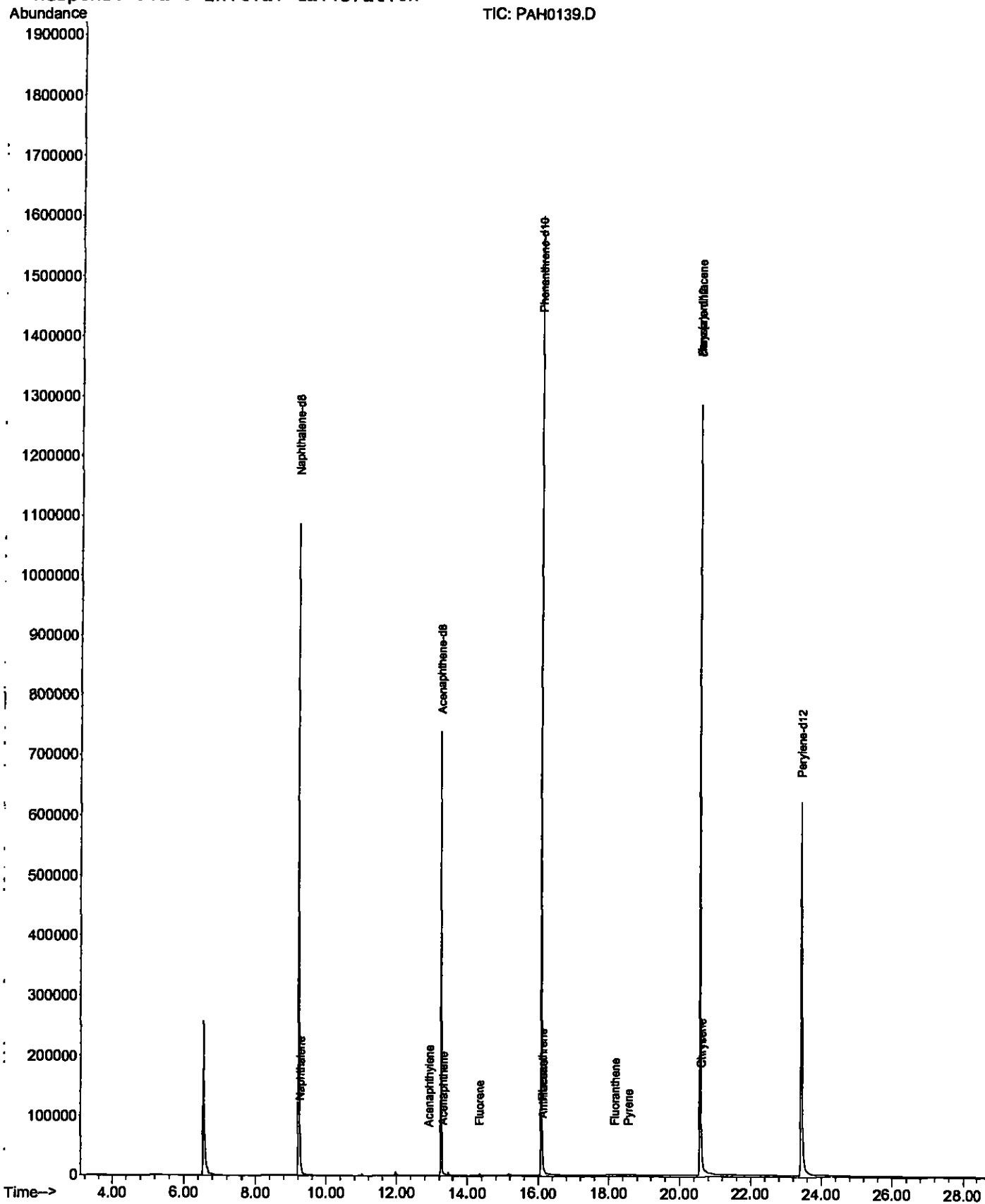
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 Sample : DUB-02-B01335-S0012 BH4  
 Misc : Irish Geotechnical Services Ltd /Soil

Vial: 77  
 Operator: Mathilde Ernoult  
 Inst : GCMS1  
 Multiplr: 1.50  
 Sample Amount: 0.00

MS Integration Params: AUTOINT1.E  
 Quant Time: Sep 23 12:19 2002

Quant Results File: DPAH19.RES

Method : C:\MSDCHEM\1\METHODS\DPAH19.M (Chemstation Integrator)  
 Title : 19 PAH Analysis  
 Last Update : Mon Sep 23 09:09:21 2002  
 Response via : Initial Calibration



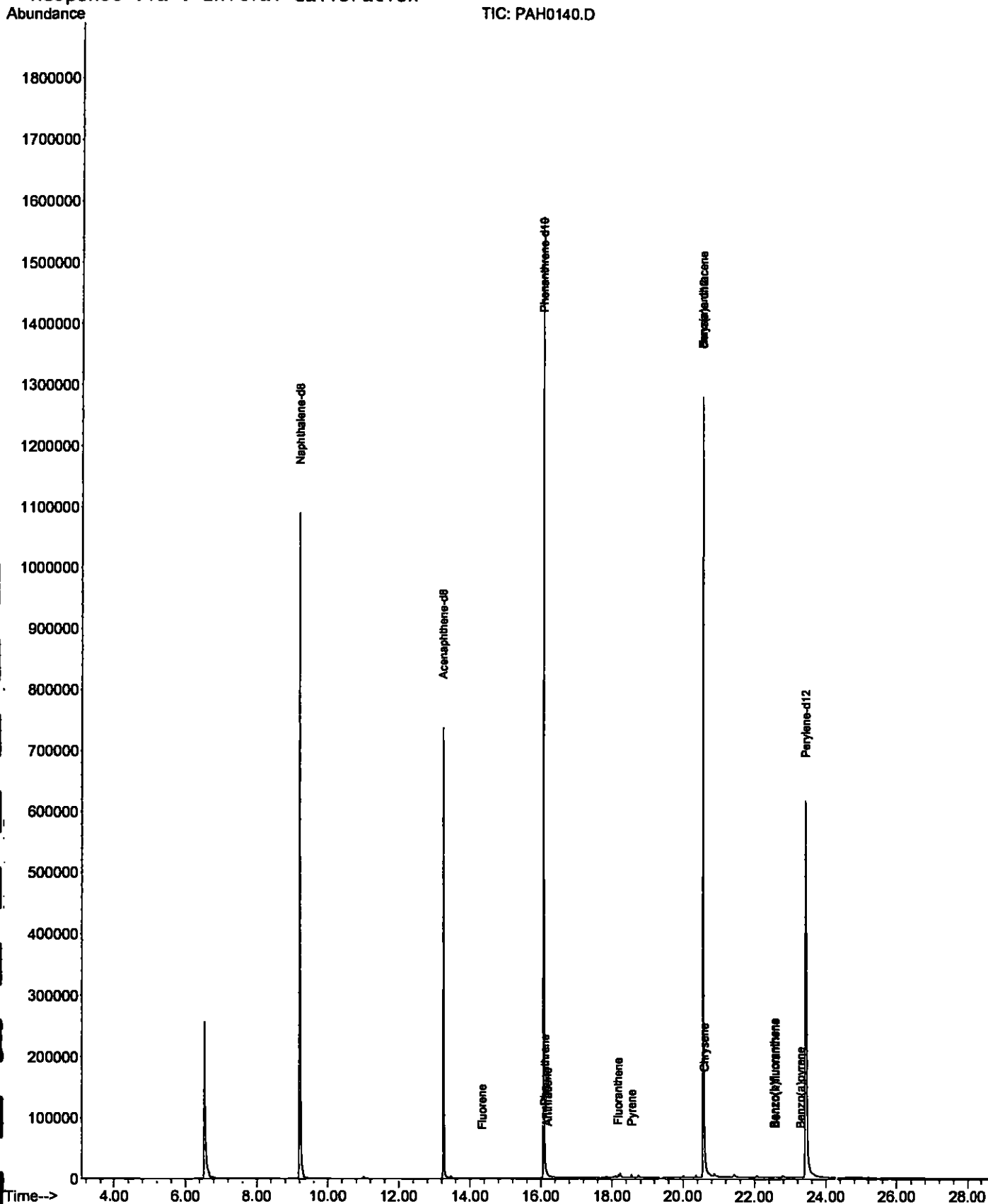
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Acq On : 22 Sep 2002 23:29  
Sample : DUB-02-B01335-S0013 BH6  
Misc : Irish Geotechnical Services Ltd /Soil

vial: 78  
Operator: Mathilde Ernoult  
Inst : GCMS1  
Multiplr: 1.53  
Sample Amount: 0.00

MS Integration Params: AUTOINT1.E  
Quant Time: Sep 23 12:21 2002

Quant Results File: DPAH19.RES

Method : C:\MSDCHEM\1\METHODS\DPAH19.M (Chemstation Integrator)  
Title : 19 PAH Analysis  
Last Update : Mon Sep 23 09:09:21 2002  
Response via : Initial Calibration

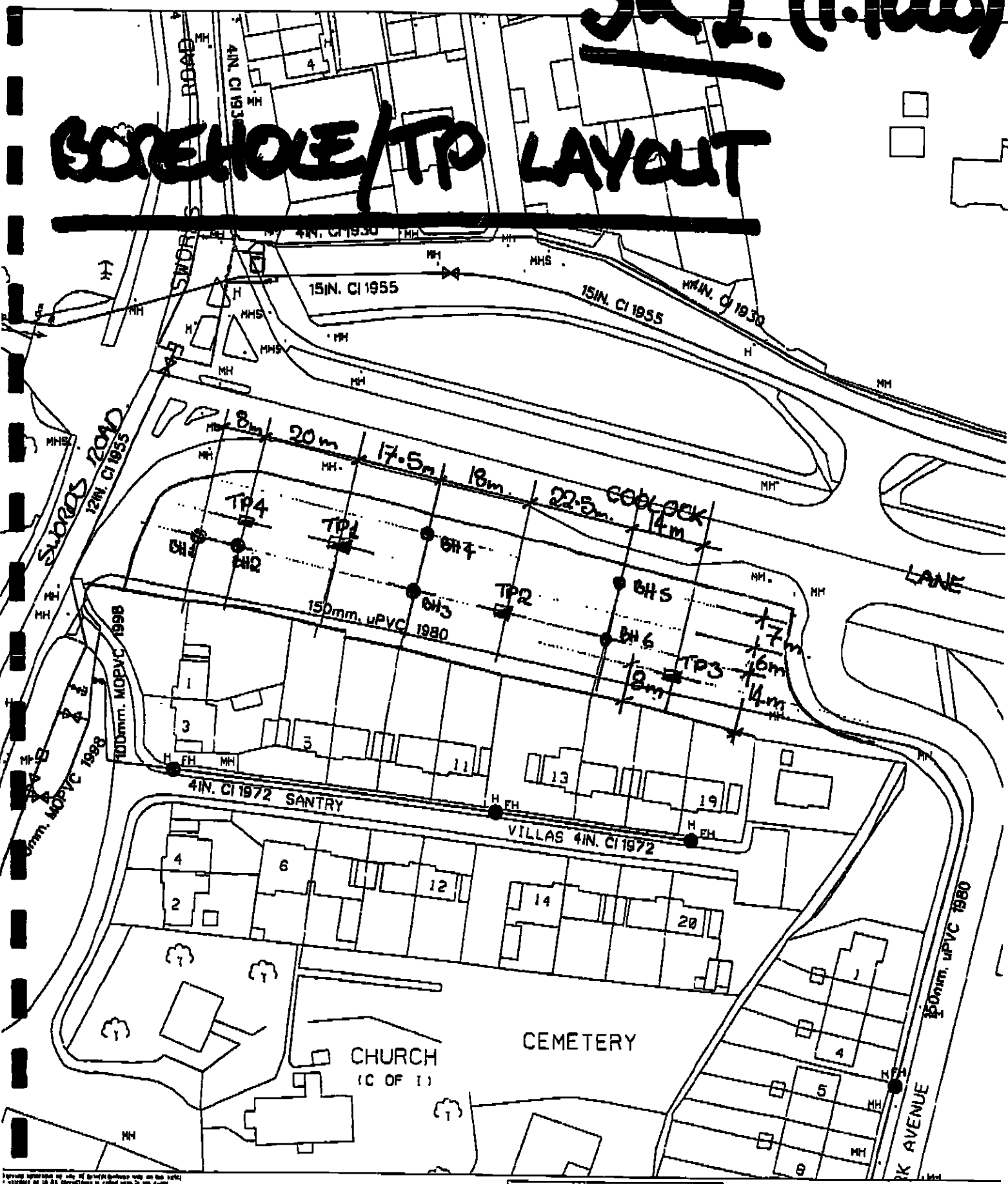


**APPENDIX IV**  
**SITE PLAN**

coolock lane

# SK 1. (1:1000)

## BOREHOLE/TP LAYOUT



Approved for use as a guide only on the basis of a survey of the site by the author. It is not intended to be used as a basis for any other survey or for any other purpose. The author is not responsible for any errors or omissions in this document.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

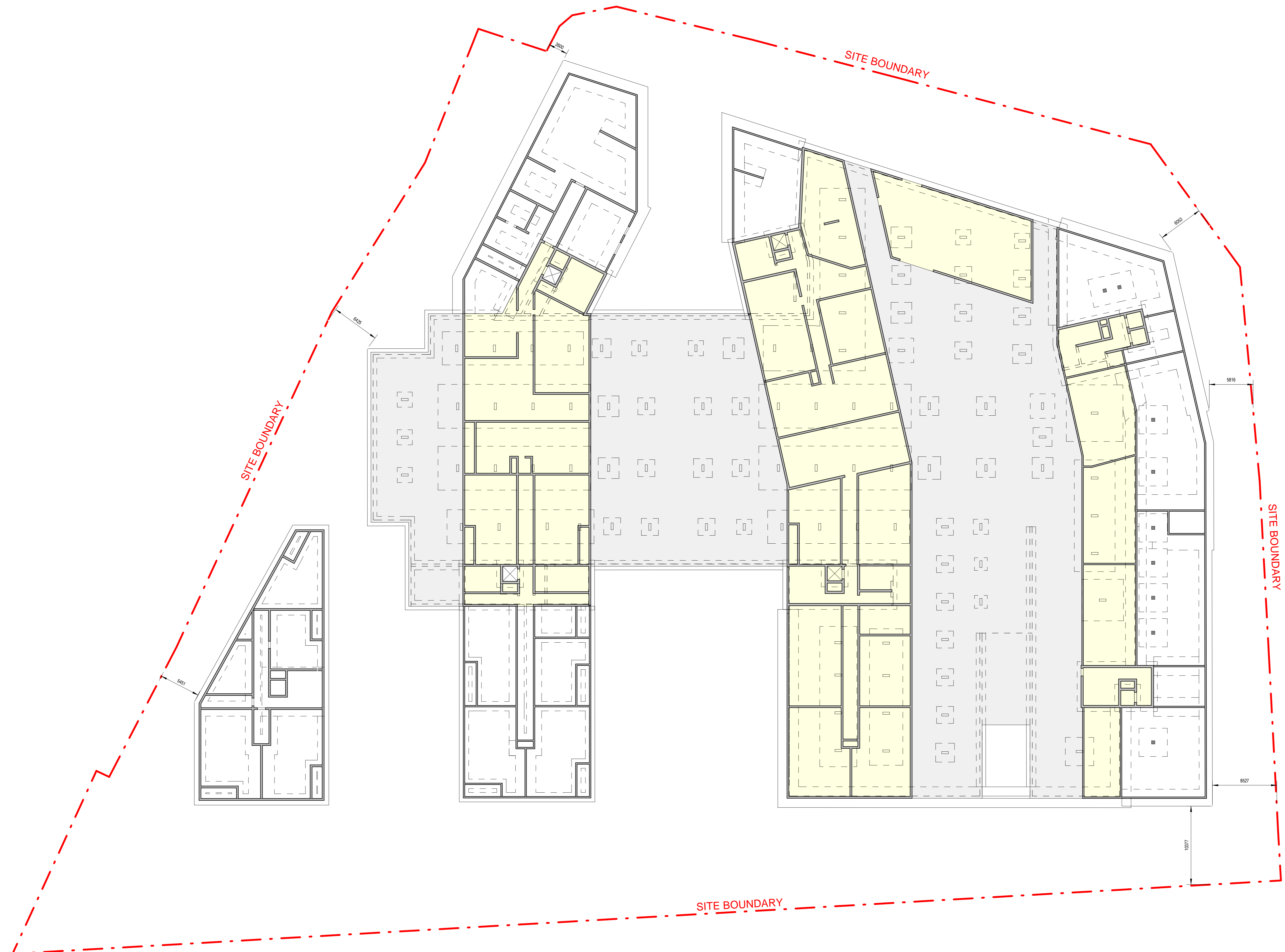
**APPENDIX D**

Key plan and Site Boundary



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 Figured dimension only to be taken from this drawing. All dimensions to be checked on site. Consultants to be informed immediately of any discrepancies before work proceeds.

**NOTE:**  
 SIZING/POSITIONING OF STRUCTURAL ELEMENT SHOWN, INCLUDING FOUNDATIONS, ARE PRELIMINARY ONLY AND ARE SUBJECT TO CHANGE BASED ON FURTHER GEOTECHNICAL IN-SITU TESTING AND AT DETAILED DESIGN PHASE



**GROUND FLOOR PLAN Copy 1**  
 1:250


PO1	24-08-2021	ISSUED FOR INFORMATION	GD	KDC
REV	date	description	by	chkd.
		A - Approved		
		B - Approved with comments		
		C - Do not use		

suitability FOR INFORMATION issue purpose PLANNING

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project ref.  
**PROPOSED RESIDENTIAL DEVELOPMENT AT SWORDS RD, SANTRY, PHASE 2**

drawing title  
**KEYPLAN AND SITE BOUNDARY**

client  
**DWYER NOLAN DEVELOPMENTS**

designed by	author	scale	sheet size
KDC	GD	AS SHOWN	A1
drawing no.	revision		
200060-DBFL-XX-XX-DR-S-1000	PO1		