Appendix F : Extracts from Site Investigation Report

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Ground Investigations Ireland

Sandford Park Milltown

DBFL

Ground Investigation Report

October 2020

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DOCUMENT CONTROL SHEET

Project Title	Sandford Park Milltown
Engineer	DBFL
Client	DBFL
Project No	9338-12-19
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Draft	M Sutton	A McDonnell	A McDonnell	Dublin	22 April 2020
B	Final	M Sutton	A McDonnell	A McDonnell	Dublin	19 June 2020
C	Final	M Sutton	A McDonnell	A McDonnell	Dublin	29 October 2020

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CONTENTS

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APPENDICES

1.0 Preamble

On the instructions of DBFL Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., between January and June 2020 at the site of the proposed residential development in Milltown Park in Milltown, Dublin 6, Co. Dublin. A second phase of investigation was undertaken in October 2020.

2.0 Overview

2.1. Background

It is proposed to construct a new residential development including apartments and town houses with associated services, access roads and car parking at the site. The site is currently the grounds of Millfield Park and is partly greenfield with a portion on the eastern side of the site occupied by a car park and existing access road. The proposed construction is envisaged to consist of conventional or piles foundations and pavement make up with some local excavations for services and plant. A basement is proposed as part of the proposed scheme beneath the apartments at the centre of the site which will require excavation of approximately 4m BGL.

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, including both phases of this investigation for this project included the following:

- Visit project site to observe existing conditions
- Carry out 11 No. Trial / Foundation Inspection Pits to determine existing foundation details
- Carry out 3 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Carry out 14 No. Window Sample Boreholes to recover soil samples
- Carry out 13 No. Dynamic Probes to determine soil strength/density characteristics
- Carry out 16 No. Cable Percussion boreholes to a maximum depth of 8m BGL
- Carry out 5 No. Rotary Core follow on boreholes to a maximum depth of 20m BGL
- Carry out 9 No. Plate Load tests to determine CBR Value
- Carry out 1 No TRL probe to determine CBR Value
- Installation of 7 No. Groundwater monitoring wells
- 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 / Foundation Pits

The trial pits were excavated using a JCB 3CX or 3T 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 the exposed foundations were logged and sketched prior to backfilling and reinstatement. The logs and sketches are provided in Appendix 2 of this Report.

3.3. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 3 of this Report.

3.4. Window Sampling

The window sampling was carried out at the locations shown in the location plan in Appendix 1 using a Tecopsa SPT Tec 10 percussion drilling rig. The window sampling consists of a 1m long steel tube with a cutting edge and an internal plastic liner which is mechanically driven into the ground utilising a 50kg weight falling a height of 500mm. Upon completion of the 1m sample, the tube is withdrawn and the plastic liner removed and sealed for logging and sub sampling by a Geotechnical Engineer/Engineering Geologist. The tube is replaced in the borehole and a subsequent 1m sample can be recovered. Occasionally outer casing or a reduced diameter tube is utilised to enable the window sample to progress in difficult drilling conditions. Geotechnical or environmental soil samples can be recovered from each of the liners following logging. The window sample records are provided in Appendix 6 of this Report.

3.5. Dynamic Probing

The dynamic probe tests (DPH) were carried out at the locations shown in the location plan in Appendix 1 in accordance with B.S. 1377: Part 9 1990. The test consists of mechanically driving a cone with a 50kg weight in 100mm intervals and monitoring the number of blows required. An equivalent Standard Penetration Test (SPT) 'N' value may be calculated by dividing the total number of blows over a 300mm drive length by 1.5. The dynamic probe logs are provided in Appendix 5 of this Report.

3.6. 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 60º 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 7 of this Report.

3.7. 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 7 of this Report.

3.8. Surveying

The exploratory hole locations have been recorded using a KQ GEO Technologies KQ-M8 System which records the coordinates and elevation of the locations to ITM or Irish National Grid as required by the project specification. The coordinates and elevations will be included on the exploratory hole logs in the appendices of the final Report. Where levels are not shown on the logs coordinates were taken from GIS.

3.9. Groundwater/Gas Monitoring Installations

Groundwater and or Gas Monitoring Installation were installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. Where required the standpipe is sealed with a gas tap and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

3.10. Insitu Plate Bearing Test

The plate bearing tests were carried out using a 305mm or 450mm diameter plate at the locations shown on the site plan in Appendix 1. The plate was loaded in increments using a hydraulic jack and an excavator to provide a reaction and the displacement was monitored in accordance with BS1377 Part 9 using independently mounted digital strain gauges. The constrained modulus and equivalent CBR are calculated in accordance with HD29/75 and are provided on the test reports in Appendix 4 of this Report.

3.1. TRL Dynamic Cone Penetrometer

The TRL DCP tests were carried out at locations where plate load tests were not possible, to determine a CBR design value for the design of external pavements. The testing was carried out below the Topsoil or existing pavement at the depths detailed on the test report. The test consists of dropping a 10kg weight on

an anvil to drive a small diameter cone and recording the blows for a given penetration. The results of the DCP testing is included in Appendix 4 of this Report.

3.2. 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 & Chemical testing as required by the specification, including the Rilta Suite pH and sulphate testing was carried out by Element Materials Technology Laboratory in the UK. The Rilta suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria.
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 8 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;

- Topsoil/Surfacing
- Made Ground
- Cohesive Deposits
- Granular Deposits (Rarely Encountered)
- Bedrock

TOPSOIL/SURFACING: Topsoil was encountered in the majority of the exploratory holes and was typically present to a depth of between 0.20 and 0.40m BGL with a maximum depth of 0.7m BGL encountered in TP05. Tarmac surfacing was present in WS04, WS12, BH05 and BH11 typically to a depth of between 0.08m and 0.10mBGL. Concrete was encountered in BH08 to a depth on 0.10m BGL.

MADE GROUND: Made Ground deposits were encountered beneath the Topsoil/Surfacing in some investigation locations and were present to a depth of between 0.5m and 1.0m BGL. These deposits were described generally as *brown slightly sandy slightly gravelly CLAY with occasional cobbles* or *grey sandy angular Gravel.* In some locations the made ground contained *occasional fragments of mortar, red brick, and charcoal.*

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Topsoil or Made Ground and were described typically as *brown slightly sandy slightly gravelly CLAY with occasional cobbles* overlying a *stiff or very stiff dark grey /black slightly sandy slightly gravelly CLAY with occasional cobbles*. A brown *very stiff slightly sandy slightly gravelly CLAY* was also encountered in some boreholes below the dark grey/black clay. 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 very stiff below 2.2m BGL in the majority of the exploratory holes with some extending to 2.6m BGL before very stiff deposits were encountered.

GRANULAR DEPOSITS: Granular deposits were encountered in BH16 within the cohesive deposits and were typically described as G*rey brown slightly clayey sandy sub angular sub rounded fine to coarse GRAVEL with occasional cobbles.*
Based on the SPT N values the deposits are typically medium dense. A significant groundwater strike was noted in the borehole on encountering the granular deposits.

BEDROCK: The rotary core boreholes recovered weak to strong grey/dark grey fine to medium grained LIMESTONE w calcite veining. In some locations the beds of stiff brown clay were encountered which have been interpreted as residual weathered mudstone. This is typical of the Calp Formation, which is noted on the geological mapping to the east of the proposed site.
The depth to rock varies from 9.0m BGL in BH11 to a maximum of 18.45m BGL in BH03. In BH03 there was poor recovery and where cobbles of limestone where recovered that presumed to be rock. Generally rock was encountered at higher levels in the eastern area of the site. The total core recovery is good, typically 100% with some of the uppermost runs dropping to 80 or 90%. The SCR and RQD vary in the borehole across the site, with some core recovered as non-intact and some hole encountering clay bands within the limestone, however generally both indices show an increase with depth.

4.2. Insitu Strength Testing

The correlated DPH blow counts indicate that the overburden deposits are typically soft to depths of between 0.7 and 1.6m BGL and become firm to stiff and stiff to very stiff with depth. Generally stiff soils were encountered from between depths of 1.2 and 2.4m BGL at the dynamic probe locations.

4.3. 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. For this reason, standpipes were installed in BH02, BH03, BH07, BH09, BH11 BH14 and BH16 to allow the equilibrium groundwater level to be determined. The groundwater monitoring will be included in Appendix 9 of the final Report.

4.4. Laboratory Testing

4.4.1. Geotechnical 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 intermediate plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 20% and 30% generally with fines contents of 40% to 60%.

4.4.1. Chemical Laboratory Testing

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.

4.4.1. Environmental Laboratory Testing

A number of samples were analysed for a suite of parameters which allows for the assessment of the sampled material in terms of total pollutant content for classification of materials as *hazardous* or *non-hazardous*. The suite also allows for the assessment of the sampled material in terms of suitability for placement at licenced landfills (inert, stable non-reactive, hazardous etc.). The parameter list for the suite includes analysis of the solid samples for arsenic, barium, cadmium, chromium, copper, cyanide, lead, nickel, mercury, zinc, speciated aliphatic and aromatic petroleum hydrocarbons, pH, sulphate, sulphide, moisture content, soil organic matter and an asbestos screen.

The suite also includes those parameters specified in the EU Council Decision establishing criteria for the acceptance of waste at Landfills (Council Decision 2003/33/EC), which for the solid samples are total organic carbon (TOC), speciated aliphatic and aromatic petroleum hydrocarbons, BTEX, phenol, polychlorinated biphenyls (PCB) and PAH.

As part of the suite a leachate is generated from the solid sample which is analysed for antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, chloride, fluoride, soluble sulphate, sulphide, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS).

While the laboratory report provides a comparison with the waste acceptance criteria limits it does not provide a waste classification of the material sampled nor does it comment on any potentially hazardous properties of the materials tested. The possibility for contamination, not revealed by the testing undertaken should be borne in mind particularly where Made Ground deposits are present or the previous site use or location indicate a risk of environmental variation. The waste classification report is included under the cover of a sperate report by Ground Investigations Ireland.

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 200 kN/m^2 is recommended for conventional strip or pad foundations on the stiff or very stiff dark grey/back cohesive deposits encountered at a depth of between 2.0m and 2.6m BGL on the northern part of the site.

On the western part of the site where the 3 storey structures are proposed in the locations of DP03 to DP06 and DP10 to DP12 a bearing capacity 100 kN/m^2 is achievable at depths of between 1.2m and 1.5m BGL.

For the area of the proposed basement a bearing capacity of 350 kN/m^2 would be achievable at 4 m below ground level in the very stiff dark grey Clay, however a settlement assessment should be carried out to ensure the structure can deal with the potential settlement, total and differential due to this increased loading.

In the area to the west on the existing building in the location of BH13, BH16, DP01 and DP02 where a 5 story building is proposed an allowable bearing capacity of 200 kN/m^2 is achievable between depths of 2.0 and 2.6mBGL for conventional strip or pad foundations on the stiff or very stiff dark grey/back cohesive deposits or medium dense granular deposits. It should be noted that the strata varied between holes in this area so foundation inspections should be undertaken and it is recommended that the foundations from the structure be placed on the same strata to avoid differential settlement.

For the area to the south of the existing building near to the location of BH13, BH14 and BH15 where a 7 story building is proposed, a bearing capacity of 200 kN/m^2 would be achievable at depths of between 2.4m to 2.7m BGL and below ground level in the very stiff dark grey Clay. A bearing capacity of 125 kN/m^2 is achievable on the firm to stiff brown clay at a depth of 2.0m BGL.

The possibility for variation in the depth of the made ground of soft 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. Where the depth of Made Ground/Soft deposits exceeds 0.9m then suspended floor slabs should be considered.

Due to the potential high loading anticipated from some of the proposed structures, piled foundations may be more economically advantageous. The type, size and depth of the pile foundations should be confirmed by a specialist piling contractor based on the loading from the proposed building.

The pH and sulphate testing completed on samples recovered from the exploratory holes 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. The samples tested were below the limits of DS1 in the BRE Special Digest 1:2005.

5.3. External Pavements

The proposed pavements are recommended to be designed in accordance with the CBR test results included in the Appendixes of this Report. The low CBR test results indicate that a capping layer or a sufficient depth of crushed stone fill may be required. Plate bearing tests are recommended at the time of construction to verify the design assumptions for the proposed pavement make up and to verify adequate compaction has been achieved.
The use of a geogrid and separation membrane may improve the performance of the proposed pavement and enable a more economical pavement design to be achieved, a specialist supplier is recommended to advise of the required strength, depth and type of geotextile for the proposed design.

5.4. 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.
Any excavations which penetrate the granular deposits will require to be appropriately battered or the sides supported and are likely to require dewatering due to the groundwater seepages noted in the exploratory hole logs in the Appendices of this Report.
The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations. An assessment by a specialist dewatering contractor is recommended to determine the most cost effective approach to the proposed excavation.

Excavations in the upper cohesive deposits are expected to be excavatable with conventional excavation equipment.

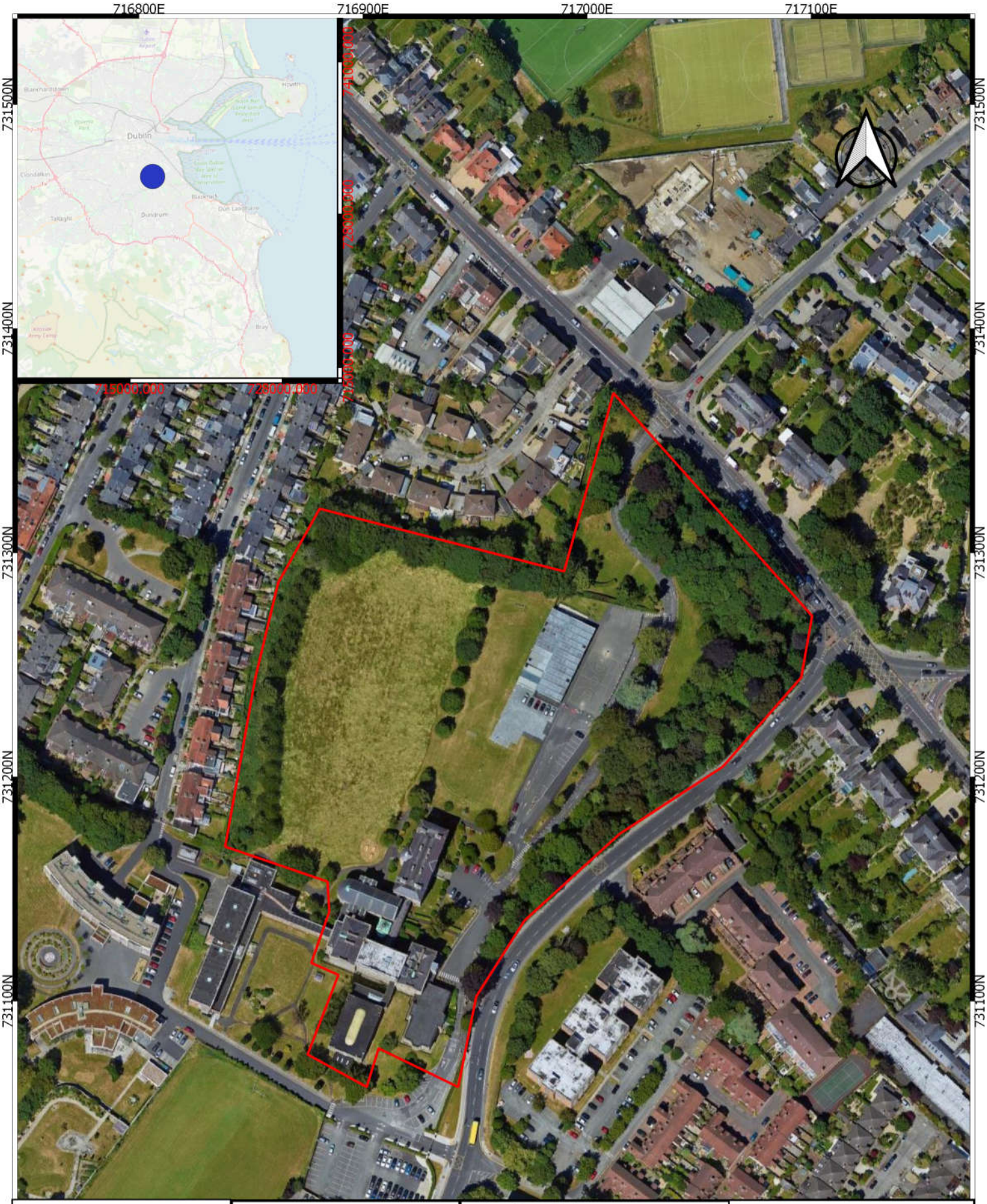
Any waste material to be removed off site should be disposed of to a suitably licenced landfill.
The environmental testing completed during the ground investigation is reported under the cover of a separate GII Waste Classification/Subsoil Assessment Report.

5.5. Soakaway Design

At the locations of SA01, SA02 and SA03 the water level dropped too slowly to allow calculation of ‘f’ the soil infiltration rate. These locations are therefore not recommended as suitable for soakaway design and construction.

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



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Client:

Project Title:
Sandford Park

Drawing Title:
Figure 1 Site Location

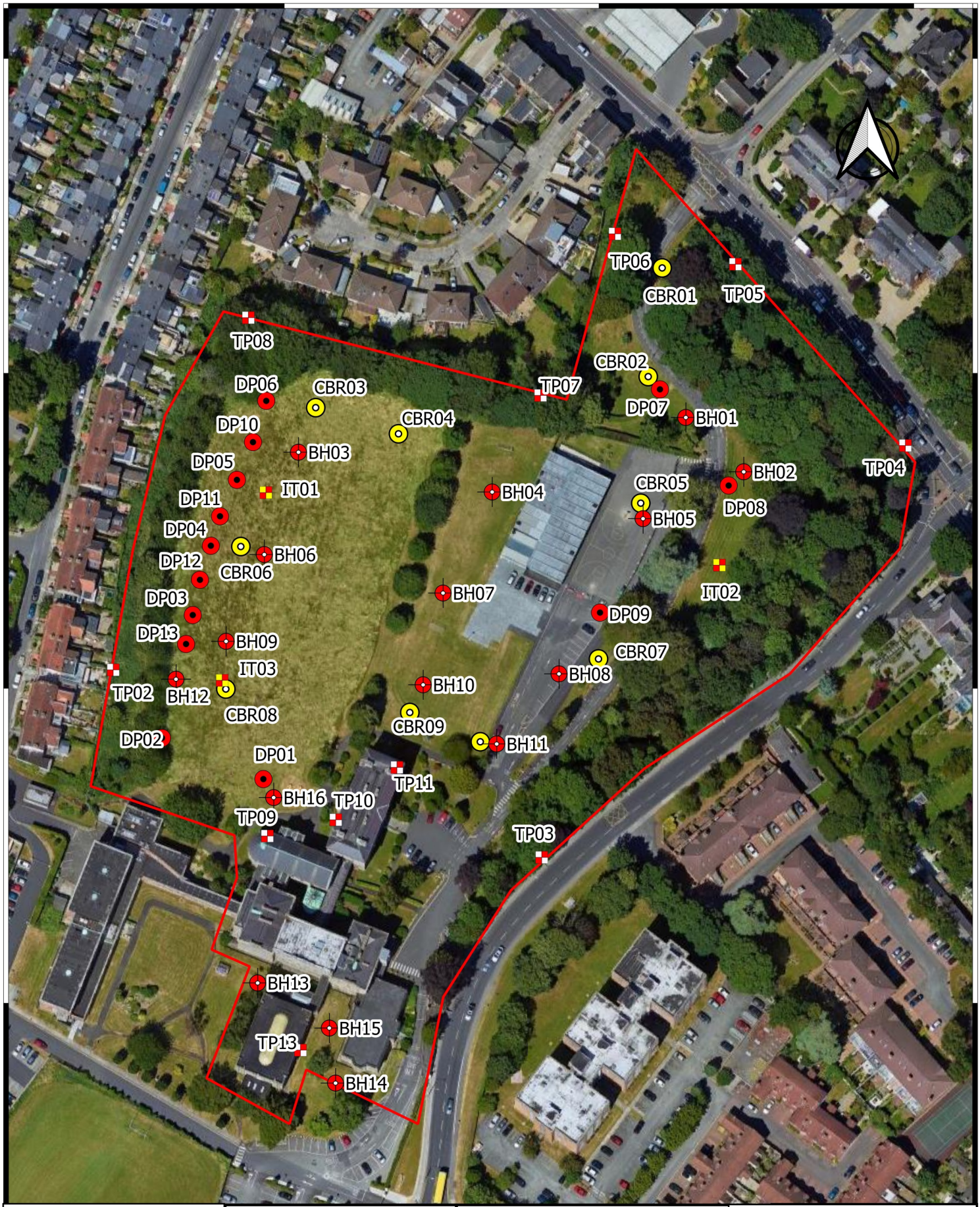
GII Project Reference:
9338-12-19

Drawn By:
NM

Date:
18/06/2020

Site Location

Indicative Site Boundary



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Client:

0 20 40 60 m

Project Title:
Sandford Park

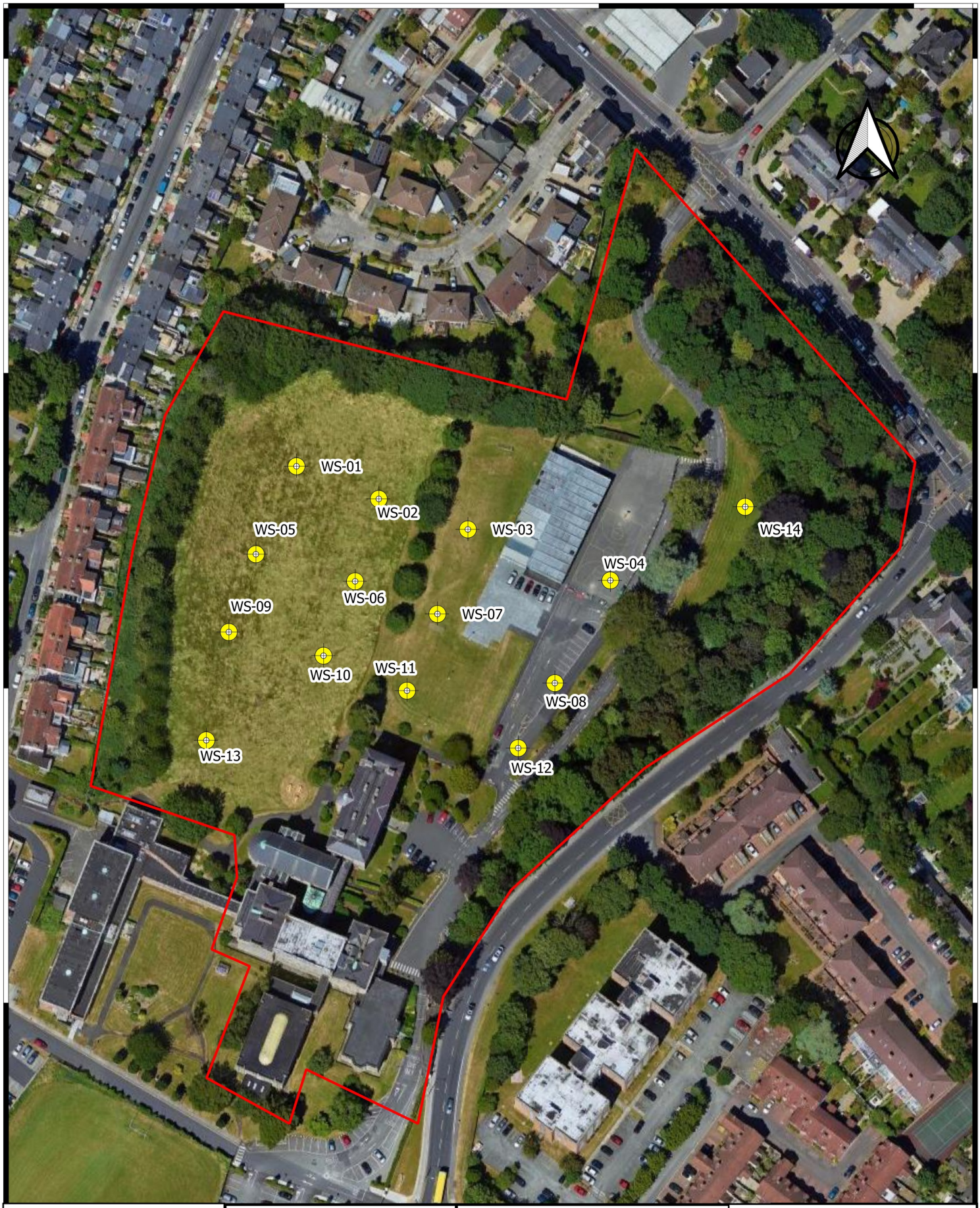
Drawing Title:
Figure 2: GI Locations

GII Project Reference:
9338-12-19

Drawn By:
NM

Date:
23/10/2020

- Indicative Site Boundary
- Borehole
- CBR
- Dynamic Probe
- Trial Pit
- Window Sample
- Soakaway



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Client:

0 20 40 60 m

Project Title:
Sandford Park

Drawing Title:
Figure 3: WS Locations

GII Project Reference:
9338-12-19

Drawn By:
NM

Date:
23/10/2020

- Indicative Site Boundary
- Borehole
- CBR
- Dynamic Probe
- Trial Pit
- Window Sample
- Soakaway

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Trial Pit Number** TP02
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m W x 1.2m L	**Ground Level (mOD)**	**Client** DBFL	**Job Number** 9338-12-19
	Location 716845.6 E 731205.5 N	**Dates** 17/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL.		
					(0.55) 0.75	Firm light brown slightly sandy slightly gravelly CLAY.		
					(0.30) 1.05	Firm to stiff brown slightly sandy slightly gravelly CLAY with occasional sub-angular cobbles.		
						Complete at 1.05m		

Plan

Remarks

Groundwater not encountered during excavation.
Trial pit stable.
Trial pit terminated at 1.05m BGL on exposing the foundation and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	NM	9338-12-19.TP02

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Site Sandford Park Milltown			**Trial Pit Number** TP03
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m W x 1.4m L	**Ground Level (mOD)**	**Client** DBFL	**Job Number** 9338-12-19
	Location 716981.8 E 731146 N	**Dates** 17/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	MADE GROUND: Topsoil with roots plastic redbrick and concrete fragments.		
					0.30	MADE GROUND: Brown slightly sandy slightly gravelly CLAY with root concrete and fragments.		
					(0.90)			
					1.20	Complete at 1.20m		

Plan

Remarks

Groundwater not encountered during excavation.
Trial pit stable.
Trial pit terminated at 1.20m BGL due to a concrete protection and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	NM	9338-12-19.TP03

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Site Sandford Park Milltown			**Trial Pit Number** TP04
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m W x 1.5m L	**Ground Level (mOD)**	**Client** DBFL	**Job Number** 9338-12-19
	Location 717097.4 E 731276.8 N	**Dates** 17/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL with roots.		
					(0.50) 0.70	Firm dark brown slightly sandy slightly gravelly CLAY with root fragments.		
					(0.70) 1.40	Firm to stiff light brown slightly sandy slightly gravelly CLAY.		
						Complete at 1.40m		

Plan

Remarks

Groundwater not encountered during excavation.
Trial pit stable.
Trial pit terminated at 1.40m BGL on exposing the foundation and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	NM	9338-12-19.TP04

Ground Investigations Ireland Ltd
www.gii.ie

Site Sandford Park Milltown			**Trial Pit Number** TP05
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m W x 1.5m L	**Ground Level (mOD)**	**Client** DBFL	**Job Number** 9338-12-19
	Location 717043.4 E 731334.3 N	**Dates** 17/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.70)	TOPSOIL with roots.		
					0.70	Firm to stiff brown slightly sandy slightly gravelly CLAY.		
					(0.80)			
					1.50	Complete at 1.50m		

Plan

Remarks

Groundwater not encountered during excavation.
Trial pit stable.
Trial pit terminated at 1.50m BGL on exposing the foundation and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	NM	9338-12-19.TP05

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Trial Pit Number** TP06
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m W x 1.2m L	**Ground Level (mOD)**	**Client** DBFL	**Job Number** 9338-12-19
	Location 717005.1 E 731344 N	**Dates** 17/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25) 0.25	TOPSOIL with small concrete and plastic fragments.		
					(0.75) 1.00	Firm dark brown slightly sandy slightly gravelly CLAY.		
						Complete at 1.00m		

Plan

Remarks

Groundwater not encountered during excavation.
Trial pit stable.
Trial pit terminated at 1.0m BGL on exposing the foundation and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	NM	9338-12-19.TP06

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Site Sandford Park Milltown			**Trial Pit Number** TP07
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m W x 1.3m L	**Ground Level (mOD)**	**Client** DBFL	**Job Number** 9338-12-19
	Location 716981.4 E 731292.7 N	**Dates** 17/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25)	TOPSOIL.		
					0.25	Firm to stiff light brown slightly sandy slightly gravelly CLAY.		
					(0.90)			
					1.15	Complete at 1.15m		

Plan

Remarks

Groundwater not encountered during excavation.
Trial pit stable.
Trial pit terminated at 1.15m BGL on exposing the foundation and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	NM	9338-12-19.TP07

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Site Sandford Park Milltown			**Trial Pit Number** TP08
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m W x 1.5m L	**Ground Level (mOD)**	**Client** DBFL	**Job Number** 9338-12-19
	Location 716888.6 E 731317.4 N	**Dates** 17/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	MADE GROUND: Topsoil with roots plastic redbrick and concrete fragments.		
					0.40			
					(0.30)	Firm light brown grey slightly sandy slightly gravelly CLAY.		
					0.70			
					(0.50)	Firm to stiff light brown slightly sandy slightly gravelly CLAY.		
					1.20			
						Complete at 1.20m		

Plan

Remarks

Groundwater not encountered during excavation.
Trial pit stable.
Trial pit terminated at 1.20m BGL on exposing the foundation and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	NM	9338-12-19.TP08

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Site Sandford Park Milltown			**Trial Pit Number** TP09
Machine : 3T 360 **Method :** Trial Pit	**Dimensions** 0.6m W x 2.0m L	**Ground Level (mOD)** 20.90	**Client** DBFL	**Job Number** 9338-12-19
	Location (dGPS) 716894.6 E 731152.8 N	**Dates** 27/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15)	Topsoil		
				20.75	0.15	Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY with occasional subangular cobbles. Gravel is angular to subrounded fine to coarse.		
					(0.45)			
0.50	B			20.30	0.60	Stiff greyish brown slightly sandy slightly gravelly CLAY with occasional subanugular cobbles and boulders. Gravel is angular to subrounded fine to coarse.		
1.00	B				(0.80)			
				19.50	1.40	Complete at 1.40m		

Plan

Remarks

Groundwater encountered at 1.40m
Trial pit stable.
Trial pit terminated at 1.40m BGL on exposing the foundation and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	PC	9338-12-19.TP09

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Trial Pit Number** TP10
Machine : 3T 360 **Method :** Trial Pit	**Dimensions** 0.6m W x 1.1m L	**Ground Level (mOD)**	**Client** DBFL	**Job Number** 9338-12-19
	Location (Handheld GPS) 716916.4 E 731157.9 N	**Dates** 27/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15) 0.15	Topsoil		
					(0.25) 0.40	MADE GROUND: Brown slightly gravelly sandy Clay with occassional fragments of metal and red brick.		
					(0.40) 0.80	Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY with occasional subangular cobbles. Gravel is angular to subrounded fine to coarse.		
1.20	B				(0.40) 1.20	Stiff brown mottled grey slightly sandy slightly gravelly CLAY with occasional subanugular cobbles and boulders. Gravel is angular to subrounded fine to coarse. Complete at 1.20m		

Plan

Remarks

Groundwater not encountered during excavation.
Trial pit stable.
Trial pit terminated at 1.20m BGL on exposing the foundation and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	PC	9338-12-19.TP10

Ground Investigations Ireland Ltd
www.gii.ie

Site Sandford Park Milltown			**Trial Pit Number** TP11
Machine : 3T 360 **Method :** Trial Pit	**Dimensions** 0.6m W x 1.6m L	**Ground Level (mOD)** 20.81	**Client** DBFL	**Job Number** 9338-12-19
	Location (dGPS) 716935.8 E 731174.6 N	**Dates** 27/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15)	Topsoil		
				20.66	0.15			
					(0.15)	MADE GROUND: Brown slightly gravelly sandy Clay with occassional fragments of red brick.		
				20.51	0.30			
						Stiff brown mottled grey slightly sandy slightly gravelly CLAY with occasional subanugular cobbles and boulders. Gravel is angular to subrounded fine to coarse.		
					(0.70)			
0.80	B							
				19.81	1.00			
						Complete at 1.00m		

Plan

Remarks

Groundwater not encountered during excavation.
Trial pit stable.
Trial pit terminated at 1.00m BGL on exposing the foundation and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	PC	9338-12-19.TP11

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Trial Pit Number** TP13
Machine : 3T 360 **Method :** Trial Pit	**Dimensions** 0.6m W x 1.0m L	**Ground Level (mOD)** 21.95	**Client** DBFL	**Job Number** 9338-12-19
	Location (dGPS) 716905.1 E 731084.8 N	**Dates** 27/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15)	Topsoil		
				21.80	0.15	MADE GROUND: Brown slightly gravelly sandy Clay with rootlets and occassional fragments of glass and red brick.		
					(0.45)			
0.50	B			21.35	0.60	Stiff brown mottled grey slightly sandy slightly gravelly CLAY with occasional subanugular cobbles. Gravel is angular to subrounded fine to coarse. Possible madeground.		
1.00	B				(0.70)			
				20.65	1.30	Complete at 1.30m		

Plan

Remarks

Groundwater not encountered during excavation.
Trial pit stable.
Trial pit terminated at 1.30m BGL on exposing the foundation and backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	PC	9338-12-19.TP13

APPENDIX 3 – Soakaway Records

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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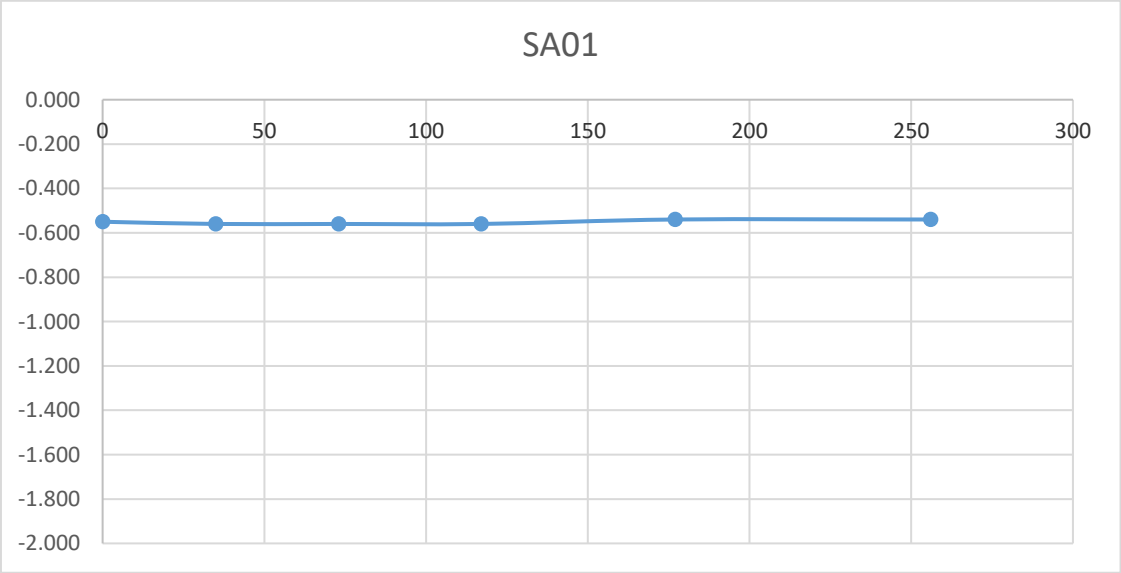
SA01

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.5m x 0.60m 2.5m (L x W x D)

Date	Time	Water level (m bgl)
16/01/2020	0	-0.550
16/01/2020	35	-0.560
16/01/2020	73	-0.560
16/01/2020	117	-0.560
16/01/2020	177	-0.540
16/01/2020	256	-0.540

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.55	2.500	1.950	1.0375	2.0125



GROUND INVESTIGATIONS IRELAND
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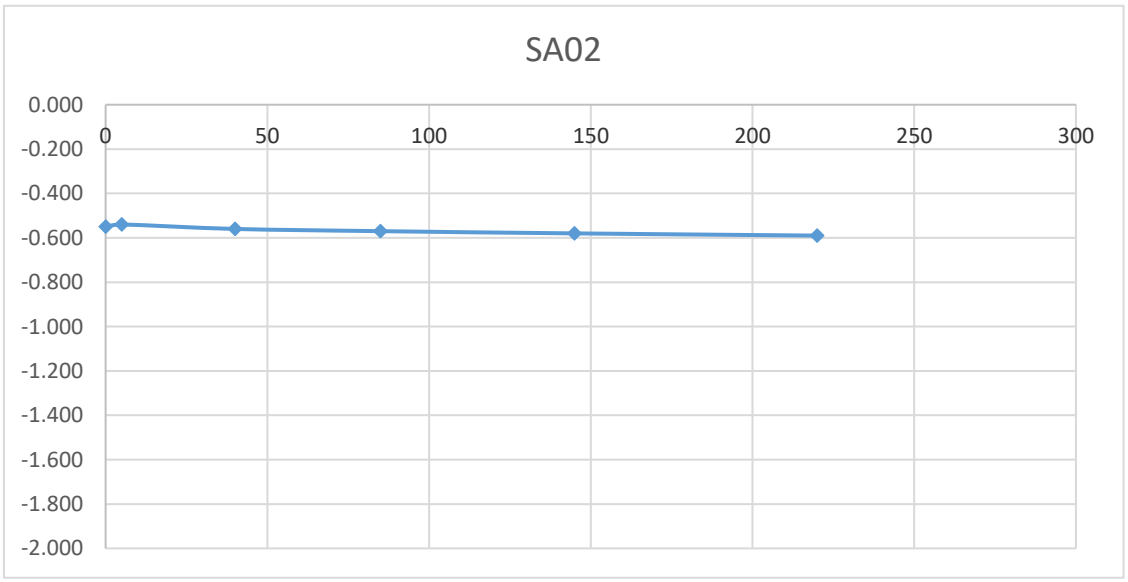
SA02

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.5m x 0.60m 2.5m (L x W x D)

Date	Time	Water level (m bgl)
16/01/2020	0	-0.550
16/01/2020	5	-0.540
16/01/2020	40	-0.560
16/01/2020	85	-0.570
16/01/2020	145	-0.580
16/01/2020	220	-0.590

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.55	2.500	1.950	1.0375	2.0125



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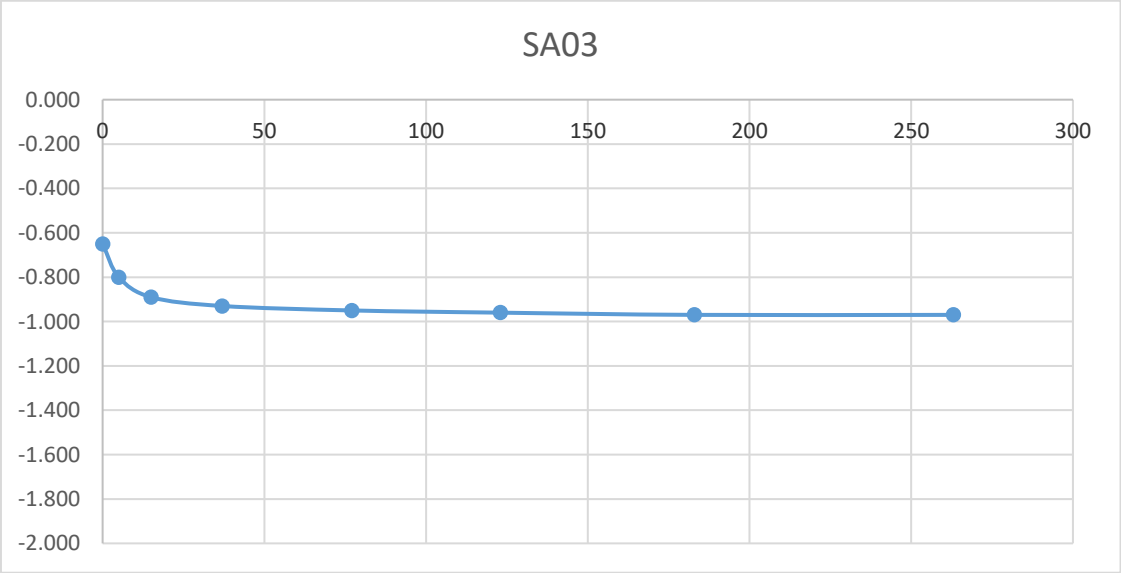
SA03

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.6m x 0.60m 2.60m (L x W x D)

Date	Time	Water level (m bgl)
16/01/2020	0	-0.650
16/01/2020	5	-0.800
16/01/2020	15	-0.890
16/01/2020	37	-0.930
16/01/2020	77	-0.950
16/01/2020	123	-0.960
16/01/2020	183	-0.970
16/01/2020	263	-0.970

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.65	2.600	1.950	1.1375	2.1125



Ground Investigations Ireland Ltd
www.gii.ie

Site Sandford Park Milltown			**Trial Pit Number** SA01
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m W x 2.5m L	**Ground Level (mOD)** 20.09	**Client** DBFL	**Job Number** 9338-12-19
	Location 716894.1 E 731261.8 N	**Dates** 16/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL.		
				19.89	0.20	POSSIBLE MADE GROUND: Brown slightly sandy slightly gravelly Clay.		
					(0.25)			
				19.64	0.45	Firm light brown slightly sandy slightly gravelly CLAY.		
					(1.85)			
				17.79	2.30	Firm to stiff brown grey slightly sandy gravelly CLAY with occasional sub-angular to sub-rounded cobbles and boulders		
					(0.20)			
				17.59	2.50	Complete at 2.50m		

Plan

Remarks

Groundwater not encountered during excvation.
Trial pit stable.
Trial pit terminated at 2.50m BGL and backfilled upon completion of soakaway.

Scale (approx)	Logged By	Figure No.
1:25	NM	9338-12-19.SA01

Ground Investigations Ireland Ltd
www.gii.ie

Site Sandford Park Milltown			**Trial Pit Number** SA02
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m W x 2.5m L	**Ground Level (mOD)**	**Client** DBFL	**Job Number** 9338-12-19
	Location 717038.2 E 731238.8 N	**Dates** 16/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL.		
					(0.20) 0.40	Soft to firm brown grey mottled sandy very gravelly CLAY with occasional sub-angular cobbles.		
					(0.80) 1.20	Brown grey sandy very clayey fine to coarse sub-angular to sub-rounded GRAVEL.		
					(0.90) 2.10	Firm brown slightly sandy slightly gravelly CLAY with occasional sub-angular to sub-rounded cobbles.		
					(0.40) 2.50	Stiff dark grey black slightly sandy slightly gravelly CLAY.		
						Complete at 2.50m		

Plan

Remarks

No groundwater encountered.
Trial pit spalling at 0.50m BGL.
Trial pit terminated at 2.50m BGL and backfilled upon completion of soakaway.

Scale (approx)	Logged By	Figure No.
1:25	NM	9338-12-19.SA02

Ground Investigations Ireland Ltd
www.gii.ie

Site Sandford Park Milltown			**Trial Pit Number** SA03
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 0.6m W x 2.6m L	**Ground Level (mOD)** 21.18	**Client** DBFL	**Job Number** 9338-12-19
	Location 716880.2 E 731202.2 N	**Dates** 16/01/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL.		
				20.98	0.20	POSSIBLE MADE GROUND: Brown slightly sandy slightly gravelly Clay.		
					(0.20)			
				20.78	0.40	Firm light brown slightly sandy slightly gravelly CLAY.		
					(0.30)			
				20.48	0.70	Firm to stiff brown grey slightly sandy gravelly CLAY with occasional sub-angular cobbles.		
					(1.10)			
				19.38	1.80	Stiff to very stiff brown grey slightly sandy gravelly CLAY with occasional sub-angular to sub-rounded cobbles.		
					(0.80)			
			Water strike(1) at 2.50m.	18.58	2.60	Complete at 2.60m		▽1

Plan

Remarks

Slow ingress of groundwater encountered at 2.5m BGL.
Trial pit stable.
Trial pit terminated at 2.60m BGL and backfilled upon completion of soakaway.

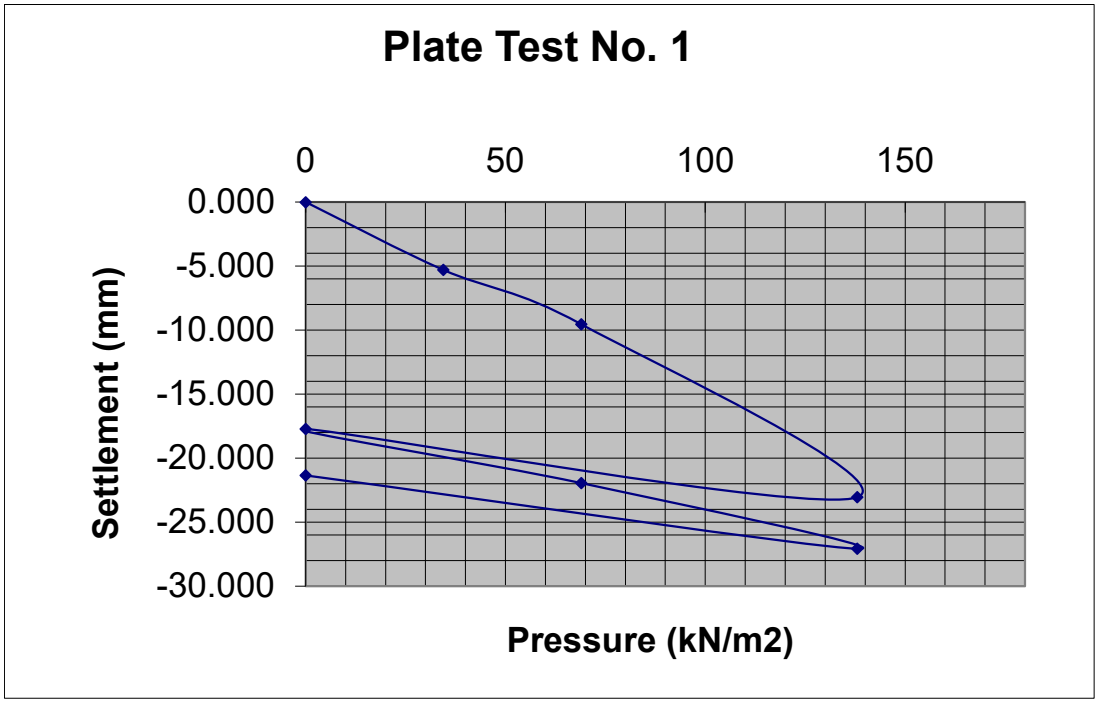
Scale (approx)	Logged By	Figure No.
1:25	NM	9338-12-19.SA03

APPENDIX 4 – Plate Load Test and TRL Probe Records

Applied Load	Gauge settlement
0	**0.000**
34.5	-5.3
69	-9.535
138	-23.05
0	-17.715
69	-21.95
138	-27.07
0	-21.335

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Sandford Park Milltown	**MATERIAL**	MADE GROUND: Light brown slightly sandy slightly gravelly Clay with rootlets and small redbrick and mortar fragments.
CONTRACT NO.	9338-12-19		
DATE	21/01/2020		
CLIENT	DBFL	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR01	**SAMPLES**	



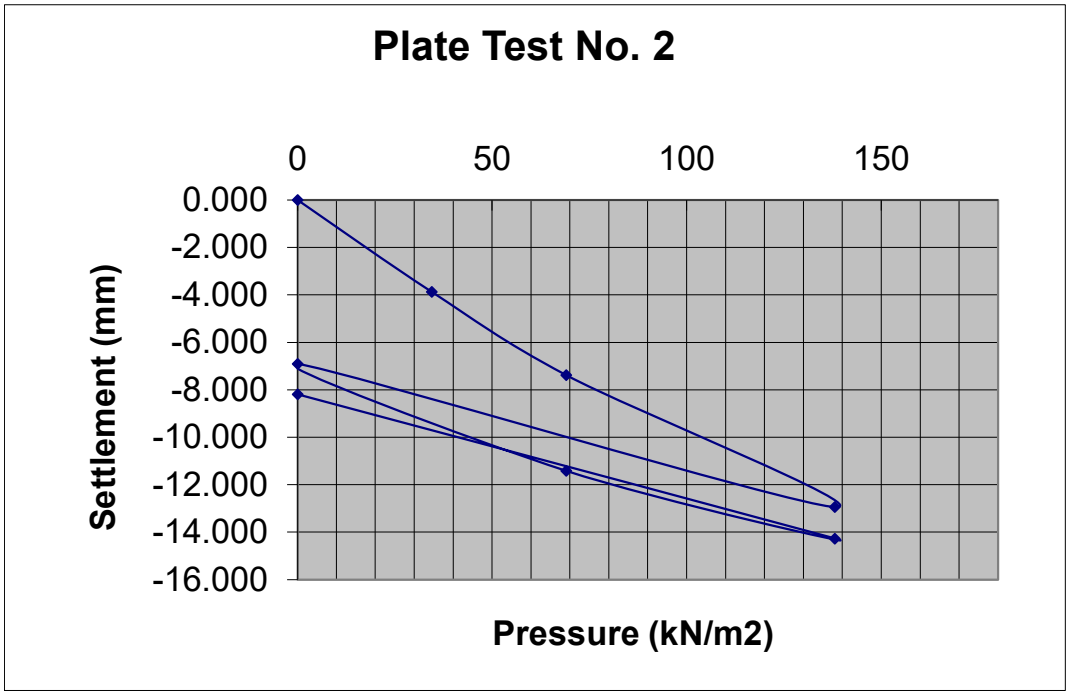
Modulus of subgrade reaction, K (Initial) = **4.89 MN/m2/m**
Modulus of subgrade reaction, K (Reload) = **11.01 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.15 %**
Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.62 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-3.87
69	-7.38
138	-12.93
0	-6.9
69	-11.415
138	-14.265
0	-8.19

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Sandford Park Milltown	**MATERIAL**	MADE GROUND: Light brown slightly sandy slightly gravelly Clay with rootlets and small redbrick fragments.
CONTRACT NO.	9338-12-19		
DATE	21/01/2020		
CLIENT	DBFL	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR02	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **6.32 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **10.33 MN/m2/m**

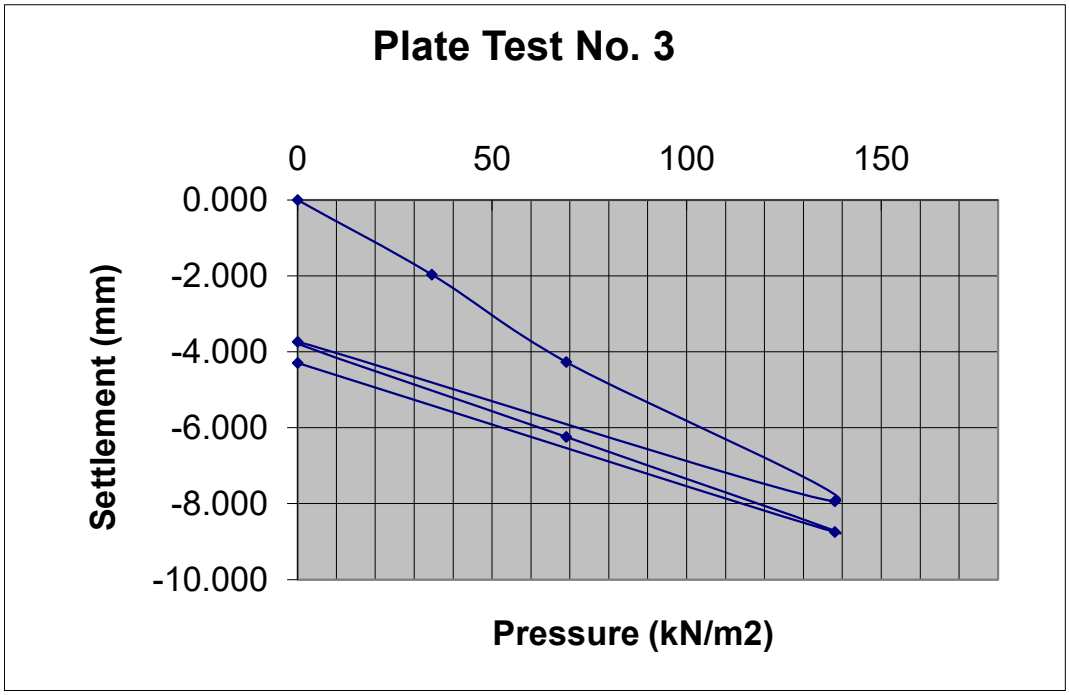
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.24 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.55 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-1.96
69	-4.265
138	-7.93
0	-3.73
69	-6.24
138	-8.745
0	-4.29

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Sandford Park Milltown	**MATERIAL**	POSSIBLE MADE GROUND: Light brown slightly sandy slightly gravelly Clay with rootlets.
CONTRACT NO.	9338-12-19		
DATE	21/01/2020		
CLIENT	DBFL	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR03	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **10.93 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **18.58 MN/m2/m**

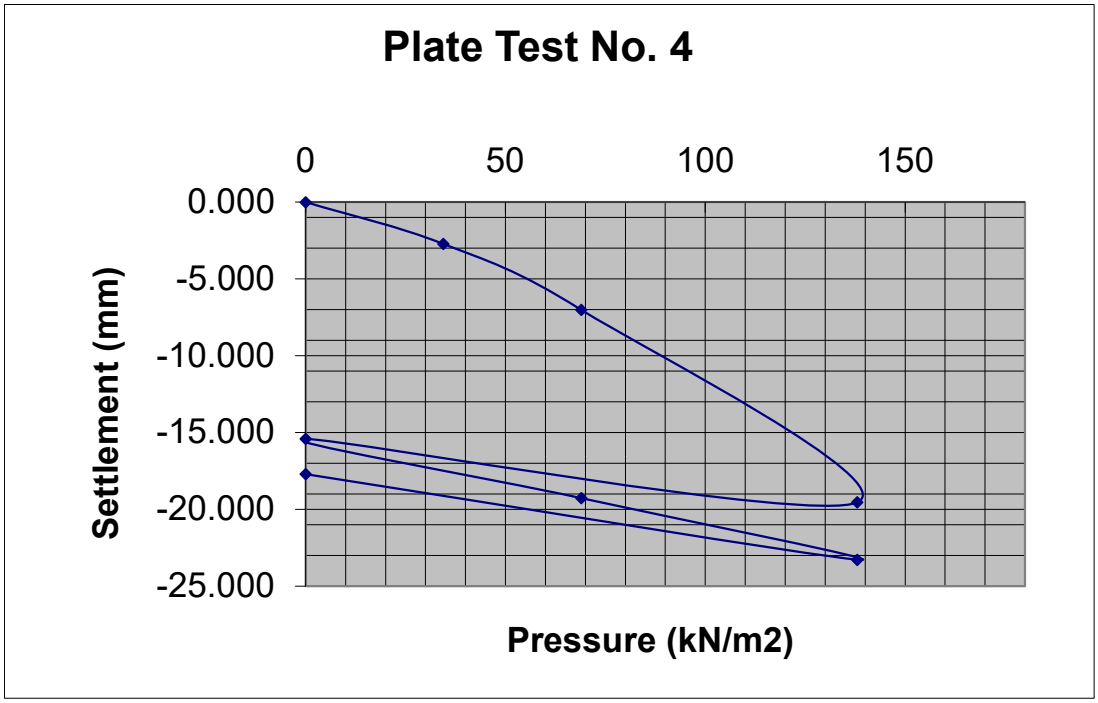
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.61 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **1.53 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-2.71
69	-7.01
138	-19.54
0	-15.41
69	-19.275
138	-23.28
0	-17.7

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Sandford Park Milltown	**MATERIAL**	POSSIBLE MADE GROUND: Light brown slightly sandy slightly gravelly Clay with rootlets
CONTRACT NO.	9338-12-19		
DATE	20/01/2020		
CLIENT	DBFL	**DEPTH**	0.30m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR04	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **6.65 MN/m2/m**
Modulus of subgrade reaction, K (Reload) = **12.06 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.26 %**
Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.72 %**

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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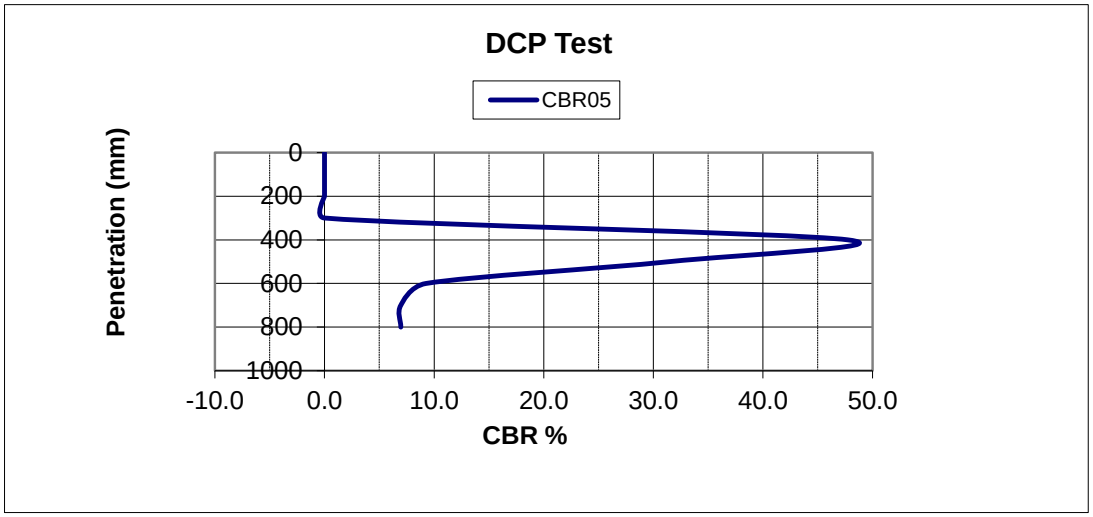
Job Name	Sandford Park Milltown	**Test Type**	Dynamic Cone Penetration Test
Job No.	9338-12-19	**Test Reference**	CBR05
Client	DBFL	**By**	N Morgan
		Date	21/01/2020
Initial Depth	0.3		

Depth (mm bgl)	No. of Blows per 100mm	Penetration per Blow (mm)	CBR (%)
0	-	-	0.0
100	-	-	0.0
200	-	-	0.0
300	-	-	0.0
400	18	5.6	47.7
500	13	7.7	31.5
600	5	20.0	9.3
700	4	25.0	7.0
800	4	25.0	7.0
900	4	25.0	7.0
1000	-		
1100	-		
1200	-		
1300	-		
1400	-		
1500	-		

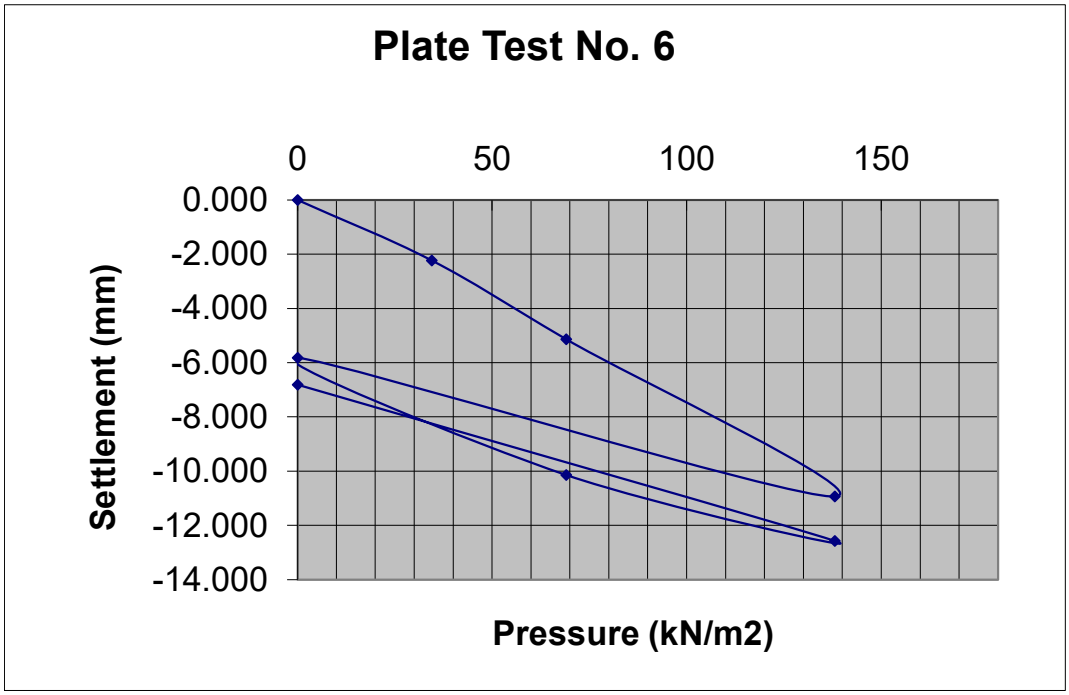
Reference **Kleyn and Van Heerden (60^{o} Cone)**
Formula Log10 (CBR) = 2.632 - 1.28 Log10 (mm/blow)



Applied Load	Gauge settlement
0	**0.000**
34.5	-2.225
69	-5.135
138	-10.93
0	-5.815
69	-10.14
138	-12.565
0	-6.81

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Sandford Park Milltown	**MATERIAL**	Possible MADE GROUND: Light brown slightly sandy slightly gravelly Clay with rootlets.
CONTRACT NO.	9338-12-19		
DATE	21/01/2020		
CLIENT	DBFL	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR06	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **9.08 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **10.78 MN/m2/m**

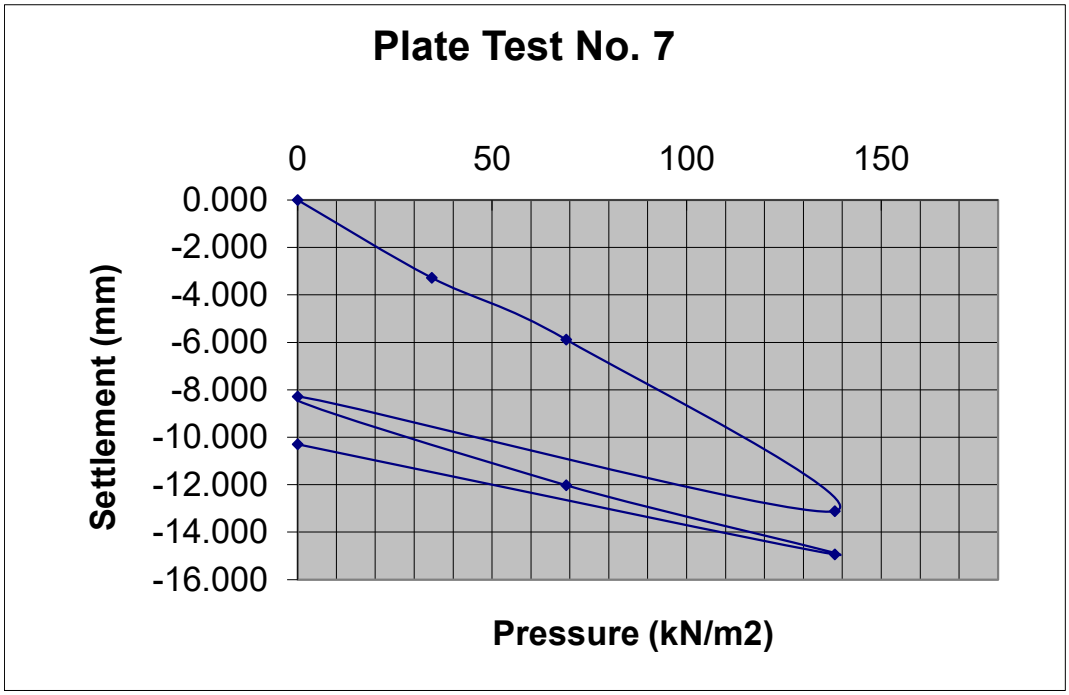
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.44 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.59 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-3.275
69	-5.88
138	-13.11
0	-8.275
69	-12.015
138	-14.935
0	-10.29

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Sandford Park Milltown	**MATERIAL**	MADE GROUND: Light brown slightly sandy slightly gravelly Clay with rootlets redbrick mortar and bone fragments.
CONTRACT NO.	9338-12-19		
DATE	21/01/2020		
CLIENT	DBFL	**DEPTH**	0.45m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR07	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **7.93 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **12.47 MN/m2/m**

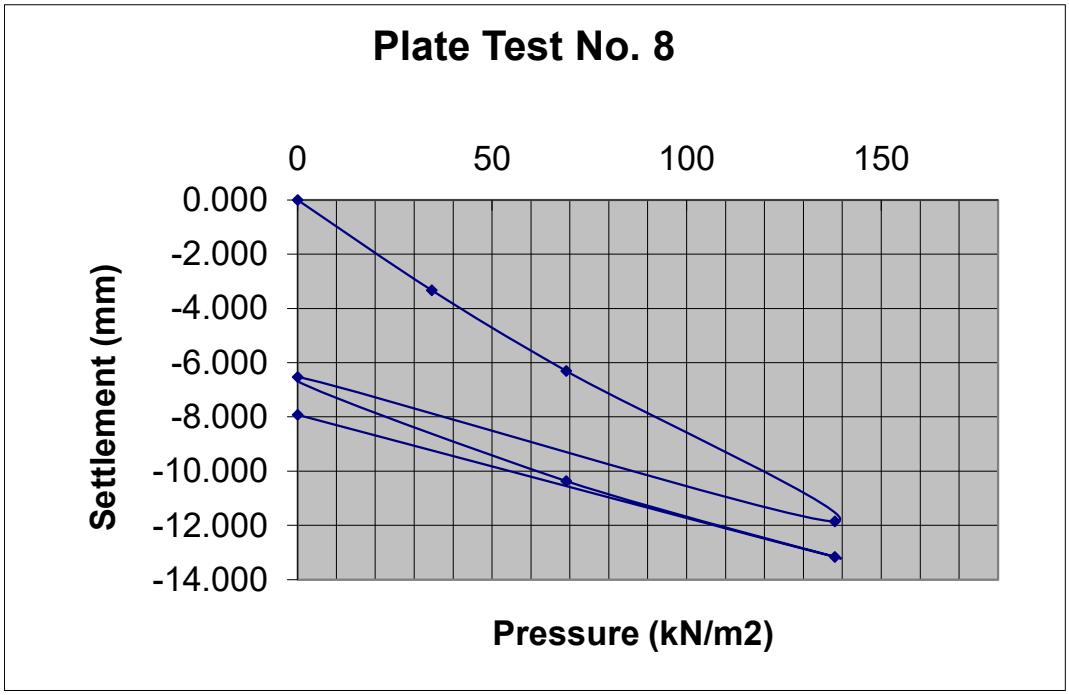
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.35 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.76 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-3.33
69	-6.305
138	-11.85
0	-6.52
69	-10.36
138	-13.16
0	-7.92

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Sandford Park Milltown	**MATERIAL**	POSSIBLE MADE GROUND: Light brown slightly sandy slightly gravelly Clay with rootlets.
CONTRACT NO.	9338-12-19		
DATE	21/01/2020		
CLIENT	DBFL	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR08	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **7.39 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **12.14 MN/m2/m**

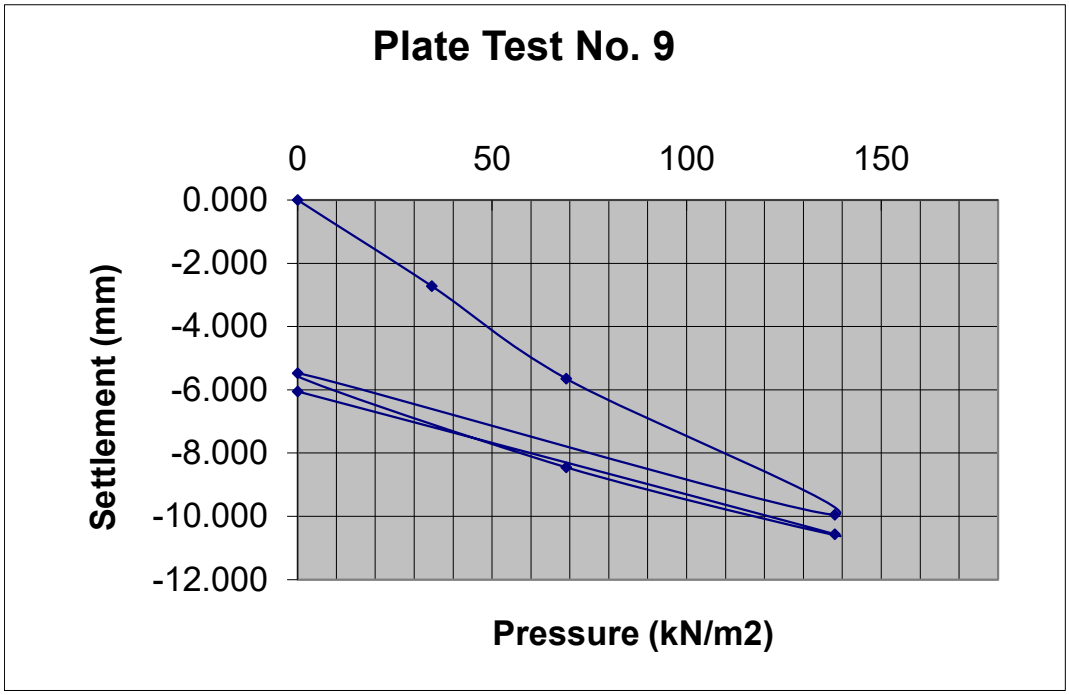
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.31 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.73 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-2.715
69	-5.64
138	-9.94
0	-5.47
69	-8.445
138	-10.56
0	-6.045

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Sandford Park Milltown	**MATERIAL**	MADE GROUND: Light brown slightly sandy slightly gravelly Clay with rootlets and small redbrick and plastic fragments.
CONTRACT NO.	9338-12-19		
DATE	21/01/2020		
CLIENT	DBFL	**DEPTH**	0.30m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR09	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **8.27 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **15.67 MN/m2/m**

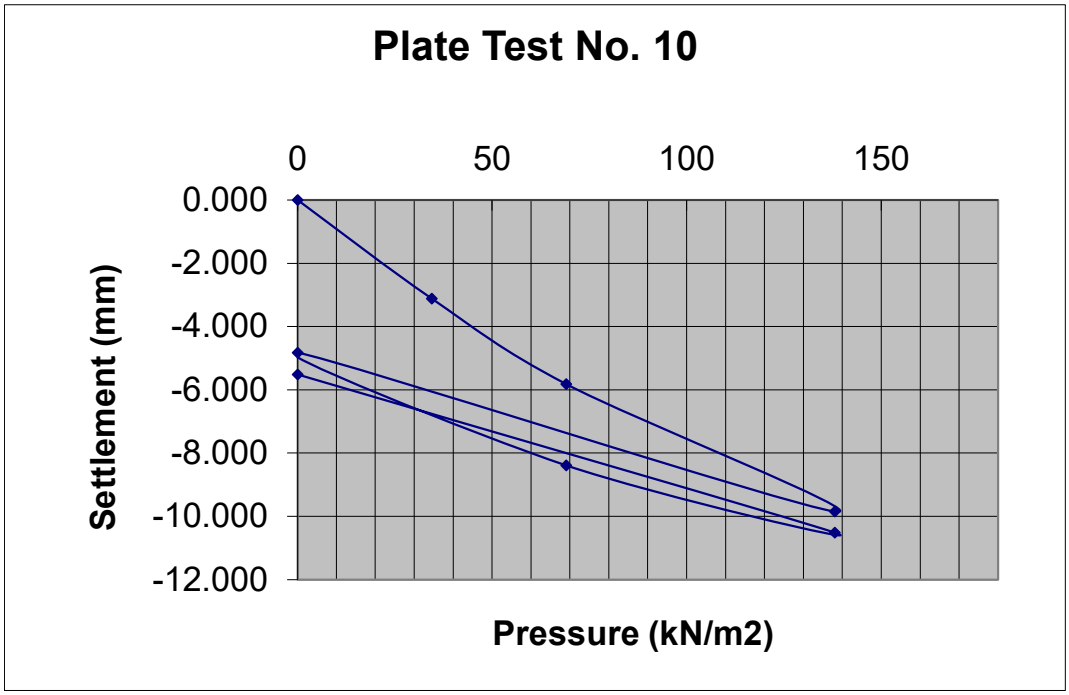
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.38 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **1.14 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-3.11
69	-5.82
138	-9.84
0	-4.82
69	-8.385
138	-10.515
0	-5.51

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Sandford Park Milltown	**MATERIAL**	MADE GROUND: Light brown slightly sandy slightly gravelly Clay with rootlets and small redbrick and plastic fragments.
CONTRACT NO.	9338-12-19		
DATE	21/01/2020		
CLIENT	DBFL	**DEPTH**	0.30m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR10	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **8.01 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **13.08 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.36 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.83 %**

APPENDIX 7 – Borehole Records

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH01
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 5.70m	**Ground Level (mOD)** 18.33	**Client** DBFL	**Job Number** 9338-12-19
	Location (dGPS) 717027.6 E 731285.9 N	**Dates** 04/03/2020-05/03/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					18.03	(0.30) 0.30	Dark brown sandy slightly gravelly TOPSOIL with occasional rootlets.		
0.50	B				17.53	(0.50) 0.80	Soft light brown slightly sandy slightly gravelly CLAY.		
1.00-1.45 1.00	SPT(C) N=11 B			1,2/2,3,3,3		(1.70)	Firm to stiff light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
2.00-2.45 2.00	SPT(C) N=19 B			2,3/4,5,5,5	15.83	2.50	Very stiff dark grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
3.00-3.45 3.00	SPT(C) N=40 B			3,5/7,9,11,13					
4.00-4.45 4.00	SPT(C) N=39 B			5,6/7,9,9,14		(3.20)			
5.00-5.38 5.00	SPT(C) 50/225 B			6,9/13,17,19,1					
					12.63	5.70	Refusal at 5.70m		

Remarks
No groundwater encountered during drilling
Borehole backfilled on complertion.
Borehole terminated at 5.70m BGL due to obstruction, possible boulder or rock
Chiselling from 5.70m to 5.70m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 9338-12-19.BH01

Ground Investigations Ireland Ltd
www.gii.ie

Site Sandford Park Milltown			**Borehole Number** BH02
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 7.00m	**Ground Level (mOD)** 18.40	**Client** DBFL	**Job Number** 9338-12-19
	Location (dGPS) 717045.9 E 731268.6 N	**Dates** 06/03/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.30)	Dark brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets.			
					18.10	0.30				
0.50	B					(0.80)	Soft light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
1.00-1.45 1.00	SPT(C) N=14 B			1,2/3,3,4,4	17.30	1.10				
						(1.20)	Firm to stiff light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
2.00-2.45 2.00	SPT(C) N=18 B			2,3/4,5,4,5	16.10	2.30				
3.00-3.45 3.00	SPT(C) N=33 B			4,6/7,8,9,9			Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
4.00-4.40 4.00	SPT(C) 50/250 B			6,8/11,15,17,7						
						(4.70)				
5.00-5.40 5.00	SPT(C) 50/250 B			7,10/13,15,17,5						
6.00-6.30 6.00	SPT(C) 50/150 B			8,10/17,21,12						
7.00-7.00 7.00	SPT(C) 25*/0 50/0 B			25/50	11.40	7.00	Refusal at 7.00m			

Remarks
No groundwater encountered during drilling
Slotted pipe with pea gravel surround from 7.0m BGL to 1.0m BGL, plain pipe with bentonite seal from 1.0m BGL to GL, finished with an upright cover
Borehole terminated at 7.00m BGL due to obstruction, possible boulder or rock
Chiselling from 7.00m to 7.00m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 9338-12-19.BH02

Ground Investigations Ireland Ltd
www.gii.ie

Site Sandford Park Milltown			**Borehole Number** BH03
Machine : Dando 2000, Beretta T44 **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 7.20m 63mm cased to 20.00m	**Ground Level (mOD)** 19.67	**Client** DBFL	**Job Number** 9338-12-19
	Location 716904.5 E 731274.9 N	**Dates** 06/03/2020	**Project Contractor** GII	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					19.37	(0.30) 0.30	Dark brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets.			
0.50	B					(0.60)	Soft light brown slightly sandy slightly gravelly CLAY.			
1.00 1.00-1.45	B SPT(C) N=13			1,2/3,2,4,4	18.77	0.90 (0.30)	Soft light brown mottled orange grey slightly sandy slightly gravelly CLAY.			
					18.47	1.20	Firm to stiff light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Some yellow and grey mottling.			
2.00 2.00-2.45	B SPT(C) N=22			7,4/5,6,6,5		(1.10)				
					17.37	2.30	Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
3.00 3.00-3.31	B SPT(C) 50/160			7,12/18,25,7						
4.00 4.00-4.45	B SPT(C) N=39			7,10/8,9,11,11						
						(4.20)				
5.00 5.00-5.45	B SPT(C) N=47			6,8/10,12,12,13						
6.00 6.00-6.45	B SPT(C) N=50			6,9/10,11,14,15						
					13.17	6.50	Very stiff brown slightly sandy gravelly CLAY.			
7.00 7.00-7.22	TCR:	SCR:	RQD:	FI: 10,20/50 B SPT(C) 50/70		(0.50)				
7.00	75				12.67	7.00	Very stiff brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
8.20-8.28 8.20	93			22,3/50 SPT(C) 25*/75 50/0						
						(4.20)				
9.70-9.78 9.70				22,3/50 SPT(C) 25*/75 50/0						

Remarks
No groundwater encountered during cable percusion drilling.
Cable percussion to 7.00m BGL with Rotary core follow on to 20.00m BGL.
Slotted pipe installed from 8.5m BGL to 3m BGL with pea grval filter zone from 8.5m BGL to 1.0m BGL and bentonite seal from 1.0m BGL to GL, finished with an upright cover
Chiselling from 7.20m to 7.20m for 1 hour.

Scale (approx)	Logged By
1:50	PM, CB

Figure No. 9338-12-19.BH03

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH03
Machine : Dando 2000, Beretta T44 **Flush :** Water **Core Dia :** 63 mm **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 7.20m 63mm cased to 20.00m	**Ground Level (mOD)** 19.67	**Client** DBFL	**Job Number** 9338-12-19
	Location 716904.5 E 731274.9 N	**Dates** 06/03/2020	**Project Contractor** GII	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	93				26/50 SPT(C) 26*/75 50/0						
11.20-11.28 11.20						8.47	11.20	Very stiff brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse.			
	67						(2.20)				
12.70-12.70 12.70					25/50 SPT(C) 25*/0 50/0						
	73					6.27	13.40	Very stiff grey slightly sandy gravelly CLAY with many subangular to subrounded cobbles and boulders. Gravel is subangular to subrounded fine to coarse.			
14.20-14.20 14.20					25/50 SPT(C) 25*/0 50/0						
	73						(3.80)				
15.70-15.78 15.70					22,3/50 SPT(C) 25*/75 50/0						
	100										
17.20-17.28 17.20					21,4/50 SPT(C) 25*/75 50/0	2.47	17.20	Poor recovery. Recovery consists of slightly clayey slightly gravelly clayey subangular to subrounded COBBLES of limestone.			
	33						(1.25)				
18.70						1.22	18.45	Poor recovery. Recovery consists of COBBLES of limestone. Presumed rock.			
	62						(1.55)				
20.00						-0.33	20.00				

Remarks

Scale (approx)	Logged By
1:50	PM, CB

Figure No. 9338-12-19.BH03

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH04
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 7.30m	**Ground Level (mOD)** 19.44	**Client** DBFL	**Job Number** 9338-12-19
	Location 716966.1 E 731262.2 N	**Dates** 10/03/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					19.24	(0.20) 0.20	Dark brown sandy slightly gravelly TOPSOIL with occasional rootlets.		
0.50	B					(0.70)	Soft to firm light brown mottled grey slightly sandy slightly gravelly CLAY.		
1.00-1.45 1.00	SPT(C) N=8 B			1,1/2,1,2,3	18.54	0.90			
						(0.50)	Soft to firm light brown slightly sandy slightly gravelly CLAY.		
					18.04	1.40			
2.00-2.02 2.00	SPT(C) 25*/20 50/0 B			25/50		(1.10)	Firm to stiff light brown slightly sandy slightly gravelly CLAY.		
					16.94	2.50			
3.00-3.45 3.00	SPT(C) N=47 B			6,8/11,12,13,11			Very stiff, dark grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
4.00-4.45 4.00	SPT(C) N=50 B			6,8/11,13,14,12					
						(4.40)			
5.00-5.43 5.00	SPT(C) 50/275 B			7,8/10,15,16,9					
6.00-6.37 6.00	SPT(C) 50/215 B			9,10/14,16,20					
					12.54	6.90			
7.00-7.35 7.00	SPT(C) 50/195 B			10,10/15,20,15		(0.40)	Very stiff greyish brown slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
					12.14	7.30	Refusal at 7.30m		

Remarks
No groundwater encountered during drilling
Borehole backfilled on complertion.
Borehole terminated at 7.30m BGL due to obstruction, possible boulder or rock
Chiselling from 2.50m to 2.62m for 0.75 hours. Chiselling from 7.30m to 7.30m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 9338-12-19.BH04

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH05
Machine : Dando 2000, Beretta T44 **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 5.30m 63mm cased to 16.50m	**Ground Level (mOD)** 18.75	**Client** DBFL	**Job Number** 9338-12-19
	Location 717014 E 731253.8 N	**Dates** 03/03/2020	**Project Contractor** GII	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					18.65	0.10	MADE GROUND: Tarmacadam		
						(0.40)	MADE GROUND: Light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and occasional fragments of red brick cloth fibres and tarmacadam.		
0.50	B				18.25	0.50			
1.00 1.00-1.45	B SPT(C) N=12			1,2/3,3,3,3		(1.70)	Firm light brown slightly sandy slightly gravelly CLAY. Some orange mottling.		
2.00 2.00-2.45	B SPT(C) N=37			2,4/5,7,12,13	16.55	2.20	Very stiff dark grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse.		
3.00 3.00-3.45	B SPT(C) N=51			5,7/11,11,14,15 Water strike(1) at 3.10m, rose to 2.60m in 20 mins, sealed at NOm.				▼1 ▽1	
4.00 4.00-4.45	B SPT(C) N=55			5,7/10,13,15,17		(4.50)			
5.00 5.00-5.30	B SPT(C) 50/150			7,15/20,30					
5.30	TCR: 25	SCR	RQD	FI					
6.70-6.85 6.70	TCR: 100	SCR	RQD	FI	12.05	6.70	Very stiff brown slightly sandy slightly gravelly CLAY with some subangular to subrounded cobbles and boulders. Gravel is subanugular to subrounded fine to coarse.		
8.20-8.28 8.20	TCR: 100	SCR	RQD	FI					
9.70-9.78 9.70									

14,22/50
SPT(C) 50/0

22,3/50
SPT(C) 25*/75
50/0

22,3/50
SPT(C) 25*/75
50/0

Remarks
Groundwater encountered at 3.10m BGL.
Borehole backfilled on completion.
Cable percussion to 5.30m BGL with Rotary core follow on to 16.50m BGL.
Chiselling from 5.30m to 5.30m for 1 hour.

Scale (approx)	Logged By
1:50	PM, CB

Figure No. 9338-12-19.BH05

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH05
Machine : Dando 2000, Beretta T44 **Flush :** Water **Core Dia :** 63 mm **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 5.30m 63mm cased to 16.50m	**Ground Level (mOD)** 18.75	**Client** DBFL	**Job Number** 9338-12-19
	Location 717014 E 731253.8 N	**Dates** 03/03/2020	**Project Contractor** GII	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	93						(6.60)			
11.20-11.28					22,3/50 SPT(C) 25*/75					
11.20	73				50/0					
12.70-13.15					8,9/10,12,12,11 SPT(C) N=45					
12.70										
13.30	50	22	22			5.45	13.30	Weak- medium strong fine grained grey LIMESTONE distinctly weathered with calcite veining and occasional beds of stiff brown Clay. (possible residual mudstone) One set of fractures. F1: 0-10 degrees. Very closely-closely spaced undulating smooth occasionally open with brown staining and clay smearing.		
14.20	87	59	52	7			(3.20)			
15.40								From 15.40 to 16.50 Non Intact.		
15.70	81	23	16	N.I.						
16.50						2.25	16.50	Complete at 16.50m		

Remarks

Scale (approx)	Logged By
1:50	PM, CB

Figure No. 9338-12-19.BH05

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Site	Borehole Number
Sandford Park Milltown	BH06

Machine : Dando 2000 Method : Cable Percussion	Casing Diameter 200mm cased to 8.00m	Ground Level (mOD) 20.32	Client DBFL	Job Number 9338-12-19
	Location 716893.6 E 731242.4 N	Dates 11/03/2020	Project Contractor GII	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					20.12	(0.20) 0.20	Dark brown sandy slightly gravelly TOPSOIL with occasional rootlets.		
0.50	B				19.72	(0.40) 0.60	Soft light brown slightly sandy slightly gravelly CLAY with some grey mottling.		
1.00-1.45 1.00	SPT(C) N=10 B			1,1/2,2,3,3		(1.60)	Firm light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
2.00-2.45 2.00	SPT(C) N=19 B			2,2/3,4,5,7	18.12	2.20	Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
3.00-3.42 3.00	SPT(C) 50/265 B			10,10/10,15,15,10					
4.00-4.39 4.00	SPT(C) 50/235 B			11,12/13,14,16,7		(4.80)			
5.00-5.38 5.00	SPT(C) 50/230 B			10,12/12,16,17,5					
6.00-6.35 6.00	SPT(C) 50/200 B			11,13/17,19,14					
7.00-7.33 7.00	SPT(C) 50/180 B			12,14/16,22,12	13.32	7.00	Very stiff light brown slightly sandy slightly gravelly CLAY.		
						(1.00)			
8.00-8.28 8.00	SPT(C) 50/125 B			16,19/25,25	12.32	8.00	Complete at 8.00m		

Remarks
No groundwater encountered during drilling
Borehole terminated at 8.00m BGL

Scale (approx)	Logged By
1:50	PM

Figure No.
9338-12-19.BH06

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH07
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 8.00m	**Ground Level (mOD)** 20.00	**Client** DBFL	**Job Number** 9338-12-19
	Location 716950.4 E 731230.1 N	**Dates** 12/03/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.50	B					(1.00)	MADE GROUND: Light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and occasional fragments of concrete and red brick.			
1.00-1.45 1.00	SPT(C) N=5 B			1,1/1,2,1,1	19.00	1.00 (0.40)	POSSIBLE MADE GROUND: Light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
2.00-2.45 2.00	SPT(C) N=27 B			1,2/4,6,8,9	18.60	1.40 (1.00)	Firm to Stiff light brown slightly sandy slightly gravelly CLAY.			
3.00-3.45 3.00	SPT(C) N=44 B			5,7/10,11,11,12	17.60	2.40	Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
4.00-4.44 4.00	SPT(C) 50/285 B			8,8/11,14,15,10						
5.00-5.43 5.00	SPT(C) 50/275 B			9,11/11,13,17,9		(4.80)				
6.00-6.37 6.00	SPT(C) 50/220 B			11,14/15,16,19						
7.00-7.37 7.00	SPT(C) 50/220 B			12,12/14,16,20	12.80	7.20 (0.80)	Very stiff light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
8.00-8.31 8.00	SPT(C) 50/155 B			14,17/20,25,5	12.00	8.00	Complete at 8.00m			

Remarks
No groundwater encountered during drilling
Slotted pipe with pea gravel surround from 8.0m BGL to 1.0m BGL, plain pipe with bentonite seal from 1.0m BGL to GL, finished with an upright cover
Borehole terminated at 8.00m BGL

Scale (approx)	Logged By
1:50	PM

Figure No. 9338-12-19.BH07

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH08
Machine : Dando 2000, Beretta T44 **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 8.00m 96mm cased to 13.70m	**Ground Level (mOD)** 19.76	**Client** DBFL	**Job Number** 9338-12-19
	Location 716987.3 E 731204.4 N	**Dates** 13/03/2020	**Project Contractor** GII	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					19.66	0.10	CONCRETE.		
						(0.40)			
0.50	B				19.26	0.50	MADE GROUND: Light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and occasional fragments of red brick and concrete.		
1.00	B					(0.80)	Soft light brown very sandy slightly gravelly CLAY.		
1.00-1.45	SPT(C) N=5			1,1/1,1,1,2	18.46	1.30			
2.00	B					(1.30)	Soft to firm brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
2.00-2.45	SPT(C) N=9			1,1/1,2,3,3	17.16	2.60			
3.00	B						Very stiff dark grey slightly sandy slightly gravelly CLAY with rare subangular to subrounded cobbles.		
3.00-3.45	SPT(C) N=38			5,5/8,9,10,11					
4.00	B								
4.00-4.45	SPT(C) N=41			4,5/8,10,11,12					
5.00	B					(4.60)			
5.00-5.45	SPT(C) N=41			5,6/7,9,11,14					
6.00	B								
6.00-6.45	SPT(C) N=47			8,9/10,11,13,13					
7.00	B								
7.00-7.37	SPT(C) 55/220			11,14/16,17,22	12.56	7.20	Very stiff dark brown very sandy very gravelly CLAY. Gravel is subangular to subrounded fine to coarse.		
						(0.80)			
8.00	B			14,20/27,23	11.76	8.00	Very stiff brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and boulders. Gravel is subangular to subrounded fine to coarse.		
8.00-8.25	SPT(C) 50/95								
8.20	TCR 100 / SCR / RQD / FI					(1.70)			
9.70-9.78	63			12,13/50 SPT(C) 25*/75	10.06	9.70	Medium strong- strong fine grained grey LIMESTONE partially- distinctly weathered with calcite veining.		
9.70	50/0								

Remarks
No groundwater encountered during drilling
Cable percussion to 8.00m BGL with Rotary core follow on to 13.70m BGL.
Borehole backfilled on completion.

Scale (approx)	Logged By
1:50	PM, CB

Figure No. 9338-12-19.BH08

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH08
Machine : Dando 2000, Beretta T44 **Flush :** Water **Core Dia :** 96 mm **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 8.00m 96mm cased to 13.70m	**Ground Level (mOD)** 19.76	**Client** DBFL	**Job Number** 9338-12-19
	Location 716987.3 E 731204.4 N	**Dates** 13/03/2020	**Project Contractor** GII	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	100	67	60					Two sets of fractures. F1: 0-10 degrees. Very closely-closely spaced undulating smooth occasionally open with clay smearing. F2: 30-45 degrees. Very closely-closely spaced undulating smooth closed.		
11.20	100	59	59	9			(4.00)			
12.50	100	75	68							
13.70						6.06	13.70	Complete at 13.70m		

Remarks

Scale (approx)	Logged By
1:50	PM, CB

Figure No. 9338-12-19.BH08

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH09
Machine : Dando 2000, Beretta T44 **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 8.00m 63mm cased to 18.70m	**Ground Level (mOD)** 20.84	**Client** DBFL	**Job Number** 9338-12-19
	Location 716881.5 E 731214.8 N	**Dates** 17/03/2020	**Project Contractor** GII	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.30)	Dark brown sandy slightly gravelly TOPSOIL with occasional rootlets.			
					20.54	0.30				
0.50	B					(0.60)	Soft light brown slightly sandy slightly gravelly CLAY.			
1.00	B				19.94	0.90				
1.00-1.45	SPT(C) N=10			1,1/2,3,3,2			Firm light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
						(1.50)				
2.00	B									
2.00-2.45	SPT(C) N=11			1,2/3,3,3,2						
					18.44	2.40	Very stiff dark grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
3.00	B									
3.00-3.45	SPT(C) N=28			2,3/5,7,7,9						
4.00	B									
4.00-4.45	SPT(C) N=38			5,7/7,9,11,11						
5.00	B									
5.00-5.45	SPT(C) N=43			7,7/8,10,12,13		(5.20)				
6.00	B									
6.00-6.44	SPT(C) 50/285			10,12/12,14,14,10						
7.00	B									
7.00-7.34	SPT(C) 50/190			12,14/16,23,11						
				12,17/24,26	13.24	7.60	Very stiff light brown slightly sandy slightly gravelly CLAY with rare subangular to subrounded cobbles.			
8.00	TCR / SCR	RQD	FI	B		(0.40)				
8.00-8.28				SPT(C) 50/125	12.84	8.00				
8.00	100						Very stiff slightly sandy slightly gravelly CLAY with occsional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse.			
8.20										
	100					(2.50)				
				12,22/50						
9.70-9.85				SPT(C) 50/0						
9.70										

Remarks
No groundwater encountered durig cable percussion drilling
Cable percussion drilling to 8.00m BGL with rotary follow on to 18.70m BGL.
Slotted pipe installed from 9.5 BGL to 3.0m BGL with pea gravel filter zone from 9.5m BGL to 1.0m BGL and bentonite seal from 1.0m BGL to GL, finished with an upright cover

Scale (approx)	Logged By
1:50	PM, CB

Figure No. 9338-12-19.BH09

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH09
Machine : Dando 2000, Beretta T44 **Flush :** Water **Core Dia :** 63 mm **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 8.00m 63mm cased to 18.70m	**Ground Level (mOD)** 20.84	**Client** DBFL	**Job Number** 9338-12-19
	Location 716881.5 E 731214.8 N	**Dates** 17/03/2020	**Project Contractor** GII	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	100					10.34	10.50	Very stiff brown slightly sandy slightly gravelly CLAY with somel subangular to subrounded cobbles and boulders.			
11.20-11.28 11.20					19,6/50 SPT(C) 25*/75 50/0		(2.50)				
	83										
12.70						7.84	13.00	No recovery. Driller notes possible rock at 13.00m.			
	27						(1.20)				
14.20						6.64	14.20	Possible weathered rock recovered as slightly sandy gravelly CLAY with subangular to subrounded cobbles of limestone.			
	77						(1.50)				
15.70						5.14	15.70	Medium strong- strong fine grained grey LIMESTONE partially to distinctly weathered, with closely to medium spaced thin beds of stiff brown Clay (possible residual mudstone). One set of fractures. F1: 0-10 degrees. Very closely-closely spaced undulating smooth occasionally open with brown staining and clay smearing.			
	93	51	51				(3.00)				
17.20											
	80	32	32								
18.70						2.14	18.70	Complete at 18.70m			

Remarks

Scale (approx)	Logged By
1:50	PM, CB

Figure No. 9338-12-19.BH09

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH10
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 7.20m	**Ground Level (mOD)** 20.35	**Client** DBFL	**Job Number** 9338-12-19
	Location 716944.1 E 731201 N	**Dates** 17/03/2020-18/03/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					20.15	(0.20) 0.20	Dark brown sandy slightly gravelly TOPSOIL with occasional rootlets.		
0.50	B					(1.00)	Soft light brown slightly sandy slightly gravelly CLAY. Mottled grey.		
1.00-1.45 1.00	SPT(C) N=11 B			1,1/2,3,3,3	19.15	1.20	Firm to stiff light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
2.00-2.45 2.00	SPT(C) N=21 B			2,3/4,5,5,7		(1.30)			
3.00-3.45 3.00	SPT(C) N=44 B			5,7/9,10,12,13	17.85	2.50	Very stiff dark grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
4.00-4.44 4.00	SPT(C) 50/285 B			7,9/11,14,16,9 Water strike(1) at 4.30m, rose to 4.20m in 20 mins.		(4.70)			▼1 ▽1
5.00-5.40 5.00	SPT(C) 44/245 B			7,10/10,10,17,7					
6.00-6.37 6.00	SPT(C) 50/215 B			9,11/14,17,19					
7.00-7.17 7.00	SPT(C) 50/20 B			12,14/50	13.15	7.20	Refusal at 7.20m		

Remarks
Groundwater encountered at 4.30m.
Borehole backfilled on completion
Borehole terminated at 7.20m BGL due to obstruction, possible boulder or rock

Scale (approx)	Logged By
1:50	PM

Figure No. 9338-12-19.BH10

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH11
Machine : Dando 2000, Beretta T44 **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 8.00m 96mm cased to 13.00m	**Ground Level (mOD)** 20.45	**Client** DBFL	**Job Number** 9338-12-19
	Location 716967.5 E 731182.2 N	**Dates** 18/03/2020	**Project Contractor** GII	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					20.35	0.10	MADE GROUND: Tarmacadam			
						(0.40)	MADE GROUND: Light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles			
0.50	B				19.95	0.50				
					19.75	(0.20) 0.70	Soft light brown slightly sandy slightly gravelly CLAY with rare subangular to subrounded cobbles.			
1.00	B					(0.50)				
1.00-1.45	SPT(C) N=6			1,1/1,2,1,2	19.25	1.20	Soft light brown mottled grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
						(1.20)	Firm light brown slightly sandy slightly gravelly CLAY.			
2.00	B				18.05	2.40				
2.00-2.45	SPT(C) N=12			1,1/2,3,3,4			Very stiff dark grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
3.00	B									
3.00-3.45	SPT(C) N=48			7,9/10,12,12,14						
4.00	B									
4.00-4.45	SPT(C) N=49			7,10/10,12,14,13						
						(4.70)				
5.00	B									
5.00-5.44	SPT(C) 50/285			8,9/11,12,13,14						
6.00	B									
6.00-6.40	SPT(C) 50/245			8,10/12,14,14,10						
7.00				10,11/14,16,20 B						
7.00-7.37				SPT(C) 50/220						
7.00	TCR 33	SCR -	RQD	FI	13.35	7.10	Very stiff light brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles.			
						(0.90)				
8.00-8.34				12,14/17,20,15 SPT(C) 52/190 B	12.45	8.00	Very stiff brown slightly sandy slightly gravelly CLAY with some subangular to subrounded cobbles and boulders.			
8.00										
8.20						(1.00)				
9.00	TCR 87	SCR 18	RQD 9		11.45	9.00	Medium strong-strong grey fine grained LIMESTONE partially weathered with calcite veining. Two sets of fractures. F1: 0-10 degrees. Very closely- closely spaced undulating smooth closed. F2 35-45 degrees. Closely- medium spaced undulating smooth closed.			
9.70										

Remarks
No groundwater encountered during cable percussive drilling
Cable percussion to 8.00m BGL with Rotary core follow on to 13.00m BGL.
Slotted pipe installed from 7.0m BGL to 3m BGL with pea gravel filter zone from 7.0m BGL to 1.0m BGL and bentonite seal from 1.0m BGL to GL, finished with a flush cover.

Scale (approx)	Logged By
1:50	PM, CB

Figure No. 9338-12-19.BH11

Ground Investigations Ireland Ltd
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Site Sandford Park Milltown			**Borehole Number** BH11
Machine : Dando 2000, Beretta T44 **Flush :** Water **Core Dia :** 96 mm **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 8.00m 96mm cased to 13.00m	**Ground Level (mOD)** 20.45	**Client** DBFL	**Job Number** 9338-12-19
	Location 716967.5 E 731182.2 N	**Dates** 18/03/2020	**Project Contractor** GII	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	93	89	87	8			(4.00)				
11.20	100	67	36								
12.70	100	67	67								
13.00						7.45	13.00	Complete at 13.00m			

Remarks

Scale (approx)	Logged By
1:50	PM, CB

Figure No. 9338-12-19.BH11

Ground Investigations Ireland Ltd
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Site	Borehole Number
Sandford Park Milltown	BH12

Machine : Dando 2000 Method : Cable Percussion	Casing Diameter 200mm cased to 8.00m	Ground Level (mOD) 21.41	Client DBFL	Job Number 9338-12-19
	Location 716865.6 E 731202.8 N	Dates 19/03/2020	Project Contractor GII	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.30)	Dark brown sandy slightly gravelly TOPSOIL with occasional rootlets.		
					21.11	0.30			
0.50	B					(0.70)	POSSIBLE MADE GROUND: light brown sandy gravelly CLAY.		
1.00-1.45 1.00	SPT(C) N=6 B			1,1/1,1,2,2	20.41	1.00			
						(0.90)	Soft light brown mottled grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
					19.51	1.90			
2.00-2.45 2.00	SPT(C) N=10 B			2,2/2,3,3,2		(0.70)	Firm light brown slightly sandy slightly gravelly CLAY.		
					18.81	2.60			
3.00-3.45 3.00	SPT(C) N=25 B			2,3/4,5,7,9			Very stiff dark grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
4.00-4.45 4.00	SPT(C) N=30 B			3,4/5,7,9,9					
5.00-5.45 5.00	SPT(C) N=35 B			6,6/7,8,9,11		(5.40)			
6.00-6.45 6.00	SPT(C) N=46 B			7,10/10,11,12,13					
7.00-7.40 7.00	SPT(C) 50/245 B			10,12/14,14,15,7					
8.00-8.37 8.00	SPT(C) 50/220 B			10,14/16,17,17	13.41	8.00	Complete at 8.00m		

Remarks
No groundwater encountered durig drillling
Borehole backfilled on completion.
Borehole complete at 8.00m BGL

Scale (approx)	Logged By
1:50	PM

Figure No.
9338-12-19.BH12

Ground Investigations Ireland Ltd
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Site	Borehole Number
Sandford Park Milltown	BH13

Machine :	Casing Diameter	Ground Level (mOD)	Client	Job Number
Dando 2000	200mm cased to 3.70m	22.64	DBFL	9338-12-19
Method : Cable Percussion	**Location** 716891.5 E 731106.3 N	**Dates** 05/10/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.30)	Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets		
					22.34	0.30			
0.50	B						Soft to firm brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and occasional rootlets. Gravel is subangular to subrounded fine to coarse		
1.00-1.45 1.00	SPT(C) N=7 B			1,2/2,1,2,2		(1.70)			
					20.64	2.00			
2.00-2.45 2.00	SPT(C) N=14 B			2,2/3,3,4,4			Firm to stiff brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
						(0.60)			
					20.04	2.60			
							Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
3.00-3.45 3.00	SPT(C) N=39 B			4,6/7,9,10,13		(1.10)			
					18.94	3.70			
3.70	B						Obstruction: presumed boulder		
							Complete at 3.70m		

Remarks
Borehole terminated at 3.70m BGL due to an obstruction on a presumed boulder
No groundwater encountered during drilling
Borehole backfilled upon completion
Chiselling from 3.70m to 3.70m for 1 hour.

Scale (approx)	Logged By
1:50	PC

Figure No. 9338-12-19.BH13

Ground Investigations Ireland Ltd
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Site	Borehole Number
Sandford Park Milltown	BH14

Machine : Dando 2000 Method : Cable Percussion	Casing Diameter 200mm cased to 3.50m	Ground Level (mOD) 22.96	Client DBFL	Job Number 9338-12-19
	Location 716916.3 E 731074.5 N	Dates 05/10/2020	Project Contractor GII	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.40)	Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets			
					22.56	0.40				
0.50	B						Firm brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
1.00-1.45 1.00	SPT(C) N=11 B			2,2/2,3,3,3		(1.60)				
2.00-2.45 2.00	SPT(C) N=15 B			2,3/3,3,4,5	20.96	2.00				
						(0.70)	Firm to stiff brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
					20.26	2.70				
3.00-3.45 3.00	SPT(C) N=36 B			4,5/6,8,10,12		(0.80)	Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		▼1	
3.50	B			Water strike(1) at 3.50m, rose to 3.00m in 20 mins.	19.46	3.50	Obstruction: presumed boulder		▽1	
							Complete at 3.50m			

Remarks
Borehole terminated at 3.50m BGL due to an obstruction on a presumed boulder
Groundwater encountered at 3.50m BGL
Slotted pipe with pea gravel surround from 3.50m BGL to 1.00m BGL, plain pipe with bentonite seal from 1.00m BGL to GL, finished with a flush cover
Chiselling from 3.50m to 3.50m for 1 hour.

Scale (approx)	Logged By
1:50	PC

Figure No.
9338-12-19.BH14

Ground Investigations Ireland Ltd
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Site	Borehole Number
Sandford Park Milltown	BH15

Machine : Dando 2000 Method : Cable Percussion	Casing Diameter 200mm cased to 9.50m	Ground Level (mOD) 22.71	Client DBFL	Job Number 9338-12-19
	Location 716914.3 E 731092 N	Dates 06/10/2020	Project Contractor GII	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.30)	Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets		
					22.41	0.30			
0.50	B					(0.60)	MADE GROUND: Brown slightly sandy slightly gravelly Clay with occasional rootlets and occasional fragments of concrete and red brick		
					21.81	0.90			
1.00-1.45 1.00	SPT(C) N=13 B			2,2/3,3,3,4			Firm to stiff brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
						(1.10)			
					20.71	2.00			
2.00-2.45 2.00 2.00	SPT(C) N=17 B EN			2,3/3,4,5,5		(0.40)	Stiff brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
					20.31	2.40			
							Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
3.00-3.45 3.00 3.00	SPT(C) N=32 B EN			3,5/6,8,9,9					
4.00-4.45 4.00	SPT(C) N=39 B			3,6/7,10,11,11					
5.00-5.42 5.00	SPT(C) 50/270 B			5,8/11,15,17,7					
						(6.70)			
6.00-6.39 6.00	SPT(C) 50/240 B			4,7/12,15,19,4					
7.00-7.38 7.00	SPT(C) 50/225 B			5,9/13,15,22					
8.00-8.36 8.00	SPT(C) 50/210 B			6,10/14,17,19					
9.00-9.38 9.00	SPT(C) 50/225 B			5,9/12,18,20	13.61	9.10			
						(0.40)	Very stiff brown slightly sandy gravelly CLAY with some angular to subrounded cobbles. Gravel is angular to subrounded fine to coarse		
9.50	B				13.21	9.50	Obstruction: presumed boulder		
							Complete at 9.50m		

Remarks
Borehole terminated at 9.50m BGL due to an obstruction on a presumed boulder
No groundwater encountered during drilling
Borehole backfilled upon completion
Chiselling from 9.40m to 9.50m for 1 hour.

Scale (approx)	Logged By
1:50	PC

Figure No.
9338-12-19.BH15

Ground Investigations Ireland Ltd
www.gii.ie

Site Sandford Park Milltown			**Borehole Number** BH16
Machine : DANDO 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 5.70m	**Ground Level (mOD)** 21.38	**Client** DBFL	**Job Number** 9338-12-19
	Location 716896.6 E 731165.2 N	**Dates** 07/10/2020	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.40)	Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets			
					20.98	0.40				
0.50	B						Firm brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and occasional rootlets			
1.00-1.45 1.00	SPT(C) N=12 B			2,2/3,3,3,3		(1.40)				
				Water strike(1) at 1.80m, rose to 1.30m in 20 mins.	19.58	1.80			▼1	
2.00 2.00-2.45	B SPT(C) N=15			2,3/4,3,4,4			Medium dense greyish brown slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with occasional angular to subrounded cobbles		▽1	
3.00-3.45 3.00	SPT(C) N=16 B			3,4/3,3,5,5		(2.70)				
4.00-4.17 4.00	SPT(C) 25*/95 50/75 B			19,6/50						
					16.88	4.50	Very stiff dark grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
5.00-5.45 5.00	SPT(C) N=41 B			4,3/7,9,12,13		(1.20)				
					15.68	5.70	Obstruction: presumed boulder			
5.70	B						Complete at 5.70m			

Remarks
Borehole terminated at 5.70m BGL due to an obstruction on a presumed boulder
Groundwater encountered at 1.80m BGL
Slotted pipe with pea gravel surround from 5.70m BGL to 1.00m BGL, plain pipe with bentonite seal from 1.00m BGL to GL, finished with a raised cover
Chiselling from 4.30m to 4.40m for 0.10 hours. Chiselling from 5.70m to 5.70m for 1 hour.

Scale (approx)	Logged By
1:50	PC

Figure No. 9338-12-19.BH16

APPENDIX 9 – Groundwater Monitoring

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

GROUNDWATER MONITORING

Sandford Park Miltown

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
BH02	04/06/2020	17:15	1.31	
BH02	09/06/2020	16:15	1.37	
BH03	05/06/2020	14:58	7.00	
BH03	09/06/2020	15:50	7.25	
BH07	05/06/2020	14:37	1.47	
BH07	09/06/2020	16:06	1.50	
BH09	05/06/2020	15:20	7.50	
BH09	09/06/2020	15:25	7.74	
BH11	05/06/2020	15:55	1.40	
BH11	09/06/2020	16:11	1.50	

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

GROUNDWATER MONITORING

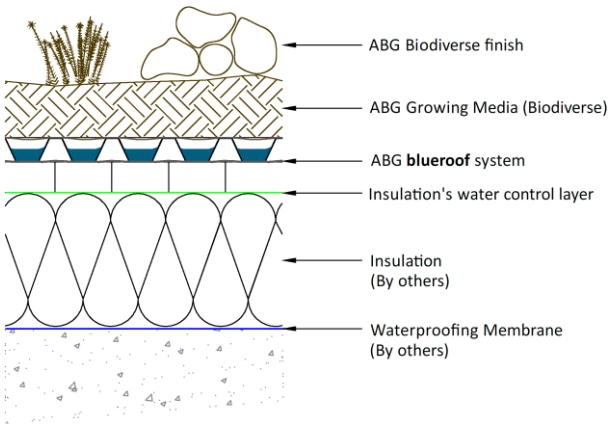
Sandford Park Miltown

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
BH02	23/10/2020	09:05	0.77	
BH03	23/10/2020	08:50	6.30	
BH07	23/10/2020	08:52	1.37	
BH09	23/10/2020	08:47	6.69	
BH11	23/10/2020	09:00	1.10	
BH14	23/10/2020	08:35	1.43	
BH16	23/10/2020	08:45	1.22	

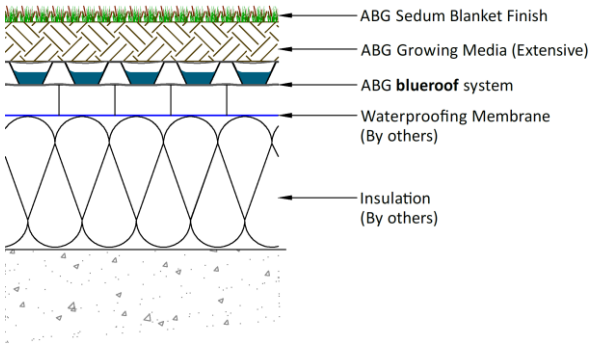
Appendix G : Green/Blue Roof Calculations

blueroof System Range C

creative geosynthetic engineering



Inverted Roof Construction



Warm Roof Construction

Data Sheet

ABG **blueroof** systems provide a constant drainage path, SuDS attenuation, filtration and controlled release of stormwater, combining all the key elements of a good SuDS design. The storage element of the system must be used in conjunction with the 'blue roof' restrictor chamber. These chambers are bespoke to each project in order to help achieve the project engineer's maximum discharge rates, and to suit the required build-up and final use of the podium/roof area.ABG's 'blue roofs' are generally used for zero falls, inverted/warm roof and podium applications, under a mix of hard and soft landscaped finishes. Other combinations of ABG **blueroof** systems and most surface finishes are available. Please refer to ABG's Technical team for project/system specific advice & 'blue roof' SuDS calculations.

		ABG blueroof VF HD						
System Properties		**79mm**	**104mm**	**129mm**	**154mm**	**179mm**		
Thickness at 2kPa	(mm)	79	104	129	154	179	±10%	EN ISO 9863-1
Maximum saturated weight	(kg/m²)	79	104	129	154	179	approx.	EN ISO 9864
Stormwater attenuation volume	(l/m^2)	66	86	114	134	161		
Growing medium recharge value	(l/m^2)	25	25	25	25	25		Per 100mm depth
Drainable void space	%	84	83	88	87	90		
Resistance to weathering		Greater than 60% retained tensile strength						EN 12224
Resistance to chemicals		Excellent						EN 14030
Upper Filter/Separator Properties								
Pore size O_{90}	(µm)	120					±30%	EN ISO 12956
Breakthrough head	(mm)	0					nominal	BS 6906 Part 3
CBR puncture resistance	(N)	1 600					-20%	EN ISO 12236
Dynamic perforation cone drop	(mm)	32					+20%	EN ISO 13433
Type and material	Non-woven needle-punched and heat-treated long staple fibre polypropylene Protector: Non-woven felt of polypropylene. Min wt. of 120g/m^2							
'Blue roof' system use & compatible surface finishes								
Suitable for up to ABG Load Class 2 (Pedestrians, cycles and light vehicles, MUGAs, medium sized plant installations). Green roof & biodiverse roof finishes where additional attenuation volume is required.								

Notes

1. The values given are indicative and correspond to nominal results obtained in our laboratories and testing institutes. In line with our policy of continuous improvement the right is reserved to make changes without notice at any time.
2. Any additional installations such as plant/services, PV panels, paved areas or additional vehicular/traffic access, must be discussed with ABG prior to their installation/use.
3. Final determination of the suitability of any information is the sole responsibility of the user. ABG will be pleased to discuss the use of this or any other product but responsibility for selection of a material and its application in any specific project remains with the user.
4. Can be used in conjunction with rainwater harvesting & grey water recycling systems. Any petrochemical pollution waste discharged from the system to be treated by others.

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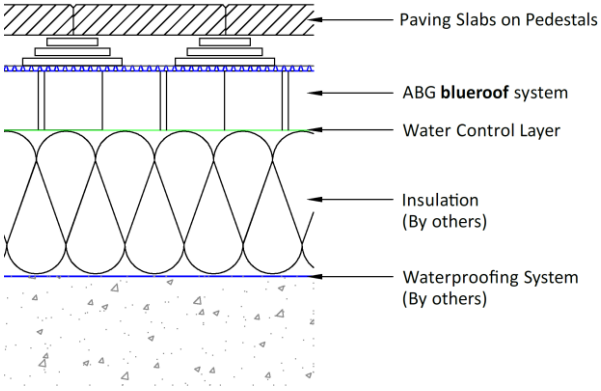
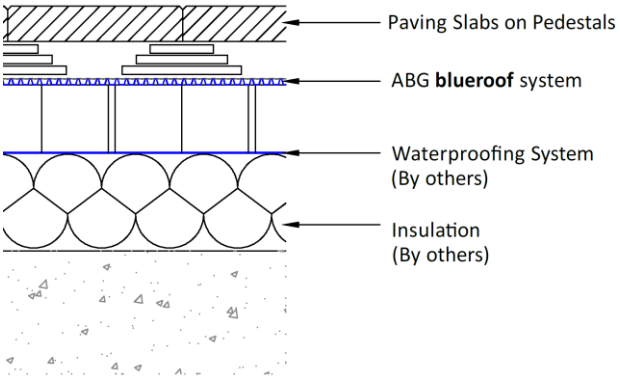
blueroof System Range D

creative geosynthetic engineering



Inverted Roof Construction



Warm Roof Construction

Data Sheet

ABG **blueroof** systems provide a constant drainage path, SuDS attenuation, filtration and controlled release of stormwater, combining all the key elements of a good SuDS design. The storage element of the system must be used in conjunction with the 'blue roof' restrictor chamber. These chambers are bespoke to each project in order to help achieve the project engineer's maximum discharge rates, and to suit the required build-up and final use of the podium/roof area. ABG's 'blue roofs' are generally used for zero falls, inverted/warm roof and podium applications, under a mix of hard and soft landscaped finishes. Other combinations of ABG **blueroof** systems and most surface finishes are available. Please refer to ABG's Technical team for project/system specific advice & 'blue roof' SuDS calculations.

		ABG blueroof VF HD							
System Properties		**58mm**	**80mm**	**108mm**	**130mm**	**158mm**	**180mm**		
Thickness at 2kPa	(mm)	58	80	108	130	158	180	±10%	EN ISO 9863-1
Maximum saturated weight	(kg/m²)	58	80	108	130	158	180	approx.	EN ISO 9864
Stormwater attenuation volume	(l/m^2)	50	65	97	113	145	160		
Growing medium recharge value	(l/m^2)	25	25	25	25	25	25		Per 100mm depth
Drainable void space	%	86	81	90	87	92	89		
Resistance to weathering	Greater than 60% retained tensile strength								EN 12224
Resistance to chemicals	Excellent								EN 14030
Upper Filter/Separator Properties									
Pore size O_{90}	(µm)	120						±30%	EN ISO 12956
Breakthrough head	(mm)	0						nominal	BS 6906 Part 3
CBR puncture resistance	(N)	1 600						-20%	EN ISO 12236
Dynamic perforation cone drop	(mm)	32						+20%	EN ISO 13433
Type and material	Non-woven needle-punched and heat-treated long staple fibre polypropylene Protector: Non-woven felt of polypropylene. Min wt. of 120g/m^2								
'Blue roof' system use & compatible surface finishes									
Suitable for ABG Load Class 2 (Pedestrians, cycles and light vehicles, MUGAs, medium sized plant installations). Landscaped, paved or permeable resin-bound gravel finishes.									

Notes

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4. Can be used in conjunction with rainwater harvesting & grey water recycling systems. Any petrochemical pollution waste discharged from the system to be treated by others.

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ABG blueroof

DESIGN CALCULATION REPORT

Project name: Sandford Rd, Dublin

Project ID: **ABG/O/25/002652**

Calculated by: MG

Date: 01.12.25

abg creative geosynthetic engineering

Blue Roof Systems

Traditional rainwater drainage systems are designed to allow water to be discharged from the roof of a building as quickly as possible. However, as pressure on water management within new developments becomes more critical and waterproofing systems evolve and improve, this principle is increasingly being challenged.

Blue roofs are designed to temporarily attenuate rainwater during storm events and then gradually release the water at a controlled rate following the storm to help prevent localised flooding. Designed and implemented correctly, they can form an integral source control and attenuation element to satisfy Sustainable Drainage System (SuDS) requirements on modern developments.

Blue roofs are rated as one of the most sustainable techniques in CIRIA's SuDS hierarchy, based on their contribution to reducing the risk of flooding and pollution, and their positive impact on the local landscape & wildlife ecosystems when combined with a green roof finish.

Legislation change, advancements in roofing and the need for sustainability in an evolving construction industry, means Blue Roofs are now becoming a first choice solution for new developments.

Implementing effective SuDS demands that

water falling on a development is not simply channeled into stormwater drains and discharged into overburdened local sewer and river systems. **ABG blueroof** is designed to mimic the process found in nature whereby water is attenuated, treated and filtered at a controlled rate using the patented **ABG blueroof** Restrictor Chamber. With land at a premium, Blue Roofs also allow the developer to maximise usage of any site, especially in city centre developments where underground storage systems are expensive and unsustainable to construct.

Blue Roofs are not just limited to the roof areas, they are versatile and are used extensively on podium deck and amenity spaces. ABG's development in product design and expertise in geosynthetics means a multitude of surface finishes can be achieved and a wide range of traffic requests accommodated.

ABG blueroof

ABG blueroof provides temporary attenuation within the roof or podium deck construction of a development. Utilising space in this way means that the attenuation capacity required to meet SuDS best practice can be met.

ABG blueroof comprises an attenuation and drainage void within the roof structure and a patented stormwater management system designed to release the attenuated water at a controlled discharge rate as agreed in the planning phase.

- Storage capacity calculated to match storm duration
- Designed to match one in a hundred year storm events
- Additional allowance made for the effects of climate change
- **ABG blueroof** can be designed to operate across multiple roof areas or cascade from higher to lower roof areas
- Stored water is released at a controlled rate into the sewer system or used as grey water.

The system can be used to address different climactic environments. In the UK, the primary concern is to mitigate the impact of storms. Rainwater is stored for up to twenty four hours before being gradually released into the surface water management system.

In regions or countries with extremely low rainfall, the Blue Roof stores rainwater to be harvested for use in irrigation or grey water processes. In intermediate regions, the blue roof provides both stormwater attenuation and complements the supply of water for irrigation.

Under normal rainfall events, the roof will drain like a normal flat roof, and the patented stormwater management system only comes into effect during a storm event. The built in overflow provides a factor of safety in the event a storm occurs that exceeds that which it has been designed for.

About ABG

ABG is a market leader in the design, development, manufacture and technical support of high performance geosynthetic systems for use in a wide range of civil engineering, environmental and sustainable building projects.

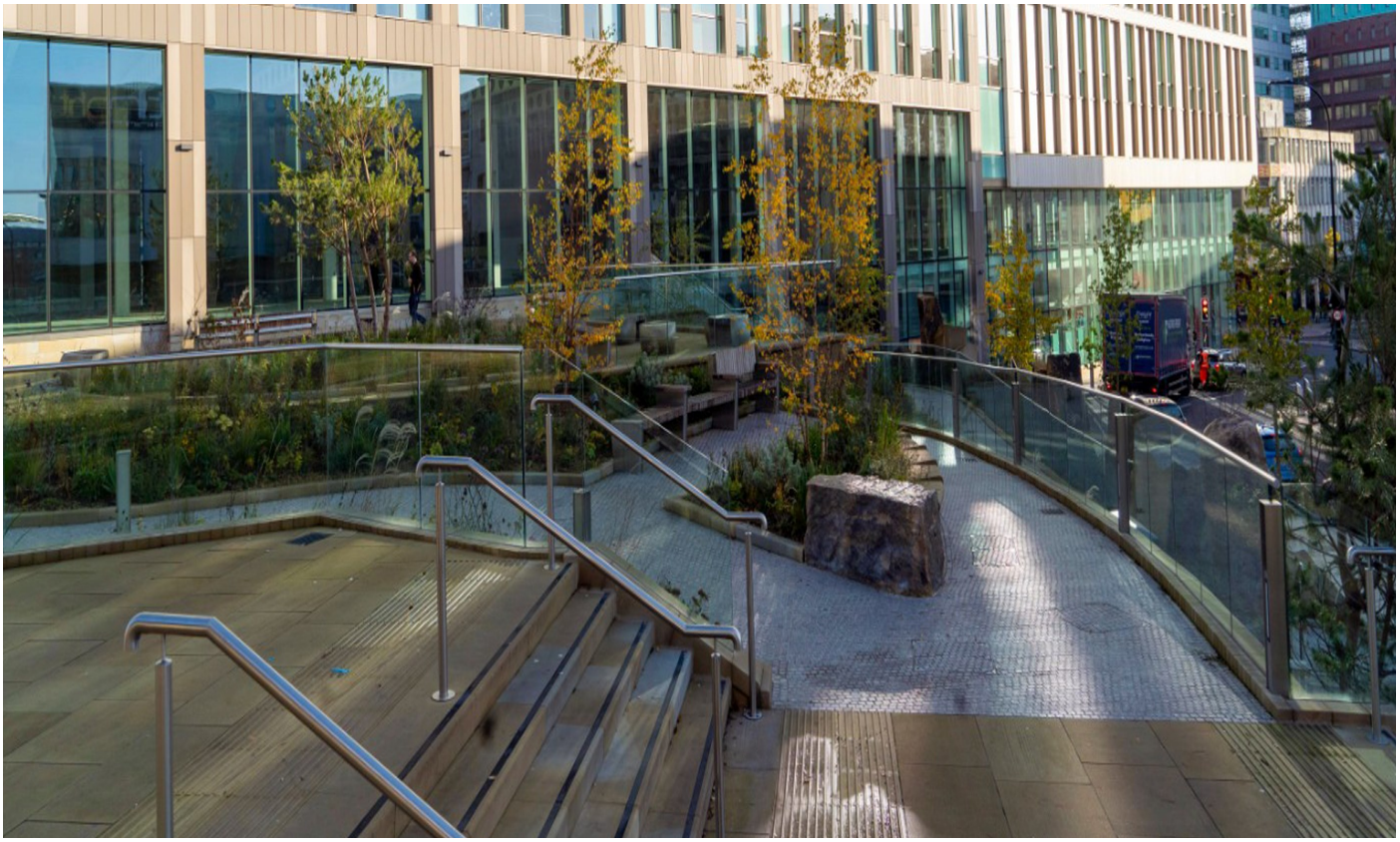
Formed in 1988, based in Meltham, in the heart of the Pennines, ABG have developed an excellent reputation for developing quality products and delivering outstanding service. The ability for rapid product development ensures that the most innovative, up to date and cost effective solution can be found for many engineering problems.

ABG's involvement in roof drainage extends to over thirty years and we have a complete range of products developed specifically for use in this technically demanding application.

ABG are one of the leading proponents of Blue Roof systems in the UK, with a patented design for **ABG blueroof** and over 15 years experience of installing the system.

Technical support is provided by our trained and experienced staff, many of whom are Chartered Civil Engineers. This extensive support extends to full design, design validation, feasibility studies, cost advice and advice on meeting regulatory requirements.

Part of this technical support includes developing and driving knowledge within our active markets, including working with both international and local regulatory bodies on developing guidance and best practice in the use of innovative geosynthetics to solve complex engineering issues.



BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block A Podium A

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
5 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 108mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	2008 m^2		*As supplied by Client*
Storage area:	2008 m^2		*As supplied by Client*
Maximum allowable runoff:	1.64 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	14 hours and 10 minutes	0.77
10 mins	0.0436	30	18 hours and 50 minutes	0.93
15 mins	0.0343	34	21 hours and 20 minutes	1.01
30 mins	0.0211	41	24 hours and 50 minutes	1.12
1 hour	0.0131	50	28 hours and 30 minutes	1.24
2 hours	0.0081	59	32 hours and 20 minutes	1.37
4 hours	0.0050	69	36 hours and 10 minutes	1.49
6 hours	0.0038	75	38 hours and 10 minutes	1.56
12 hours	**0.0023**	**82**	**40 hours and 40 minutes**	**1.63**
24 hours	0.0014	81	40 hours and 20 minutes	1.62
48 hours	0.0008	55	30 hours and 50 minutes	1.32
72 hours	0.0006	36	22 hours and 0 minutes	1.03

Total storage required: 164.9m^3 **Total storage provided: 194.77m^3**
Half empty time: 12 hours and 0 minutes.

Notes:

1. This document contains an estimate which has been prepared by ABG Ltd and is illustrative only and not a detailed design.
2. Further details on the theories used in this estimate are available upon request from ABG. The values given are indicative and correspond to nominal results obtained in our laboratories and testing institutes. In line with our policy of continuous improvement the right is reserved to make changes without notice at any time.
3. This estimate is specific to the characteristics of ABG products and may not be applicable to other products.
4. The copyright in this document belongs to ABG Ltd.
5. The estimate given in this report is based on the stated parameters as per the brief. If these parameters are not correct or have changed, ABG should be contacted to provide a revised estimate.
6. No guarantee or liability can be drawn from the information in this report.
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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block A Roof A1

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 108mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		542 m^2	*As supplied by Client*
Storage area:		348 m^2	*As supplied by Client*
Maximum allowable runoff:		0.85 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	31	7 hours and 10 minutes	0.45
10 mins	0.0436	43	9 hours and 20 minutes	0.55
15 mins	0.0343	50	10 hours and 30 minutes	0.59
30 mins	0.0211	60	12 hours and 0 minutes	0.66
1 hour	0.0131	72	13 hours and 30 minutes	0.72
2 hours	0.0081	84	15 hours and 0 minutes	0.79
4 hours	0.0050	94	16 hours and 10 minutes	0.83
6 hours	**0.0038**	**96**	**16 hours and 30 minutes**	**0.84**
12 hours	0.0023	90	15 hours and 50 minutes	0.82
24 hours	0.0014	64	12 hours and 30 minutes	0.68
48 hours	0.0008	16	3 hours and 50 minutes	0.30
72 hours	0.0006	6	0 hours and 10 minutes	0.09

Total storage required: 33.5m^3 **Total storage provided: 33.75m^3**
Half empty time: 6 hours and 0 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block A Roof A2

creative geosynthetic engineering

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Technical

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		877 m^2	*As supplied by Client*
Storage area:		864 m^2	*As supplied by Client*
Maximum allowable runoff:		0.65 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	16 hours and 10 minutes	0.30
10 mins	0.0436	30	21 hours and 30 minutes	0.36
15 mins	0.0343	35	24 hours and 20 minutes	0.39
30 mins	0.0211	42	28 hours and 10 minutes	0.44
1 hour	0.0131	50	32 hours and 20 minutes	0.48
2 hours	0.0081	60	36 hours and 50 minutes	0.53
4 hours	0.0050	71	41 hours and 20 minutes	0.58
6 hours	0.0038	77	43 hours and 50 minutes	0.61
12 hours	0.0023	86	47 hours and 0 minutes	0.64
24 hours	**0.0014**	**87**	**47 hours and 30 minutes**	**0.65**
48 hours	0.0008	63	38 hours and 10 minutes	0.54
72 hours	0.0006	44	29 hours and 20 minutes	0.45

Total storage required: 75.3m³ **Total storage provided: 98.49m³**
Half empty time: 11 hours and 20 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block A Roof A3

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		115 m^2	*As supplied by Client*
Storage area:		115 m^2	*As supplied by Client*
Maximum allowable runoff:		0.18 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	21	7 hours and 10 minutes	0.10
10 mins	0.0436	29	9 hours and 20 minutes	0.11
15 mins	0.0343	33	10 hours and 20 minutes	0.12
30 mins	0.0211	40	12 hours and 0 minutes	0.14
1 hour	0.0131	47	13 hours and 30 minutes	0.15
2 hours	0.0081	55	15 hours and 0 minutes	0.16
4 hours	0.0050	61	16 hours and 10 minutes	0.17
6 hours	**0.0038**	**63**	**16 hours and 30 minutes**	**0.18**
12 hours	0.0023	60	15 hours and 50 minutes	0.17
24 hours	0.0014	43	12 hours and 40 minutes	0.14
48 hours	0.0008	12	3 hours and 50 minutes	0.07
72 hours	0.0006	4	0 hours and 0 minutes	0.02

Total storage required: 7.3m³ **Total storage provided: 13.11m³**
Half empty time: 1 hours and 10 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block A Roof A4

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		127 m^2	*As supplied by Client*
Storage area:		127 m^2	*As supplied by Client*
Maximum allowable runoff:		0.18 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	21	8 hours and 0 minutes	0.10
10 mins	0.0436	29	10 hours and 10 minutes	0.11
15 mins	0.0343	33	11 hours and 30 minutes	0.12
30 mins	0.0211	40	13 hours and 10 minutes	0.14
1 hour	0.0131	48	15 hours and 0 minutes	0.15
2 hours	0.0081	56	16 hours and 40 minutes	0.16
4 hours	0.0050	63	18 hours and 10 minutes	0.17
6 hours	**0.0038**	**65**	**18 hours and 30 minutes**	**0.18**
12 hours	0.0023	63	18 hours and 10 minutes	0.18
24 hours	0.0014	49	15 hours and 10 minutes	0.15
48 hours	0.0008	16	6 hours and 0 minutes	0.08
72 hours	0.0006	5	0 hours and 40 minutes	0.03

Total storage required: 8.3m³ **Total storage provided: 14.47m³**
Half empty time: 1 hours and 30 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block A Roof A5

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 108mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	366 m^2		*As supplied by Client*
Storage area:	233 m^2		*As supplied by Client*
Maximum allowable runoff:	0.66 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	31	6 hours and 50 minutes	0.32
10 mins	0.0436	43	9 hours and 0 minutes	0.38
15 mins	0.0343	50	10 hours and 0 minutes	0.42
30 mins	0.0211	61	11 hours and 30 minutes	0.46
1 hour	0.0131	72	13 hours and 0 minutes	0.51
2 hours	0.0081	84	14 hours and 30 minutes	0.55
4 hours	0.0050	93	15 hours and 30 minutes	0.58
6 hours	**0.0038**	**96**	**15 hours and 40 minutes**	**0.59**
12 hours	0.0023	89	15 hours and 0 minutes	0.57
24 hours	0.0014	61	11 hours and 40 minutes	0.46
48 hours	0.0008	14	3 hours and 0 minutes	0.19
72 hours	0.0006	5	0 hours and 0 minutes	0.06

Total storage required: 22.3m^3 **Total storage provided: 22.6m^3**
Half empty time: 5 hours and 40 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block A Roof A6

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 108mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	160 m^2		*As supplied by Client*
Storage area:	160 m^2		*As supplied by Client*
Maximum allowable runoff:	0.19 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	10 hours and 0 minutes	0.10
10 mins	0.0436	29	13 hours and 0 minutes	0.11
15 mins	0.0343	34	14 hours and 30 minutes	0.12
30 mins	0.0211	40	16 hours and 40 minutes	0.14
1 hour	0.0131	48	19 hours and 0 minutes	0.15
2 hours	0.0081	57	21 hours and 30 minutes	0.16
4 hours	0.0050	65	23 hours and 30 minutes	0.18
6 hours	0.0038	69	24 hours and 30 minutes	0.18
12 hours	**0.0023**	**71**	**24 hours and 50 minutes**	**0.19**
24 hours	0.0014	61	22 hours and 30 minutes	0.17
48 hours	0.0008	29	12 hours and 50 minutes	0.11
72 hours	0.0006	12	5 hours and 10 minutes	0.06

Total storage required: 11.4m³ **Total storage provided: 15.52m³**
Half empty time: 5 hours and 30 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block A Roof A7

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		211 m^2	*As supplied by Client*
Storage area:		211 m^2	*As supplied by Client*
Maximum allowable runoff:		0.20 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	13 hours and 10 minutes	0.10
10 mins	0.0436	29	17 hours and 0 minutes	0.12
15 mins	0.0343	34	19 hours and 10 minutes	0.12
30 mins	0.0211	41	22 hours and 0 minutes	0.14
1 hour	0.0131	49	25 hours and 10 minutes	0.15
2 hours	0.0081	58	28 hours and 30 minutes	0.17
4 hours	0.0050	67	31 hours and 30 minutes	0.18
6 hours	0.0038	72	33 hours and 10 minutes	0.19
12 hours	**0.0023**	**78**	**34 hours and 40 minutes**	**0.20**
24 hours	0.0014	74	33 hours and 30 minutes	0.19
48 hours	0.0008	45	23 hours and 40 minutes	0.15
72 hours	0.0006	25	15 hours and 0 minutes	0.11

Total storage required: 16.5m^3 **Total storage provided: 24.05m^3**
Half empty time: 6 hours and 10 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block B Podium B

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
5 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 108mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	2208 m^2		*As supplied by Client*
Storage area:	2208 m^2		*As supplied by Client*
Maximum allowable runoff:	1.83 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	14 hours and 30 minutes	0.87
10 mins	0.0436	29	19 hours and 0 minutes	1.04
15 mins	0.0343	34	21 hours and 30 minutes	1.13
30 mins	0.0211	41	24 hours and 50 minutes	1.26
1 hour	0.0131	49	28 hours and 30 minutes	1.39
2 hours	0.0081	59	32 hours and 20 minutes	1.53
4 hours	0.0050	69	36 hours and 0 minutes	1.67
6 hours	0.0038	74	38 hours and 0 minutes	1.74
12 hours	**0.0023**	**81**	**40 hours and 20 minutes**	**1.82**
24 hours	0.0014	80	40 hours and 0 minutes	1.81
48 hours	0.0008	54	30 hours and 20 minutes	1.46
72 hours	0.0006	34	21 hours and 30 minutes	1.13

Total storage required: 179.7m^3 **Total storage provided: 214.17m^3**
Half empty time: 11 hours and 40 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block B Roof B1

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		153 m^2	*As supplied by Client*
Storage area:		152 m^2	*As supplied by Client*
Maximum allowable runoff:		0.19 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	9 hours and 30 minutes	0.10
10 mins	0.0436	29	12 hours and 20 minutes	0.12
15 mins	0.0343	34	13 hours and 50 minutes	0.13
30 mins	0.0211	40	15 hours and 50 minutes	0.14
1 hour	0.0131	48	18 hours and 0 minutes	0.15
2 hours	0.0081	57	20 hours and 20 minutes	0.17
4 hours	0.0050	65	22 hours and 10 minutes	0.18
6 hours	0.0038	68	23 hours and 0 minutes	0.18
12 hours	**0.0023**	**70**	**23 hours and 10 minutes**	**0.18**
24 hours	0.0014	59	20 hours and 40 minutes	0.17
48 hours	0.0008	26	11 hours and 0 minutes	0.11
72 hours	0.0006	10	3 hours and 50 minutes	0.06

Total storage required: 10.6m^3 **Total storage provided: 17.32m^3**
Half empty time: 2 hours and 50 minutes.

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block B Roof B2

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		132 m^2	*As supplied by Client*
Storage area:		131 m^2	*As supplied by Client*
Maximum allowable runoff:		0.19 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	8 hours and 10 minutes	0.10
10 mins	0.0436	29	10 hours and 40 minutes	0.12
15 mins	0.0343	34	11 hours and 50 minutes	0.12
30 mins	0.0211	40	13 hours and 40 minutes	0.14
1 hour	0.0131	48	15 hours and 30 minutes	0.15
2 hours	0.0081	56	17 hours and 20 minutes	0.17
4 hours	0.0050	63	18 hours and 50 minutes	0.18
6 hours	**0.0038**	**66**	**19 hours and 20 minutes**	**0.18**
12 hours	0.0023	65	19 hours and 10 minutes	0.18
24 hours	0.0014	51	16 hours and 10 minutes	0.16
48 hours	0.0008	18	6 hours and 50 minutes	0.09
72 hours	0.0006	6	1 hour and 0 minutes	0.03

Total storage required: 8.7m³ **Total storage provided: 14.93m³**
Half empty time: 1 hours and 50 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block B Roof B3

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 108mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	456 m^2		*As supplied by Client*
Storage area:	330 m^2		*As supplied by Client*
Maximum allowable runoff:	0.55 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	28	10 hours and 20 minutes	0.28
10 mins	0.0436	38	13 hours and 20 minutes	0.33
15 mins	0.0343	45	14 hours and 50 minutes	0.36
30 mins	0.0211	54	17 hours and 0 minutes	0.40
1 hour	0.0131	65	19 hours and 20 minutes	0.44
2 hours	0.0081	77	21 hours and 40 minutes	0.48
4 hours	0.0050	88	23 hours and 40 minutes	0.52
6 hours	0.0038	93	24 hours and 30 minutes	0.53
12 hours	**0.0023**	**95**	**24 hours and 50 minutes**	**0.54**
24 hours	0.0014	81	22 hours and 30 minutes	0.50
48 hours	0.0008	36	12 hours and 40 minutes	0.32
72 hours	0.0006	13	5 hours and 0 minutes	0.17

Total storage required: 31.4m³ **Total storage provided: 32.01m³**
Half empty time: 8 hours and 40 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block B Roof B4

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	379 m^2		*As supplied by Client*
Storage area:	379 m^2		*As supplied by Client*
Maximum allowable runoff:	0.22 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	23 hours and 40 minutes	0.10
10 mins	0.0436	29	30 hours and 40 minutes	0.12
15 mins	0.0343	34	34 hours and 20 minutes	0.13
30 mins	0.0211	41	39 hours and 50 minutes	0.14
1 hour	0.0131	49	45 hours and 40 minutes	0.15
2 hours	0.0081	60	52 hours and 0 minutes	0.17
4 hours	0.0050	71	58 hours and 30 minutes	0.19
6 hours	0.0038	78	62 hours and 10 minutes	0.20
12 hours	0.0023	89	67 hours and 50 minutes	0.21
24 hours	**0.0014**	**95**	**70 hours and 50 minutes**	**0.22**
48 hours	0.0008	78	62 hours and 10 minutes	0.20
72 hours	0.0006	63	53 hours and 50 minutes	0.17

Total storage required: 36.1m^3 **Total storage provided: 43.2m^3**
Half empty time: 19 hours and 20 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block C Podium C

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
5 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 108mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	223 m^2		*As supplied by Client*
Storage area:	223 m^2		*As supplied by Client*
Maximum allowable runoff:	0.20 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	14 hours and 0 minutes	0.10
10 mins	0.0436	29	18 hours and 0 minutes	0.11
15 mins	0.0343	34	20 hours and 20 minutes	0.12
30 mins	0.0211	41	23 hours and 30 minutes	0.14
1 hour	0.0131	49	26 hours and 50 minutes	0.15
2 hours	0.0081	58	30 hours and 20 minutes	0.17
4 hours	0.0050	68	33 hours and 40 minutes	0.18
6 hours	0.0038	73	35 hours and 20 minutes	0.19
12 hours	**0.0023**	**79**	**37 hours and 20 minutes**	**0.20**
24 hours	0.0014	77	36 hours and 30 minutes	0.19
48 hours	0.0008	49	26 hours and 40 minutes	0.15
72 hours	0.0006	29	17 hours and 50 minutes	0.11

Total storage required: 17.7m^3 **Total storage provided: 21.63m^3**
Half empty time: 10 hours and 10 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block C Roof C1

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		416 m^2	*As supplied by Client*
Storage area:		404 m^2	*As supplied by Client*
Maximum allowable runoff:		0.33 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	15 hours and 40 minutes	0.15
10 mins	0.0436	30	20 hours and 30 minutes	0.18
15 mins	0.0343	35	23 hours and 10 minutes	0.20
30 mins	0.0211	42	26 hours and 40 minutes	0.22
1 hour	0.0131	51	30 hours and 40 minutes	0.25
2 hours	0.0081	61	34 hours and 50 minutes	0.27
4 hours	0.0050	71	38 hours and 50 minutes	0.30
6 hours	0.0038	77	41 hours and 0 minutes	0.31
12 hours	0.0023	85	43 hours and 50 minutes	0.32
24 hours	**0.0014**	**85**	**43 hours and 50 minutes**	**0.32**
48 hours	0.0008	59	34 hours and 10 minutes	0.27
72 hours	0.0006	39	25 hours and 20 minutes	0.21

Total storage required: 34.4m³ **Total storage provided: 46.05m³**
Half empty time: 9 hours and 50 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block C Roof C2

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		429 m^2	*As supplied by Client*
Storage area:		428 m^2	*As supplied by Client*
Maximum allowable runoff:		0.33 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	16 hours and 20 minutes	0.15
10 mins	0.0436	29	21 hours and 20 minutes	0.18
15 mins	0.0343	34	24 hours and 0 minutes	0.20
30 mins	0.0211	41	27 hours and 50 minutes	0.22
1 hour	0.0131	49	32 hours and 0 minutes	0.24
2 hours	0.0081	59	36 hours and 20 minutes	0.27
4 hours	0.0050	70	40 hours and 40 minutes	0.29
6 hours	0.0038	76	43 hours and 0 minutes	0.30
12 hours	0.0023	84	46 hours and 0 minutes	0.32
24 hours	**0.0014**	**85**	**46 hours and 20 minutes**	**0.32**
48 hours	0.0008	60	36 hours and 40 minutes	0.27
72 hours	0.0006	41	27 hours and 50 minutes	0.22

Total storage required: 36.3m³ **Total storage provided: 48.79m³**
Half empty time: 10 hours and 20 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block C Roof C3

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		245 m^2	*As supplied by Client*
Storage area:		234 m^2	*As supplied by Client*
Maximum allowable runoff:		0.21 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	15 hours and 0 minutes	0.10
10 mins	0.0436	30	19 hours and 30 minutes	0.12
15 mins	0.0343	35	21 hours and 50 minutes	0.13
30 mins	0.0211	42	25 hours and 10 minutes	0.14
1 hour	0.0131	51	28 hours and 50 minutes	0.16
2 hours	0.0081	61	32 hours and 40 minutes	0.17
4 hours	0.0050	71	36 hours and 20 minutes	0.19
6 hours	0.0038	77	38 hours and 10 minutes	0.20
12 hours	**0.0023**	**84**	**40 hours and 30 minutes**	**0.20**
24 hours	0.0014	83	40 hours and 0 minutes	0.20
48 hours	0.0008	55	30 hours and 20 minutes	0.16
72 hours	0.0006	34	21 hours and 20 minutes	0.13

Total storage required: 19.8m^3 **Total storage provided: 26.67m^3**
Half empty time: 8 hours and 50 minutes.

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block C Roof C4

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	99 m^2		*As supplied by Client*
Storage area:	98 m^2		*As supplied by Client*
Maximum allowable runoff:	0.18 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	6 hours and 10 minutes	0.10
10 mins	0.0436	29	8 hours and 0 minutes	0.12
15 mins	0.0343	34	8 hours and 50 minutes	0.12
30 mins	0.0211	40	10 hours and 10 minutes	0.14
1 hour	0.0131	47	11 hours and 30 minutes	0.15
2 hours	0.0081	55	12 hours and 40 minutes	0.16
4 hours	0.0050	60	13 hours and 30 minutes	0.17
6 hours	**0.0038**	**61**	**13 hours and 40 minutes**	**0.17**
12 hours	0.0023	54	12 hours and 40 minutes	0.16
24 hours	0.0014	35	9 hours and 10 minutes	0.13
48 hours	0.0008	7	1 hour and 30 minutes	0.04
72 hours	0.0006	4	0 hours and 0 minutes	0.01

Total storage required: 6m^3 **Total storage provided: 11.17m^3**
Half empty time: 0 hours and 40 minutes.

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block C Roof C5

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		294 m^2	*As supplied by Client*
Storage area:		293 m^2	*As supplied by Client*
Maximum allowable runoff:		0.25 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	14 hours and 40 minutes	0.12
10 mins	0.0436	29	19 hours and 0 minutes	0.14
15 mins	0.0343	34	21 hours and 20 minutes	0.16
30 mins	0.0211	41	24 hours and 30 minutes	0.17
1 hour	0.0131	49	28 hours and 10 minutes	0.19
2 hours	0.0081	58	31 hours and 50 minutes	0.21
4 hours	0.0050	68	35 hours and 20 minutes	0.23
6 hours	0.0038	74	37 hours and 10 minutes	0.24
12 hours	**0.0023**	**80**	**39 hours and 20 minutes**	**0.25**
24 hours	0.0014	79	38 hours and 50 minutes	0.25
48 hours	0.0008	51	29 hours and 0 minutes	0.20
72 hours	0.0006	32	20 hours and 10 minutes	0.15

Total storage required: 23.6m³ **Total storage provided: 33.4m³**
Half empty time: 7 hours and 40 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block C Roof C7

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:	100 years		*As supplied by Client*
Allowance for Climate Change:	20 %		*As supplied by Client*
Rainfall Data Source:	Met Éireann		*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:	80 m^2		*As supplied by Client*
Storage area:	79 m^2		*As supplied by Client*
Maximum allowable runoff:	0.17 l/s		*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	5 hours and 0 minutes	0.10
10 mins	0.0436	29	6 hours and 30 minutes	0.12
15 mins	0.0343	33	7 hours and 10 minutes	0.12
30 mins	0.0211	40	8 hours and 10 minutes	0.14
1 hour	0.0131	47	9 hours and 10 minutes	0.15
2 hours	0.0081	53	10 hours and 0 minutes	0.16
4 hours	**0.0050**	**56**	**10 hours and 30 minutes**	**0.17**
6 hours	0.0038	56	10 hours and 20 minutes	0.16
12 hours	0.0023	46	9 hours and 0 minutes	0.15
24 hours	0.0014	24	5 hours and 20 minutes	0.10
48 hours	0.0008	4	0 hours and 0 minutes	0.02
72 hours	0.0006	4	0 hours and 0 minutes	0.01

Total storage required: 4.5m³ **Total storage provided: 9m³**
Half empty time: The critical storm does not result in the storage reaching half full

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block D Roof D1

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 108mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		335 m^2	*As supplied by Client*
Storage area:		242 m^2	*As supplied by Client*
Maximum allowable runoff:		0.41 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	28	9 hours and 40 minutes	0.21
10 mins	0.0436	39	12 hours and 40 minutes	0.25
15 mins	0.0343	45	14 hours and 10 minutes	0.27
30 mins	0.0211	54	16 hours and 10 minutes	0.30
1 hour	0.0131	65	18 hours and 30 minutes	0.34
2 hours	0.0081	77	20 hours and 40 minutes	0.37
4 hours	0.0050	88	22 hours and 30 minutes	0.39
6 hours	0.0038	93	23 hours and 20 minutes	0.40
12 hours	**0.0023**	**94**	**23 hours and 30 minutes**	**0.41**
24 hours	0.0014	79	21 hours and 0 minutes	0.37
48 hours	0.0008	34	11 hours and 20 minutes	0.23
72 hours	0.0006	12	4 hours and 0 minutes	0.12

Total storage required: 22.8m^3 **Total storage provided: 23.47m^3**
Half empty time: 8 hours and 10 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block D Roof D2

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		137 m^2	*As supplied by Client*
Storage area:		134 m^2	*As supplied by Client*
Maximum allowable runoff:		0.19 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	8 hours and 30 minutes	0.10
10 mins	0.0436	30	11 hours and 0 minutes	0.12
15 mins	0.0343	34	12 hours and 20 minutes	0.13
30 mins	0.0211	41	14 hours and 10 minutes	0.14
1 hour	0.0131	49	16 hours and 0 minutes	0.15
2 hours	0.0081	57	18 hours and 0 minutes	0.17
4 hours	0.0050	65	19 hours and 30 minutes	0.18
6 hours	**0.0038**	**68**	**20 hours and 0 minutes**	**0.18**
12 hours	0.0023	67	20 hours and 0 minutes	0.18
24 hours	0.0014	53	17 hours and 0 minutes	0.16
48 hours	0.0008	20	7 hours and 40 minutes	0.09
72 hours	0.0006	6	1 hour and 30 minutes	0.04

Total storage required: 9.1m³ **Total storage provided: 15.27m³**
Half empty time: 2 hours and 10 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block F Roof F1

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 108mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		432 m^2	*As supplied by Client*
Storage area:		301 m^2	*As supplied by Client*
Maximum allowable runoff:		0.55 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 108mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	29	9 hours and 40 minutes	0.28
10 mins	0.0436	40	12 hours and 30 minutes	0.34
15 mins	0.0343	46	14 hours and 0 minutes	0.37
30 mins	0.0211	56	16 hours and 0 minutes	0.41
1 hour	0.0131	67	18 hours and 0 minutes	0.45
2 hours	0.0081	79	20 hours and 10 minutes	0.49
4 hours	0.0050	90	22 hours and 0 minutes	0.53
6 hours	0.0038	95	22 hours and 40 minutes	0.54
12 hours	**0.0023**	**95**	**22 hours and 40 minutes**	**0.54**
24 hours	0.0014	79	20 hours and 0 minutes	0.49
48 hours	0.0008	31	10 hours and 20 minutes	0.30
72 hours	0.0006	10	3 hours and 10 minutes	0.14

Total storage required: 28.8m³ **Total storage provided: 29.19m³**
Half empty time: 8 hours and 0 minutes.

Notes:

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BLUE ROOF PRELIMINARY DESIGN

Sandford Road, Dublin - Block F Roof F2

Prepared for:	DBFL		
ABG Project ID:		Calculator version:	1.21
Issue status:	PRELIMINARY	Revision:	1.03
Designed by:	MH	Checked by:	
Design date:	27/11/2025	Check date:	

Brief:

Catchment area, attenuation area, location and rainfall data taken from "190226 - Final Areas 26.11.25" spreadsheet, PDF drawings and blueroof design information form completed and emailed by Susan.Mwaniki@dbfl.ie on 26/11/2025.
2 blueroof attenuation chambers required. Design to limit discharge to lowest possible using 129mm system.

Technical

Input Parameters - Rainfall Information (Custom)			
Return period:		100 years	*As supplied by Client*
Allowance for Climate Change:		20 %	*As supplied by Client*
Rainfall Data Source:		Met Éireann	*Assumed*
Rainfall Data Location:	Easting: 317107	Northing: 231255	*Irish Grid*

Input Parameters - Roof Information			
Catchment area:		374 m^2	*As supplied by Client*
Storage area:		370 m^2	*As supplied by Client*
Maximum allowable runoff:		0.32 l/s	*As supplied by Client*
Blue roof system:	ABG blueroof VF HD 129mm		*Proposed*

Output - Rainfall Calculation

Duration	Rainfall (l/s/m^2)	Storage Required (l/m^2)	Time to Empty	Restricted Outflow (l/s)
5 mins	0.0628	22	13 hours and 50 minutes	0.15
10 mins	0.0436	30	18 hours and 20 minutes	0.18
15 mins	0.0343	34	20 hours and 40 minutes	0.20
30 mins	0.0211	42	24 hours and 0 minutes	0.22
1 hour	0.0131	50	27 hours and 40 minutes	0.24
2 hours	0.0081	60	31 hours and 20 minutes	0.26
4 hours	0.0050	70	35 hours and 0 minutes	0.29
6 hours	0.0038	75	36 hours and 50 minutes	0.30
12 hours	**0.0023**	**82**	**39 hours and 10 minutes**	**0.31**
24 hours	0.0014	81	38 hours and 40 minutes	0.31
48 hours	0.0008	53	29 hours and 0 minutes	0.25
72 hours	0.0006	34	20 hours and 10 minutes	0.19

Total storage required: 30.4m³ **Total storage provided: 42.18m³**
Half empty time: 8 hours and 20 minutes.

Notes:

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Appendix H : Surface Water Outfall Calculations

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	181.175	3.030	59.8	0.350	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.78	16.060	0.350	0.0	0.0	9.5	1.69	67.4	56.9

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.000	2	15.410	13.030	0.000	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	20.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.600	Storm Duration (mins)	30
Ratio R	0.278		

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	181.175	3.030	59.8	0.350	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.78	16.060	0.350	0.0	0.0	9.5	1.69	67.4	56.9

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.000	2	15.410	13.030	0.000	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	20.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.600	Storm Duration (mins)	30
Ratio R	0.278		

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for SW_1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
P1.000	29.654	0.131	226.4	0.000	4.00	9.1	0.600	o	300	Pipe/Conduit	
P1.001	29.869	0.121	246.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
P1.002	20.136	0.082	245.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
P1.003	24.969	0.101	247.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
P1.004	34.840	0.141	247.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
P1.005	36.693	0.147	249.6	0.055	0.00	0.0	0.600	o	300	Pipe/Conduit	
P1.006	38.349	0.153	250.6	0.031	0.00	0.0	0.600	o	300	Pipe/Conduit	
P1.007	85.930	0.341	252.0	0.067	0.00	0.0	0.600	o	300	Pipe/Conduit	
P1.008	20.041	0.340	58.9	0.017	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
P1.000	50.00	4.47	15.454	0.000	9.1	0.0	1.8	1.04	73.6	10.9
P1.001	50.00	4.97	15.323	0.000	9.1	0.0	1.8	1.00	70.4	10.9
P1.002	50.00	5.31	15.202	0.000	9.1	0.0	1.8	1.00	70.6	10.9
P1.003	50.00	5.73	15.120	0.000	9.1	0.0	1.8	1.00	70.4	10.9
P1.004	50.00	6.31	14.150	0.000	9.1	0.0	1.8	1.00	70.4	10.9
P1.005	50.00	6.93	14.009	0.055	9.1	0.0	3.3	0.99	70.0	19.8
P1.006	50.00	7.58	13.862	0.086	9.1	0.0	4.2	0.99	69.9	24.9
P1.007	48.96	9.03	13.709	0.153	9.1	0.0	5.9	0.99	69.7	35.3
P1.008	48.56	9.19	13.369	0.171	9.1	0.0	6.3	2.05	145.0	37.8

PIPELINE SCHEDULES for SW_1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
P1.000	o	300	S8	19.024	15.454	3.270	Open Manhole	1200
P1.001	o	300	S7	18.716	15.323	3.093	Open Manhole	1200
P1.002	o	300	S6	18.520	15.202	3.018	Open Manhole	1200
P1.003	o	300	S5	18.314	15.120	2.894	Open Manhole	1200
P1.004	o	300	S4	18.333	14.150	3.883	Open Manhole	1200
P1.005	o	300	S3	17.613	14.009	3.304	Open Manhole	1200
P1.006	o	300	S2	17.148	13.862	2.986	Open Manhole	1200
P1.007	o	300	S1	16.665	13.709	2.656	Open Manhole	1200
P1.008	o	300	S0	15.655	13.369	1.986	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
P1.000	29.654	226.4	S7	18.716	15.323	3.093	Open Manhole	1200
P1.001	29.869	246.9	S6	18.520	15.202	3.018	Open Manhole	1200
P1.002	20.136	245.6	S5	18.314	15.120	2.894	Open Manhole	1200
P1.003	24.969	247.2	S4	18.333	15.019	3.014	Open Manhole	1200
P1.004	34.840	247.1	S3	17.613	14.009	3.304	Open Manhole	1200
P1.005	36.693	249.6	S2	17.148	13.862	2.986	Open Manhole	1200
P1.006	38.349	250.6	S1	16.665	13.709	2.656	Open Manhole	1200
P1.007	85.930	252.0	S0	15.655	13.368	1.987	Open Manhole	1200
P1.008	20.041	58.9		15.410	13.029	2.081	Open Manhole	300

Free Flowing Outfall Details for SW_1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
P1.008		15.410	13.029	0.000	300	0

Simulation Criteria for SW_1

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	20.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0	Number of Offline Controls 0	Number of Time/Area Diagrams 0
Number of Online Controls 0	Number of Storage Structures 0	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	5	Cv (Summer)	1.000
Region	Scotland and Ireland	Cv (Winter)	1.000
M5-60 (mm)	16.600	Storm Duration (mins)	30
Ratio R	0.278		