

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

VOLUME III TECHNICAL APPENDICES A-C



PROPOSED RESIDENTIAL DEVELOPMENT
AT
Folkstown, Balbriggan, Co. Dublin
Prepared by



In Conjunction with
Doran Cray Architects, Paul McGrail Consulting Engineers, Openfield Ecology, AWN, ENX Consulting
Engineers, IAC Archaeology, Modelworks

July 2024

DOCUMENT CONTROL SHEET

RECEIVED: 06/08/2024

Client:	Marshall Yards Development Company Limited
Project Title:	Ladywell Phase 4 Balbriggan
Document Title:	Environmental Impact Assessment Report Volume III
Document No:	23146EIARVol3

Rev.	Status	Author(s)	Reviewed By	Approved By	Issue Date
D01	Draft	EIAR TEAM	RK	RK	20-6-2024
F01	Final	EIAR TEAM	RK	RK	26-7-2024

LIST OF APPENDICES

RECEIVED: 06/08/2024

Appendix A – Archaeology and Cultural Heritage

Geophysical Report

Archaeological Testing Report

Appendix B – Other Assessments

Other Assessments

Appendix C – Soil and Land take

Appendix 5.1 Ground Investigations Ireland Taylor Hill, Balbriggan Phase 3 Site Investigation Report, June 2020, Rev B

Appendix 5.2 List of Soils Generic Assessment Criteria (GAC)

Appendix 5.2 GII Site Investigations June 2024

Appendix D Construction Environmental Management Plan (CEMP)

Appendix D Paul McGrail Consulting Engineers CEMP

Appendix E Material Assets – Waste Management

Resource and Waste Management Plan (RWMP)

Operational Waste Management Plan (OWMP)

Appendix F Material Assets – Traffic and Transportation

Transport Insights LRD TTA Briefing Note

Transport Insights LRD Pre Application Consultation Feedback

Appendix G – Photomontages

Modelworks Photomontages

APPENDIX - A ARCHAEOLOGICAL AND CULTURAL HERITAGE

RECEIVED: 06/08/2024

Appendix 14.1 Geophysical Report

RECEIVED: 06/08/2024

RECEIVED: 06/08/2024

GEOPHYSICAL SURVEY REPORT

Clogheder,
Balbriggan,
County Dublin

Licence Number: 24R0031

Date:
29/01/2024

J. M. Leigh Surveys Ltd.
124 Oaklawn West
Leixlip
County Kildare
www.jmlsurveys.com
01 615 4647



•
•
•
•
•
•

J. M. Leigh Surveys Ltd.
124 Oaklawn West,
Leixlip, Co. Kildare
Tel: 01 615 4647
Mobile: 0879062729
www.jmlsurveys.com

RECEIVED: 06/01/2024

GEOPHYSICAL SURVEY SUMMARY SHEET
CLOGHEDER, BALBRIGGAN, COUNTY DUBLIN

Site Name	Clogheder, Balbriggan, County Dublin	JML Ref No.	24005
Townland	Clogheder	Licence No.	24R0031
County	County Dublin	Licence Holder	Joanna Leigh
ITM (centre)	E718570, N763230	Purpose	Pre-planning Investigation
Client	IAC Ltd.	Reference No.	NA

Ground Conditions The application area is contained within a single level pasture field. Ground conditions were good at the time of survey.

Survey Type Detailed gradiometer survey totalling c.2 hectares.

Summary of Results

In the northwest of the application area there are a series of irregular shaped responses. Although these have no clear pattern, a curvilinear ditch-type response appears to extend from them, and run south through the field. Although interpretation is unclear, these responses must be considered to be of archaeological potential.

Elsewhere in the data there are three distinct areas of increased magnetic response, spaced 30m apart. These responses are indicative of burnt spreads and are of archaeological potential. The eastern most response has a heightened magnetic signature, perhaps suggesting the remains of a burnt feature or more intense burning activity.

A fourth possible burnt spread may be located along the eastern field boundary. However, interpretation is cautious due to magnetic disturbance here from the boundary fence.

Fieldwork Date 24th January 2024

Report Date 29/01/2024

Report Author Joanna Leigh



RECEIVED: 06/08/2024

Consent to use a Detection Device
National Monuments Acts (1930-2004)

Consent Number	24R0031
Application having been duly made to me by	Joanna Leigh
Of	J.M. Leigh Surveys Ltd 124 Oaklawn West Leixlip, Co. Kildare
For a consent to use a specified detection device	Bartington GRAD601 Dual Sensor
at the site known/located at	Co. Dublin Balbriggan Clogheder
Being part of the townland of	Clogheder
In or under the portion of land/land underwater owned by	Glenveagh Homes
Of	Block C, Maynooth Business Campus Straffan Road, Moneycooly Maynooth Co. Kildare
In county of	Dublin

The Minister for Housing, Local Government and Heritage, in accordance with the conditions of Section 2 of the National Monuments (Amendment) Act, 1987, as amended, and subject to the conditions overleaf, does hereby issue his consent, to the applicant, to carry out the specified works and to use a detection device, for the purpose specified.

Duration of Consent: 22/02/2024 to 21/03/2024

Signed:

Date: 28/12/2023

Contents

1. Introduction	1
2. Survey ground conditions and further information	1
3. Survey Methodology	2
4. Data Display	2
5. Survey Results	3
6. Conclusion	5
7. Technical Information	6

RECEIVED: 06/08/2024

Clogheder, Balbriggan, County Dublin

RECEIVED: 06/02/2024

1 Introduction

- 1.1 A geophysical survey has been conducted by J. M. Leigh Surveys Ltd. at a site in the townland of Clogheder, Balbriggan, County Dublin. This survey forms part of a wider archaeological study by IAC Ltd, for a pre-planning site investigation on behalf of Glenveagh Homes.
- 1.2 The application area is contained within a single pasture field to the west of Balbriggan. The R122 Clonard Road is to the immediate south of the application area, with the L1130 to the immediate west. Figure 1 presents the site and survey location at a scale of 1:2,000.
- 1.3 There are no recorded monuments within the application area. An excavation (RMP DU005-117) is recorded 450m to the south-east. The excavation (Licence no. 08E0106), in advance of road construction identified the remains of a ditch (0.7m width) that extended for 32m NE-SW. A pit was associated with the ditch. Both contained charcoal rich fills with heat-cracked stones and were interpreted as Bronze Age in date (Clarke and Linnane 2008, archaeology.ie).
- 1.4 The main aim of the survey was to identify any geophysical responses that may represent unknown archaeological features within the application area. A detailed gradiometer survey was conducted under licence 24R0031, issued by the Department of Housing, Local Government and Heritage.

2 Survey ground conditions and further information

- 2.1 The application area is contained within a level pasture field. Ground conditions were good at the time of survey.
- 2.2 At the eastern extent of the field there is a broken post and wire fence and fallen metal gate. This has produced some localized magnetic disturbance but has not affected the overall interpretation of the results.
- 2.3 Some electricity poles in the west of the application area produced isolated ferrous responses. There is also a high metal fence and gate, located along the southern boundary which resulted in some localized magnetic disturbance.

3 Survey Methodology

- 3.1 A detailed gradiometer survey detects subtle variations in the local magnetic field and measurements are recorded in nano-Tesla (nT). Some archaeological features such as ditches, large pits and fired features have an enhanced magnetic signal and can be detected through recorded survey.
- 3.2 Data was collected with a Bartington Grad 601-2 instrument. This is a specifically designed gradiometer for use in archaeological prospection. The gradiometer operates with a dual sensor capacity making survey fast and effective.
- 3.3 The instrument is calibrated in the field to ensure a constant high quality of data. Extremely sensitive, these instruments can detect variations in soil magnetism to 0.01nT, affording diverse application throughout a variety of archaeological, soil morphological and geological conditions.
- 3.4 All data was collected in 'zigzag' traverses. Grid orientation was positioned to facilitate data collection and remained constant throughout the survey. Data was collected with a sample interval of 0.25m and a traverse interval of 1m. The survey grid was set out using a GPS VRS unit. Survey tie-in information is available upon request.

4 Data display

- 4.1 A summary greyscale image is presented in Figure 2, at a scale of 1:1,250. An accompanying interpretation diagram is presented in Figure 3, also at a scale of 1:1,250.
- 4.2 Numbers in parentheses in the text refer to specific responses highlighted in the interpretation diagram (Figure 3).
- 4.3 Isolated ferrous responses in the gradiometer data highlighted in the interpretation diagram most likely represent modern ferrous litter and debris and are not of archaeological interest. These are not discussed in the text unless considered relevant.
- 4.4 The raw gradiometer data is presented in archive format in Appendix A1.01. The raw data is displayed as a greyscale image and xy-trace plot, both at a scale of 1:500. The archive plots are used to aid interpretation of the results and are for reference only. These are available as PDF images upon request.

- 4.5 The display formats referred to above and the interpretation categories are discussed in the summary technical information section at the end of this report.

5 Survey Results (Figure 3)

- 5.1 In the northwest corner of the data set, there are several responses (1) which form an amorphous pattern. There are several ferrous responses within this and (1) may represent more recent ground disturbance. However, it is equally possible that ephemeral or plough damaged archaeological remains are located here. A curvilinear response (2) appears to extend from (1) to the south and is typical of an archaeological ditched feature. Although no clear archaeological pattern is evident, the responses (1) and (2) must be considered to be of archaeological potential.
- 5.2 Several isolated responses (3) are to the east of (1). These have no clear pattern but have a magnetic signature typical of large archaeological pits. It is speculated that these may be associated with (1) and are also considered to be of archaeological potential.
- 5.3 Several faint linear trends (4) are evident in the data. Archaeological potential is unclear as these responses may equally represent more recent agricultural activity. However, an archaeological interpretation must be considered. It is possible that the plough damaged remains of archaeological ditches are represented here. This interpretation is cautious.
- 5.4 In the centre of the data set there are a cluster of responses (5) within an area of increased magnetic response. This is typical of a spread of burnt material and is of potential archaeological interest.
- 5.5 To the south of (5) are faint linear trends (6). These are at the limits of instrument detection, but it is possible that a small rectilinear feature, measuring c.9m x 7.5m, is located here. This interpretation is tentative as the trends are barely discernible in the data.
- 5.6 Another series of responses within an area of increased magnetic response (7) is c.30m to the east of (5). This is similar in form to (5) and may represent another spread of burnt material. A further 30m to the east of (7) is another cluster of responses within an area of increased response (8). The responses (8) have a heightened magnetic signature, stronger than those of (7) or (5). This suggests significant burning has occurred, or the remains of a burnt feature are located here.

- 5.7 Another cluster of responses (9) is at the eastern field boundary. Interpretation is less clear as (9) may merely reflect modern disturbance along the field boundary. However, an archaeological interpretation must be considered. It is possible that another spread of burnt material is represented here.
- 5.8 Magnetic disturbance (10) in the southeast of the data results from a broken post and wire fence and a fallen metal gate.
- 5.9 The magnetic disturbance (11) extending along the south of the data results from the adjacent boundary metal fence.

6 Conclusion

- 6.1 The gradiometer survey has successfully identified responses of archaeological potential.
- 6.2 In the northwest of the data there are responses indicative of archaeological activity. There is no clear shape or form but a curvilinear ditch-type response appears to extend to the south. Although interpretation is cautious, these responses must be considered to be of archaeological potential.
- 6.3 Running along the northern extent of the application area are three distinct areas of increased magnetic response with associated isolated responses. These are suggestive of burning activity and appear to be 30m apart from one another. It is speculated that three burnt spreads are represented here. The eastern most spread appears to have a heightened magnetic signature and it is possible that a burnt feature, or more intense burning is represented here.
- 6.4 A final area of increased response is recorded at the easternmost field boundary. Interpretation of this is cautious as it may result from more recent activity along the field boundary. Nevertheless, it is possible that a fourth spread of burnt material has been identified.
- 6.5 Consultation with a licensed archaeologist and with the Department of Housing, Local Government and Heritage is recommended to establish if any additional archaeological works are required.

7 Technical Information Section

Instrumentation & Methodology

Detailed Gradiometer Survey

Detailed gradiometer survey can either be targeted across a specific area of interest or conducted as a blanket survey across an entire application area, often as a standalone methodology.

Sampling methodologies can vary but a typical survey is conducted with a sample interval of 0.25m and a traverse interval of 1m. This allows detection of potential archaeological responses. Data is collected in grids measuring 40m x 40m, with the data displayed accordingly. A more detailed survey methodology may be applied where archaeological remains are thought likely. This can sometimes produce results with a more detailed resolution. A survey with a grid size of 20m x 20m and a traverse interval of 0.5m will provide a data set with high resolution.



Bartington GRAD 601-2

The Bartington Grad 601-2 instrument is a specifically designed gradiometer for use in archaeological prospection. The gradiometer operates with a dual sensor capacity making survey very fast and effective. The sensors have a separation of 1m allowing greater sensitivity.

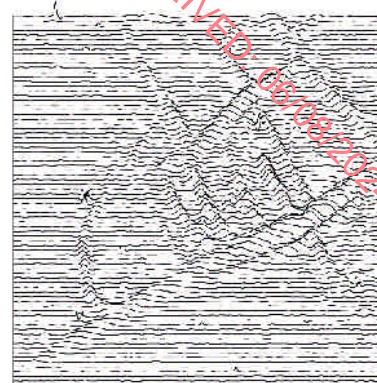


Frequent realignment of the instruments and zero drift correction ensure a constant high quality of data. Extremely sensitive, these instruments can detect variations in soil magnetism to 0.1nT, affording diverse application throughout a variety of archaeological, soil morphological and geological conditions.

Gradiometer Data Display & Presentation

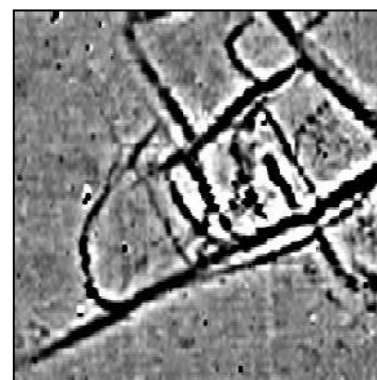
XY Trace

The data are presented as a series of linear traces, enabling a semi-profile display of the respective anomalies along the X and Y-axes. This display option is essential for distinguishing between modern ferrous materials (buried metal debris) and potential archaeological responses. The XY trace plot provides a linear display of the magnitude of the response within a given data set.



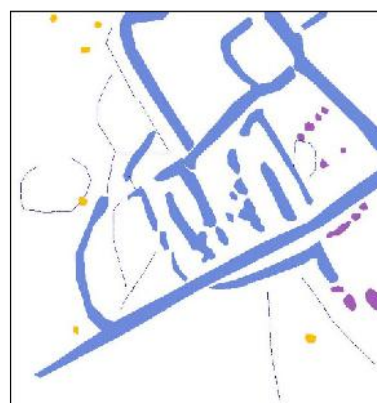
Greyscale*

As with dot density plots, the greyscale format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within the given data set. This display method also enables the identification of discrete responses that may be at the limits of instrument detection. In the summary diagrams processed, interpolated data is presented. Raw un-interpolated data is presented in the archive drawings along with the xy-trace plots.



Interpretation

An interpretation of the data is made using many of the plots presented in the final report, in addition to examination of the raw and processed data. The project managers' knowledge and experience allow a detailed interpretation of the survey results with respect to archaeological potential.



**XY Trace and raw greyscale plots are presented in archive form for display of the raw survey data. Summary greyscale images of the interpolated data are included for presentation purposes and to assist interpretation. The archive plots are provided as PDF images upon request.*

Glossary of Interpretation Terms

Categories of responses may vary for different data sets. The list below are the most used categories for describing geophysical responses, as presented in the summary interpretation diagrams.

Archaeology

This category refers to responses which are interpreted as of clear archaeological potential and are supported by further archaeological evidence such as aerial photography or excavation. The term is generally associated with significant concentrations of former settlement, such as ditched enclosures, pits, and associated features.

? Archaeology

This term corresponds to anomalies that display typical archaeological patterns where no record of comparative archaeological evidence is available. In some cases, it may prove difficult to distinguish between these and evidence of more recent activity also visible in the data.

Area of Increased Magnetic Response

These responses often lack any distinctive archaeological form, and it is therefore difficult to assign any specific interpretation. The resulting responses are site specific, possibly associated with concentrations of archaeological debris or more recent disturbance to underlying archaeological features.

Trend

This category refers to low-level magnetic responses barely visible above the magnetic background of the soil. Interpretation is tentative, as these anomalies are often at the limits of instrument detection.

Ploughing/Ridge & Furrow

Visible as a series of linear responses, these anomalies equate with recent or archaeological cultivation activity.

? Natural

A broad response resulting from localised natural variations in the magnetic background of the subsoil; presenting as broad amorphous responses most likely resulting from geological features.

Ferrous Response

These anomalies exhibit a typically strong magnetic response, often referred to as 'iron spikes,' and are the result of modern metal debris located within the topsoil.

Area of Magnetic Disturbance

This term refers to large-scale magnetic interference from existing services or structures. The extent of this interference may in some cases obscure anomalies of potential archaeological interest.

Bibliography

European Archaeological Council (EAC) (2016) '*Guidelines for the use of Geophysics in Archaeology*' by Armin Schmidt, Paul Linford, Neil Linford, Andrew David, Chris Gaffney, Apostolos Sarris, and Jörg Fassbinder.

English Heritage (2008) '*Geophysical guidelines: Geophysical Survey in Archaeological Field Evaluation*.' Second Edition.

Gaffney, C. Gater, J. & Ovenden, S. (2006) '*The use of Geophysical Techniques in Archaeological Evaluations*.' IFA Paper No. 6.

Gaffney, C & Gater, J (2003). '*Revealing the buried past: Geophysics for Archaeologists*.' Tempus Publishing Limited.

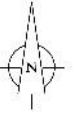
National Soil Survey of Ireland (1980) *General soil map second edition (1:575,000)*. An Foras Taluntais.

List of Figures

Figure	Description	Scale
Figure 1	Site & Survey Location Diagram	1:2,000
Figure 2	Summary Greyscale Image	1:1,250
Figure 3	Summary Interpretation Diagram	1:1,250

Archive Data Supplied as a PDF Upon Request

A1.01	Raw data XY-Trace plot & greyscale image	1:500
-------	--	-------



RECEIVED: 06/08/2024



Application Area



Detailed
Gradiometer Survey

0 metres 80

Client:

IAC Ltd.

Project:

Geophysical Survey
Clogheder, Balbriggan,
County Dublin

Title:

Site & Survey Location

 J.M. Leigh
Surveys Ltd.
www.jmlsurveys.com

Scale @ A4: 1:2,000
Figure: 1
Licence No.: 24R0031
Issue Date: 29.01.2024

RECEIVED: 06/08/2024



0 50 metres



Client:

IAC Ltd.

Project:

Geophysical Survey
Clogheder, Balbriggan,
County Dublin

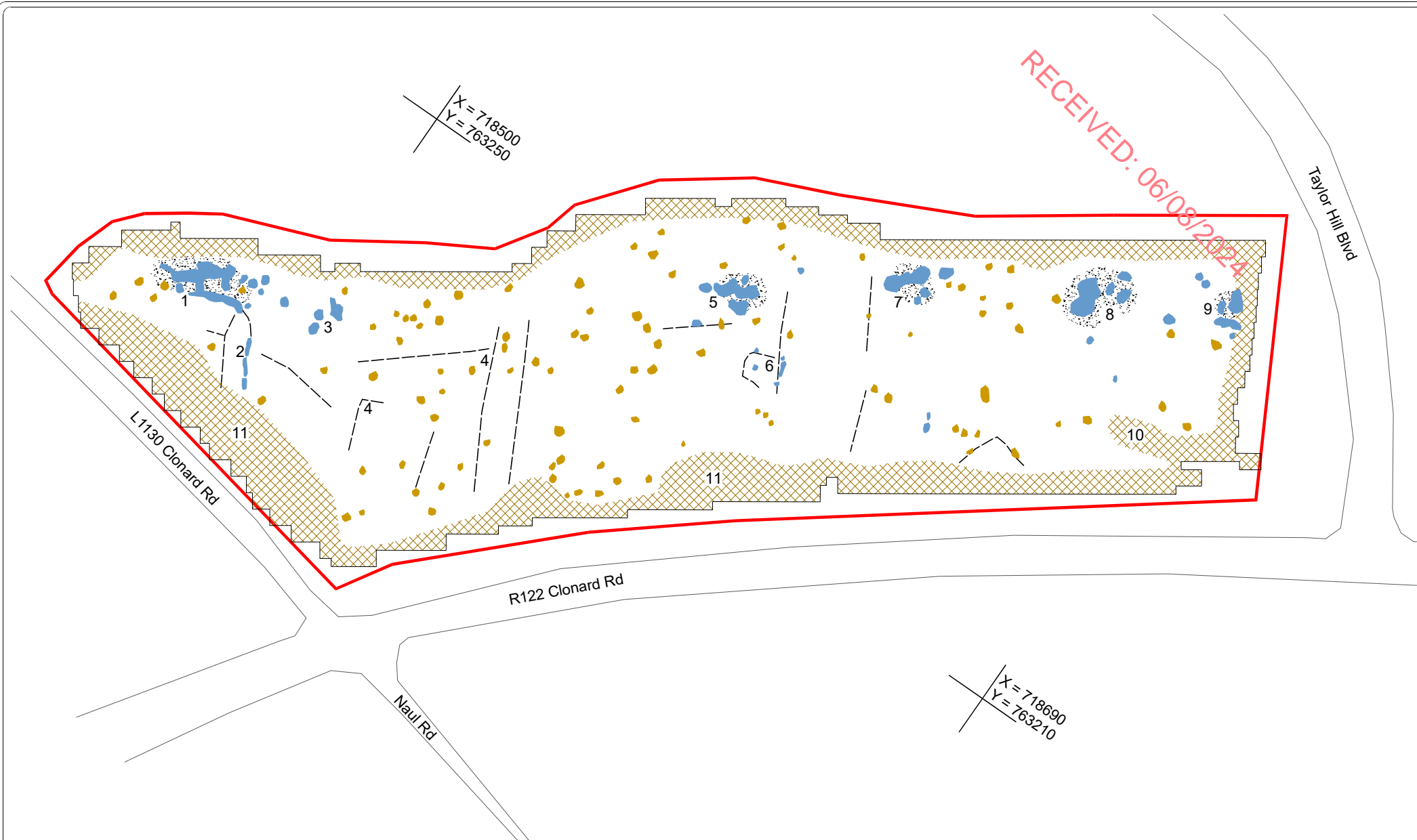
Title:

Summary Greyscale Image

 **J.M. Leigh
Surveys Ltd.**
www.jmlsurveys.com

Scale @ A4: 1:1,250
Figure: 2
Licence No.: 24R0031
Issue Date: 29.01.2024

RECEIVED: 06/08/2024



0 metres 50



Client:

IAC Ltd.

Project:

Geophysical Survey
Clogheder, Balbriggan,
County Dublin

Title:

Summary Interpretation

 **J.M. Leigh
Surveys Ltd.**
www.jmlsurveys.com

Scale @ A4: 1:1,250
Figure: 3
Licence No.: 24R0031
Issue Date: 29.01.2024

Appendix 14.2 Archaeology Testing Report

RECEIVED: 06/08/2024

RECEIVED: 06/08/2024

**ARCHAEOLOGICAL ASSESSMENT
AT
CLOGHEDER AND CLONARD OR FOLKSTOWN
GREAT,
COUNTY DUBLIN
(PHASE 4, LADYWELL, BALBRIGGAN)**

LICENCE NUMBER: 24E0590

ON BEHALF OF: GLENVEAGH HOMES LTD

ITM: 718582,763227

LICENCEE: JANE WHITAKER

REPORT STATUS: FINAL

JULY 2024

IAC PROJECT REF.: J4135.1

DOCUMENT CONTROL SHEET

DATE	DOCUMENT TITLE	REV.	PREPARED BY	REVIEWED BY	APPROVED BY
25.07.24	Archaeological Assessment at Clogheder and Clonard or Folkstown Great, Balbriggan, Co Dublin	0	J. Whitaker	F. Bailey	F. Bailey

RECEIVED: 08/08/2024

ABSTRACT

IAC Archaeology has prepared this report on behalf of Glenveagh Homes Ltd, to study the impact, if any, on the archaeological and historical resource of a proposed residential development, which is located at Clogheder and Clonard or Folkstown Great, Balbriggan, Co Dublin (ITM 718582,763227; OS Sheet DU002). The assessment was carried out by Jane Whitaker of IAC Archaeology under licence 24E0590. Test trenching has been carried out to inform an Environmental Impact Assessment Report for the proposed development and follows on from a programme of geophysical survey (Leigh 2024, Licence 24R0031).

Archaeological testing was carried out over the course of three days from 17th June 2024 using a mechanical excavator fitted with a flat grading bucket. The trenches targeted geophysical anomalies and open green space in order to fully investigate the archaeological potential of the site. Testing revealed four areas of archaeological significance, which have been designated as Archaeological Areas 1-4. These comprised evidence for probable Bronze Age burnt mound activity along the northwestern boundary of the field, in close proximity to an existing watercourse.

Due to the layout requirements for the proposed development, including access roads, services and residential units (along with the provision of a green corridor for the existing stream) it is not possible to preserve the archaeological remains in-situ. As such ground disturbances associated with the development will result in a direct, negative and permanent impact on AA1-4. Prior to the application of mitigation, the significance of effect is predicted to be very significant.

It is acknowledged that preservation in-situ of archaeological remains is the preferred method in which to conserve the archaeological resource. However, due to the requirements of the proposed development, this is not possible. Therefore, prior to the commencement of construction, the four archaeological areas will be subject to preservation by record (archaeological excavation). This will be carried out by an archaeologist under licence from the DoHLGH.

It is possible that small or isolated archaeological features survive beneath the current ground level outside of the footprint of the excavated test trenches. Ground disturbances associated with the development may result in a direct, negative and permanent impact on any such remains. Prior to the application of mitigation, the significance of effect may vary from moderate to very significant. This is dependent on the nature, extent and significance of any remains that may be identified.

All topsoil stripping associated with the proposed development be monitored by a suitably qualified archaeologist. If any features of archaeological potential are discovered during the course of the works further archaeological mitigation may be required, such as preservation in-situ or by record. Any further mitigation will require approval from the National Monuments Service of the DoHLGH.

CONTENTS

ABSTRACT.....	I
CONTENTS.....	II
List of Figures.....	iii
List of Plates	iii
1 INTRODUCTION.....	1
1.1 General	1
1.2 The Development	1
2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND	2
2.1 Introduction.....	2
2.2 Summary of Previous Archaeological Fieldwork.....	7
2.3 Cartographic Analysis	8
2.4 Summary of Geophysical Results.....	9
2.5 Aerial Photographic Analysis	9
2.6 Topographical Files	9
3 ARCHAEOLOGICAL TESTING	10
3.1 General	10
3.2 Testing Results.....	10
3.3 Conclusions.....	12
4 IMPACT ASSESSMENT AND MITIGATION MEASURES	13
4.1 Impact Assessment.....	13
4.2 Mitigation	13
5 REFERENCES	15
APPENDICES	I
Appendix 1 Contexts	i
Appendix 2 SMR/RMP Sites within 200m	ii
Appendix 3 Legislation Protecting the archaeological Resource	iv
Appendix 4 Impact Assessment & the Cultural Heritage Resource	ix
Appendix 6 Mitigation Measures & the Cultural Heritage Resource	xi

FIGURES

PLATES

LIST OF FIGURES

- Figure 1 Site Location showing nearby recorded monuments
Figure 2 Plan of the proposed development
Figure 3 Proposed development boundary overlaying previous Testing (Licence No. 07E0057) and Geophysical Survey results (Licence No. 05R0137)
Figure 4 Extracts from Ordnance Survey Maps (1843 and 1909) showing the proposed development area
Figure 5 Interpretation of geophysical survey results (Licence No. 24R0031) within the proposed development area
Figure 6 Plan of excavated test trenches
Figure 7 Detailed plans of Archaeological Areas (AA) 1-4

LIST OF PLATES

- Plate 1 Trench 3, facing northeast, C3.2 in foreground
Plate 2 Possible Trough C3.1, facing northeast
Plate 3 Trench 4, facing southwest
Plate 4 Trench 7, Pit C7.1 facing north
Plate 5 Trench 9, facing northwest
Plate 6 Trench 11, facing north
Plate 7 Trench 13, facing north
Plate 8 Trench 14, facing north Spread C14.1
Plate 9 Trench 18, facing north-northeast, Ditch C18.1
Plate 10 Trench 19, facing west-southwest
Plate 11 Trench 20, facing north-northwest, Spread C20.1
Plate 12 Trench 21, facing east-northeast
Plate 13 Trench 23, facing northeast
Plate 14 Trench 24 facing southeast
Plate 15 Spread 24.1 facing southeast
Plate 16 Trench 25, facing northeast
Plate 17 Trench 27, facing south-southeast
Plate 18 C27.1 Trough facing south-southeast
Plate 19 C27.2 Spread facing south-southeast
Plate 20 Trench 28 facing northeast

1 INTRODUCTION

1.1 GENERAL

The following report details the results of a programme of archaeological testing undertaken within the southern portion of a proposed development (Figure 1). The assessment has been carried out to ascertain the potential impact of the proposed development on the archaeological resource that may exist within the site. The remainder of the proposed development was subject to previous archaeological investigations. The assessment has been carried out by Jane Whitaker of IAC Archaeology (IAC), on behalf of Glenveagh Homes Ltd, under licence 24E0590, as issued by the National Monuments Service of the Department of Housing, Local Government and Heritage (DoHLGH).

Test trenching commenced at the site on 17th June 2024 and continued for three days. This was carried out using a 13 tonne 360 degree tracked excavator, with a flat, toothless bucket, under strict archaeological supervision. A total of 26 trenches were mechanically investigated across the test area which measured c. 640 linear metres in total. The testing assessment follows a programme of geophysical survey carried out within the area by Joanna Leigh, under licence 24R0031.

1.2 THE DEVELOPMENT

The proposed development will consist of the construction of 197 no. dwellings along with 1 no. retail/café unit and 1 no. retail/medical unit consisting of 129 no. houses, 18 no. townhouses, 16 no. duplex dwellings, 4 no. apartments, 12 no. maisonette apartments and 18 no. later living dwellings all on a 3 parcel site of c. 7.15 hectares. access, infrastructure, car parking, open space, boundary treatments and all associated site development works (Figure 2).

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 INTRODUCTION

The proposed development area is located within the townlands of Cloghader and Clonard or Folkstown Great, Parish of Balrothery and Barony of Balrothery East, County Dublin (Figure 1). It is situated c. 1.5km west of the centre of Balbriggan and located within lands that are zoned for residential development within the Fingal County Development Plan (2023-2029).

There are no recorded monuments located within the proposed development area. The closest recorded monument comprises the site of a pit (RMP DU001-029) recorded c. 23m to the southeast of the northern site. An enclosure is located c. 115m to the west (RMP DU001-027). This assessment focuses on the southern portion of the proposed development, where limited investigations have been carried out in the past. The remainder of the site has been previously assessed, as shown in Figure 3 and described below.

3.1.1 Prehistoric Period

Mesolithic Period (c. 8000–4000 BC)

Recent discoveries may suggest the possibility of a human presence in the southwest of Ireland as early as the Upper Palaeolithic (Dowd and Carden 2016); however, the Mesolithic period is the earliest time for which there is clear evidence for prehistoric human colonisation of the island of Ireland. During this period people hunted, foraged and gathered food and appear to have led a primarily mobile lifestyle. The presence of Mesolithic communities is most commonly evidenced by scatters of worked flint material, a by-product of the production of flint implements.

The eastern seaboard of Ireland has long been associated with prehistoric settlement. This area was intensively and repeatedly settled during this period. Clonard or Folkstown Great contains sites from the Mesolithic through to the Bronze Age and the medieval period. A Mesolithic pathway was identified during excavation in advance of a school development (Bennett 2016:150, Licence No. 15E0586), c. 113m to the north of the southern portion of the proposed development area.

Neolithic Period (c. 4000–2500 BC)

During this period communities became less mobile and their economy became based on the rearing of stock and cereal cultivation. The transition to the Neolithic was marked by major social change. Communities had expanded and moved further inland to more permanent settlements. This afforded the development of agriculture which demanded an altering of the physical landscape. Forests were rapidly cleared and field boundaries were constructed. Pottery was also being produced, possibly for the first time. The advent of the Neolithic period also provided the megalithic tomb. There are four types of tomb in Ireland, namely the Court Cairn, Portal, Passage and Wedge; of which the latter style straddles the Neolithic to Bronze Age transition.

A Neolithic cremation pit was uncovered during testing and excavations (Bennett 2018:822, Licence No. 18E0238), c. 36m to the northeast of the northern portion of the proposed development area. Linear enclosing ditches and evidence of Neolithic activity in the form of a curvilinear channel and the burnt remnants of a possible hearth were also revealed. Evidence for Neolithic habitation (DU001-014) was identified c. 243m northeast of the northern portion of the site at Flemington. Here a substantial assemblage of early Neolithic pottery was recovered (Bolger 2009, 25). Within the wider area, a passage tomb cemetery (DU002-001001-5) is located at Bremore to the north of Balbriggan, c. 2.8km northeast of the northern portion of the proposed development area.

Bronze Age (c. 2500–800 BC)

This period is marked by the use of metal for the first time. As with the transition from Mesolithic to Neolithic, the transition into the early Bronze Age was accompanied by changes in society. Megaliths were replaced in favour of individual, subterranean cist or pit burials that were either in isolation or in small cemeteries. These burials contained inhumed or cremated remains and were often, but not always, accompanied by a pottery vessel.

An enclosure (DU002-020), c. 346m to the east-northeast of the northern portion of the proposed development area, was tested in 2017 (Bennett 2017:238, Licence No. 17E0247). This recovered late Bronze Age pottery from an inner enclosure ditch and identified peripheral features comprising a rectangular trough and six pits. The feature may represent a larger-scale Bronze Age funerary monument, several of which have been identified in Fingal to date.

In 2015, archaeological testing to the immediate northeast of the southern site identified 26 features comprising prehistoric and medieval activity (Bennett 2015:372, Licence No. 15E0507). These features included a Bronze Age penannular enclosure likely representative of a burial monument as well as a portion of a ring barrow (Bennett 2016:150, Licence No. 15E0586). The southern portion of the ring barrow had been previously excavated in relation to the Boulevard Road (Bennett 2015:165, Licence No. 15E0558).

Over 7,000 burnt mounds or *fulacht fia* sites have been recorded in the country and c. 1,500 examples excavated, making them the most common prehistoric monument in Ireland (Waddell 2022, 164). Although burnt mounds of shattered stone occur as a result of various activities that have been practised from the Mesolithic to the present day, the Bronze Age has long been believed to have seen the peak of this activity. Dating evidence from a growing number of burnt mounds, suggests activities resulting in burnt mounds were being carried over a span of 3,500 years in Ireland (Hawkes 2018). They are typically located in areas where there is a readily available water source, often in proximity to a river or stream or in places with a high-water table. In the field burnt mounds may be identified as charcoal-rich mounds or spreads of heat shattered stones, however, in many cases, the sites have been disturbed by later agricultural activity and are no longer visible on the field surface. Nevertheless, even

disturbed spreads of burnt mound material often preserve the underlying associated features, such as troughs, pits and gullies, intact.

A burnt spread (DU002-021) was identified by testing, c. 200m to the north of the southern portion of the proposed development area (Bennett 2007:422, Licence No. 07E0057) although it is incorrectly plotted on the SMR map. Testing (Bennett 2015:372, Licence No. 15E0507) in advance of a school in 2015 (see above) identified a middle Bronze Age burnt spread and a late Bronze Age *fulacht fia*.

Iron Age (c. 800 BC–AD 500)

There is increasing evidence for Iron Age settlement and activity in recent years as a result of development-led excavations as well as projects such as Late Iron Age and Roman Ireland (Cahill Wilson 2014). Yet this period is distinguishable from the rather rich remains of the preceding Bronze Age and subsequent early medieval period, by a relative paucity within the current archaeological record. The Iron Age in Ireland is problematic for archaeologists as few artefacts dating exclusively to this period have been found and without extensive excavation, it cannot be determined whether several monument types, such as ring barrows or standing stones, date to the late Bronze Age or Iron Age. It is likely that there was significant continuity in the Iron Age, with earlier monuments re-used in many cases. An Iron Age charcoal production pit was discovered during testing (see above) in advance of a school development (Bennett 2015:372, Licence No. 15E0507).

3.1.2 Early Medieval Period (AD 500–1100)

The early medieval period is depicted in the surviving sources as an almost entirely rural based society. Territorial divisions were based on the *túath*, or petty kingdom, with Byrne (1973) estimating that there may have been at least 150 kings in Ireland at any given time. This period, with a new religious culture and evolving technologies, saw significant woodland clearance and the expansion of grassland. A new type of plough and the horizontal mill were two innovations that improved agriculture and allowed for the population to increase. Consequently, from c. AD 500 onwards, the landscape became well settled, as evidenced by the profuse distribution of ringforts, a dispersed distribution of enclosed settlements, normally associated with various grades of well-to-do farming and aristocratic classes in early medieval Ireland (Stout and Stout 1997, 20).

Between the 7th and 10th centuries AD, the area of the proposed development was located within the eastern part of the *Bréga* territory of the *Síl nÁedo Sláine* branch of the southern *Uí Néill*, which included most of Meath, south Louth, and north Dublin (Byrne 1973, 397). Whilst this tribe had ultimate control, the area was occupied and controlled on a local level by indigenous tribal groups who most likely paid tribute to the *Uí Néill* during this period (Carroll 2008, 13). The tribal groups associated with the Fingal area around the 7th century may have included the *Árd Ciannachta* and the *Gailenga* (ibid. 13). While the general area of Balbriggan and its surroundings could have fallen at some point within the territory of the *Gailenga* and would have certainly formed part of the early *Ciannachta* coastal hegemony, likely, it is more closely associated with the *Saithne* (Bolger 2009, 28). They are particularly associated

with the Barony of Balrothery and claimed descent from *Tadc Meic Céin*. Their rise to prominence was aided by the collapse of the *Ciannachta* hegemony and the increasing fragmentation of the *Síl nÁedo Sláine*. It has been suggested that their land formed a buffer between the territory controlled by the Norse of Dublin and the main sub-kingdoms of *Bréga* (Bhrethnach 1999, 5-6). They profited politically from an ambiguous relationship with the Norse and by the 11th and 12th centuries, the ruling branch, the *Ua Cathasaig*, were styling themselves as Kings of Brega (Bolger 2009, 28).

The ringfort or rath is considered to be the most common indicator of settlement during the early medieval period (Stout 1997). One of the most recent studies of early medieval settlement enclosures has suggested that there is potential for at least 60,000 such sites to have existed on the island (O'Sullivan et al. 2014, 49). Ringforts were often constructed to protect rural farmsteads and are usually defined as a broadly circular enclosure delineated by a bank and ditch. Ringforts can be divided into three broad categories – univallate sites, with one bank or ditch; multivallate sites with as many as four levels of enclosing features and platform or raised ringforts, where the interior of the ringfort has been built up. These enclosed sites were intimately connected to the division of land and the status of the occupant. A possible ringfort (DU001-027) is located c. 115m to the west of the proposed development area, measuring approximately 30m in diameter. Within the wider area, a large-scale bivallate ringfort (DU005-115), with an associated souterrain, field system and outer enclosure is recorded at Stephenstown, c. 877m to the southeast of the southern portion of the proposed development area. A portion of this site was excavated in 2008 (Bennett 2007:549, Licence No. 07E0836ext) and was carbon 14 dated to cal. AD 779-960.

Evidence for early medieval settlement has also been recorded in the wider area of the proposed development. In 2005, a programme of test trenching and a geophysical survey (Bennett 2005:487 Licence No. 05E0663; Leigh 2005, Licence No. 05R0114), c. 336m to the north of the northern portion of the proposed development area, identified a number of archaeological features and deposits. These features included a sub-square enclosure (DU001-024) and a multi-ditched enclosure (DU001-015). Additional testing was carried out in 2006 to provide more information on the exposed features (Bolger 2006). Excavation of the enclosures dated them to the early medieval period based on finds of several ring-headed pins (Bennett 2006:658, Licence No. 05E0663).

3.1.3 Medieval Period (AD 1100–1600)

In the 11th and 12th centuries, just before the Anglo-Norman invasion, Fingal lay between the competing political and territorial zones of the Kingdom of *Midhe* and the Hiberno-Norse Kingdom of Dublin. The piecemeal conquest by the Anglo-Normans of Ireland, which commenced in 1169, had a fundamental impact on the Irish landscape. By 1185 the Anglo-Normans held the cities of Dublin, Waterford and Cork along with their immediate hinterlands. The initial military successes of the Anglo-Normans are attributed to their fighting skill especially on horseback, their organisation and their ability to build strongholds quickly in strategic positions. They

also had a preference for established sites with existing infrastructure. The introduction of the large earthwork (Motte) and timber and stone castles of the Anglo-Normans was novel to the Irish landscape and these features are predominantly found in the south and east of the country in the areas of Anglo-Norman colonisation.

The largest medieval settlement within the landscape surrounding the proposed development area is Balrothery, which is located c. 2.3km to the southeast. A probable small manor was also present at Bremore, adjacent to Bremore Castle (DU002-002001), c. 1.7km to the northeast, with a further medieval settlement present at Folkstown Little and Folkstown Great, c. 423m to the southeast of the southern portion of the proposed development area (Kavanagh 2010, Licence No. 08E0054). One Anglo-Norman name links Bremore and Balrothery during the medieval period, which is De Rosel. Robert de Rosel was granted land at Balrothery at an early stage of the Anglo-Norman invasion. He was a direct descendent of Hugh de Rozel who came from a hamlet of the same name in Normandy (Carroll 2008, 17).

De Rosel and his men helped Strongbow's army take the Viking city of Dublin and De Rosel was rewarded with lands in Balrothery. He had seven sons and one daughter. His fourth son Patrick, who had been enfeoffed in one knight's fee with land in Derbyshire is recorded as living in Balrothery during c. 1200. By this time land at Balrothery also belonged to de Costedin, as it is recorded that he donated land to the church between 1192 and 1212. However, as de Rosel is recorded as a parson in Balrothery Church, the transfer of land was not to take place until after his death (ibid. 17).

At Bremore, the earliest references to a possible castle or manor are found in the Gormanston Register, which names Wylliam Rosselle as Lord of Dunbegh in County Derby and Bremore in Ireland (O'Carroll 2009, 79). The Gormanston Register is a collection of manuscripts dating from 1175 to 1397, which were collected by the Viscounts Gormanston and are now held by the National Library. The Dunbegh title presumably refers to the knight's fee in County Derby that was held by Patrick de Rosel at the turn of the 13th century. William is also mentioned in association with Bremore in the Calendar of Documents Relating to Ireland in 1299-1300 (ibid. 79). It is therefore reasonable to argue that de Rosel was granted a large amount of land in and around Balrothery, which may well have included Folkstown Little and Great.

3.1.4 Post-Medieval Period (AD 1600–1800)

After defeating James II at the Battle of the Boyne in 1690, William of Orange established his camp in Balbriggan c. 1.5km to the east of the proposed development area. The population of Balbriggan was relatively small in 1659, consisting of only 30 people, with 26 being Irish and four being English, compared to neighbouring villages like Balrothery with a population of 204 and Balscadden with 190. With the introduction of new industrial developments in the weaving industries and the construction of a new coach road that ran through the town, Balbriggan began to experience rapid growth. The expansion of the town is well-documented and owes much to the foresight and ambition of the Hamilton family, who owned a large

portion of the area. In 1780, Baron Hamilton established Smyco, a weaving company that provided significant employment opportunities for the region.

2.2 SUMMARY OF PREVIOUS ARCHAEOLOGICAL FIELDWORK

A review of the Excavations Bulletin (1970–2024) has revealed that previous archaeological investigations have been carried out within the proposed development area. Additional investigations have also been carried out within the environs of the site, which are summarised below.

A geophysical survey was carried out on the lands to the south of Flemington Lane to the R122 in 2005, which included portions of the proposed development area (Nicholls and Shiel 2005, Licence No. 05R0137). A number of anomalies were identified within the surrounding landscape including several enclosures (DU001-027, DU001-020/5) and a field system (DU001-023). Part or all of seven panels of the geophysical survey were carried out within the southern extents of the proposed development area: 8e, 9a, 14a, 16b, 18, 19 and 20.

No definitive archaeological sites were identified within the panels of the geophysical survey, although 16b highlighted one well defined linear response/possible former boundary. Area 18 revealed the presence of a large ferrous object, such as a pipe. In addition, possible archaeological anomalies were identified in Area 20, which were interpreted as potentially representing the remains of a settlement. This area was subject to further geophysical survey in 2024.

In 2007, a detailed programme of archaeological testing was carried out across a portion of the landscape including the northern and central portions of the proposed development and part of the southern site (Figure 3). This identified 38 varied archaeological sites across the wider landscape including enclosures, pits, linear features and burnt spreads (Elliot 2007a, Licence No. 07E0057). A large circular pit (DU001-029) was recorded c. 23m southeast of the northern portion of the proposed development area, which contained a charcoal-rich fill. A flint blade was recovered from the fill suggesting a prehistoric date. No features of archaeological significance were identified within the proposed development area, although the enclosure (DU001-027) located c. 115m to the west was positively identified.

Three of the sites identified during testing under licence 07E0057 were archaeologically excavated in 2018 (as evidenced by Google Earth coverage dating to 2018). The published excavation summary (Bennett 2018:822, Licence No. 18E0238) does not include a cross-reference to the testing IDs assigned to the sites when initially identified. The investigations identified a number of scattered pits, post holes and some linear ditches. Some probable Neolithic flints were recovered, indicating the activity is likely to be prehistoric in date. The excavated area were located to the immediate southeast of the northern portion of the proposed development area.

In 2024, archaeological monitoring was carried out in the northern part of the proposed development area as part of permitted development (Planning Ref.: F22A/0526) (Whitaker 2024, Licence No. 23E0879). Nothing of archaeological

potential was identified during the course of these works. The location of pit DU001-029 was exposed but was found to represent the remains of a degraded dark grey stone.

2.3 CARTOGRAPHIC ANALYSIS

Sir William Petty, Down Survey, Barony of Balruddery, Parish of Balruddery, c. 1655.

The area of the proposed development is located within the townlands of 'Big Foulkstonne' and 'Fleiningtonne' on the barony map or 'Great Fowcktowne' and 'Flemming's-Towne' on the parish map. No details are depicted within the site; however, a road that is orientated northwest-southeast is depicted traversing 'Great Fowcktowne' and continues north-south through 'Flemming's-Towne'. This is likely to represent Clonard Road. The terroir records that the proprietor of the 180-acre townland of 'Great Fowcktowne' was 'Peter Hufsey of Westowne' and that the 265 acres of 'Flemingtowne' were owned by Matthew Barnwell of Bremore.

John Rocque's Map of the City and County of Dublin, 1760

The scale of the proposed development is not entirely accurate on this map and the site is depicted within several open fields in proximity to Clonard Road. The Clonard Brook is shown within the southeastern portion of the proposed development area. There are several structures depicted along the road as well as a bridge indicated across the stream.

First Edition Ordnance Survey Map, 1843, scale 1:10,560 (Figure 4)

This is the first accurate historic mapping coverage of the area containing the proposed development. The overall site (northern, central and southern) is depicted within 10 fields. Five structures are located within the southeast portion of the proposed development area, adjacent to the road that borders the site to the southwest and either side of the Clonard Stream. A further group of structures are shown to the immediate south of the road and annotated as 'Clonard'. A bridge across the stream is indicated and gardens or an orchard are shown to the north of the structures, within the proposed development area. Although not labelled as such, it is possible the buildings relate to milling activity in the area given their location immediate to the stream.

Second Edition Ordnance Survey Map, 1871, scale 1:10,560

By the time of this map, three of the structures either side of the Clonard Stream have been removed and only two remain, although the orchard or gardens to the north remain present. The structures to the south of the road remain present and have been slightly expanded. The remaining surrounding fields are unchanged in form.

Ordnance Survey Map, 1909, scale 1:2,500 (Figure 4)

There are no major changes to note within the cartography of this map that relate to the proposed development area.

2.4 SUMMARY OF GEOPHYSICAL RESULTS

A geophysical survey was undertaken to inform this assessment in January 2024 (Leigh 2024, Licence No. 24R0031; Figure 5).

Potential archaeological anomalies were confirmed in the southeast of development area. These include several responses of amorphous pattern (1), possibly the result of recent ground disturbance or damaged archaeological remains. A curvilinear response (2), typical of an archaeological ditch feature, was identified extending south from response (1). Several possible pit features (3) were found to the east of (1).

Three others areas of archaeological potential (5, 7 and 8), possibly representing the remains of burnt mounds, were identified, located adjacent to a stream to the north. Linear trends, possibly outlining a small rectilinear feature (6) were also noted south of area 5. There is another cluster of responses (9) located in the east of the field, possibly representing another spread of burnt material, or modern disturbance; the interpretation is less clear on this feature.

Additional faint linear trends (4) were identified across the southern portion of the site, and although possibly of archaeological origin, they may also represent recent agricultural activity.

Two other areas of magnetic disturbance (10) and (11) were attributed to metal fencing and gates along the site boundaries.

2.5 AERIAL PHOTOGRAPHIC ANALYSIS

Inspection of the aerial photographic coverage of the proposed development area held by the Ordnance Survey (1995–2013), Google Earth (2008–2024) and Bing Maps revealed that the proposed development area remained largely as greenfield with the exception of the northern portion of the site. The northern site experienced ground disturbance associated with the Taylor Hill development in 2019 (Google Earth, June 2019). Parts of the southern site experienced disturbance associated with a school development to the immediate north (February 2016). At this time Taylors Hill Boulevard within the development area was developed.

2.6 TOPOGRAPHICAL FILES

Information on artefact finds from the study area in County Dublin has been recorded by the National Museum of Ireland since the late 18th century. Location information relating to these finds is important in establishing prehistoric and historic activity in the study area. There are no files relating to the townlands surrounding the study area recorded by the National Museum of Ireland regarding artefact discoveries.

3 ARCHAEOLOGICAL TESTING

3.1 GENERAL

Test trenching took place between the 17th and 19th June 2024, using a 13 tonne 360 degree tracked excavator equipped with a flat, toothless bucket under strict archaeological supervision. Any investigated deposits were preserved by record. This was by means of written, drawn and photographic records.

A total of 26 trenches were excavated across the site measuring c. 640 linear metres (Figures 6-7, Plates 1-20). The trenches targeted geophysical anomalies along the northwestern field boundary as well as open spaces to the south. Trenches 1 and 2 of the 28 trenches that formed part of the licence application method statement were not excavated as this area had previously been monitored by the author during preparatory groundworks for topsoil storage.

The test trenches were excavated to determine, as far as reasonably possible, the location, extent, date, character, condition, significance and quality of any surviving archaeological remains threatened by the proposed development. Test trenching was also carried out to clarify the nature and extent of existing disturbance and intrusions and to assess the degree of archaeological survival in order to formulate further mitigation strategies. These are designed to reduce or offset the impact of the proposed development scheme.

3.2 TESTING RESULTS

Topsoil across the site consisted of a pale to mid brown silty stone free soil that ranged in depth from 0.50 to 0.90m. Subsoil varied across the site from a mottled grey brown stony natural to a mottled orange and pale grey sticky plastic stony clay.

A total of four Archaeological Areas were confirmed during the course of testing and the results and features contained within these areas are presented below. Further details on each of the contexts provided in Appendix 1.

TABLE 1: Test Trench Results

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
1	N/A	N/A	N/A	N/A	Previously monitored
2	N/A	N/A	N/A	N/A	Previously monitored
3	30	1.80	0.50	ENE/WSW	Two possible troughs (C3.1 & C3.2) and a large burnt spread (C3.3)(Plates 1 & 2, Figure 7) AA1
4	20	1.80	0.50	ENE/WSW	Two agricultural drainage ditches (Plate 3). Nothing of archaeological significance
5	20	1.80	0.50	WNW/ESE	Two agricultural field drains. Nothing of archaeological significance
6	15	1.80	0.70	NE/SW	Nothing of archaeological significance
7	15	1.80	0.50	NE/SW	Possible pit (C7.1) and agricultural field drain (Plate 4, Figure 7) AA1
8	20	1.80	0.50	NW/SE	Two agricultural field drains. Nothing of

TRENCH	LENGTH (m)	WIDTH (m)	DEPTH (m)	ORIENTATION	DETAILS
					archaeological significance
9	15	1.80	0.50	NW/SE	Two agricultural field drains. Nothing of archaeological significance (Plate 5)
10	45	1.80	0.67	NE/SW	Two agricultural field drains. Nothing of archaeological significance
11	25	1.80	0.50	NNE/SSW	Two agricultural field drains. Nothing of archaeological significance (Plate 6)
12	15	1.80	0.50	N/S	Nothing of archaeological significance
13	10	1.80	0.90	NNW/SSE	Nothing of archaeological significance (Plate 7)
14	10	1.80	0.80	NW/SE	Burnt spread (C14.1) (Plate 8, Figure 7)
15	50	1.80	0.60	NE/SW	Nothing of archaeological significance
16	5	1.80	0.50	ENE/WSW	Nothing of archaeological significance
17	15	1.80	0.70	ENE/WSW	Nothing of archaeological significance
18	30	1.80	0.80	NE/SW	Northwest southeast oriented ditch (C18.1) also in T28 (Plate 9, Figure 7) AA2
19	5	1.80	0.95	ENE/WSW	Nothing of archaeological significance (Plate 10)
20	10	1.80	0.58	NW/SE	Burnt spread (C20.1) (Plate 11, Figure 7) AA3
21	30	1.80	0.70	ENE/WSW	Nothing of archaeological significance (Plate 12)
22	40	1.80	0.65	ENE/WSW	Nothing of archaeological significance
23	50	1.80	0.65	ENE/WSW	Nothing of archaeological significance (Plate 13)
24	25	1.80	0.25-0.70	NE/SW	Burnt spread (C24.1) (Plate 14 & 15, Figure 7) AA4
25	15	1.80	0.65	NE/SW	Agricultural field drain. Nothing of archaeological significance (Plate 16)
26	50	1.80	0.70	NNE/SSW	Agricultural field drain. Nothing of archaeological significance
27	20	1.80	0.52	NNE/SSW	Possible trough (C27.1) and burnt spread (C27.2)(Plate 17-19, Figure 7) AA4
28	25	1.80	0.70	NE/SW	Northwest southeast oriented ditch (C28.1) also in T18 (Plate 20, Figure 7) AA2

Archaeological Area 1 (AA1, Figures 6-7) 50 x 30m

Geophysical anomalies in the western extent of the development site were confirmed as burnt mound activity. Two possible troughs (C3.1 and C3.2) 1.80 by 1.90m in size and 0.28m and 0.22m in minimum depth and a burnt spread (C3.1) were identified in Trench 3 (Plates 1 and 2). Trench 7 contained a pit (C7.1) 0.90 x 0.54m in minimum size and containing burnt mound material (Plate 4). The remains are likely to be representative of Bronze Age burnt mound/ *fulacht fia* activity.

Archaeological Area 2 (AA2, Figures 6-7) 40 x 30m

The entire base of Trench 14 contained a burnt spread likely to be representative of Bronze Age burnt mound / *fulacht fia* activity. Trenches 18 and 28 contained a northwest southeast oriented linear ditch (C18.1 and C28.1) 1.60m wide, 0.52m deep with steep sides to a flat base 0.70m wide (Plates 9 and 20).

Archaeological Area 3 (AA3, Figures 6-7) 30 x 30m

The southeastern half of Trench 20 contained burnt spread material (C20.1)(Plate 11). Overhead power lines to the north of Trench 20 limited investigation of the potential archaeological material identified by geophysical survey but is contained within this Archaeological Area.

Archaeological Area 4 (AA4, Figures 6-7) 60 x 30m

Archaeological Area 4 is located immediately east of AA3 and contained a large burnt spread (C24.1) 18.5m in length within Trench 24 (Plates 14 and 15). A possible trough (C27.1) 1.90m in length and a minimum of 1.80m wide and another burnt spread (C27.2) 4.20m in length were recorded within Trench 27 (Plates 17-19).

3.3 CONCLUSIONS

The programme of archaeological test trenching targeted geophysical anomalies along the northwestern field boundary as well as open spaces to the south. Trenches 1 and 2 of the 28 trenches that formed part of the licence application method statement were not excavated as this area had previously been monitored by the author during preparatory groundworks for topsoil storage. Seventeen of the trenches (T4-6, T8-13, T15-17, T19, T21-23, T25 and T26) were devoid of archaeological material.

Test trenching confirmed that the potential archaeological anomalies recorded during the 2024 geophysical survey along the northwestern boundary were archaeological in nature (AA1-4). The features identified are representative of Bronze Age burnt mound/ *fulacht fia* activity and a single northwest southeast oriented linear ditch. The location of the archaeological remains, adjacent to a watercourse, is typical for the landscape context of this site type.

4 IMPACT ASSESSMENT AND MITIGATION MEASURES

Impacts can be identified from detailed information about a project, the nature of the area affected and the range of archaeological resources potentially affected. Archaeological sites can be affected adversely in a number of ways: disturbance by excavation, topsoil stripping; disturbance by vehicles working in unsuitable conditions; and burial of sites, limiting access for future archaeological investigation.

4.1 IMPACT ASSESSMENT

- Four areas of archaeological significance were identified during the course of archaeological testing. These all relate to probable burnt mound activity. Due to the layout requirements for the proposed development, including access roads, services and residential units (along with the provision of a green corridor for the existing stream) it is not possible to preserve the archaeological remains in-situ. As such ground disturbances associated with the development will result in a direct, negative and permanent impact on AA1-4. Prior to the application of mitigation, the significance of effect is predicted to be very significant.
- It is possible that small or isolated archaeological features survive beneath the current ground level outside of the footprint of the excavated test trenches. Ground disturbances associated with the development may result in a direct, negative and permanent impact on any such remains. Prior to the application of mitigation, the significance of effect may vary from moderate to very significant. This is dependent on the nature, extent and significance of any remains that may be identified.

4.2 MITIGATION

- It is acknowledged that preservation in-situ of archaeological remains is the preferred method in which to conserve the archaeological resource. However, due to the requirements of the proposed development, this is not possible. Therefore, prior to the commencement of construction, the four archaeological areas will be subject to preservation by record (archaeological excavation). This will be carried out by an archaeologist under licence from the DoHLGH.
- All topsoil stripping associated with the proposed development be monitored by a suitably qualified archaeologist. If any features of archaeological potential are discovered during the course of the works further archaeological mitigation may be required, such as preservation in-situ or by record. Any further mitigation will require approval from the National Monuments Service of the DoHLGH.

It is the developer's responsibility to ensure full provision is made available for the resolution of any archaeological remains, both on site and during the post excavation process, should that be deemed the appropriate manner in which to proceed.

Please note that all recommendations are subject to approval by the National Monuments Service of the Heritage and Planning Division, Department of Housing, Local Government and Heritage.

5 REFERENCES

Bennett, I. (ed.) 1987-2010. Excavations: Summary Accounts of Archaeological Excavations in Ireland. Bray. Wordwell.

Bolger, T. 2006. Archaeological Test Excavation and Archaeological Monitoring, Flemington, Balbriggan, County Dublin (Licence No. 05E0663). Unpublished report by Margaret Gowen & Co. Ltd.

Bolger, T. 2009. Archaeological excavations at Flemington, Balbriggan. In C. Baker (ed.), Axes, Warriors and Windmills: Recent archaeological discoveries in North Fingal. Fingal County Council.

Bhrethnach, E. 1999. 'Authority and Supremacy in Tara and its Hinterland c. 950-1200' in Discovery Reports 5. RIA, Dublin:1-24.

Byrne, F. J. 1973. Irish Kings and High Kings. Dublin. Four Courts Press.

Cahill Wilson, J. 2014. Late Iron Age and Roman Ireland, Discovery Programme Report Series No. 8, Discovery Programme. Dublin. Wordwell.

Carroll, J. 2008. Archaeological Excavations at Rosepark, Balrothery, Co. Dublin Vol. 1. Heritage Council.

Chartered Institute for Archaeologists 2014 (updated 2020). Standard and guidance for historic environment desk-based assessment.

Department of Arts, Heritage, Gaeltacht and the Islands. 1999a. Framework and Principles for the Protection of the Archaeological Heritage. Dublin. Government Publications Office.

Department of Arts, Heritage, Gaeltacht and the Islands. 1999b. Policy and Guidelines on Archaeological Excavation. Dublin. Government Publications Office.

Dowd, M. and Carden, R.F. 2016. First evidence of a Late Upper Palaeolithic human presence in Ireland. Quaternary Science Reviews 139, 158-163.

Elliot, R. 2007a. Archaeological Testing at Balbriggan, Co. Dublin. Preliminary Report (Licence No. 07E0057). Unpublished report prepared by The Archaeology Company.

Elliot, R. 2007b. Archaeological Testing at Balbriggan, Co. Dublin (Licence No. 07E0361). Unpublished report prepared by The Archaeology Company.

Environmental Protection Agency. 2017. Draft Advice Notes on Current Practice (in the preparation of Environmental Impact Statements). Dublin. Government Publications Office.

Environmental Protection Agency. 2022. Guidelines on the Information to be Contained in Environmental Impact Statements. Dublin. Government Publications Office.

Fingal County Development Plan, 2023-2029.

Hawkes, A. 2018. The Archaeology of Prehistoric Burnt Mounds in Ireland. Oxford. Archaeopress.

Kavanagh, H. 2010. Final archaeological report on the excavation of Area 2/3 at Folkstown Great or Conard, Balbriggan, Co. Dublin (Licence No. 08E0854). Unpublished report by Irish Archaeological Consultancy Ltd.

Leigh, J. 2005. Geophysical Survey Report Flemington, Balbriggan, County Dublin (Licence No. 05R0114). Unpublished report prepared by J. M. Leigh Surveys Ltd.

Leigh, J. 2024. Geophysical Survey Report Clogheder, Balbriggan, County Dublin (Licence No. 24R0031). Unpublished report prepared by J. M. Leigh Surveys Ltd.

McErlean, T. 1983. 'The Irish townland system of landscape organisation', in Reeves-Smyth, T. Hamond, F. Landscape Archaeology in Ireland. BAR British Series 116. pp. 315–39.

McGlade, S. 2016. Excavations at Clonard or Folkstown Great, Balbriggan, Co. Dublin (Licence No. 15E0586). Unpublished report by Archaeological Planning Consultancy.

National Monuments Service, Department of Housing, Local Government and Heritage. Sites and Monuments Record, County Dublin.

National Museum of Ireland. Topographical Files, County Dublin.

Nicholls, J. and Shiel, D. 2005. Geophysical Survey Report: Balbriggan, North County Dublin (Licence No. 05R0137). Unpublished report prepared by Target Archaeological Geophysics.

Nicholls, J. 2007. Geophysical Survey Report: North-West Balbriggan The the the northern Distribution Road. Clonard or Folkstown Great Townlands, North Co. Dublin (Licence No. 07R0242). Unpublished report prepared by Target Archaeological Geophysics.

O'Carroll, F. 2009 'Bremore, Co. Dublin, the Field by the Castle' in Baker, C. (ed) Axes, Warriors and Windmills: Recent Archaeological Discoveries in North Fingal Fingal County Council.

O'Sullivan, A., McCormick, F., Kerr, T.R., Harney, L. 2014. Early Medieval Ireland, AD 400-1100: The Evidence from Archaeological Excavations. Dublin. Royal Irish Academy.

Stout, M. 2017. Early Medieval Ireland 431-1169. Dublin. Wordwell.

Stout, M. 1997. The Irish Ringfort. Dublin. Four Courts Press.

Stout, G. and Stout, M. 1997. Early Landscapes: from Prehistory to Plantation. In F.H.A. Aalen et al. (eds), Atlas of the Irish Rural Landscape. Cork. Cork University Press.

Waddell, J. 2022. The Prehistoric Archaeology of Ireland (New Edition). Dublin. Wordwell.

Cartographic Sources

Sir William Petty, Down Survey, Barony of Balruddery, Parish of Balruddery, c. 1655

John Rocque, Map of the City and County of Dublin, 1760

Ordnance Survey maps of County Dublin, 1843, 1871, 1909

Electronic Sources

www.excavations.ie – Summary of archaeological excavation from 1970-2024.

www.archaeology.ie – DoH LGH website listing all SMR/RMP sites.

www.heritagemaps.ie – The Heritage Council web-based spatial data viewer which focuses on the built, cultural and natural heritage.

www.geohive.ie – Ordnance Survey Ireland National Townland and Historical Map Viewer (including Aerial imagery 1995, 2000, 2005 and 2013).

www.googleearth.com – Satellite imagery (2005–2024).

www.apple.com/maps/ - Satellite imagery (2024).

APPENDICES

APPENDIX 1 CONTEXTS

CONTEXT NO.	TRENCH NO.	DESCRIPTION
1	N/A	Topsoil
2	N/A	Natural subsoil
3.1	3	Possible trough 1.80 x 1.90m within trench, steep sides 0.28m min deep
3.11	3	Blackish silty soil with frequent fire cracked stones fill of 3.1
3.2	3	Possible trough 1.80 x 1.90m contained within spread 3.3, 0.22m min deep
3.21	3	Blackish silty soil with frequent fire cracked stones fill of 3.2
3.3	3	Burnt spread, 4.50m in length within southern extent of trench consisting of a black grey silty soil with fire cracked stones
7.1	7	Pit, 0.90 x 0.54m where exposed within the trench
7.11	7	Fill of pit 7.1 consisting of a black silty clay containing frequent fire cracked stones
14.1	14	Spread of mid grey silty clay with occasional fire cracked stone inclusions along base of Trench 14
18.1	18	Northwest southeast oriented ditch c1.40m wide located at the western extent of Trench 18
18.11	18	Mid brown silty clay fill of 18.1
20.1	20	Spread of grey silty clay with moderate fire cracked stone inclusions within southeastern extent of trench 20 0.04-0.05m deep
24.1	24	Large burnt spread 18.5m in length consisting of blackish silty clay with fire cracked stone inclusions
27.1	27	Possible trough 1.90 x 1.80m in size
27.11	27	Fill of trough 27.1 consisting of a dark grey sticky clay with frequent fire cracked stone inclusions
27.2	27	Spread of pale grey sticky clay with occasional fire cracked stones 0.06-0.08m deep
28.1	28	Northwest southeast oriented linear ditch 1.60m wide 0.52m deep with steep sides to a flattish base 0.70m in width
28.2	28	Mid brown silty clay fill of ditch 28.1

APPENDIX 2 SMR/RMP SITES WITHIN 200M

RECEIVED: 06/08/2024

SMR NO.	DU001-027
RMP STATUS	Scheduled for inclusion
TOWNLAND	Clonard or Folkstown Great
PARISH	Balrothery
BARONY	Balrothery East
CLASSIFICATION	Enclosure
DIST. FROM DEVELOPMENT	c. 115m west
DESCRIPTION	Geophysical survey (licence no. 05R0137) identified the remains of a circular enclosure, of probable stone origin, measuring approximately 30m in diameter (Nicholls and Shiel 2005, 9).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	DU001-029
RMP STATUS	Scheduled for inclusion
TOWNLAND	Balrothery
PARISH	Balrothery East
BARONY	Clonard or Folkstown Great
CLASSIFICATION	Pit
DIST. FROM DEVELOPMENT	c. 23m southeast
DESCRIPTION	Test excavation (licence no. 07E0057) identified a large circular pit with charcoal rich fill. A flint blade was recovered from the fill suggesting prehistoric date for the feature (Elliot 2007, 297).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	DU002-021
RMP STATUS	Scheduled for inclusion
TOWNLAND	Flemingtown
PARISH	Balrothery
BARONY	Balrothery East
CLASSIFICATION	Burnt spread
DIST. FROM DEVELOPMENT	c. 200m north (incorrectly plotted on SMR map)
DESCRIPTION	Test excavation (Licence no. 07E0057) identified a burnt spread (7m by 10m) within a natural basin (Elliot 2007, 305).
REFERENCE	www.archaeology.ie/ SMR file

SMR NO.	DU001-028
RMP STATUS	Scheduled for inclusion
TOWNLAND	Clonard or Folkstown Great

PARISH	Balrothery
BARONY	Balrothery East
CLASSIFICATION	Excavation
DIST. FROM DEVELOPMENT	c. 71m north
DESCRIPTION	Test excavation (licence no. 07E0057) identified a V-shaped linear feature orientated north-west/south-east (Elliot 2007, 295). A flint blade was recovered from the fill suggesting a prehistoric date. In the field to the north east is a Neolithic house (DU001-014).
REFERENCE	www.archaeology.ie/ SMR file

RECEIVED: 06/08/2024

APPENDIX 3 LEGISLATION PROTECTING THE ARCHAEOLOGICAL RESOURCE

PROTECTION OF CULTURAL HERITAGE

The cultural heritage in Ireland is safeguarded through national and international policy designed to secure the protection of the cultural heritage resource to the fullest possible extent (Department of Arts, Heritage, Gaeltacht and the Islands 1999, 35). This is undertaken in accordance with the provisions of the *European Convention on the Protection of the Archaeological Heritage* (Valletta Convention), ratified by Ireland in 1997.

THE ARCHAEOLOGICAL RESOURCE

The *National Monuments Act 1930 to 2014* and relevant provisions of the *National Cultural Institutions Act 1997* are the primary means of ensuring the satisfactory protection of archaeological remains, which includes all man-made structures of whatever form or date except buildings habitually used for ecclesiastical purposes. A National Monument is described as 'a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (National Monuments Act 1930 Section 2). A number of mechanisms under the National Monuments Act are applied to secure the protection of archaeological monuments. These include the Register of Historic Monuments, the Record of Monuments and Places, and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

OWNERSHIP AND GUARDIANSHIP OF NATIONAL MONUMENTS

The Minister may acquire national monuments by agreement or by compulsory order. The state or local authority may assume guardianship of any national monument (other than dwellings). The owners of national monuments (other than dwellings) may also appoint the Minister or the local authority as guardian of that monument if the state or local authority agrees. Once the site is in ownership or guardianship of the state, it may not be interfered with without the written consent of the Minister.

REGISTER OF HISTORIC MONUMENTS

Section 5 of the 1987 Act requires the Minister to establish and maintain a Register of Historic Monuments. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. Any interference with sites recorded on the register is illegal without the permission of the Minister. Two months notice in writing is required prior to any work being undertaken on or in the vicinity of a registered monument. The register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are included in the Record of Monuments and Places.

PRESERVATION ORDERS AND TEMPORARY PRESERVATION ORDERS

Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with the site

illegal. Temporary Preservation Orders can be attached under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister.

RECORD OF MONUMENTS AND PLACES

Section 12(1) of the 1994 Act requires the Minister for Arts, Heritage, Gaeltacht and the Islands (now the Minister for Housing, Local Government and Heritage) to establish and maintain a record of monuments and places where the Minister believes that such monuments exist. The record comprises a list of monuments and relevant places and a map/s showing each monument and relevant place in respect of each county in the state. All sites recorded on the Record of Monuments and Places receive statutory protection under the National Monuments Act 1994. All recorded monuments on the proposed development site are represented on the accompanying maps.

Section 12(3) of the 1994 Act provides that 'where the owner or occupier (other than the Minister for Arts, Heritage, Gaeltacht and the Islands) of a monument or place included in the Record, or any other person, proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such a monument or place, he or she shall give notice in writing to the Minister of Arts, Heritage, Gaeltacht and the Islands to carry out work and shall not, except in case of urgent necessity and with the consent of the Minister, commence the work until two months after giving of notice'.

Under the National Monuments (Amendment) Act 2004, anyone who demolishes or in any way interferes with a recorded site is liable to a fine not exceeding €3,000 or imprisonment for up to 6 months. On summary conviction and on conviction of indictment, a fine not exceeding €10,000 or imprisonment for up to 5 years is the penalty. In addition they are liable for costs for the repair of the damage caused.

In addition to this, under the *European Communities (Environmental Impact Assessment) Regulations 1989*, Environmental Impact Statements (EIS) are required for various classes and sizes of development project to assess the impact the proposed development will have on the existing environment, which includes the cultural, archaeological and built heritage resources. These document's recommendations are typically incorporated into the conditions under which the proposed development must proceed, and thus offer an additional layer of protection for monuments which have not been listed on the RMP.

THE PLANNING AND DEVELOPMENT ACT 2000

Under planning legislation, each local authority is obliged to draw up a Development Plan setting out their aims and policies with regard to the growth of the area over a five-year period. They cover a range of issues including archaeology and built heritage, setting out their policies and objectives with regard to the protection and enhancement of both. These policies can vary from county to county. The Planning and Development Act 2000 recognises that proper planning and sustainable

development includes the protection of the archaeological heritage. Conditions relating to archaeology may be attached to individual planning permissions.

Fingal County Development Plan, 2023-2029

Archaeology is a non-renewable resource in that once an archaeological feature or site is excavated or removed it is gone forever from the landscape. Therefore, any proposed development should consider the potential impact on archaeology in the very earliest stages and seek to avoid affecting archaeological features or sites and their setting. This includes development along or in Fingal's rivers, coastline, and tidal estuaries. Currently 40% of the recorded archaeological sites within Fingal are sub surface. Therefore, any development has the potential to uncover previously unknown archaeological sites.

Statement of Policy:

The Council is committed to the protection and conservation of buildings, areas, structures, sites, and features of archaeological, architectural, historical, artistic, cultural, scientific, social, or technical interest:

- By safeguarding archaeological sites, monuments, objects, and their settings listed in the Record of Monuments and Places (RMP), and any additional newly discovered archaeological remains, and by identifying archaeologically sensitive historic landscapes.
- By protecting the architectural heritage of Fingal through the identification of Protected Structures, the designation of Architectural Conservation Areas (ACAs), the safeguarding of designed landscapes and historic gardens, and the recognition of structures and elements that contribute positively to the vernacular and industrial heritage of the County.
- By favouring the preservation in-situ (or at a minimum preservation by record) of all sites and features of historical and archaeological interest.
- By making our cultural heritage more accessible and maximise its potential as a learning resource.
- By promoting the understanding of Fingal's cultural heritage in terms of its inherent and unique character and to recognise what elements should be preserved, conserved, or enhanced.
- By implementing the objectives and actions of the Fingal Heritage Plan to raise the profile and awareness of Fingal's heritage.
- The Council is dedicated to protecting, conserving, and presenting the County's rich cultural heritage while promoting sustainable economic development and the enrichment of the environment.

Objective CH02:

Favour the preservation in situ or at a minimum preservation by record, of archaeological sites, monuments, features, or objects in their settings. In securing such preservation the Council will have regard to the advice and recommendations of the National Monuments Service of the Department of the Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

Objective CH03:

Protect all archaeological sites and monuments, underwater archaeology, and archaeological objects, which are listed in the Record of Monuments and Places and all sites and features of archaeological and historic interest discovered subsequent to the publication of the Record of Monuments and Places, and to seek their preservation in situ (or at a minimum, preservation by record) through the planning process.

Objective CH04:

Encourage and promote the appropriate management and maintenance of the County's archaeological heritage, including historical burial grounds, in accordance with conservation principles and best practice guidelines.

Objective CH05:

Ensure archaeological remains are identified and fully considered at the very earliest stages of the development process, that schemes are designed to avoid impacting on the archaeological heritage.

Objective CH06:

Require that proposals for linear development over one kilometre in length; proposals for development involving ground clearance of more than half a hectare; or developments in proximity to areas with a density of known archaeological monuments and history of discovery; to include an Archaeological Impact Assessment and refer such applications to the relevant Prescribed Bodies.

Objective CH07:

Ensure that development within the vicinity of a Recorded Monument or Zone of Archaeological Notification does not seriously detract from the setting of the feature and is sited and designed appropriately.

Objective CH09:

Recognise the importance of archaeology or historic landscapes and the connectivity between sites, where it exists, in order to safeguard them from developments that would unduly sever or disrupt the relationship and/or inter-visibility between sites.

Objective CH12:

Promote best practice for archaeological excavation by ensuring that they are undertaken according to best practice as outlined by the National Monuments Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, The National Museum, and the Institute of Archaeologists of Ireland.

Objective CH13:

Actively support the dissemination of the findings of archaeological investigations and excavations through the publication of excavation reports thereby promoting public awareness and appreciation of the value of archaeological resources.

Objective CH14:

Identify Zones of Archaeological Notification that contain clusters of Recorded Monuments or have a significant history of the discovery of archaeological sites, features, and objects in order to allow for their designation, protection of their setting and environs.

Objective CH15:

Raise public awareness of the cultural heritage and improve legibility by providing appropriate signage or interpretation in areas, sites, villages, and buildings of archaeological and historic significance.

Objective CH16:

Develop and implement the findings of the Community Archaeology Strategy for Fingal.

Objective CH17:

Support the growth of cultural tourism in the County, including the potential for niche heritage-based tourism products by facilitating the development of heritage events, infrastructure such as heritage trails, walkways, and cycleways etc. and activities such as community excavation.

Objective CH18:

Manage the archaeological sites and monuments that Fingal County Council owns or is responsible for according to best practice and according to Conservation Plans where they exist.

APPENDIX 4 IMPACT ASSESSMENT & THE CULTURAL HERITAGE RESOURCE

POTENTIAL IMPACTS ON ARCHAEOLOGICAL AND HISTORICAL REMAINS

Impacts are defined as 'the degree of change in an environment resulting from a development' (Environmental Protection Agency 2022). They are described as profound, significant or slight impacts on archaeological remains. They may be negative, positive or neutral, direct, indirect or cumulative, temporary or permanent.

Impacts can be identified from detailed information about a project, the nature of the area affected and the range of archaeological and historical resources potentially affected. Development can affect the archaeological and historical resource of a given landscape in a number of ways.

- Permanent and temporary land-take, associated structures, landscape mounding, and their construction may result in damage to or loss of archaeological remains and deposits, or physical loss to the setting of historic monuments and to the physical coherence of the landscape.
- Archaeological sites can be affected adversely in a number of ways: disturbance by excavation, topsoil stripping and the passage of heavy machinery; disturbance by vehicles working in unsuitable conditions; or burial of sites, limiting accessibility for future archaeological investigation.
- Hydrological changes in groundwater or surface water levels can result from construction activities such as de-watering and spoil disposal, or longer-term changes in drainage patterns. These may desiccate archaeological remains and associated deposits.
- Visual impacts on the historic landscape sometimes arise from construction traffic and facilities, built earthworks and structures, landscape mounding and planting, noise, fences and associated works. These features can impinge directly on historic monuments and historic landscape elements as well as their visual amenity value.
- Landscape measures such as tree planting can damage sub-surface archaeological features, due to topsoil stripping and through the root action of trees and shrubs as they grow.
- Ground consolidation by construction activities or the weight of permanent embankments can cause damage to buried archaeological remains, especially in colluviums or peat deposits.
- Disruption due to construction also offers in general the potential for adversely affecting archaeological remains. This can include machinery, site offices, and service trenches.

Although not widely appreciated, positive impacts can accrue from developments. These can include positive resource management policies, improved maintenance and access to archaeological monuments, and the increased level of knowledge of a site or historic landscape as a result of archaeological assessment and fieldwork.

PREDICTED IMPACTS

The severity of a given level of land-take or visual intrusion varies with the type of monument, site or landscape features and its existing environment. Severity of impact can be judged taking the following into account:

- The proportion of the feature affected and how far physical characteristics fundamental to the understanding of the feature would be lost;
- Consideration of the type, date, survival/condition, fragility/vulnerability, rarity, potential and amenity value of the feature affected;
- Assessment of the levels of noise, visual and hydrological impacts, either in general or site specific terms, as may be provided by other specialists.

APPENDIX 6 MITIGATION MEASURES & THE CULTURAL HERITAGE RESOURCE

POTENTIAL MITIGATION STRATEGIES FOR CULTURAL HERITAGE REMAINS

Mitigation is defined as features of the design or other measures of the proposed development that can be adopted to avoid, prevent, reduce or offset negative effects.

The best opportunities for avoiding damage to archaeological remains or intrusion on their setting and amenity arise when the site options for the development are being considered. Damage to the archaeological resource immediately adjacent to developments may be prevented by the selection of appropriate construction methods. Reducing adverse effects can be achieved by good design, for example by screening historic buildings or upstanding archaeological monuments or by burying archaeological sites undisturbed rather than destroying them. Offsetting adverse effects is probably best illustrated by the full investigation and recording of archaeological sites that cannot be preserved *in situ*.

DEFINITION OF MITIGATION STRATEGIES

ARCHAEOLOGICAL RESOURCE

The ideal mitigation for all archaeological sites is preservation *in situ*. This is not always a practical solution, however. Therefore a series of recommendations are offered to provide ameliorative measures where avoidance and preservation *in situ* are not possible.

Full Archaeological Excavation involves the scientific removal and recording of all archaeological features, deposits and objects to the level of geological strata or the base level of any given development. Full archaeological excavation is recommended where initial investigation has uncovered evidence of archaeologically significant material or structures and where avoidance of the site is not possible. (CIfA 2020b)

Archaeological Test Trenching can be defined as ‘a limited programme... of intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site on land or underwater. If such archaeological remains are present test trenching defines their character and extent and relative quality.’ (CIfA 2020a)

Archaeological Monitoring can be defined as a ‘formal programme of observation and investigation conducted during any operation carried out for non-archaeological reasons within a specified area or site on land or underwater, where there is possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive.’ (CIfA 2020c)





RECEIVED: 06/08/2024



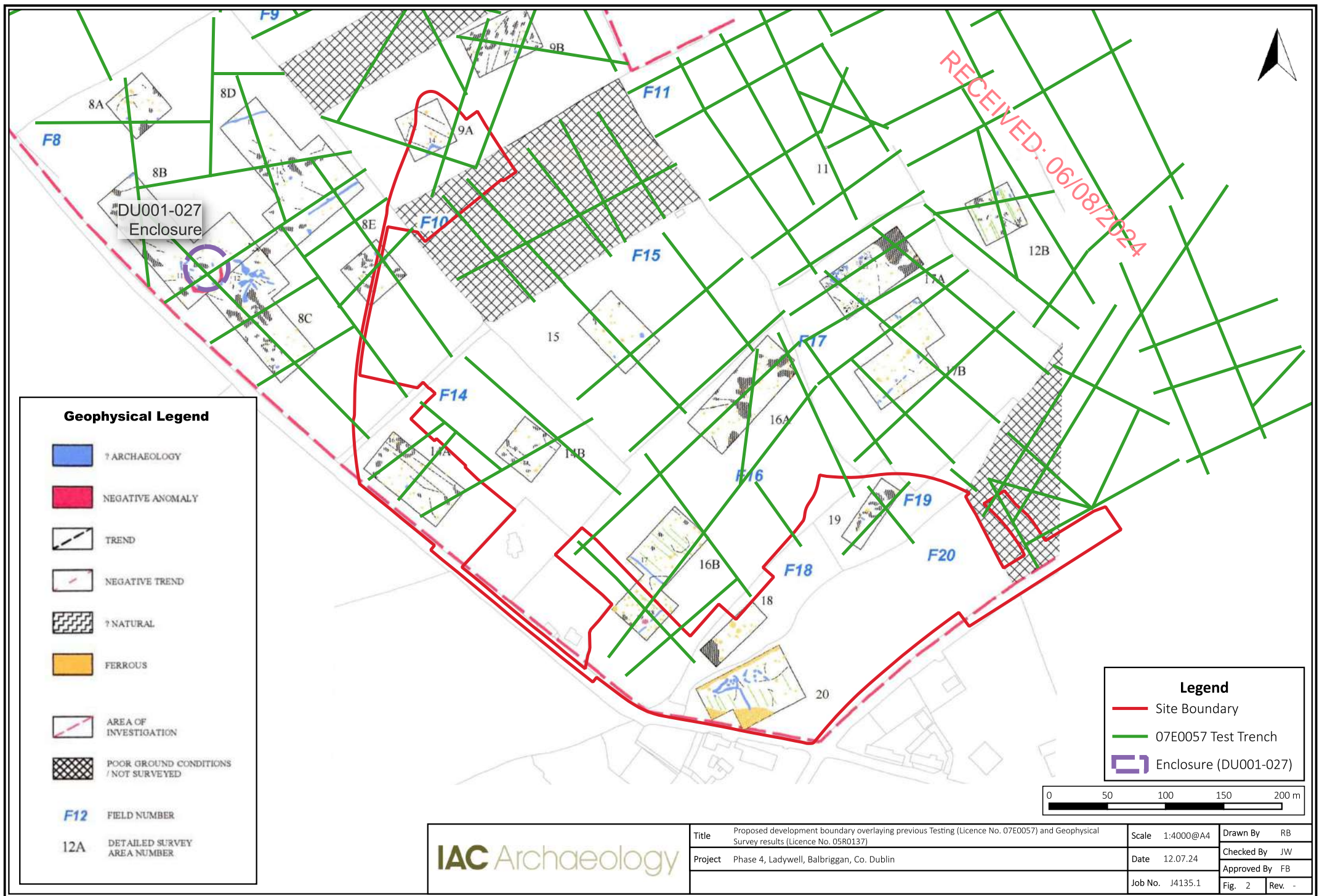
Legend

— Site Boundary

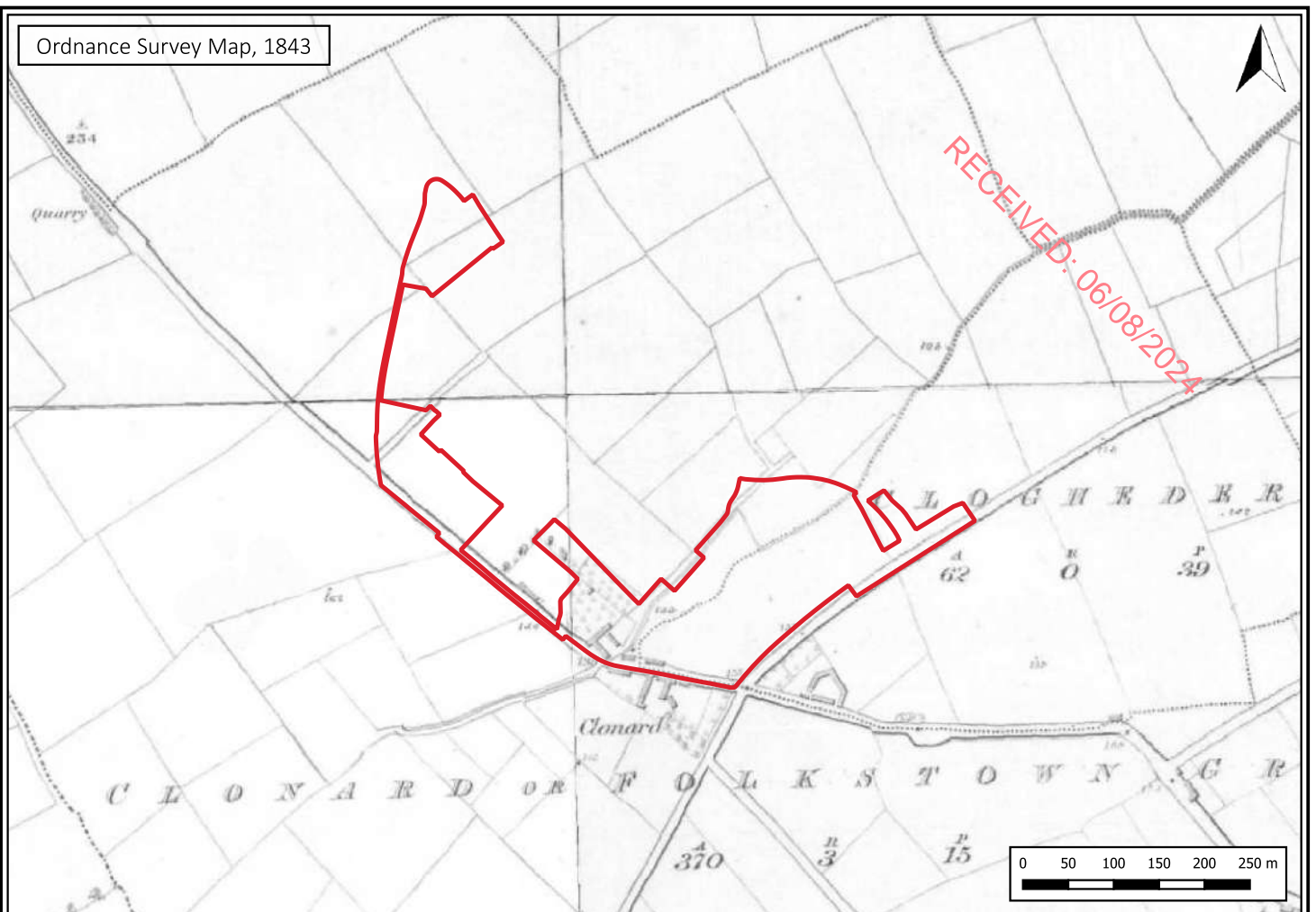
— Archaeological Areas

IAC Archaeology

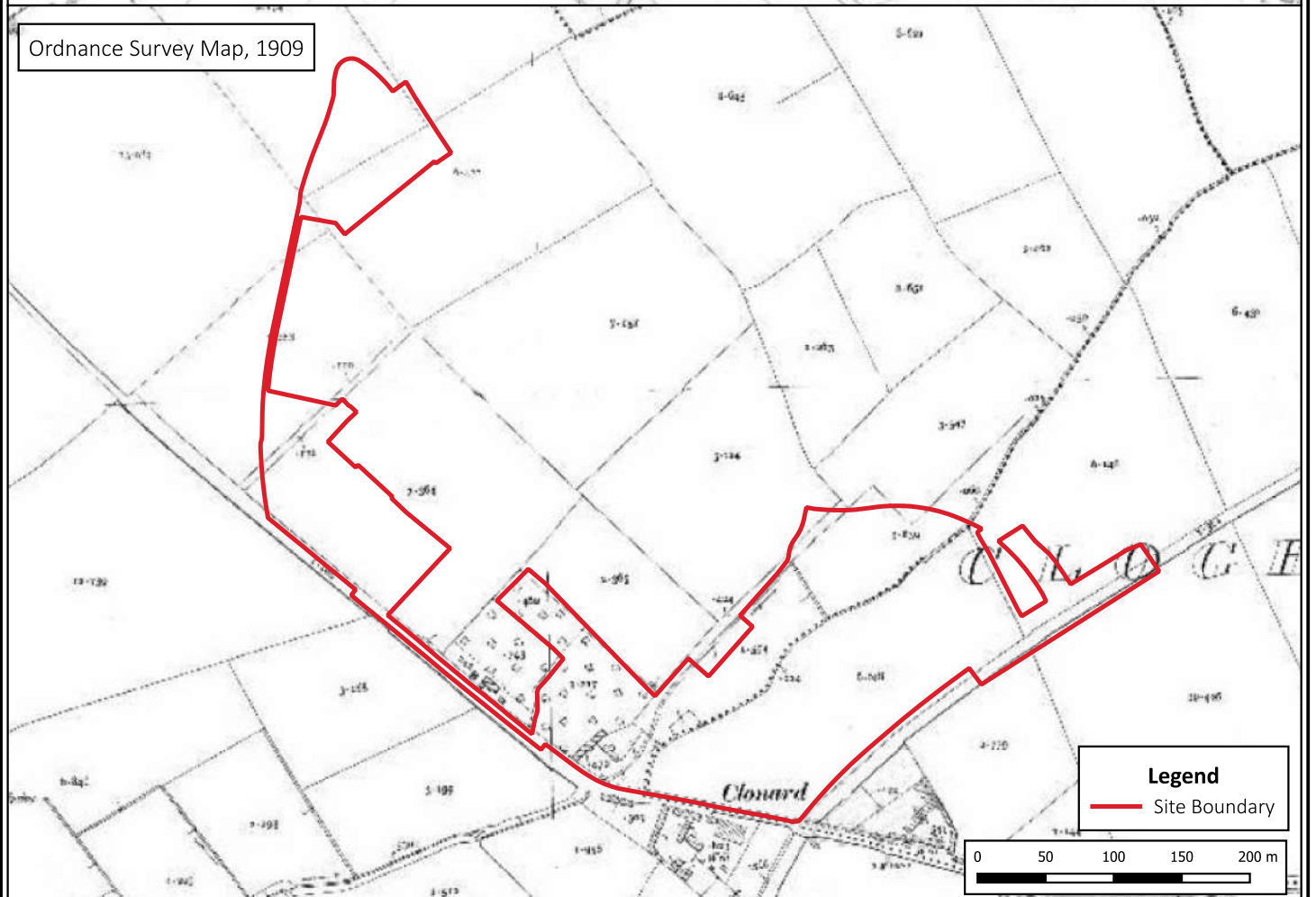
Title	Plan of the proposed development	Scale	As shown	Drawn By	RB
Project	Phase 4, Ladywell, Balbriggan, Co. Dublin	Date	25.07.24	Checked By	JW
		Job No.	J4135.1	Approved By	FB
		Fig.	2	Rev.	-

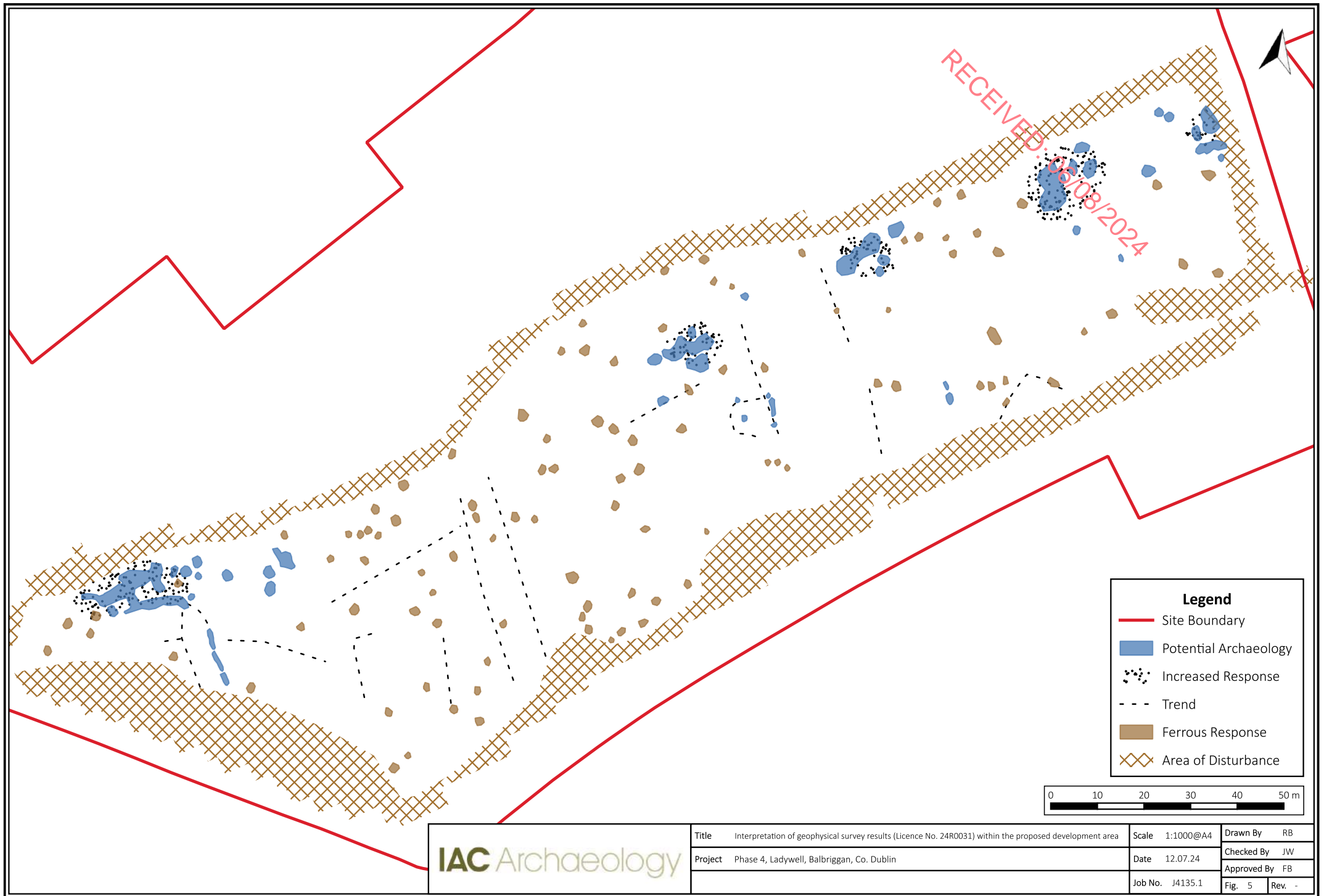


Ordnance Survey Map, 1843



Ordnance Survey Map, 1909



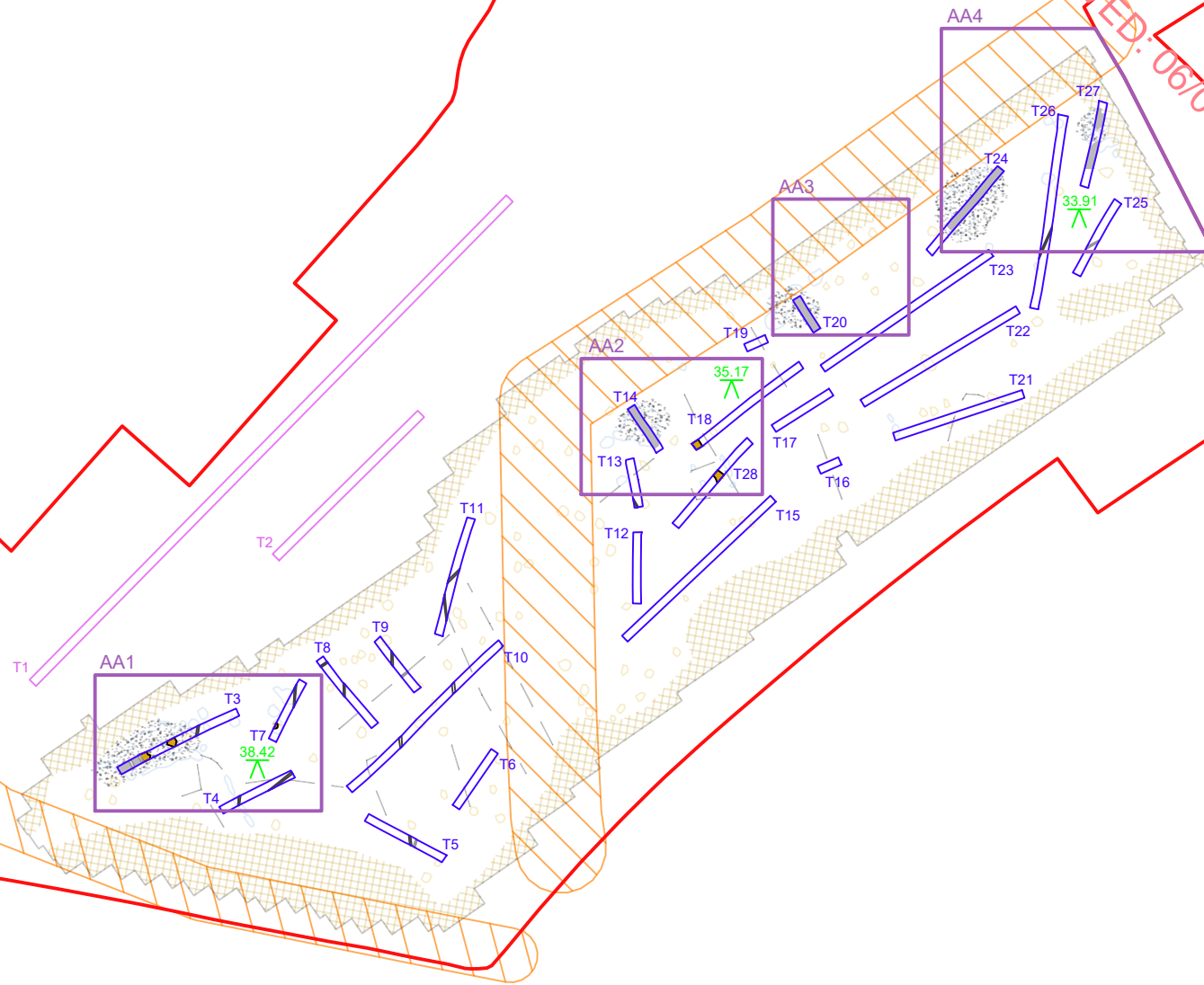




RECEIVED: 06/08/2024

+ 718400 E
763350 N

+ 718730 E
763350 N

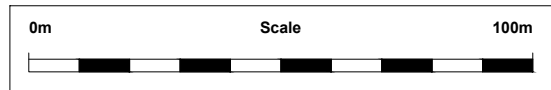


Legend

- Site Boundary
- Archaeological Area
- Test Trench
- Test Trench - Unexcavated
- CXX Cut number
- CXX Fill number
- xx.xx Level - meters OD
- XXXXXX E XXXXXX N ITM Reference
- Spread
- Archaeological Feature
- Stone Drain
- Drain
- Overhead Wire Buffer

Geophysical Legend

- Possible Archaeology
- Increased Response
- Trend
- Ferrous Response
- Area of Disturbance



IAC Archaeology

Title	Plan of excavated test trenches	Scale	1:1500@A4	Drawn by	RB
Project	Phase 4, Ladywell, Balbriggan, Co. Dublin	Date	25.07.24	Checked by	EL
		Job no.	J4135.1	Approved by	FB
			Fig. 6	Rev.	-

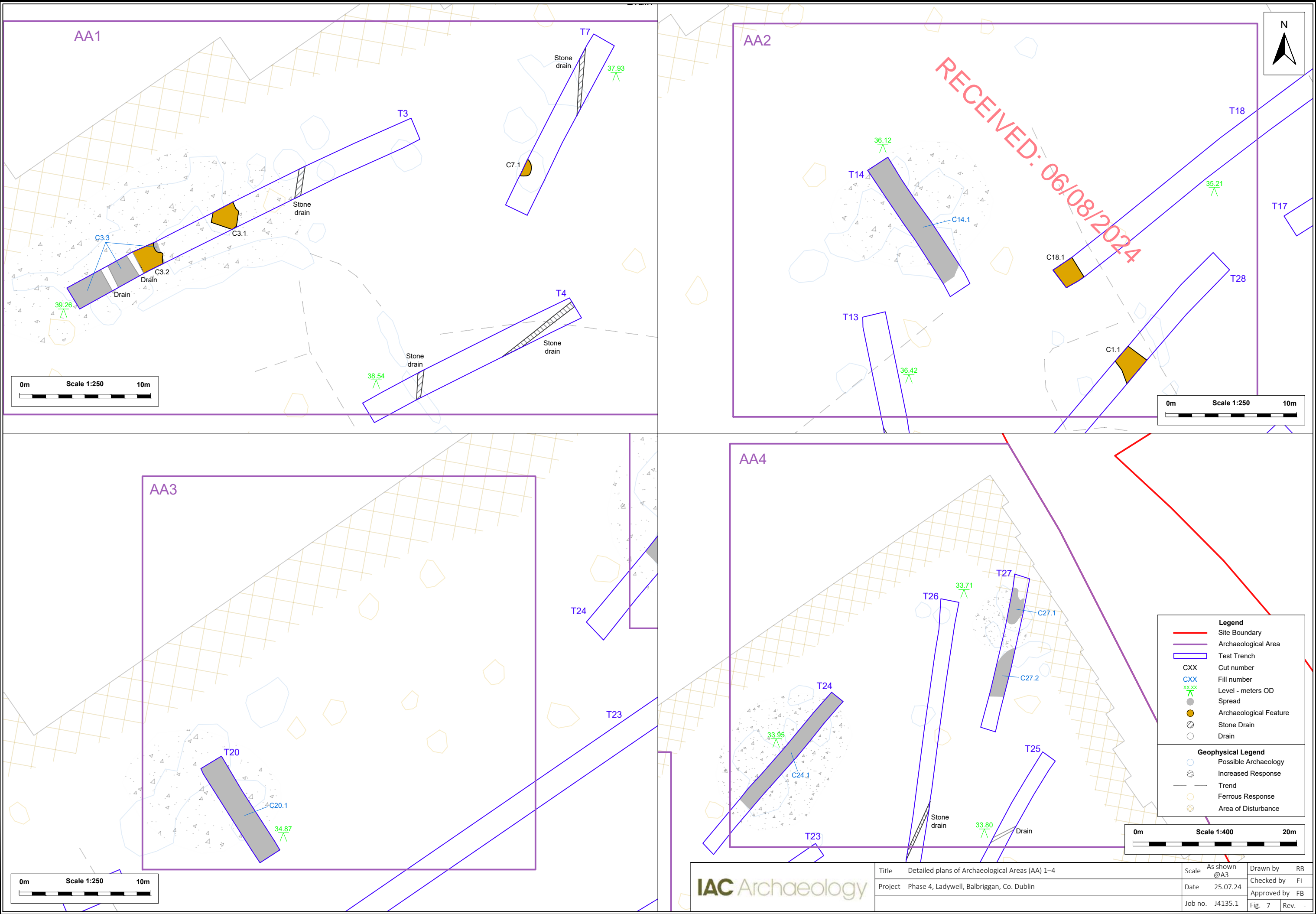




Plate 1 Trench 3, facing northeast, C3.2 in foreground



Plate 2 Possible Trough C3.1, facing northeast



Plate 3 Trench 4, facing southwest



Plate 4 Trench 7, Pit C7.1 facing north



Plate 5 Trench 9, facing northwest



Plate 6 Trench 11, facing north



Plate 7 Trench 13, facing north



Plate 8 Trench 14, facing north Spread C14.1



Plate 9 Trench 18, facing north northeast, Ditch C18.1



Plate 10 Trench 19, facing west-southwest



Plate 11 Trench 20, facing north northwest, Spread C20.1



Plate 12 Trench 21, facing east-northeast



Plate 13 Trench 23, facing northeast



Plate 14 Trench 24 facing southeast



Plate 15 Spread C24.1 facing southeast



Plate 16 Trench 25, facing northeast



Plate 17 Trench 27, facing south southeast



Plate 18 C27.1 Trough facing south-southeast



Plate 19 C27.2 Spread facing south-southeast



Plate 20 Ditch C28.1 facing southeast

APPENDIX B – OTHER ASSESSMENTS

RECEIVED: 06/08/2024

Appendix B - Other Relevant Assessments Considered

Relevant Legislation	Nature of Assessment	Relevant Assessment
<p>Directive 92/43/EEC, the Habitats Directive</p>	<p>Appropriate assessment comes from the Habitats Directive (92/43/EEC), which seeks to safeguard the long-term survival of Europe's most valuable and threatened species and habitats. The geographical areas of particular importance to these species and habitats have been selected as Special Areas of Conservation (SAC) and Special Protection Areas (SPA) which are collectively referred to (in Ireland) as European sites. Together, these sites comprise the pan-European Natura 2000 network of protected areas.</p> <p>One of the measures which protects these areas is the requirement that every project must undergo an assessment of its implications for any European site before consent for the project is given. Consent for the project can only be given after determining that it will not adversely affect the integrity of the site(s) concerned in view of the conservation objectives of that site.¹ In order to determine if an appropriate assessment is required, a screening process must be carried out for all applications for planning permission.</p> <p>The Habitats Directive (92/43/EEC) and the associated Birds Directive (2009/147/EC) are transposed into Irish legislation by Part XAB of the 2000 Act and the Birds and Natural Habitats Regulations 2011. The legislative provisions for appropriate assessment screening for planning applications are set out in Section 177U of the 2000 Act.</p>	<p>An Appropriate Assessment Screening Report and NIS accompany the current LRD application.</p> <p>The AA Screening Report concludes that Stage 2 appropriate assessment is required in relation to the proposed development,</p> <p>Fingal County Council, as the competent authority, will carry out an Appropriate Assessment of the proposed development.</p>
<p>Directive 2000/60/EC, The Water Framework Directive</p>	<p>The Water Framework Directive (WFD) (Directive 2000/60/EC) and The Groundwater Directive (Directive 2006/118/EC) requires all Member States to protect and improve water quality in all waters. The WFD is one of the key</p>	<p>The EIAR includes a detailed chapter addressing Water, Hydrology, water quality and the WFD, prepared by AWN.</p>

Relevant Legislation	Nature of Assessment	Relevant Assessment
	<p>overarching instruments in the protection of waters and includes subordinate directives or water-related legislation that complement or have been developed in response to, or coherent with, the requirements of the Water Framework Directive.</p> <p>The WFD requires 'Good Water Status' for all European waters to be achieved through a system of river basin management planning and extensive monitoring by 2015 or, at the least, by 2027. 'Good status' means both 'Good Ecological Status' and 'Good Chemical Status'.</p> <p>The WFD does not require site specific assessments to be undertaken by a developer. It lays down standards for the quality of designated waters ("guide" values as well as "imperative" values) and requires Member States to monitor the quality of designated waters and to take measures to ensure that they comply with the minimum standards¹.</p>	<p>Chapter 6 states the following:</p> <p>The proposed development is located within the Irish River Basin District), as defined under the European Communities Directive 2000/60/EC, establishing a framework for community action in the field of water policy – this is commonly known as the Water Framework Directive (WFD). It is situated in Hydrometric Area No. 08 of the Irish River Network and is located within the Nanny-Delvin Catchment and the PALMERSTOWN_SC_010 sub-catchment. The Clonard Brook Stream belongs to the MATT_010 WFD surface water body (European Code: IE_EA_08M010900) whose most recent WFD River (surface) water status (2016-2021) is 'Poor' with a current WFD risk score (3rd risk cycle) of '<i>At risk of not achieving good status</i>'. This rating and the main pressures identified on the MATT_010 waterbody are attributed to poor ecological and biological status or potential (Catchments.ie, 2024). Currently, the EPA classifies the WFD Ecological Status for the Bremore (Liffey_180 WFD) waterbody as having 'Poor' (2016-2021) status with a current WFD River Waterbody risk score of 1a, '<i>At risk of not achieving good status</i>'. This rating and the main pressures identified on the Bremore river waterbody are attributed to poor ecological and biological status or potential (Catchments.ie, 2023).</p>
Directive 2001/42/EC, The SEA Directive	<p>The Strategic Environmental Assessment (SEA) Directive 2001/42/EC, on the assessment of the effects of certain plans and programmes on the environment requires that an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment. Public plans and programmes that are likely to have significant effects on the environment must have a Strategic Environmental Assessment (SEA).</p> <p>The SEA Directive (2001/42/EC) is implemented in Ireland by the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (SI 435/2004) and</p>	<p>The SEA for the relevant County Development Plan incorporates mitigation to minimise the impact of the plans on the environment. The policies of the plan were formulated with regard to the SEA processes undertaken. The subject site was designated for the nature and form of development proposed under the relevant plan, which has been subject to SEA. This is addressed in further detail in the context of the assessment of alternatives within Chapter 2 of this EIAR.</p>

Relevant Legislation	Nature of Assessment	Relevant Assessment
	<p>the Planning and Development (Strategic Environmental Assessment) Regulations 2004 (SI 436/ 2004), as amended.</p> <p>There are no specific assessments required by the developer under the SEA Directive in respect of the current LRD application on site.</p> <p>SEA has been undertaken by the relevant authority in respect of the South Dublin County Development Plan 2022-2028.</p>	<p>RECEIVED: 06/08/2024</p>
<p>Directive 2002/49/EC, regarding environmental noise</p>	<p>The Environmental Noise Directive 2002/49/EC relates to the assessment and management of environmental noise; this is the main EU instrument to identify noise pollution levels and to trigger the necessary action both at Member State and at EU level. The Directive requires Member States to prepare and publish, every 5 years, noise maps and noise management action plans for:</p> <p>agglomerations with more than 100,000 inhabitants</p> <p>major roads (more than 3 million vehicles a year)</p> <p>major railways (more than 30.000 trains a year)</p> <p>major airports (more than 50.000 movements a year, including small aircrafts and helicopters)</p> <p>When developing noise management action plans, Member States' authorities are required to consult the concerned public. Relevant bodies develop noise action plans that we consider as appropriate.</p>	<p>Chapter 9 of this EIAR for the current LRD application comprises an assessment of noise and vibration impacts associated with the development.</p> <p>The noise assessment undertaken as part of the EIAR, has regard to the relevant provisions of Directive 2002,49/EC.</p>
<p>Seveso Directive (Directive 82/501/EEC, Directive 96/82/EC, Directive</p>	<p>The Seveso Directive (Directive 82/501/EEC, Directive 96/82/EC, Directive 2012/18/EU) was developed by the EU after a series of catastrophic accidents involving major industrial</p>	<p>The subject lands are not proximate to any Seveso/COMAH designated sites.</p> <p>Furthermore, there are no substances to be stored as part of the proposed development that would be controlled under Seveso Directive of COMAH Regulations.</p>

Relevant Legislation	Nature of Assessment	Relevant Assessment
2012/18/EU)	<p>sites and dangerous substances. Such accidents can give</p> <p>rise to serious injury to people or serious damage to the environment, both on and off the site of the accident.</p> <p>The Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015) (the “COMAH Regulations”), implements the latest Seveso III Directive (2012/18/EU). The purpose of the COMAH Regulations is to transpose the Seveso Directive into Irish law and lay down rules for the prevention of major accidents involving dangerous substances, and to seek to limit as far as possible the consequences for human health and the environment of such accidents, with the overall objective of providing a high level of protection in a consistent and effective manner.</p>	<p>RECEIVED: 06/08/2024</p>
Directive 2008/50/EC, the clean air for Europe directive	<p>The Clean Air for Europe (CAFE) Directive 2008/50/EC is the prevailing legislation to</p> <p>improve the quality of air in Europe and limit exposure to air pollution. The CAFE Directive set rules including how to monitor, assess, and manage ambient air quality.</p> <p>Overall, the main objective of the CAFE Directive is to reduce human and environmental exposure to air pollutants and ensure that the limits of values and thresholds are not exceeded. The CAFE Directive was transposed into Irish legislation by S.I. No. 180/2011 - Air Quality Standards Regulations 2011.</p> <p>The CAFÉ Directive mandates the location and quantity of air</p>	<p>Due to the nature of the proposed development, there are no specific assessments required by the applicant under the CAFE Directive for the Proposed Development.</p> <p>The air quality and climate assessment undertaken as part of the EIAR, which had regard to the relevant provisions of Directive 2008/50/EC, concluded that no significant impacts would arise subject to mitigation</p>

Relevant Legislation	Nature of Assessment	Relevant Assessment
	<p>monitoring stations that Environmental Protection Agency (EPA) should undertake ambient air monitoring. If there is an exceedance of the ambient limit value an Air Quality Action Plan must be developed by Local Authorities in conjunction with the EPA.</p> <p>Chapter 9 of this EIAR includes an assessment of air quality and climate impacts associated with the development.</p> <p>The analysis and findings within that chapter of the EIAR were made with regard to the provisions of Directive 2008/50/EC.</p>	<p>RECEIVED: 06/08/2024</p>
<p>Directive 2007/60/EC, regarding the assessment and management of flood risks</p>	<p>The Floods Directive (Directive 2007/60/EC) establishes a framework for the assessment and management of flood risks, with the aim to reduce the adverse consequences on human health, the environment and material assets.</p> <p>The Floods Directive requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk. The Floods Directive also reinforces the rights of the public to access this information and to have a say in the planning process.</p> <p>The Floods Directive must be implemented in tandem with the WFD. In Ireland, the OPW is the national authority assigned with the implementation of the Floods Directive, which was transposed into Irish law by the EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010.</p>	<p>Fingal County Council undertook a Strategic Flood Risk Assessment as part of the Development Plan preparation process, which zoned the subject site for the nature of development proposed.</p> <p>The application is accompanied by a detailed Site Specific Flood Risk Assessment Report prepared by Paul McGrail Consulting Engineers.</p> <p>All proposed residential and commercial development within the subject site is located within Flood Zone C, and there is low to very low residual risk of flooding of any sort on site.</p>

APPENDIX C – LAND AND SOILS

Appendix 5.1 Ground Investigations Ireland Taylor Hill, Balbriggan Phase 3 Site Investigation Report, June 2020, Rev B

Appendix 5.2 List of Soils Generic Assessment Criteria (GAC)

GII Site Investigations 2024

RECEIVED: 06/08/2024

Appendix 5.1 Ground Investigations Ireland Taylor Hill, Balbriggan Phase 3 Site Investigation Report, June 2020, Rev B

RECEIVED: 06/08/2024



**GROUND
INVESTIGATIONS
IRELAND**

Ground Investigations Ireland Ltd.,
Catherinestown House,
Hazelhatch Road,
Newcastle, Co Dublin.
Tel: 01 601 5175 / 5176 | Fax: 01 601 5173
Email: info@gii.ie | Web: gii.ie

RECEIVED: 06/08/2024

Ground Investigations Ireland

Taylor Hill Balbriggan (Phase 3)

Ground Investigation Report

DOCUMENT CONTROL SHEET

Project Title	Balbriggan Phase 3
Engineer	Paul McGrail
Project No	9450-02-20 & 9597-04-20
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
B	Final	S Kealy	C Finnerty	F McNamara	Dublin	30 June 2020



RECEIVED: 06/08/2024

CONTENTS

1.0	Preamble.....	3
2.0	Overview.....	3
2.1.	Background.....	3
2.2.	Purpose and Scope	3
3.0	Subsurface Exploration	3
3.1.	General	3
3.2.	Trial Pits.....	4
3.3.	Soakaway Testing	4
3.4.	Cable Percussion Boreholes.....	4
3.5.	Rotary Boreholes.....	5
3.6.	Groundwater & Surface water monitoring	5
4.0	Ground Conditions	5
4.1.	General	5
4.2.	Groundwater	6
4.3.	Laboratory Testing	7
4.3.1.	Geotechnical Laboratory Testing	7
4.3.2.	Environmental Laboratory Testing	7
5.0	Recommendations & Conclusions	8
5.1.	General	8
5.2.	Foundations	8
5.3.	Excavations.....	8
5.4.	Soakaway Design	9

APPENDICES

Appendix 1	Site Location Plan
Appendix 2	Trial Pit Records
Appendix 3	Soakaway Records
Appendix 4	Cable Percussion Borehole Records
Appendix 5	Laboratory Testing Records
Appendix 6	Rotary Borehole Records
Appendix 7	Groundwater Monitoring Records

1.0 Preamble

On the instructions of Paul McGrail Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., in February and March 2020 at the site of the proposed housing development in Balbriggan, Co. Dublin. A second set of site visits were carried out to recover groundwater and surface water samples, to complete groundwater monitoring and to complete a rotary core borehole.

2.0 Overview

2.1. Background

It is proposed to construct a new residential development with associated services, access roads and car parking at the proposed site. The site is currently greenfield and is situated in Balbriggan. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant. A basement is proposed as part of the proposed scheme, close to where the rotary borehole was carried out.

2.2. Purpose and Scope

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

- Visit project site to observe existing conditions
- Carry out 8 No. Trial Pits to a maximum depth of 3.0m BGL
- Carry out 4 No. Soakaways to BRE digest 365
- Carry out 4 No Cable Percussion boreholes to a maximum depth of 9.0m BGL
- Carry out 1 No Rotary Core borehole to a maximum depth of 8.0m BGL
- Geotechnical and Environmental Laboratory Testing
- Groundwater Monitoring
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

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

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

3.2. Trial Pits

The trial pits were excavated using a 13T tracked 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 an Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. 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. Cable Percussion Boreholes

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

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

test and also to estimate the bearing capacity and compressibility of the soil. The cable percussion borehole logs are provided in Appendix 4 of this Report.

3.5. 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 6 of this Report.

3.6. Groundwater & Surface water monitoring

During the ground investigation a series of water samples were taken from the standpipes installed in the boreholes and from the adjacent surface water stream both upstream and downstream of the proposed development. The groundwater level was monitored for a period of one month to establish the equilibrium groundwater level and any variation over that period. The laboratory testing is included in Appendix 5 while the groundwater monitoring is included in Appendix 7.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to in situ 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 variable across the site and are generally comprised;

- Made Ground/ Fill
- Cohesive Deposits
- Granular Deposits
- Weathered Rock
- Bedrock

RECEIVED: 06/08/2024

MADE GROUND: Made Ground deposits were encountered at TP01, TP04 & TP06 to a maximum depth of 0.7m BGL. The deposits were described generally as *brown sandy slightly gravelly CLAY with cobbles and was noted as reworked*. **FILL:** Fill was encountered in SA02 to a maximum depth of 0.50m BGL where it was typically described as a *grey medium to coarse angular Gravel*.

COHESIVE DEPOSITS: Cohesive deposits were encountered generally from ground level or beneath the Made Ground to a maximum depth of 3.0 and were described typically as *brown, grey brown or reddish brown sandy gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

GRANULAR DEPOSITS: Granular deposits were generally encountered within the cohesive deposits and were typically described as a *brown/grey clayey gravelly fine to coarse SAND*. The secondary sand/gravel and silt/clay constituents varied across the site and with depth while occasional or frequent cobble and boulder content also present where noted on the exploratory hole logs.

WEATHERED ROCK: Weathered Rock was encountered in TP01 and T02 at a depth of to a maximum depth of 2.4m and 0.2m BGL respectively and was typically described as *Shale*.

BEDROCK: The rotary borehole RC04 recovered weak to medium strong grey thinly laminated fine grained SILTSTONE which was partially weathered from 2.0m BGL and recovered core to a depth of 8.0m BGL.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred. 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 time of year, rainfall, nearby construction and other factors. For this reason, groundwater monitoring standpipes were installed in BH02, BH03 & RC04 to allow the equilibrium water level to be determined.

4.3. Laboratory Testing

4.3.1. 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 40% generally with fines contents of 30 to in excess of 40%.

The Particle Size Distribution tests confirm that generally the granular deposits (TP4 at 2.5m BGL) are well-graded with percentages of silt/clay 12% and sands recorded at 32.9% with a gravel content of 54.9%. The MCV testing on remoulded samples gave results ranging between 1.6 and 6.4 for the cohesive deposits, indicating the material in its current moisture content is too wet to be reused on site as Class 2 General cohesive fill.

4.3.2. Environmental Laboratory Testing

A series of samples recovered in May 2020 from selected locations were tested for the solid portion of the Rilta suite to assess the soil for the environmental impact statement.

A number of samples were also analysed for the full Rilta suite, 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. 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. A waste classification report is recommended to be carried out to provide an interpretation of the laboratory data should any material be required to be disposed of off site. The laboratory testing is included in Appendix 5 of this Report.

5.0 Recommendations & Conclusions

5.1. General

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

5.2. Foundations

An allowable bearing capacity of 75 kN/m² is recommended for conventional strip or pad foundations on the firm, firm to stiff or stiff cohesive deposits at a depth of 1.2m BGL with the exception of TP03 where these deposits are present at a depth of 1.5m BGL. TP02 had shallow bedrock and any foundations on these deposits should be carefully constructed to ensure all of the foundations for the same unit are on the same stratum, an allowable bearing capacity of in excess of 250 kN/m² is recommended for the shallow bedrock at this location.

Due to the variation with the weathered rock, granular deposits and cohesive deposits encountered with depth across the site we would recommend that all foundations be founded on the same strata. Alternatively to reduce the cost and avoid digging down to the deeper stratum, the foundations should adequately reinforced to prevent problems with differential settlement.

The possibility for variation in the depth of the made ground and the depth of soft deposits 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 or 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.

5.3. Excavations

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

Excavations in the Made Ground and 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.

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

Excavations in the upper cohesive and weathered rock deposits are expected to be excavatable with conventional excavation equipment to the depths investigated. If deeper excavations are proposed below the base of the trial pits, rotary coring would be prudent to determine the nature and strength of the underlying rock. Any material to be removed off site should be disposed of to a suitably licenced landfill. A waste classification report is recommended to be carried out if any material is to be disposed of off-site.

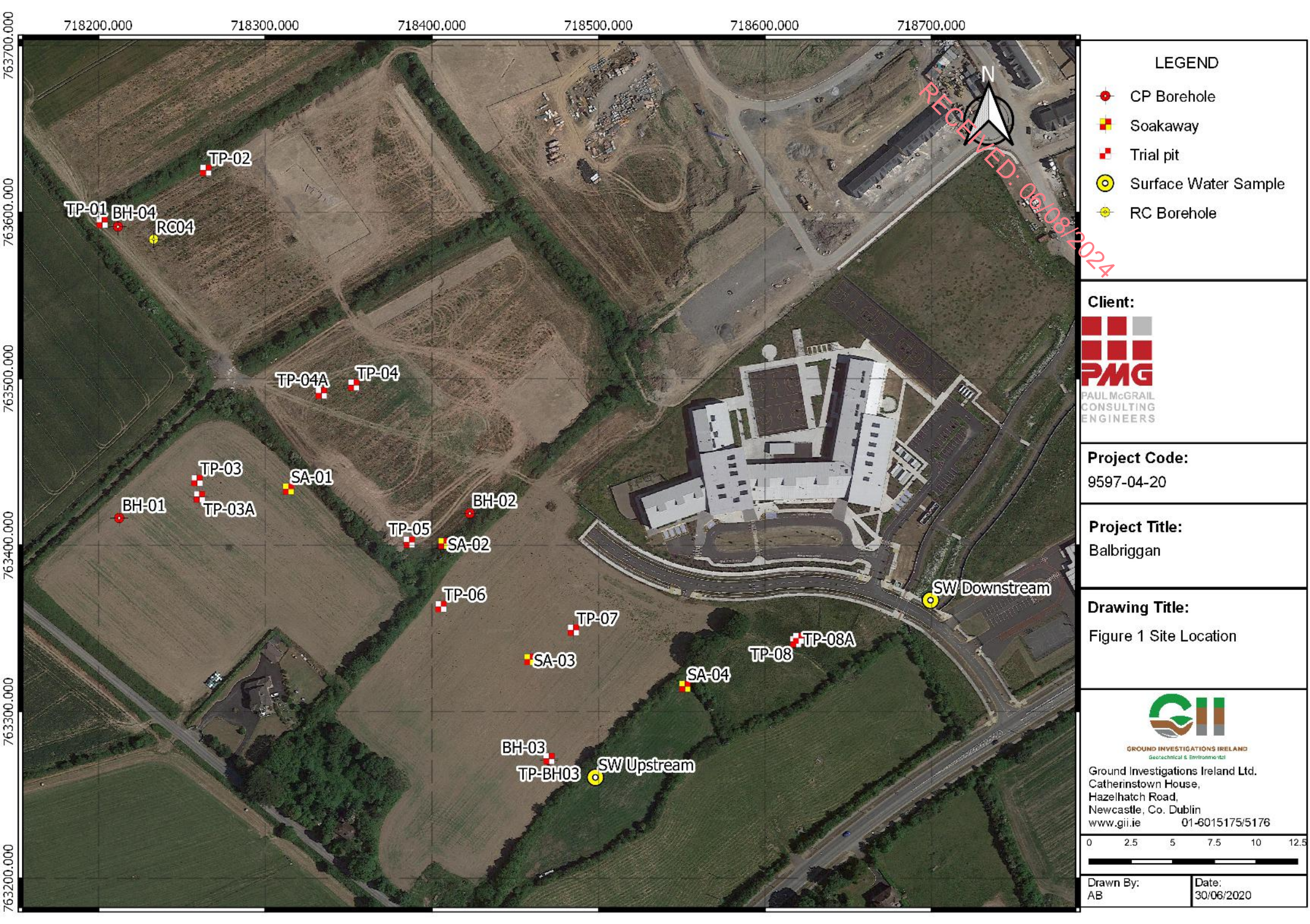
5.4. Soakaway Design

At the locations of SA01 to SA04 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.

RECEIVED: 06/08/2024

APPENDIX 1 - Site Location Plan



LEGEND

- CP Borehole
- Soakaway
- Trial pit
- Surface Water Sample
- RC Borehole

Client:



Project Code:

9597-04-20

Project Title:

Balbriggan

Drawing Title:

Figure 1 Site Location



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176



Drawn By:
AB

Date:
30/06/2020

RECEIVED: 06/08/2024

APPENDIX 2 – Trial Pit Records



Ground Investigations Ireland Ltd

www.gii.ie

Site Balbriggan Phase 3	Trial Pit Number SA01
Client Glenveagh Homes	Job Number 9450-02-20
Engineer Paul McGrail	Sheet 1/1

Machine : Case 130D Method : Trial Pit	Dimensions 2.10x0.60x2.00m	Ground Level (mOD) 46.05
	Location 718313.8 E 763433.3 N	Dates 25/02/2020

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						Brown slightly sandy slightly gravelly TOPSOIL		
				45.65	0.40	Firm brown slightly sandy gravelly CLAY with occasional subrounded cobbles		
					(1.10)			
				44.55	1.50	Firm reddish brown slightly sandy gravelly CLAY with occasional subrounded cobbles and boulders		
					(0.50)			
				44.05	2.00	Complete at 2.00m		∇1

Plan	Remarks
	Trial Pit stable Groundwater encountered at 2.00m BGL as slow seepage Trial Pit backfilled upon completion
	Scale (approx) 1:25
	Logged By EB
	Figure No. 9450-02-20.SA01



Site	Balbriggan Phase 3
-------------	--------------------

**Trial Pit
Number**
SA02

Machine : Case 130D

Method : Trial Pit

Dimensions	2.50x0.60x2.00m
-------------------	-----------------

Ground Level (mOD)	41.78
--------------------	-------

Client	Glenveagh Homes
---------------	-----------------

Job Number	9450-02-20
------------	------------

Location
718407 E 763400.5 N

Dates	25/02/2020
--------------	------------

Engineer
Paul McGrail

Sheet
1/1

Description
crushed rock FILL

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)

1:25

Logged By

EB

Figure No.

9450-02-20.SA02



Site	Balbriggan Phase 3
-------------	--------------------

**Trial Pit
Number**
SA03

Dimensions	2.20x0.60x2.00m
-------------------	-----------------

Ground Level (mOD)	39.57
--------------------	-------

Client	Glenveagh Homes
---------------	-----------------


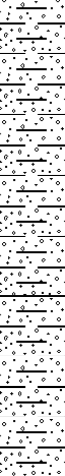
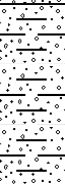
Job Number	9450-02-20
------------	------------

Location	718458.6 E 763330.8 N
-----------------	-----------------------

Dates	25/02/2020
--------------	------------

Engineer
Paul McGrail

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						Brown slightly sandy slightly gravelly TOPSOIL		
				39.17	0.40	Firm brown slightly sandy gravelly CLAY with occasional subrounded cobbles		
				38.17	1.40	Firm greyish brown sandy slightly gravelly CLAY		
				37.57	2.00	Complete at 2.00m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)

1:25

Logged By

EB

Figure No.

9450-02-20.SA03



Site	Balbriggan Phase 3
-------------	--------------------

**Trial Pit
Number**
SA04

Machine : Case 130D

Method : Trial Pit

Dimensions
1.80x0.60x2.00m

Ground Level (mOD)	36.04
--------------------	-------

Client	Glenveagh Homes
---------------	-----------------

Job Number	9450-02-20
------------	------------

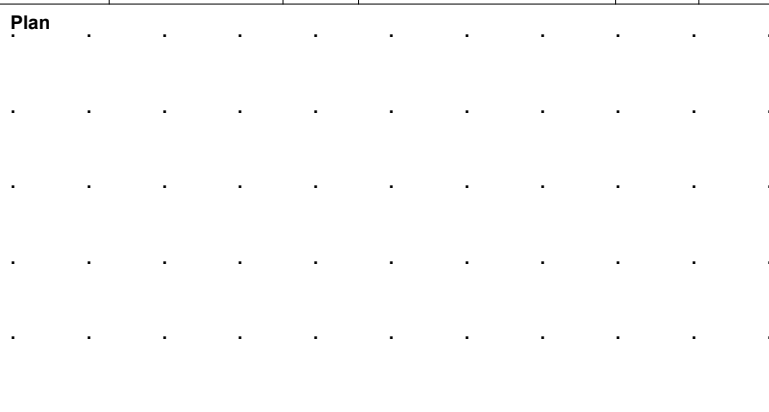
Location	718551.9 E 763314.6 N
-----------------	-----------------------

Dates	25/02/2020
--------------	------------

Engineer
Paul McGrail

Sheet
1/1

Description
ghtly gravelly TOPSOIL

Plan 	Remarks Trial Pit stable No groundwater encountered Trial Pit backfilled upon completion		
	Scale (approx) 1:25	Logged By EB	Figure No. 9450-02-20.SA04



Ground Investigations Ireland Ltd
www.gii.ie

Site Balbriggan Phase 3	Trial Pit Number TP01
Client Glenveagh Homes	Job Number 9450-02-20
Engineer Paul McGrail	Sheet 1/1

Machine : Case 130D Method : Trial Pit	Dimensions	Ground Level (mOD) 50.34
	Location 718202.1 E 763593.4 N	Dates 24/02/2020

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B				(0.70)	Grey slightly sandy gravelly Clay (Reworked)		
1.00	B			49.64	0.70 (0.90)	Firm reddish brown slightly sandy gravelly CLAY		
2.00	B			48.74	1.60 (0.80)	Greyish brown clayey gravelly fine to coarse SAND with occasional subrounded cobbles		
				47.94	2.40 (0.60)	Reddish brown weathered rock (Possible siltstone)		
				47.34	3.00	Complete at 3.00m		

Plan	Remarks
	Trial Pit collapse from 0.75m BGL No groundwater encountered Trial Pit backfilled upon completion
	Scale (approx) 1:25
	Logged By EB
	Figure No. 9450-02-20.TP01



Ground Investigations Ireland Ltd
www.gii.ie

Site Balbriggan Phase 3	Trial Pit Number TP02
Client Glenveagh Homes	Job Number 9450-02-20
Engineer Paul McGrail	Sheet 1/1

Machine : Case 130D Method : Trial Pit	Dimensions	Ground Level (mOD) 45.97
	Location 718264.4 E 763624.7 N	Dates 24/02/2020

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B			45.77	(0.20) 0.20	Brown slightly sandy gravelly Clay (Reworked)		
					(0.40)	Weathered rock (Possible siltstone)		
				45.37	0.60	Complete at 0.60m		

Plan	Remarks
<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	<div>Trial Pit stable No groundwater encountered Trial Pit backfilled upon completion</div>
	<div><div>Scale (approx) 1:25</div><div>Logged By EB</div><div>Figure No. 9450-02-20.TP02</div></div>



Ground Investigations Ireland Ltd
www.gii.ie

Site Balbriggan Phase 3	Trial Pit Number TP03
Client Glenveagh Homes	Job Number 9450-02-20
Engineer Paul McGrail	Sheet 1/1

Machine : Case 130D Method : Trial Pit	Dimensions	Ground Level (mOD) 48.63
	Location 718259.1 E 763438.3 N	Dates 24/02/2020

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.70	B			48.23	0.40 (0.20)	Brown slightly sandy slightly gravelly TOPSOIL		
				48.03	0.60	Soft brown slightly sandy slightly gravelly CLAY		
					(0.90)	Soft to firm greyish brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
1.70	B			47.13	1.50 (0.60)	Firm reddish brown slightly sandy gravelly CLAY with occasional subrounded cobbles		
				46.53	2.10	Stiff brown sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and boulders		
2.50	B				(0.90)			
				45.63	3.00	Complete at 3.00m		

Plan	Remarks
	Trial Pit stable No groundwater encountered Trial Pit backfilled upon completion
	Scale (approx) 1:25
	Logged By EB
	Figure No. 9450-02-20.TP03



Site	Balbriggan Phase 3
-------------	--------------------

**Trial Pit
Number**
TP04

Machine : Case 130D
Method : Trial Pit

Dimensions

Ground Level (mOD)	43.82
--------------------	-------

Client	Glenveagh Homes
---------------	-----------------

Job Number	9450-02-20
------------	------------

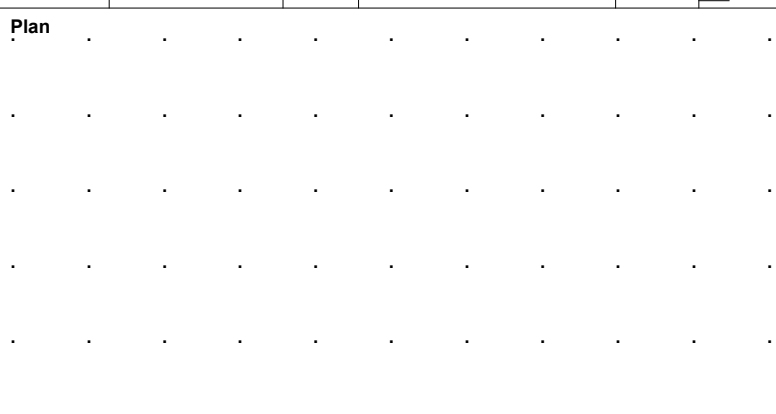
Location	718353.1 E 763495.6 N
-----------------	-----------------------

Dates	24/02/2020
--------------	------------

Engineer
Paul McGrail

Sheet
1/1

Description
avelly Clay (Reworked)

<div>Plan</div> 	Remarks		
	Trial Pit stable No groundwater encountered Trial Pit backfilled upon completion		
	Scale (approx)	Logged By	Figure No.
	1:25	EB	9450-02-20.TP04



Ground Investigations Ireland Ltd

www.gii.ie

Site
Balbriggan Phase 3

Trial Pit Number
TP05

Machine : Case 130D Method : Trial Pit	Dimensions	Ground Level (mOD) 42.52	Client Glenveagh Homes	Job Number 9450-02-20
	Location 718386.4 E 763401.3 N	Dates 24/02/2020	Engineer Paul McGrail	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B			42.27	(0.25) 0.25	Brown slightly sandy gravelly Clay (Reworked)		
						Firm to stiff greyish brown slightly sandy gravelly CLAY		
1.20	B			41.57	(0.70) 0.95	Firm to stiff brown slightly sandy gravelly CLAY with occasional subrounded cobbles		
2.00	B			40.82	1.70	Firm reddish brown slightly sandy gravelly CLAY with occasional subrounded cobbles and boulders		
					(1.10)			
			Moderate ingress(1) at 2.60m.	39.72	2.80	Stiff reddish brown slightly sandy gravelly CLAY with occasional subrounded cobbles and boulders		
				39.52	(0.20) 3.00	Complete at 3.00m		

Plan					Remarks		
.	.	.	.	.	Trial Pit collapsing from surface		
.	.	.	.	.	Groundwater encountered at 2.60m BGL as moderate ingress		
.	.	.	.	.	Trial Pit backfilled upon completion		
.			
.			
.			
					Scale (approx)	Logged By	Figure No.
					1:25	EB	9450-02-20.TP05



Ground Investigations Ireland Ltd

www.gii.ie

Site
Balbriggan Phase 3

Trial Pit Number
TP06

Machine : Case 130D Method : Trial Pit	Dimensions	Ground Level (mOD) 41.78	Client Glenveagh Homes	Job Number 9450-02-20
	Location 718405.4 E 763362.7 N	Dates 24/02/2020	Engineer Paul McGrail	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.70	B			41.43	(0.35)	Brown slightly sandy gravelly Clay (Reworked)		
					0.35	Firm greyish brown slightly sandy gravelly CLAY		
					(0.45)			
				40.98	0.80	Firm reddish brown slightly sandy gravelly CLAY with occasional subrounded cobbles		
					(1.10)			
1.40	B			39.88	1.90	Light brown very clayey gravelly predominately fine SAND with occasional subrounded cobbles		
					(1.10)			
2.50	B			38.78	3.00	Complete at 3.00m		

Plan					Remarks		
.	Trial Pit stable No groundwater encountered Trial Pit backfilled upon completion		
.			
.			
.			
.			
.			
					Scale (approx)	Logged By	Figure No.
					1:25	EB	9450-02-20.TP06



Machine : Case 130D Method : Trial Pit		Dimensions	Ground Level (mOD) 38.60	Client Glenveagh Homes	Job Number 9450-02-20
		Location 718484.9 E 763348.3 N	Dates 24/02/2020	Engineer Paul McGrail	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.70	B			38.25	(0.35) 0.35	Brown slightly sandy slightly gravelly TOPSOIL		
					(0.65)	Soft to firm greyish brown slightly sandy gravelly CLAY		
1.40	B			37.60	1.00	Firm brown slightly sandy gravelly CLAY with occasional subrounded cobbles		
					(1.30)			
2.50	B			36.30	2.30	Light brown very clayey gravelly predominately fine SAND		
					(0.70)			
				35.60	3.00	Complete at 3.00m		

Plan					Remarks		
.	.	.	.	.	Trial Pit collapsing from surface No groundwater encountered Trial Pit backfilled upon completion		
.			
.			
.			
.			
.	.	.	.	.	Scale (approx)	Logged By	Figure No.
.	.	.	.	.	1:25	EB	9450-02-20.TP07



Site	Balbriggan Phase 3
-------------	--------------------

**Trial Pit
Number
TP08**

**Job
Number**
9450-02-20

Sheet
1/1

Plan 	Remarks Trial Pit stable Groundwater encountered at 0.80m BGL as slow seepage and 2.90m BGL as fast ingress Trial Pit backfilled upon completion		
	Scale (approx) 1:25	Logged By EB	Figure No. 9450-02-20.TP08

**Balbriggan Phase 3 Trial Pit
Photographs**

RECEIVED 06/08/2024



TP01



TP01



RECEIVED 06/08/2024

TP01



TP02



TP02



TP03



TP03



TP03



TP04



TP04



TP04



TP05



TP05



TP05



TP06



TP06



TP06



TP07



TP07



TP07



TP08



TP08



TP08



SA01

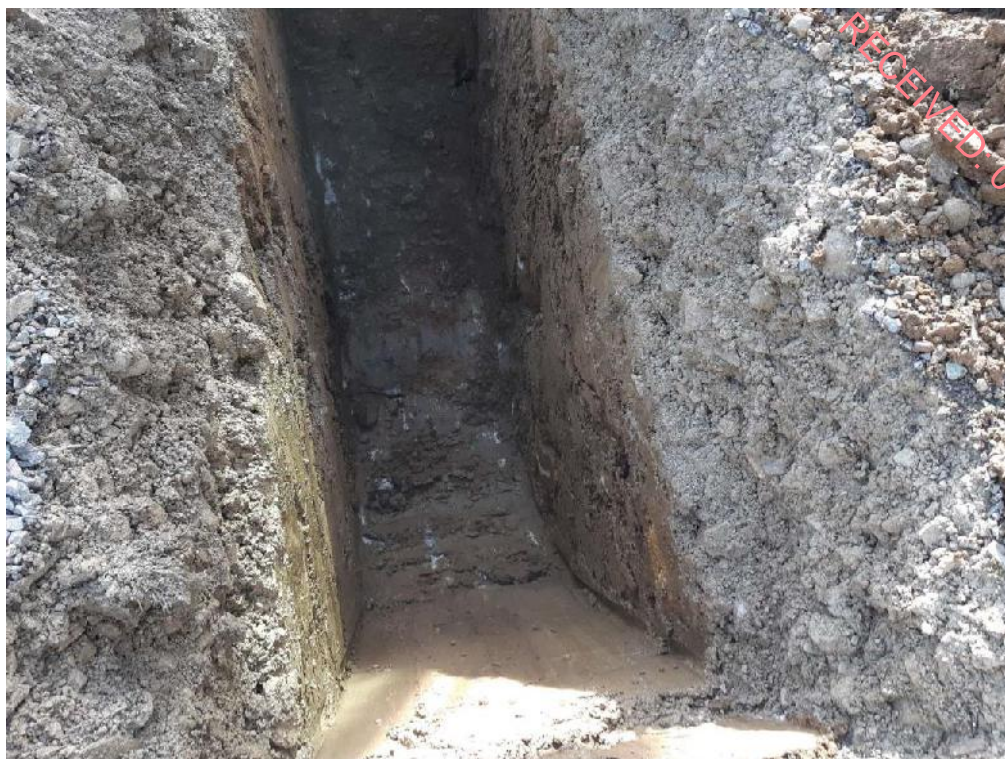


RECEIVED: 06/08/2024

SA01



SA01



SA02



SA02



SA02



SA03



SA03



SA03



SA04



SA04



SA04



Ground Investigations Ireland Ltd

www.gii.ie

Site

Balbriggan Phase Three Rotary Core

**Trial Pit
Number**
TP-03A

Machine : 13 Tonne Excavator
Method : Trial Pit

Dimensions
1.60mW x 3.00mL x 2.00mD

Ground Level (mOD)
48.59

Client
Glenveagh Properties PLC

**Job
Number**
9597-04-20

Location
718260.5 E 763428.5 N

Dates
08/05/2020

Project Contractor
Ground Investigations Ireland

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	EN			48.19	0.40 (0.20)	Dark brown sandy slightly gravelly TOPSOIL with occasional rootlets.		
				47.99	0.60 (0.80)	Firm brown slightly sandy slightly gravelly CLAY.		
						Firm brownish grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.		
1.50	EN			47.19	1.40 (0.60)	Firm to stiff reddish brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and boulders.		
				46.59	2.00	Complete at 2.00m		

Plan

.
.
.
.
.
.

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled at 2.00m

Scale (approx)

1:25

Logged By

PM

Figure No.

9597-04-20.TP-03A



Ground Investigations Ireland Ltd

www.gii.ie

Site
Balbriggan Phase Three Rotary Core

Trial Pit
Number
TP-04A

Machine : 13 Tonne Excavator Method : Trial Pit		Dimensions 1.70mW x 3.00mL x 2.00mD	Ground Level (mOD) 44.84	Client Glenveagh Properties PLC	Job Number 9597-04-20
		Location 718333.7 E 763490.8 N	Dates 08/05/2020	Project Contractor Ground Investigations Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	EN			44.34	0.50	MADE GROUND: Grey sandy clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles and boulders and occasional fragments of timber plastic and concrete.		
					(1.00)	Firm to stiff brownish grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and boulders.		
1.50	EN			43.34	1.50	Light brown very clayey gravelly fine to coarse subrounded SAND		
					(0.50)			
				42.84	2.00	Complete at 2.00m		

Plan					Remarks		
.	.	.	.	.	Trial pit stable No groundwater encountered Trial pit backfilled at 2.00m		
.			
.			
.			
.			
.			
					Scale (approx)	Logged By	Figure No.
					1:25	PM	9597-04-20.TP-04A



Ground Investigations Ireland Ltd

www.gii.ie

Site

Balbriggan Phase Three Rotary Core

Trial Pit Number

TP-BH03

Machine : 13 Tonne Excavator

Method : Trial Pit

Dimensions

1.40mW x 3.20mL x 2.00mD

Ground Level (mOD)

38.69

Client

Glennaveagh Properties PLC

Job Number

9597-04-20

Location

718470.3 E 763271.2 N

Dates

08/05/2020

Project Contractor

Ground Investigations Ireland

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	EN			38.39	(0.30) 0.30	Dark brown sandy slightly gravelly clayey TOPSOIL with occasional rootlets.		
					(0.60)	Firm greyish brown slightly sandy slightly gravelly mottled orange CLAY with occasional subangular to subrounded cobbles and boulders.		
1.50	EN			37.79	0.90	Firm to stiff reddish brown slightly sandy slightly gravelly mottled orange CLAY with occasional subangular to subrounded cobbles and boulders		
					(1.10)			
				36.69	2.00	Complete at 2.00m		

Plan

.
.
.
.
.
.

Remarks

Trial pit stable
Groundwater encountered at 1.90m
Trial pit backfilled at 2.00m

Scale (approx)

1:25

Logged By

PM

Figure No.

9597-04-20.TP-BH03

Balbriggan Phase Three, Rotary Core – Trial Pit Photographs

TP-03A

RECEIVED: 06/08/2024





TP-04A

RECEIVED: 06/08/2024





TP-08A

RECEIVED: 06/08/2024





TP-BH03

RECEIVED: 06/08/2024





RECEIVED: 06/08/2024

APPENDIX 3 – Soakaway Records



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

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

RECEIVED: 06/08/2024

SA01

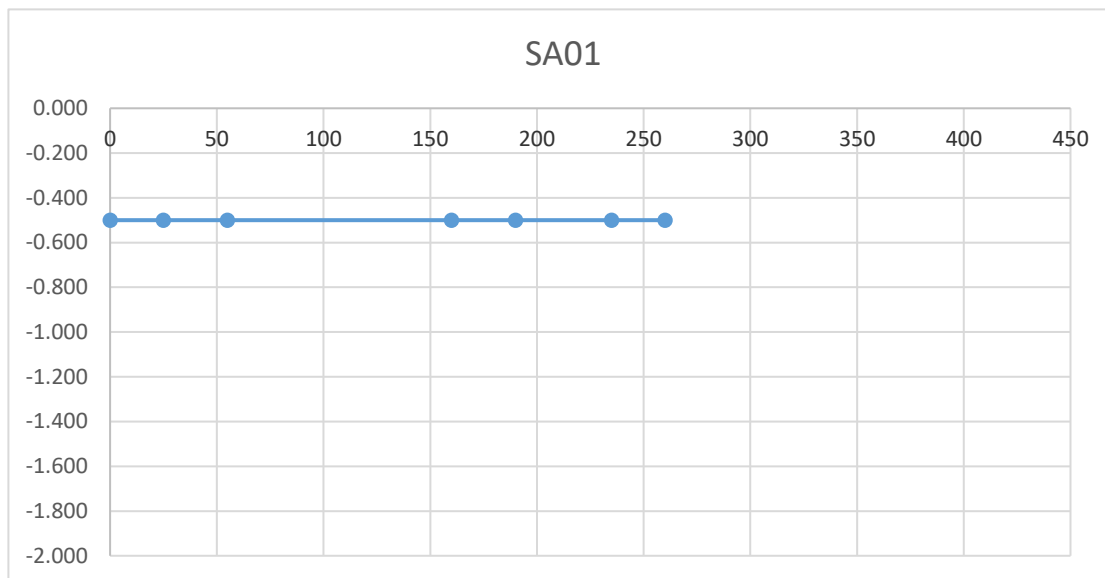
Soakaway Test to BRE Digest 365

Trial Pit Dimensions: 2.10m x 0.60m 2.00m (L x W x D)

Date	Time	Water level (m bgl)
25/02/2020	0	-0.500
25/02/2020	25	-0.500
25/02/2020	55	-0.500
25/02/2020	160	-0.500
25/02/2020	190	-0.500
25/02/2020	235	-0.500
25/02/2020	260	-0.500

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.50	2.000	1.500	0.875	1.625





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

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

RECEIVED: 06/08/2024

SA02

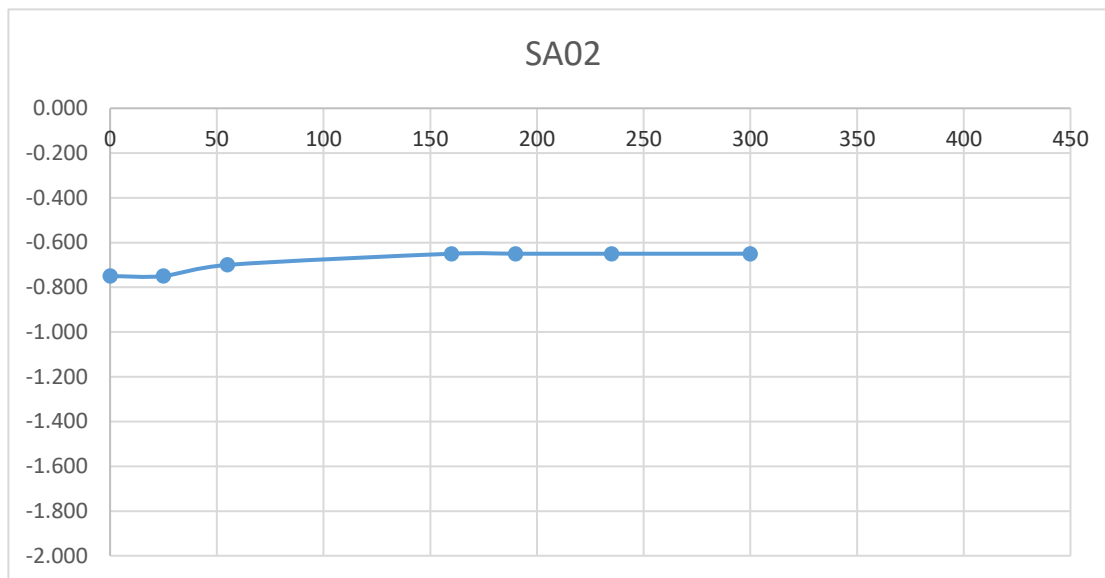
Soakaway Test to BRE Digest 365

Trial Pit Dimensions: 2.50m x 0.60m 2.00m (L x W x D)

Date	Time	Water level (m bgl)
25/02/2020	0	-0.750
25/02/2020	25	-0.750
25/02/2020	55	-0.700
25/02/2020	160	-0.650
25/02/2020	190	-0.650
25/02/2020	235	-0.650
25/02/2020	300	-0.650

*Soakaway failed - Pit backfilled

Start depth	Depth of Pit	Diff	75% full	25%full
0.75	2.000	1.250	1.0625	1.6875





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

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

RECEIVED: 06/08/2024

SA03

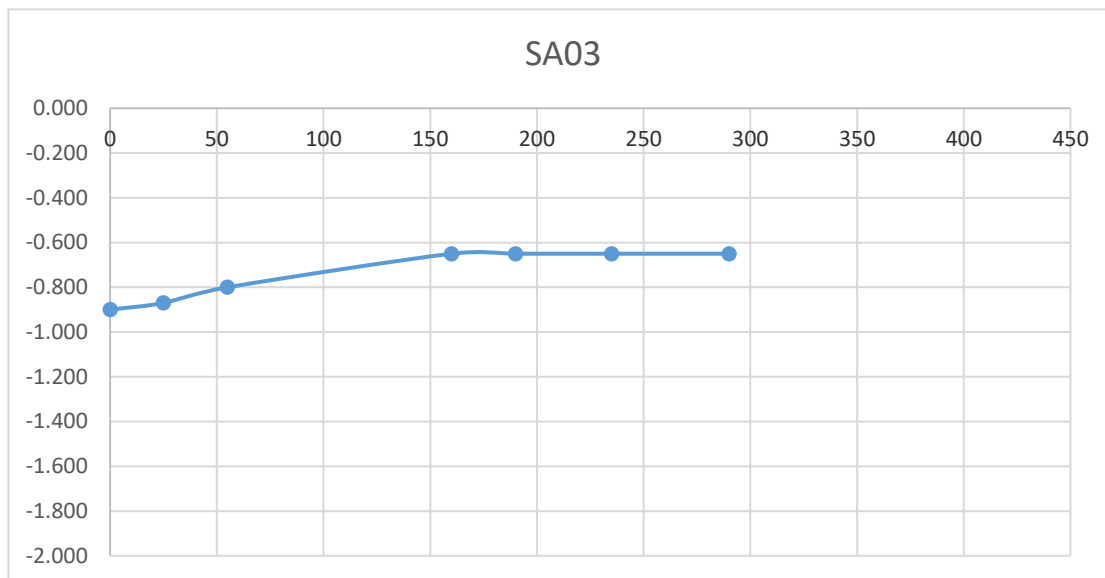
Soakaway Test to BRE Digest 365

Trial Pit Dimensions: 2.20m x 0.60m 2.00m (L x W x D)

Date	Time	Water level (m bgl)
25/02/2020	0	-0.900
25/02/2020	25	-0.870
25/02/2020	55	-0.800
25/02/2020	160	-0.650
25/02/2020	190	-0.650
25/02/2020	235	-0.650
25/02/2020	290	-0.650

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.90	2.000	1.100	1.175	1.725





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

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

RECEIVED: 06/08/2024

SA04

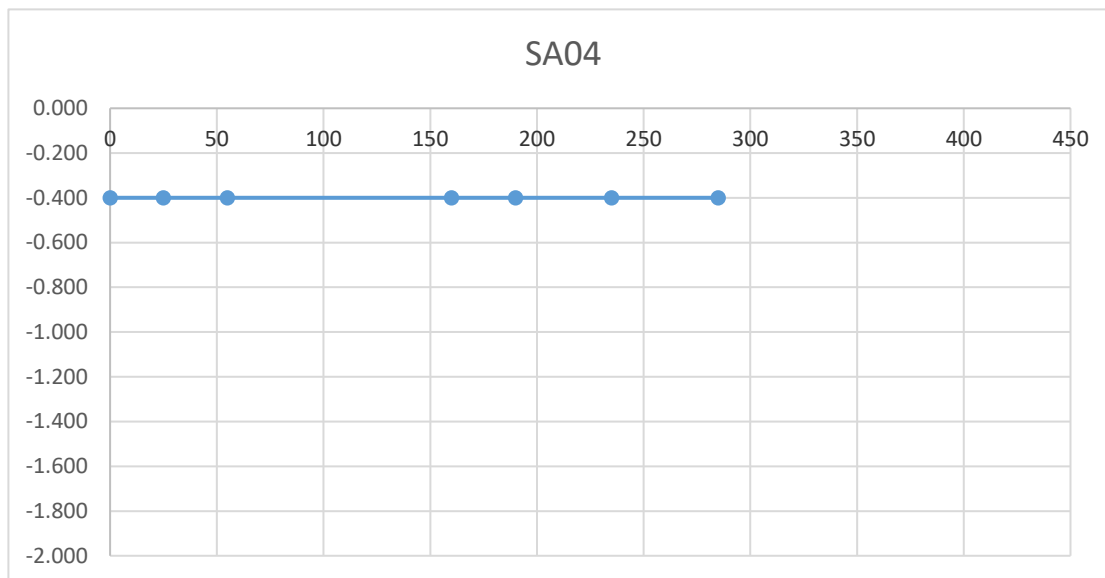
Soakaway Test to BRE Digest 365

Trial Pit Dimensions: 1.80m x 0.60m 1.50m (L x W x D)

Date	Time	Water level (m bgl)
25/02/2020	0	-0.400
25/02/2020	25	-0.400
25/02/2020	55	-0.400
25/02/2020	160	-0.400
25/02/2020	190	-0.400
25/02/2020	235	-0.400
25/02/2020	285	-0.400

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.40	1.500	1.100	0.675	1.225





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

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

RECEIVED: 06/08/2024

SA01

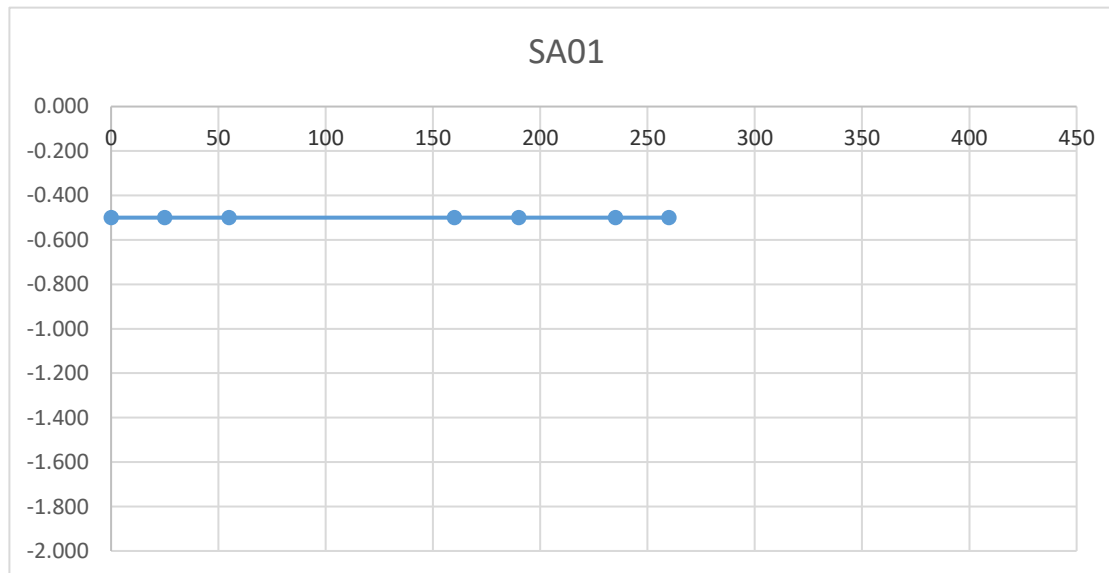
Soakaway Test to BRE Digest 365

Trial Pit Dimensions: 2.10m x 0.60m 2.00m (L x W x D)

Date	Time	Water level (m bgl)
25/02/2020	0	-0.500
25/02/2020	25	-0.500
25/02/2020	55	-0.500
25/02/2020	160	-0.500
25/02/2020	190	-0.500
25/02/2020	235	-0.500
25/02/2020	260	-0.500














*Soakaway failed - Pit backfilled

Start depth	Depth of Pit	Diff	75% full	25%full
0.50	2.000	1.500	0.875	1.625



RECEIVED: 06/08/2024

APPENDIX 4 – Cable Percussion Records

 Ground Investigations Ireland Ltd www.gii.ie							Site Balbriggan Phase 3		Borehole Number BH01
Machine : Dando 2000 Method : Cable Percussion		Casing Diameter 200mm cased to 4.30m		Ground Level (mOD) 50.54		Client Glenveagh Homes		Job Number 9450-02-20	
		Location 718212.4 E 763416.3 N		Dates 02/03/2020		Engineer Paul McGrail		Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.50	B				50.34	(0.20) 0.20	TOPSOIL: Brown sandy gravelly Clay		
						(0.80)	Brown sandy gravelly CLAY		
1.00-1.45 1.00-1.00	SPT(C) N=9 B			2,2/3,2,2,2	49.54	1.00 (0.60)	Firm brown sandy gravelly CLAY		
					48.94	1.60 (0.40)	Firm reddish brown gravelly CLAY		
2.00-2.45 2.00-2.00	SPT(C) N=18 B			2,3/4,5,5,4	48.54	2.00 (1.40)	Stiff reddish brown sandy gravelly CLAY		
									
3.00-3.30 3.00-3.00	SPT(C) 40/150 B			4,5/7,9,24					
					47.14	3.40 (0.60)	Stiff brown sandy gravelly CLAY		
									
4.00-4.00	B				46.54	4.00 (0.20)	Very stiff brown sandy gravelly CLAY		
					46.34	4.20	OBSTRUCTION - Presumed BEDROCK		
					46.24	4.30	Complete at 4.30m		
Remarks No Groundwater encountered Borehole terminated due to an obstruction - Presumed Bedrock Borehole backfilled upon completion Chiselling from 4.20m to 4.30m for 1 hour.								Scale (approx) 1:50	Logged By S Kealy
								Figure No. 9450-02-20.BH01	



Ground Investigations Ireland Ltd

www.gii.ie

Site
Balbriggan Phase 3

Borehole
Number
BH02

Machine : Dando 2000	Casing Diameter 200mm cased to 8.00m	Ground Level (mOD) 40.87	Client Glenveagh Homes	Job Number 9450-02-20
Method : Cable Percussion	Location 718422.8 E 763419.1 N	Dates 27/02/2020	Engineer Paul McGrail	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.50	B				40.57	(0.30) 0.30	Grey fine to coarse angular to sub-angular Crushed Rock FILL		
1.00-1.45 1.00-1.00	SPT(C) N=8 B			1,1/2,2,2,2	39.87	(0.70) 1.00	Brown/dark grey sandy gravelly CLAY		
2.00-2.45 2.00-2.00	SPT(C) N=21 B			3,3/4,5,6,6	38.97 38.87	(0.90) 1.90 2.00	Firm brown/dark grey sandy gravelly CLAY		
3.00-3.45 3.00-3.00	SPT(C) N=50 B			2,4/7,12,15,16		(2.80)	Firm reddish brown gravelly CLAY		
4.00-4.45 4.00-4.00	SPT(C) N=28 B			3,5/4,7,7,10			Stiff reddish brown sandy gravelly CLAY		
5.00-5.45 5.00-5.00	SPT(C) N=41 B			4,6/6,10,11,14	36.07 35.87	4.80 (0.20) 5.00	Very stiff reddish brown sandy gravelly CLAY		
6.00-6.45 6.00-6.00	SPT(C) N=38 B			3,3/7,8,8,15			Very stiff reddish brown very sandy gravelly CLAY with occasional cobbles		
7.00-7.45 7.00-7.00	SPT(C) N=44 B			4,6/6,10,13,15		(3.90)			
8.00-8.30 8.00-8.00	SPT(C) 50/150 B			5,7/10,19,21					
9.00-9.15 9.00-9.00	SPT(C) 50/0 B			25,25/50	31.97 31.87	8.90 9.00	OBSTRUCTION - Presumed BEDROCK		
							Complete at 9.00m		














Remarks

Groundwater encountered at 7.20m BGL and rose to 5.10m BGL in twenty minutes
Borehole terminated due to an obstruction - Presumed Bedrock
Borehole backfilled upon completion
Chiselling from 8.90m to 9.00m for 1 hour.

Scale (approx)
1:50

Logged By
S Kealy

Figure No.
9450-02-20.BH02

<div></div> <div>Ground Investigations Ireland Ltd</div> <div>www.gii.ie</div>						Site Balbriggan Phase 3		Borehole Number BH03	
Machine : Dando 2000 Method :		Casing Diameter		Ground Level (mOD) 38.70		Client Glenveagh Homes		Job Number 9450-02-20	
		Location Balbriggan		Dates 26/02/2020		Engineer Paul McGrail		Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45	SPT(C) N=8			1,1/1,2,2,3	38.50	(0.20) 0.20	Brown TOPSOIL		
						(1.00)	Soft grey brown sandy gravelly CLAY		
2.00-2.45	SPT(C) N=14			2,3/3,3,4,4	37.50	1.20	Stiff red brown very sandy gravelly CLAY		
						(2.00)			
3.00-3.45	SPT(C) N=23			3,3/5,5,6,7	35.50	3.20	Stiff grey sandy gravelly CLAY		
						(1.20)			
4.00-4.45	SPT(C) N=23			3,3/3,5,7,8	34.30	4.40	Red brown very sandy gravelly CLAY		
						(1.70)			
5.00-5.45	SPT(C) N=20			3,5/4,5,5,6	32.60	6.10	Complete at 6.10m		
									
6.00-6.45	SPT(C) N=50			3,13/50					
									
Remarks								Scale (approx) 1:50	Logged By EOC
								Figure No. 9450-02-20.BH03	



Ground Investigations Ireland Ltd

www.gii.ie

Site

Balbriggan Phase 3

Borehole

Number
BH04

Machine : Dando 2000

Method : Cable Percussion

Casing Diameter

Ground Level (mOD)

49.86

Client

Glenveagh Homes

Job

Number
9450-02-20

Location

Glenveigh Balbriggan

Dates

28/02/2020

Engineer

Paul McGrail

Sheet

1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B				49.66	(0.20) 0.20	Brown TOPSOIL		
1.00-1.45 1.00	SPT(C) N=10 B			1,2/2,3,2,3		(2.00)	Firm red brown slightly sandy gravelly CLAY		
2.00-2.45 2.00	SPT(C) N=15 B			2,3/4,4,3,4	47.66	2.20	Firm brown sandy gravelly CLAY. Gravel is angular to sub angular.		
					47.06	2.80	OBSTRUCTION - Presumed bedrock		
							Complete at 2.80m		

Remarks

Driller notes: Chiselling at 2.80m for 1 hour possible bedrock

Scale (approx)

1:50

Logged By

EOC

Figure No.

9450-02-20.BH04

RECEIVED: 06/08/2024

APPENDIX 5 – Laboratory Testing Results

Tests	Lab	
Train at	Vane	
Failure %	kPa	

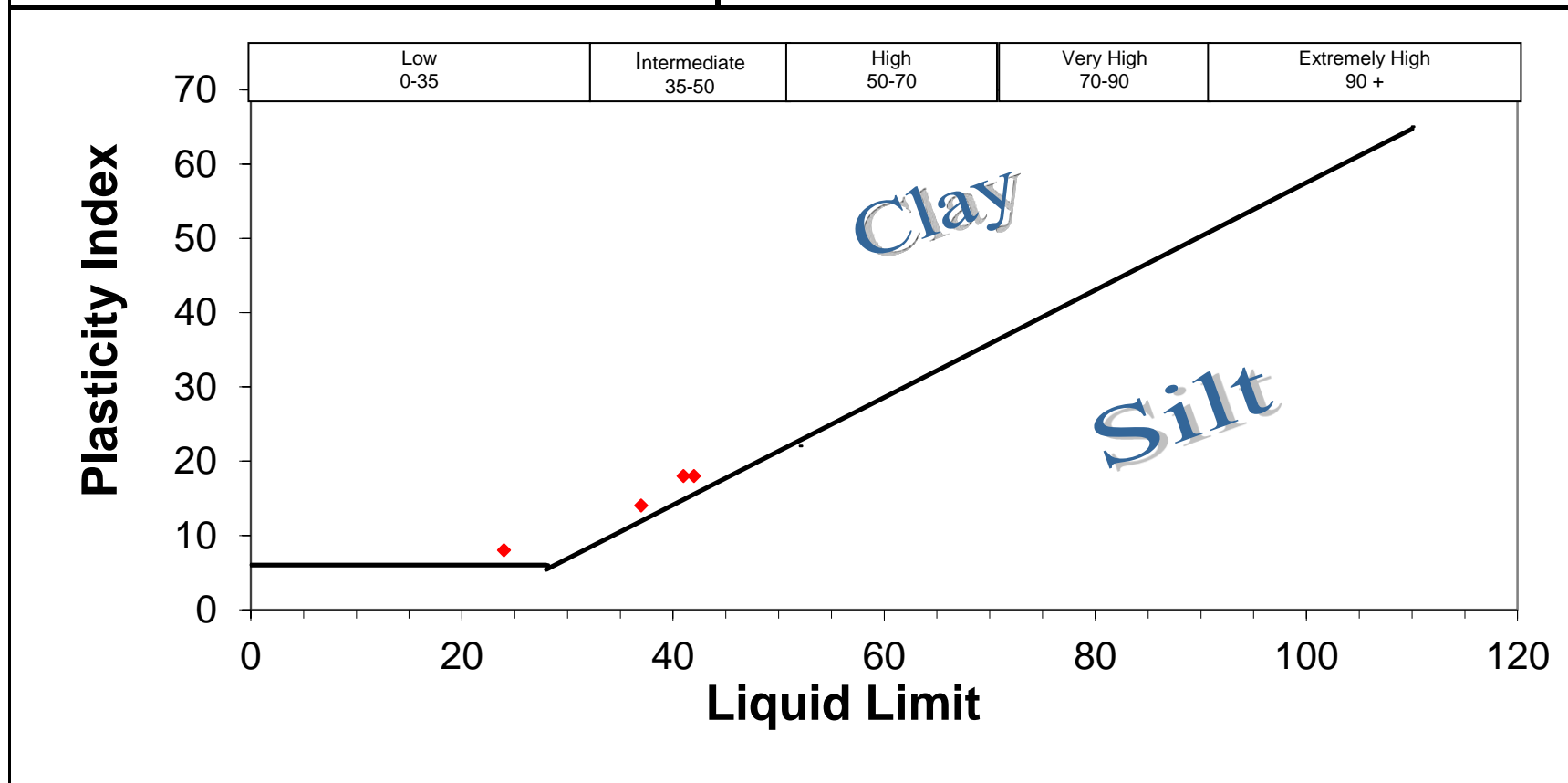
National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

				Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
TP01	0.50	B	18.7		62.3	37	23	14						
TP03	0.70	B	19.4		63.6	42	24	18						
TP04	2.50	B	11.6		24.5	22	Non Plastic							
TP06	1.40	B	11.8		44.1	24	16	8						
TP07	0.70	B	23.1		54.6	41	23	18						

RECEIVED: 06/08/2024

NMTL LTD Unit 18c, Tullow Industrial Estate Tullow County Carlow Tel: 00353 59 9180822 Mob: 00353 872575508 billa@nmtl.ie	Contract: Balbriggan Phase 3 Client: Ground Investigations Ireland Ltd Engineer: Conor Finnerty GII Project ID 9450-02-20 Date: 04/06/2020 Tested By: Sb/Tch/Ms Checked: Bc Job ref No. NMTL 3181
--	---

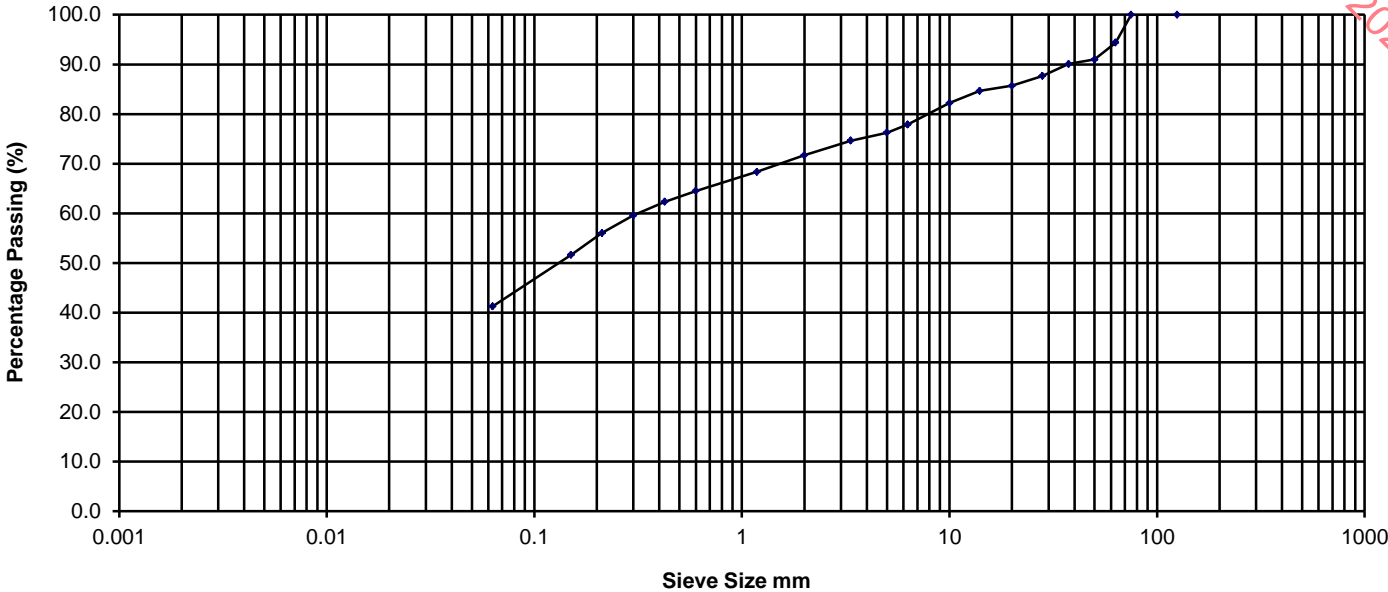


RECEIVED: 06/08/2024

NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	94.4
50.000	91.0
37.500	90.1
28.000	87.7
20.000	85.7
14.000	84.7
10.000	82.2
6.300	77.9
5.000	76.2
3.350	74.6
2.000	71.7
1.180	68.4
0.600	64.5
0.425	62.3
0.300	59.6
0.212	56.0
0.150	51.6
0.063	41.3

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	41.3			30.4			22.7			5.6	0.0

Sample Description Light brown/orange brown slightly gravelly slightly sandy silty CLAY with some cobb

BH/TP No.

Project No.

TP01

Project Balbriggan Phase 3

GII PROJECT ID: 9458-02-20

Sample No.

B

Operator

Tzr

Checked

Nc

Approved

Bc

Date sample tested

24/03/2020

Depth

0.50m

NM

TL

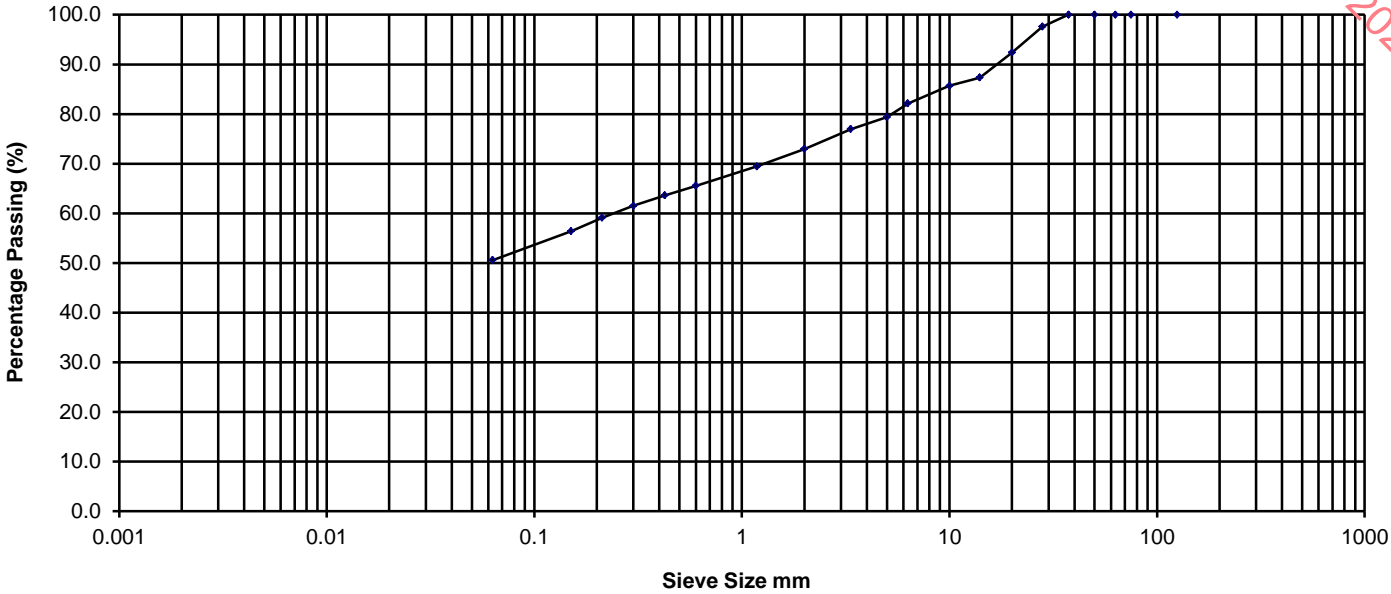
Ltd

RECEIVED: 06/08/2024

NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	97.6
20.000	92.4
14.000	87.3
10.000	85.7
6.300	82.1
5.000	79.4
3.350	77.0
2.000	73.0
1.180	69.5
0.600	65.5
0.425	63.6
0.300	61.5
0.212	59.1
0.150	56.4
0.063	50.6

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	50.6			22.4			27.0			0.0	0.0

Sample Description Light brown/orange brown slightly sandy slightly gravelly silty CLAY

Project No.

NMTL 3181

BH/TP No.

TP03

Project

Balbriggan Phase 3

GII PROJECT ID: 9458-02-20

Sample No.

B

NM

TL

Ltd

Operator

Tzr

Checked

Nc

Approved

Bc

Date sample tested

24/03/2020

Depth

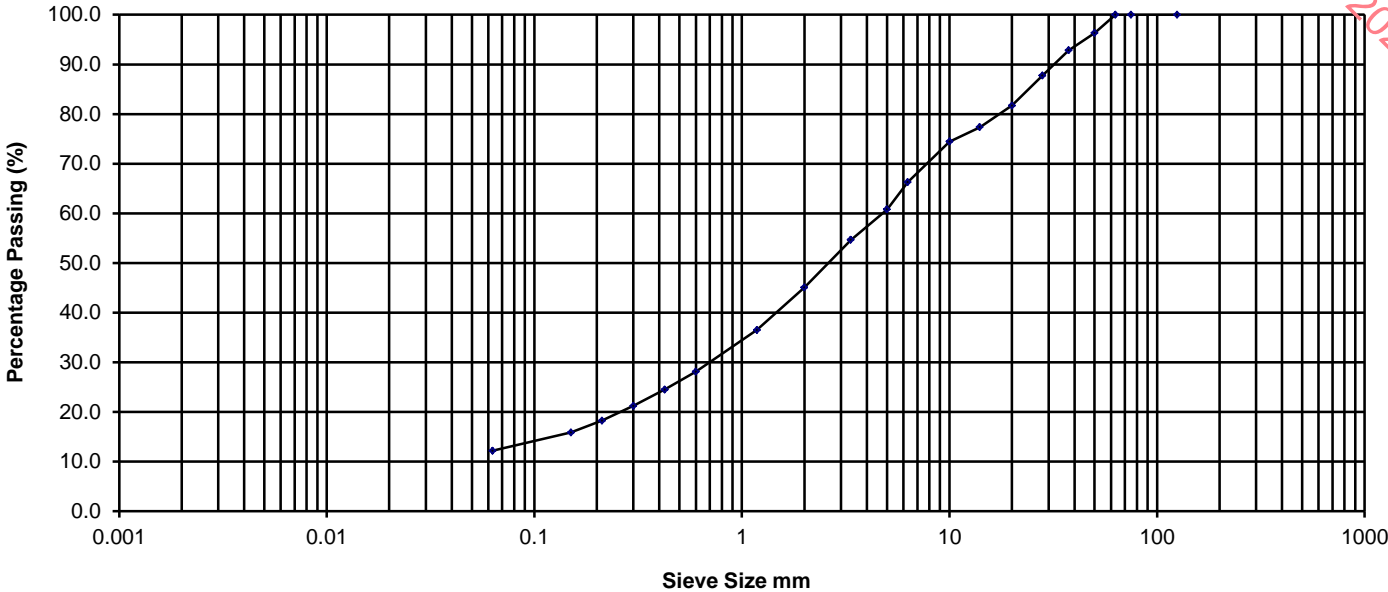
0.70m

RECEIVED: 06/08/2024

NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	96.3
37.500	92.8
28.000	87.7
20.000	81.7
14.000	77.4
10.000	74.5
6.300	66.3
5.000	60.8
3.350	54.6
2.000	45.1
1.180	36.5
0.600	28.1
0.425	24.5
0.300	21.2
0.212	18.2
0.150	15.9
0.063	12.2

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
			Silt			Sand			Gravel		
			12.2			32.9			54.9	0.0	0.0

Sample Description Brown silty very sandy GRAVEL.

Project No. NMTL 3181
BH/TP No. TP04
Sample No. B
Depth 2.50m

NMTL Ltd

Project Balbriggan Phase 3 GII PROJECT ID: 9458-02-20

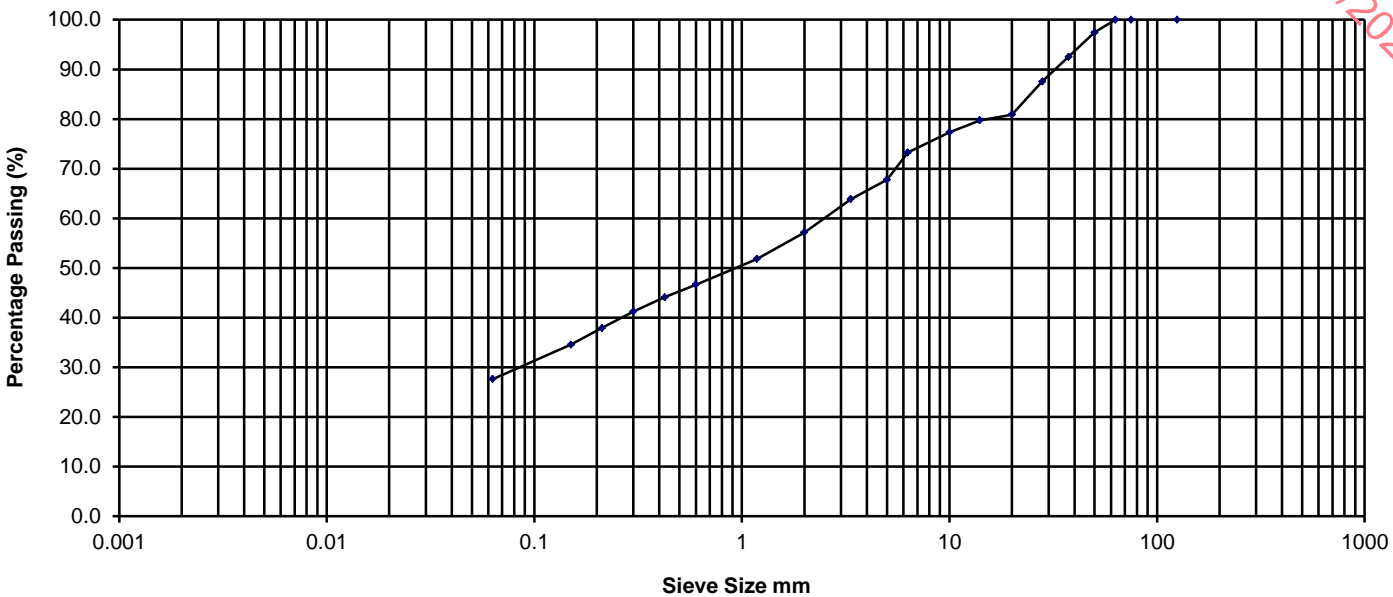
Operator Tzr Checked Nc Approved Bc Date sample tested 24/03/2020

RECEIVED: 06/08/2024

NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	97.4
37.500	92.5
28.000	87.6
20.000	80.9
14.000	79.7
10.000	77.4
6.300	73.2
5.000	67.8
3.350	63.9
2.000	57.2
1.180	51.8
0.600	46.6
0.425	44.1
0.300	41.2
0.212	37.9
0.150	34.6
0.063	27.6

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
		27.6			29.5			42.8		0.0	0.0

Sample Description Brown slightly sandy gravelly silty CLAY.

Project No. NMTL 3181
BH/TP No. TP06
Sample No. B
Depth 1.40m

NMTL Ltd

Project Balbriggan Phase 3 GII PROJECT ID: 9458-02-20

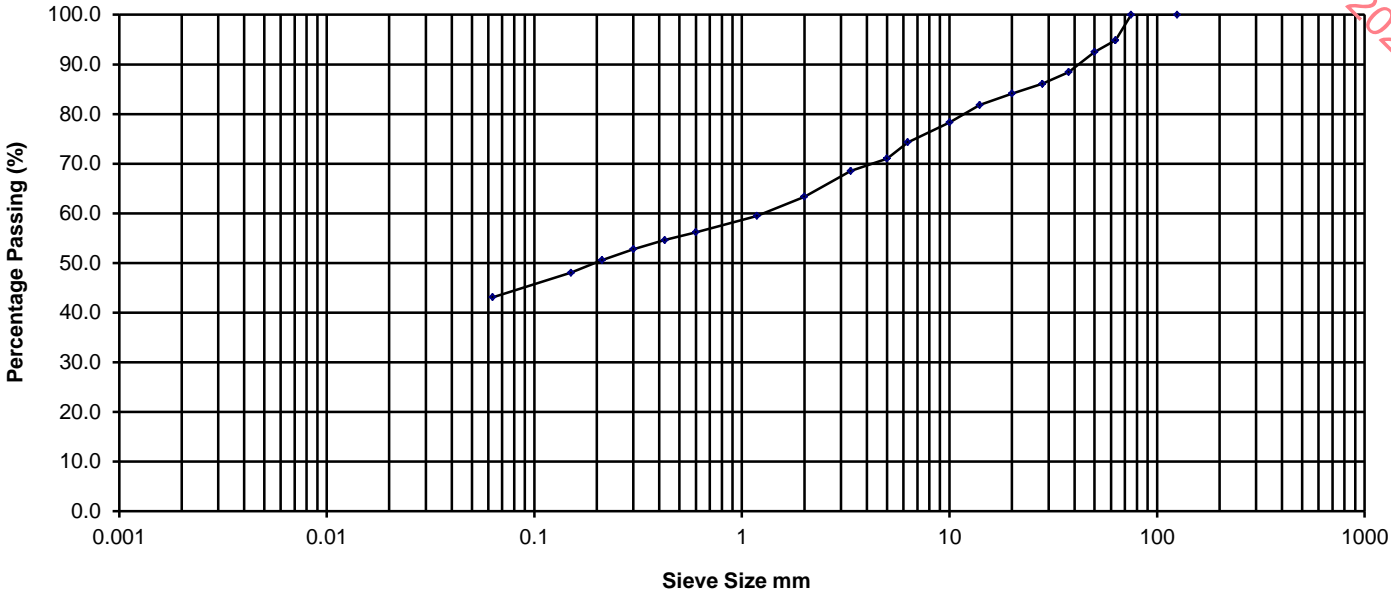
Operator Tzr Checked Nc Approved Bc Date sample tested 24/03/2020

RECEIVED: 06/08/2024

NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	94.8
50.000	92.5
37.500	88.4
28.000	86.1
20.000	84.1
14.000	81.8
10.000	78.3
6.300	74.3
5.000	71.0
3.350	68.5
2.000	63.3
1.180	59.5
0.600	56.2
0.425	54.6
0.300	52.8
0.212	50.6
0.150	48.1
0.063	43.1

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	43.1			20.3			31.5			5.2	0.0

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

Project No.

NMTL 3181

BH/TP No.

TP07

Project

Balbriggan Phase 3

GII PROJECT ID: 9458-02-20

Sample No.

B

Operator

Tzr

Checked

Nc

Approved

Bc

Date sample tested

24/03/2020

Depth

0.70m

NM

TL

Ltd

SINGLE POINT MOISTURE CONDITION VALUE TEST

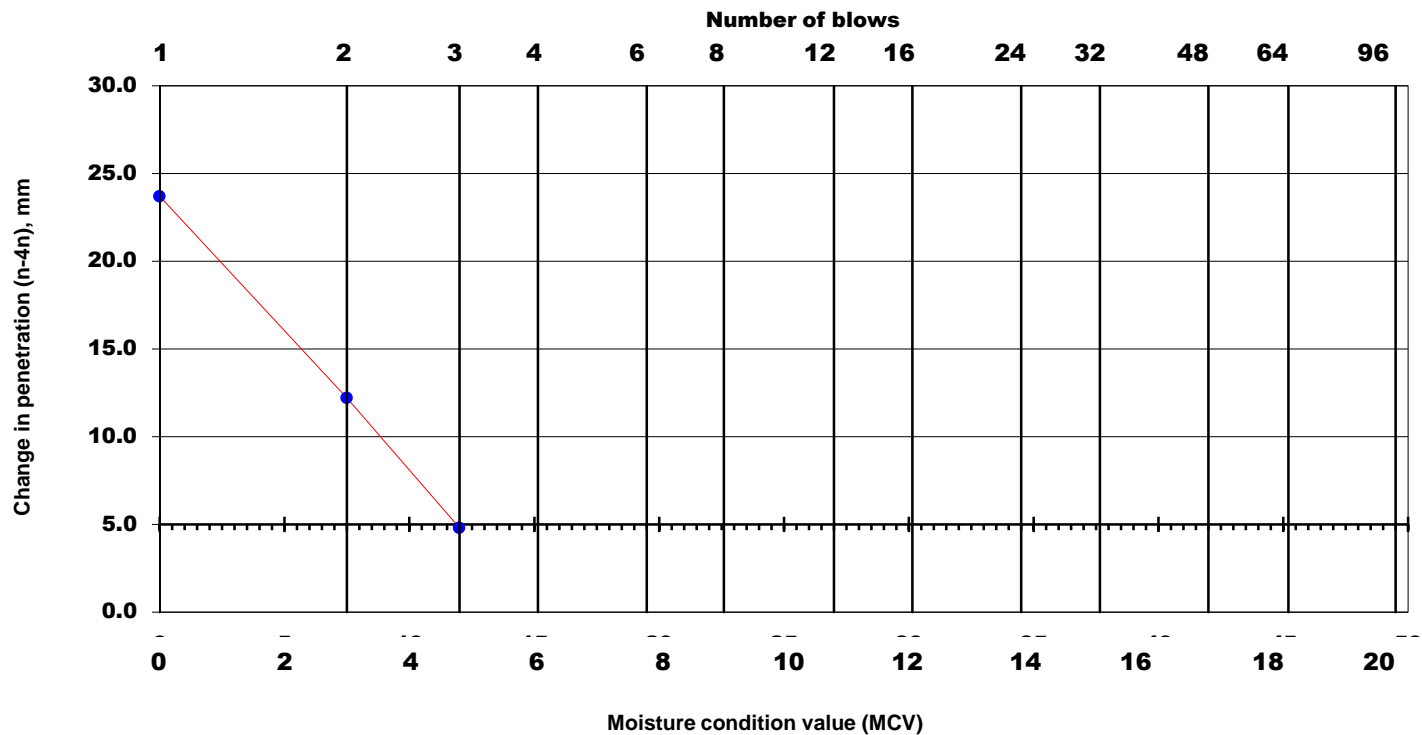
Single sample mass	
Initial sample mass	1490 g
Moisture content	18.7 %
Dry mass	1255.0 g
Mass retained on 20mm sieve	g 14.3 %

* Delete as appropriate

Project Name: Balbriggan Phase 3	Job ref. NMTL_3181
GII Projct ID: 9458-02-20	Borehole/ Pit No. BTP01
Soil description: Light brown/orange brown slightly gravelly slightly sandy silty CLAY with some cobbles.	Sample no. B
Test method BS 1377 : Part 4 : 1990 : 5	Depth 0.50m
	Date Tested 24/03/2020
	Date Sampled
	Date Received 18/03/2020

MCV 4.8 Natural

Total number of blows n	Penetration or protrusion mm	Change in penetration n to 4n mm
1	66.5	23.7
2	53.9	12.2
3	46.3	4.8
4	42.8	
6	41.9	
8	41.7	
12	41.5	
16		
24		
32		
48		
64		
96		
128		
192		
256		



NMTL Ltd

Operator	Checked	Approved
Tch	Nc	Bc

SINGLE POINT MOISTURE CONDITION VALUE TEST

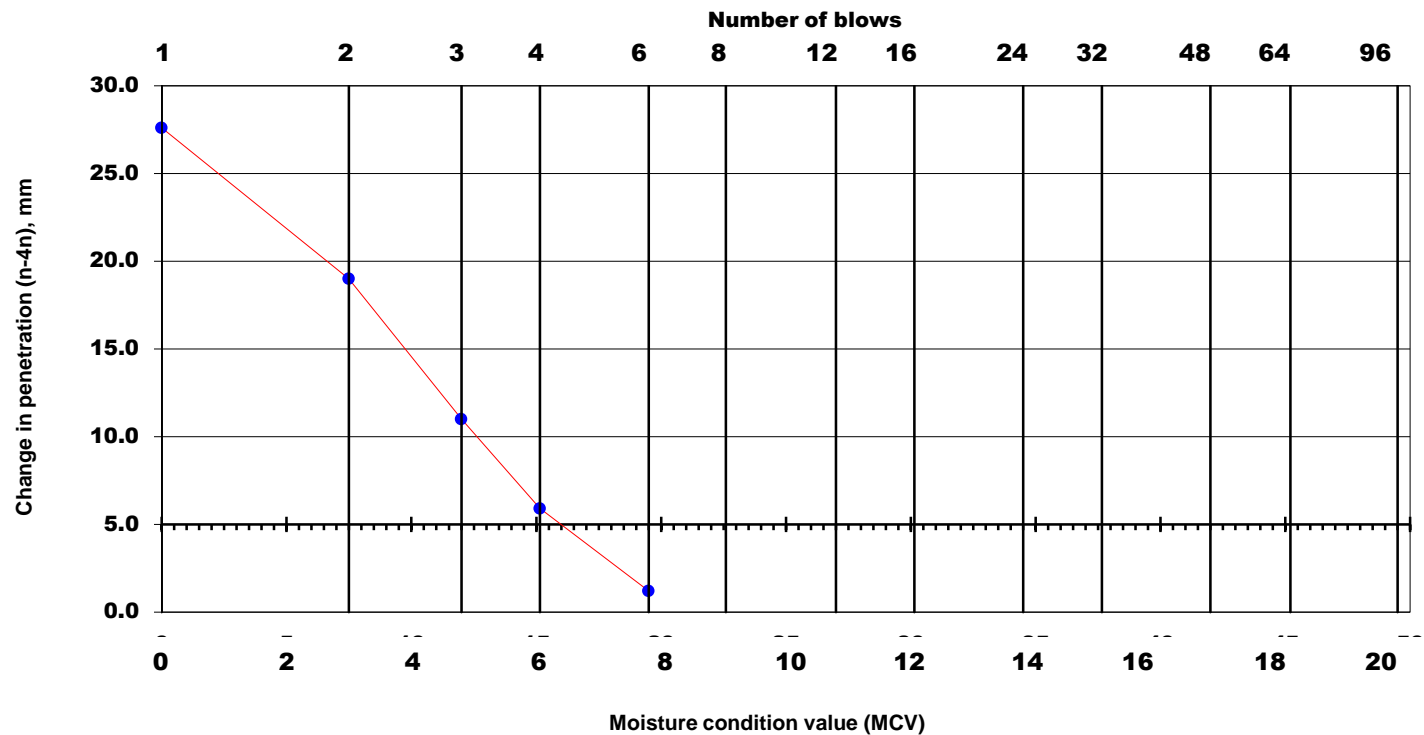
Single sample mass	
Initial sample mass	1494 g
Moisture content	19.4 %
Dry mass	1251.0 g
Mass retained on 20mm sieve	g 7.6 %

* Delete as appropriate

Project Name: Balbriggan Phase 3	Job ref. NMTL_3181
GII Projct ID: 9458-02-20	Borehole/ Pit No. TP03
Soil description: Light brown/orange brown slightly sandy slightly gravelly silty CLAY	Sample no. B
Test method BS 1377 : Part 4 : 1990 : 5	Depth 0.70m
	Date Tested 24/03/2020
	Date Sampled
	Date Received 18/03/2020

MCV 6.4 Natural

Total number of blows n	Penetration or protrusion mm	Change in penetration n to 4n mm
1	76.2	27.6
2	62.1	19.0
3	54.0	11.0
4	48.6	5.9
6	43.7	1.2
8	43.1	
12	43.0	
16	42.7	
24	42.5	
32		
48		
64		
96		
128		
192		
256		



NMTL Ltd

Operator	Checked	Approved
Tch	Nc	Bc

SINGLE POINT MOISTURE CONDITION VALUE TEST

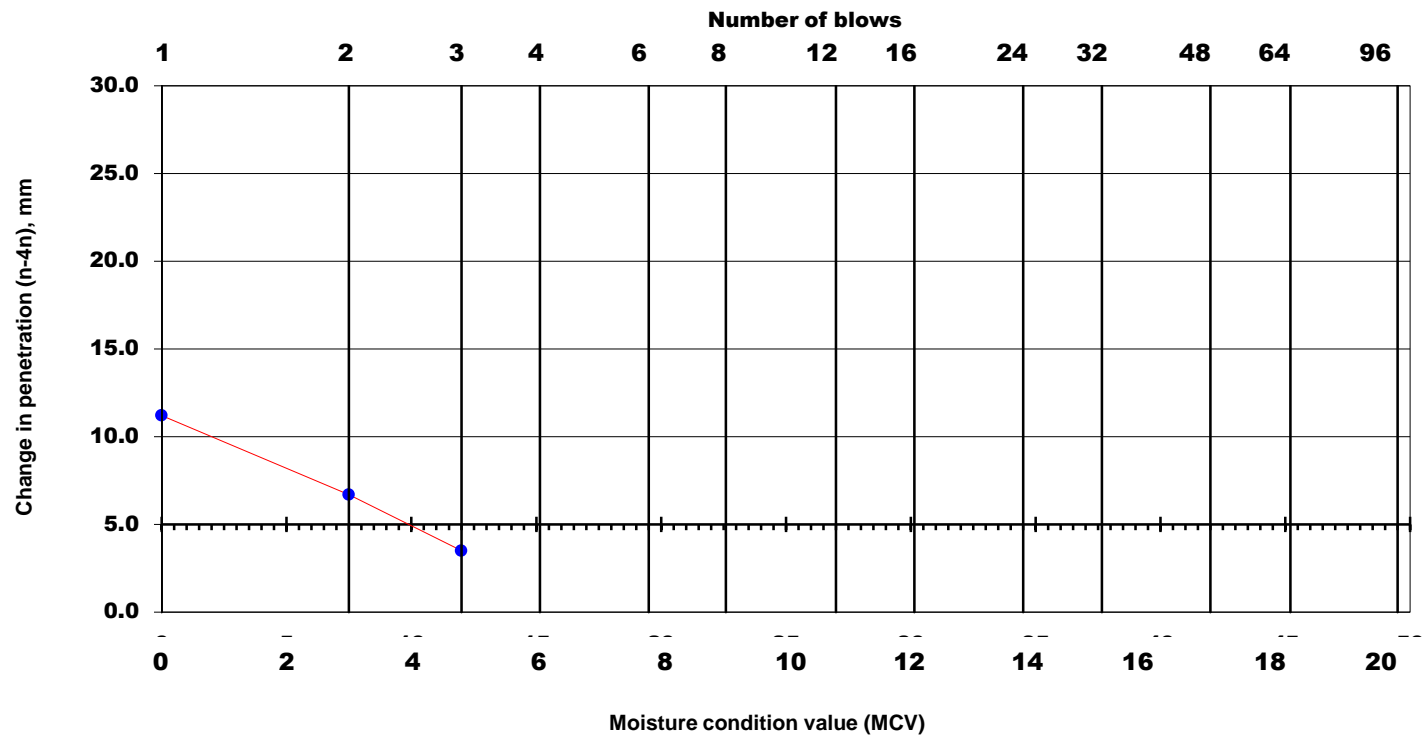
Single sample mass	
Initial sample mass	1486 g
Moisture content	11.6 %
Dry mass	1332.0 g
Mass retained on 20mm sieve	g 18.3 %

* Delete as appropriate

Project Name:	Job ref.	NMTL_3181
Balbriggan Phase 3	Borehole/	
GII Projct ID: 9458-02-20	Pit No.	TP04
Soil description:	Sample no.	B
Brown silty very sandy GRAVEL.	Depth	2.50m
Test method	Date Tested	24/03/2020
BS 1377 : Part 4 : 1990 : 5	Date Sampled	
	Date Received	18/03/2020

MCV 3.9 Natural

Total number of blows n	Penetration or protrusion mm	Change in penetration n to 4n mm
1	45.6	11.2
2	39.4	6.7
3	36.2	3.5
4	34.4	
6	33.5	
8	32.7	
12	32.7	
16		
24		
32		
48		
64		
96		
128		
192		
256		



NMTL Ltd

Operator	Checked	Approved
Tch	Nc	Bc

SINGLE POINT MOISTURE CONDITION VALUE TEST

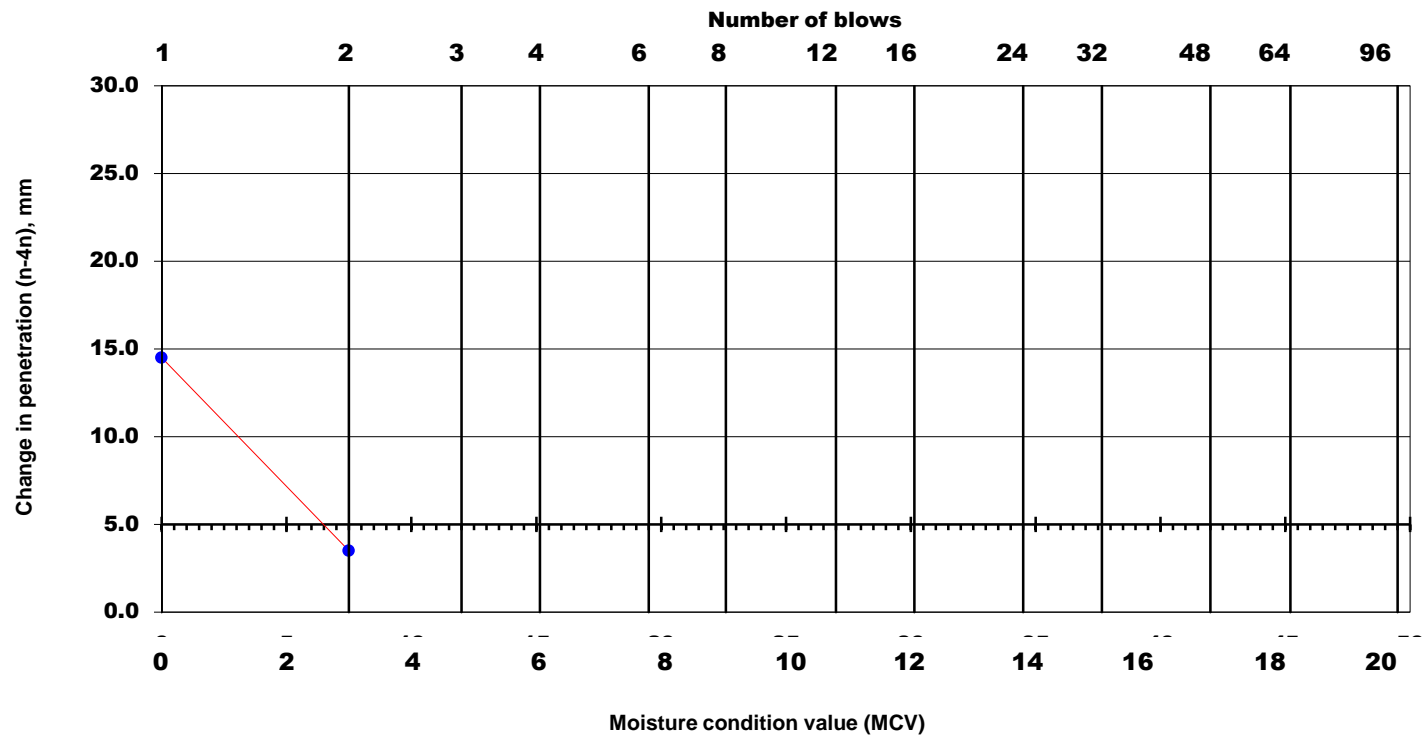
Single sample mass	
Initial sample mass	1488 g
Moisture content	11.8 %
Dry mass	1331.0 g
Mass retained on 20mm sieve	g 19.1 %

* Delete as appropriate

Project Name: Balbriggan Phase 3	Job ref. NMTL_3181
GII Projct ID: 9458-02-20	Borehole/ Pit No. TP06
Soil description: Brown slightly sandy gravelly silty CLAY.	Sample no. B
Test method BS 1377 : Part 4 : 1990 : 5	Depth 1.40m
	Date Tested 24/03/2020
	Date Sampled
	Date Received 18/03/2020

MCV 2.6 Natural

Total number of blows n	Penetration or protrusion mm	Change in penetration n to 4n mm
1	48.5	14.5
2	37.5	3.5
3	35.3	
4	34.0	
6	34.0	
8	34.0	
12		
16		
24		
32		
48		
64		
96		
128		
192		
256		



NMTL Ltd

Operator	Checked	Approved
Tch	Nc	Bc

SINGLE POINT MOISTURE CONDITION VALUE TEST

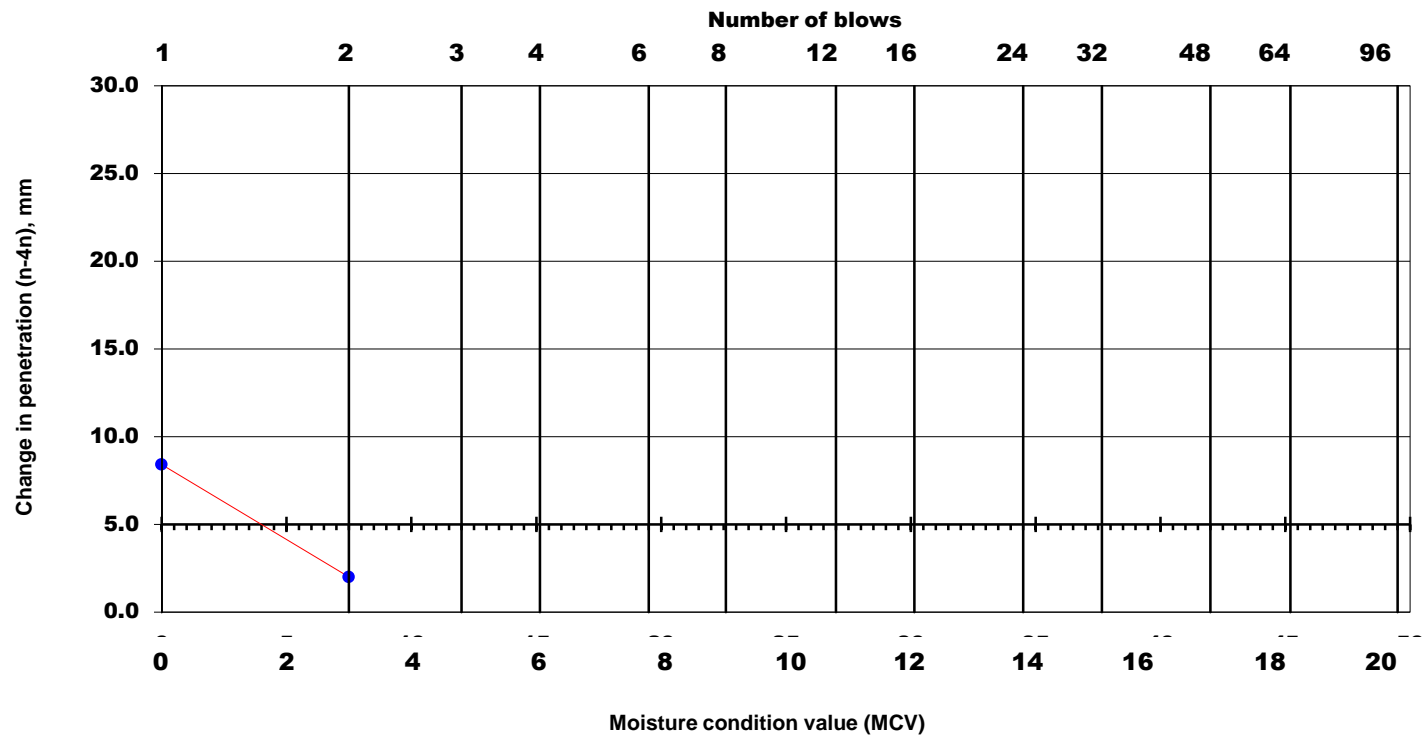
Single sample mass	
Initial sample mass	1488 g
Moisture content	23.0 %
Dry mass	1210.0 g
Mass retained on 20mm sieve	g 15.9 %

* Delete as appropriate

Project Name:	Job ref.	NMTL_3181
Balbriggan Phase 3	Borehole/	
GII Projct ID: 9458-02-20	Pit No.	TP07
Soil description:	Sample no.	B
Brown slightly sandy slightly gravelly silty CLAY, with some cobbles.	Depth	0.70m
Test method	Date Tested	24/03/2020
BS 1377 : Part 4 : 1990 : 5	Date Sampled	
	Date Received	18/03/2020

MCV 1.6 Natural

Total number of blows n	Penetration or protrusion mm	Change in penetration n to 4n mm
1	52.8	8.4
2	46.4	2.0
3	45.0	
4	44.4	
6	44.4	
8	44.4	
12		
16		
24		
32		
48		
64		
96		
128		
192		
256		



NMTL Ltd

Operator	Checked	Approved
Tch	Nc	Bc

RECEIVED: 06/08/2024

Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland



Attention : Aisling McDonnell
Date : 13th March, 2020
Your reference : 9450-02-20
Our reference : Test Report 20/3591 Batch 1
Location : Balbriggan Phase 3
Date samples received : 6th March, 2020
Status : Final report
Issue : 1

Two samples were received for analysis on 6th March, 2020 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:



Phil Sommerton BSc
Senior Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 9450-02-20
Location: Balbriggan Phase 3
Contact: Aisling McDonnell
EMT Job No: 20/3591

Report : Solid

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

EMT Sample No.	1-3	4-6											
Sample ID	TP01	TP07											
Depth	0.50	0.70											
COC No / misc													
Containers	V J T	V J T											
Sample Date	25/02/2020	25/02/2020											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	06/03/2020	06/03/2020											
											LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2									<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	<4									<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7									<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	<7									<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7									<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26									<26	mg/kg	TM5/PM8/PM16/PM12/PM10
>C6-C10	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10									<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10									<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	<0.2									<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	<4									<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7									<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	<7	<7									<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	<7									<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	<26									<26	mg/kg	TM5/PM8/PM16/PM12/PM10
Total aliphatics and aromatics(C5-40)	<52	<52									<52	mg/kg	TM5/PM8/PM16/PM12/PM10
>EC6-EC10 #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10									<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	<10	<10									<10	mg/kg	TM5/PM8/PM16
MTBE #	<5	<5									<5	ug/kg	TM31/PM12
Benzene #	<5	<5									<5	ug/kg	TM31/PM12
Toluene #	<5	<5									<5	ug/kg	TM31/PM12
Ethylbenzene #	<5	<5									<5	ug/kg	TM31/PM12
m/p-Xylene #	<5	<5									<5	ug/kg	TM31/PM12
o-Xylene #	<5	<5									<5	ug/kg	TM31/PM12
PCB 28 #	<5	<5									<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5									<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5									<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5									<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5									<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5									<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5									<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35									<35	ug/kg	TM17/PM8

Please see attached notes for all abbreviations and acronyms

Matrix : Solid

Matrix :

RECEIVED: 06/08/2024

Interpretation

[illegible]

by Stereo and Polarised Light Microscopy analysis is carried out in accordance with Fast Optical Microscopy (FOM). Samples

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

[illegible]

Client Name: Ground Investigations Ireland

Reference: 9450-02-20

Location: Balbriggan Phase 3

Contact: Aisling McDonnell

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/3591

SOILS

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

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

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

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

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

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

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

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

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

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

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

Please include all sections of this report if it is reproduced

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

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

EMT Job No: 20/3591

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3: 1990/USEPA 160.3 Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO ₂ generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

EMT Job No: 20/3591

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM17	Modified method BS EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM31	Modified USEPA 8015B. Determination of Methylterbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methylterbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes

EMT Job No: 20/3591

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060, APHA Standard Methods for Examination of Water and Wastewater 5310B, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Modified US EPA methods 245.7 and 200.7. Determination of Mercury by Cold Vapour Atomic Fluorescence.	PM0	No preparation is required.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 340.2	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method BS EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	

Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland



Attention : Barry Sexton
Date : 29th May, 2020
Your reference : 9597-04-20
Our reference : Test Report 20/6009 Batch 1
Location : Balbriggan Phase Three Rotary Core
Date samples received : 11th May, 2020
Status : Final report
Issue : 1

Eight samples were received for analysis on 11th May, 2020 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:



Phil Sommerton BSc
Senior Project Manager

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan Phase Three Rotary Core
Contact: Barry Sexton
EMT Job No: 20/6009

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

Please see attached notes for all abbreviations and acronyms

[illegible]

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan Phase Three Rotary Core
Contact: Barry Sexton
EMT Job No: 20/6009

Report : Solid

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

EMT Sample No.	1-3	10-12	13-15	22-24								
Sample ID	TP-03A	TP-04A	TP-08A	TP-BH03								
Depth	0.50	1.50	0.50	1.50								
COC No / misc												
Containers	V J T	V J T	V J T	V J T								
Sample Date	08/05/2020	08/05/2020	08/05/2020	08/05/2020								
Sample Type	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1								
Date of Receipt	11/05/2020	11/05/2020	11/05/2020	11/05/2020								
										LOD/LOR	Units	Method No.
TPH CWG												
Aliphatics												
>C5-C6 #	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2	<0.2						<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	<4	<4	<4						<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26	<26						<26	mg/kg	TM5/PM8/PM16/PM12/PM10
>C6-C10	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10						<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10	<10						<10	mg/kg	TM5/PM8/PM16
Aromatics												
>C5-EC7 #	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	<0.2	<0.2	<0.2						<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	<4	<4	<4						<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	<7	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	<26	<26	<26						<26	mg/kg	TM5/PM8/PM16/PM12/PM10
Total aliphatics and aromatics(C5-40)	<52	<52	<52	<52						<52	mg/kg	TM5/PM8/PM16/PM12/PM10
>EC6-EC10 #	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10						<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	<10	<10	<10	<10						<10	mg/kg	TM5/PM8/PM16
MTBE #	<5	<5	<5	<5						<5	ug/kg	TM36/PM12
Benzene #	<5	<5	<5	<5						<5	ug/kg	TM36/PM12
Toluene #	<5	<5	<5	<5						<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	<5	<5	<5						<5	ug/kg	TM36/PM12
m/p-Xylene #	<5	<5	<5	<5						<5	ug/kg	TM36/PM12
o-Xylene #	<5	<5	<5	<5						<5	ug/kg	TM36/PM12
PCB 28 #	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 180 #	<5 ⁺	<5 ⁺	<5 ⁺	<5 ⁺						<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35						<35	ug/kg	TM17/PM8

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan Phase Three Rotary Core
Contact: Barry Sexton
EMT Job No: 20/6009

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

[illegible]

Matrix : Solid

Matrix :

RECEIVED: 06/08/2024

Interpretation

QF-PM 3.1.8 v10

by Stereo and Polarised Light Microscopy Analysis is carried out in accordance with Fast Optical Microscopy (FCOM). Samples

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

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

[illegible]

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan Phase Three Rotary Core
Contact: Barry Sexton

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan Phase Three Rotary Core
Contact: Barry Sexton

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan Phase Three Rotary Core
Contact: Barry Sexton

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan Phase Three Rotary Core
Contact: Barry Sexton

Matrix : Solid

[illegible]

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

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

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/6009

SOILS

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

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

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

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

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

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

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

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

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

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

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

Please include all sections of this report if it is reproduced

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

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

EMT Job No: 20/6009

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO ₂ generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes

EMT Job No: 20/6009

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
NONE	No Method Code	NONE	No Method Code			AD	Yes

RECEIVED: 06/08/2024

Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland



Attention : Conor Finnerty
Date : 12th May, 2020
Your reference : 9597-04-20
Our reference : Test Report 20/5802 Batch 1
Location : Balbriggan, Phase Three Rotary Core
Date samples received : 1st May, 2020
Status : Final report
Issue : 1

Four samples were received for analysis on 1st May, 2020 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:



Phil Sommerton BSc
Senior Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan, Phase Three Rotary Core
Contact: Conor Finnerty
EMT Job No: 20/5802

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H₂SO₄, Z=ZnAc, N=NaOH, HN=HNO₃

EMT Sample No.	1-9	10-18	19-27									
Sample ID	BH-02	BH-03	SW DOWNSTREAM									
Depth												
COC No / misc												
Containers	V H H N HCL Z P BOD G	V H H N HCL Z P BOD G	V H H N HCL Z P BOD G									
Sample Date	29/04/2020	29/04/2020	29/04/2020									
Sample Type	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1									
Date of Receipt	01/05/2020	01/05/2020	01/05/2020									
										LOD/LOR	Units	Method No.
Dissolved Aluminium #	<20	<20	<20							<20	ug/l	TM30/PM14
Dissolved Arsenic #	<2.5	<2.5	<2.5							<2.5	ug/l	TM30/PM14
Dissolved Barium #	46	42	63							<3	ug/l	TM30/PM14
Dissolved Boron	30	38	39							<12	ug/l	TM30/PM14
Dissolved Calcium #	118.5	127.9	116.4							<0.2	mg/l	TM30/PM14
Total Dissolved Chromium #	<1.5	<1.5	<1.5							<1.5	ug/l	TM30/PM14
Total Dissolved Iron #	<20	<20	<20							<20	ug/l	TM30/PM14
Dissolved Lead #	<5	<5	<5							<5	ug/l	TM30/PM14
Dissolved Magnesium #	8.3	12.0	11.1							<0.1	mg/l	TM30/PM14
Dissolved Mercury #	<1	<1	<1							<1	ug/l	TM30/PM14
PAH MS												
Naphthalene #	<0.1	<0.1	<0.1							<0.1	ug/l	TM4/PM30
Acenaphthylene #	<0.013	<0.013	<0.013							<0.013	ug/l	TM4/PM30
Acenaphthene #	<0.013	<0.013	<0.013							<0.013	ug/l	TM4/PM30
Fluorene #	<0.014	<0.014	<0.014							<0.014	ug/l	TM4/PM30
Phenanthrene #	<0.011	<0.011	<0.011							<0.011	ug/l	TM4/PM30
Anthracene #	<0.013	<0.013	<0.013							<0.013	ug/l	TM4/PM30
Fluoranthene #	<0.012	<0.012	0.030							<0.012	ug/l	TM4/PM30
Pyrene #	<0.013	<0.013	0.029							<0.013	ug/l	TM4/PM30
Benzo(a)anthracene #	<0.015	<0.015	0.018							<0.015	ug/l	TM4/PM30
Chrysene #	<0.011	<0.011	0.021							<0.011	ug/l	TM4/PM30
Benzo(bk)fluoranthene #	<0.018	<0.018	0.048							<0.018	ug/l	TM4/PM30
Benzo(a)pyrene #	<0.016	<0.016	0.025							<0.016	ug/l	TM4/PM30
Indeno(123cd)pyrene #	<0.011	<0.011	0.019							<0.011	ug/l	TM4/PM30
Dibenzo(ah)anthracene #	<0.01	<0.01	<0.01							<0.01	ug/l	TM4/PM30
Benzo(ghi)perylene #	<0.011	<0.011	0.019							<0.011	ug/l	TM4/PM30
PAH 16 Total #	<0.195	<0.195	0.209							<0.195	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.01	<0.01	0.03							<0.01	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.01	<0.01	0.01							<0.01	ug/l	TM4/PM30
PAH Surrogate % Recovery	79	75	79							<0	%	TM4/PM30
MTBE #	<5	<5	<5							<5	ug/l	TM36/PM12
Benzene #	<5	<5	<5							<5	ug/l	TM36/PM12
Toluene #	<5	<5	<5							<5	ug/l	TM36/PM12
Ethylbenzene #	<5	<5	<5							<5	ug/l	TM36/PM12
m/p-Xylene #	<5	<5	<5							<5	ug/l	TM36/PM12
o-Xylene #	<5	<5	<5							<5	ug/l	TM36/PM12

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan, Phase Three Rotary Core
Contact: Conor Finnerty
EMT Job No: 20/5802

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H₂SO₄, Z=ZnAc, N=NaOH, HN=HN₃

EMT Sample No.	1-9	10-18	19-27									
Sample ID	BH-02	BH-03	SW DOWNSTREAM									
Depth												
COC No / misc												
Containers	V H H N HCL Z P BOD G	V H H N HCL Z P BOD G	V H H N HCL Z P BOD G									
Sample Date	29/04/2020	29/04/2020	29/04/2020									
Sample Type	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1									
Date of Receipt	01/05/2020	01/05/2020	01/05/2020									
										LOD/LOR	Units	Method No.
TPH CWG												
Aliphatics												
>C5-C6 #	<10	<10	<10							<10	ug/l	TM36/PM12
>C6-C8 #	<10	<10	<10							<10	ug/l	TM36/PM12
>C8-C10 #	<10	<10	<10							<10	ug/l	TM36/PM12
>C10-C12 #	<5	<5	<5							<5	ug/l	TM5/PM16/PM30
>C12-C16 #	<10	<10	<10							<10	ug/l	TM5/PM16/PM30
>C16-C21 #	<10	<10	<10							<10	ug/l	TM5/PM16/PM30
>C21-C35 #	<10	<10	<10							<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35 #	<10	<10	<10							<10	ug/l	TM5/PM16/PM30
Aromatics												
>C5-EC7 #	<10	<10	<10							<10	ug/l	TM36/PM12
>EC7-EC8 #	<10	<10	<10							<10	ug/l	TM36/PM12
>EC8-EC10 #	<10	<10	<10							<10	ug/l	TM36/PM12
>EC10-EC12 #	<5	<5	<5							<5	ug/l	TM5/PM16/PM30
>EC12-EC16 #	<10	<10	<10							<10	ug/l	TM5/PM16/PM30
>EC16-EC21 #	<10	<10	<10							<10	ug/l	TM5/PM16/PM30
>EC21-EC35 #	<10	<10	<10							<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35 #	<10	<10	<10							<10	ug/l	TM5/PM16/PM30
Total aliphatics and aromatics(C5-35) #	<10	<10	<10							<10	ug/l	TM5/PM16/PM30
Resorcinol	<0.01	<0.01	<0.01							<0.01	mg/l	TM26/PM0
Catechol	<0.01	<0.01	<0.01							<0.01	mg/l	TM26/PM0
Phenol #	<0.01	<0.01	<0.01							<0.01	mg/l	TM26/PM0
m/p-cresol	<0.02	<0.02	<0.02							<0.02	mg/l	TM26/PM0
o-cresol	<0.01	<0.01	<0.01							<0.01	mg/l	TM26/PM0
Total cresols #	<0.03	<0.03	<0.03							<0.03	mg/l	TM26/PM0
Xylenols #	<0.06	<0.06	<0.06							<0.06	mg/l	TM26/PM0
1-naphthol	<0.01	<0.01	<0.01							<0.01	mg/l	TM26/PM0
2,3,5-trimethyl phenol	<0.01	<0.01	<0.01							<0.01	mg/l	TM26/PM0
2-isopropylphenol	<0.01	<0.01	<0.01							<0.01	mg/l	TM26/PM0
Total Speciated Phenols HPLC	<0.1	<0.1	<0.1							<0.1	mg/l	TM26/PM0
Sulphate as SO ₄ #	62.4	20.9	45.7							<0.5	mg/l	TM38/PM0
Nitrate as NO ₃ #	20.8	5.0	24.4							<0.2	mg/l	TM38/PM0
Ammoniacal Nitrogen as N #	0.05	0.23	0.13							<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH ₃ #	0.07	0.27	0.16							<0.03	mg/l	TM38/PM0
Hexavalent Chromium	<0.006	<0.006	<0.006							<0.006	mg/l	TM38/PM0
Sulphide	<0.01	<0.01	<0.01							<0.01	mg/l	TM107/PM0
Dissolved Oxygen	7	4	7							<1	mg/l	TM58/PM0
pH #	7.66	7.91	7.78							<0.01	pH units	TM73/PM0

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan, Phase Three Rotary Core
Contact: Conor Finnerty

RECEIVED: 06/08/2024

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/5802

SOILS

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

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

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

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

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

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

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

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

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

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

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

Please include all sections of this report if it is reproduced

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

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

EMT Job No: 20/5802

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5/TM36	please refer to TM5 and TM36 for method details	PM12/PM16/PM30	please refer to PM16/PM30 and PM12 for method details	Yes			
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes			
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.				
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.	Yes			
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes			
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			

EMT Job No: 20/5802

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.				
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes			
TM58	APHA SMEWW 5210B:1999 22nd Edition. Comparable with ISO 5815:1989. Measurement of Biochemical Oxygen Demand. When cBOD (Carbonaceous BOD) is requested a nitrification inhibitor is added which prevents the oxidation of reduced forms of nitrogen, such as am	PM0	No preparation is required.				
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.	Yes			
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM107	Determination of Sulphide/Thiocyanate by Skalar Continuous Flow Analyser	PM0	No preparation is required.				
Subcontracted	See attached subcontractor report for accreditation status and provider.						

RECEIVED: 06/08/2024

Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland



Attention : Conor Finnerty
Date : 19th May, 2020
Your reference : 9597-04-20
Our reference : Test Report 20/5859 Batch 1
Location : Balbriggan, Phase Three Rotary Core
Date samples received : 4th May, 2020
Status : Final report
Issue : 1

Two samples were received for analysis on 4th May, 2020 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:



Phil Sommerton BSc
Senior Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan, Phase Three Rotary Core
Contact: Conor Finnerty
EMT Job No: 20/5859

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H₂SO₄, Z=ZnAc, N=NaOH, HN=HNO₃

EMT Sample No.	1-9	10-17									Please see attached notes for all abbreviations and acronyms				
Sample ID	SW UPSTREAM	BH-04													
Depth															
COC No / misc															
Containers	V H H N F H C L Z P B O D G	V H H N H C L Z P G													
Sample Date	30/04/2020	01/05/2020													
Sample Type	Ground Water	Ground Water													
Batch Number	1	1													
Date of Receipt	04/05/2020	04/05/2020										LOD/LOR	Units	Method No.	
TPH CWG															
Aliphatics															
>C5-C6 #	<10	<10										<10	ug/l	TM36/PM12	
>C6-C8 #	<10	<10										<10	ug/l	TM36/PM12	
>C8-C10 #	<10	<10										<10	ug/l	TM36/PM12	
>C10-C12 #	<5	<5										<5	ug/l	TM5/PM16/PM30	
>C12-C16 #	<10	<10										<10	ug/l	TM5/PM16/PM30	
>C16-C21 #	<10	<10										<10	ug/l	TM5/PM16/PM30	
>C21-C35 #	<10	<10										<10	ug/l	TM5/PM16/PM30	
Total aliphatics C5-35 #	<10	<10										<10	ug/l	TM5/PM16/PM30	
Aromatics															
>C5-EC7 #	<10	<10										<10	ug/l	TM36/PM12	
>EC7-EC8 #	<10	<10										<10	ug/l	TM36/PM12	
>EC8-EC10 #	<10	<10										<10	ug/l	TM36/PM12	
>EC10-EC12 #	<5	<5										<5	ug/l	TM5/PM16/PM30	
>EC12-EC16 #	<10	<10										<10	ug/l	TM5/PM16/PM30	
>EC16-EC21 #	<10	<10										<10	ug/l	TM5/PM16/PM30	
>EC21-EC35 #	<10	<10										<10	ug/l	TM5/PM16/PM30	
Total aromatics C5-35 #	<10	<10										<10	ug/l	TM5/PM16/PM30	
Total aliphatics and aromatics(C5-35) #	<10	<10										<10	ug/l	TM5/PM16/PM30	
Resorcinol	<0.01	<0.01										<0.01	mg/l	TM26/PM0	
Catechol	<0.01	<0.01										<0.01	mg/l	TM26/PM0	
Phenol #	<0.01	<0.01										<0.01	mg/l	TM26/PM0	
m/p-cresol	<0.02	<0.02										<0.02	mg/l	TM26/PM0	
o-cresol	<0.01	<0.01										<0.01	mg/l	TM26/PM0	
Total cresols #	<0.03	<0.03										<0.03	mg/l	TM26/PM0	
Xylenols #	<0.06	<0.06										<0.06	mg/l	TM26/PM0	
1-naphthol	<0.01	<0.01										<0.01	mg/l	TM26/PM0	
2,3,5-trimethyl phenol	<0.01	<0.01										<0.01	mg/l	TM26/PM0	
2-isopropylphenol	<0.01	<0.01										<0.01	mg/l	TM26/PM0	
Total Speciated Phenols HPLC	<0.1	<0.1										<0.1	mg/l	TM26/PM0	
Sulphate as SO4 #	43.1	74.4										<0.5	mg/l	TM38/PM0	
Nitrate as NO3 #	26.0	10.6										<0.2	mg/l	TM38/PM0	
Ammoniacal Nitrogen as N #	0.12	0.19										<0.03	mg/l	TM38/PM0	
Ammoniacal Nitrogen as NH3 #	0.14	0.24										<0.03	mg/l	TM38/PM0	
Hexavalent Chromium	<0.006	<0.006										<0.006	mg/l	TM38/PM0	
Sulphide	<0.01	<0.01										<0.01	mg/l	TM107/PM0	
Dissolved Oxygen	4	7										<1	mg/l	TM58/PM0	
pH #	7.65	7.96										<0.01	pH units	TM73/PM0	

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 9597-04-20
Location: Balbriggan, Phase Three Rotary Core
Contact: Conor Finnerty

Notification of Decision

RECEIVED: 06/08/2024

	Reasons
--	---------

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 20/5859						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/5859

SOILS

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

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

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

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

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

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

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

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

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

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

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

Please include all sections of this report if it is reproduced

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

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

EMT Job No: 20/5859


Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5/TM36	please refer to TM5 and TM36 for method details	PM12/PM16/PM30	please refer to PM16/PM30 and PM12 for method details	Yes			
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes			
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.				
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.	Yes			
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes			
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			

EMT Job No: 20/5859

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.				
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes			
TM58	APHA SMEWW 5210B:1999 22nd Edition. Comparable with ISO 5815:1989. Measurement of Biochemical Oxygen Demand. When cBOD (Carbonaceous BOD) is requested a nitrification inhibitor is added which prevents the oxidation of reduced forms of nitrogen, such as am	PM0	No preparation is required.				
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.	Yes			
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM107	Determination of Sulphide/Thiocyanate by Skalar Continuous Flow Analyser	PM0	No preparation is required.				
Subcontracted	See attached subcontractor report for accreditation status and provider.						

RECEIVED: 06/08/2024

APPENDIX 6 – Rotary Borehole Records

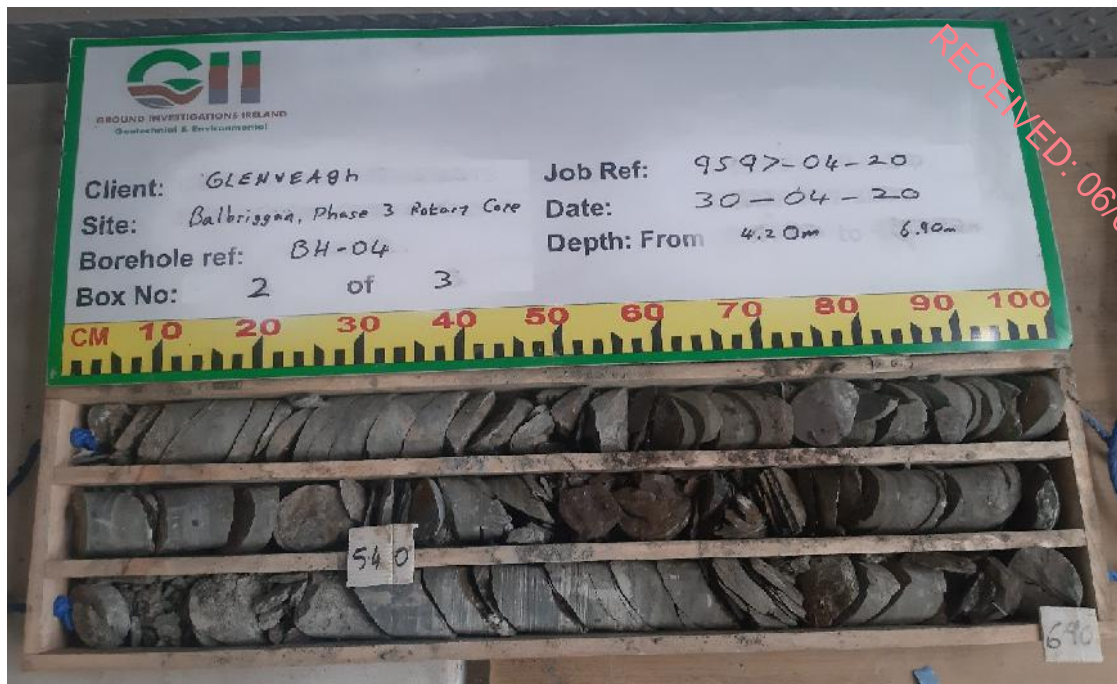
<div><div>Ground Investigations Ireland Ltd www.gii.ie</div></div>							Site Balbriggan Phase Three Rotary Core		Borehole Number RC04		
Machine : Beretta T47 Flush : Water Core Dia: HQ mm Method : Rotary Cored			Casing Diameter 100mm cased to		Ground Level (mOD) 49.86		Client Glenveagh Properties PLC		Job Number 9597-04-20		
			Location 718211.6 E 763591.3 N		Dates 30/04/2020		Project Contractor Ground Investigations Ireland		Sheet 1/1		
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
2.00 <											

Balbriggan Phase Three Rotary Core Photographs

BH-04

RECEIVED: 06/08/2024





RECEIVED: 06/08/2024

APPENDIX 7 – Laboratory Testing Results



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Ltd
Catherinstown House
Hazelhatch Road
Newcastle, Co. Dub.
Tel: 01 601 5175 / 5176 Fax: 01 601 5177
Email: info@gii.ie Web: gii.ie

RECEIVED
06/08/2024

GROUNDWATER MONITORING

Balbriggan Phase 3 Rotary Core

BOREHOLE	DATE	GROUNDWATER (m BGL)	Comments
BH-02	01/05/2020	2.50	
BH-03	01/05/2020	1.35	
BH-04	01/05/2020	1.17	



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Ltd
Catherinstown House
Hazelhatch Road
Newcastle, Co. Dub.
Tel: 01 601 5175 / 5176 | Fax: 01 601 5177
Email: info@gii.ie | Web: www.gii.ie

RECEIVED
06/06/2024

GROUNDWATER MONITORING

Balbriggan Phase 3 Rotary Core

BOREHOLE	DATE	GROUNDWATER (m BGL)	Comments
BH-02	08/05/2020	2.72	
BH-03	08/05/2020	1.48	
BH-04	08/05/2020	1.07	



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Ltd
Catherinstown House
Hazelhatch Road
Newcastle, Co. Dub.
Tel: 01 601 5175 / 5176 | Fax: 01 601 5177
Email: info@gii.ie | Web: www.gii.ie

RECEIVED
06/06/2024

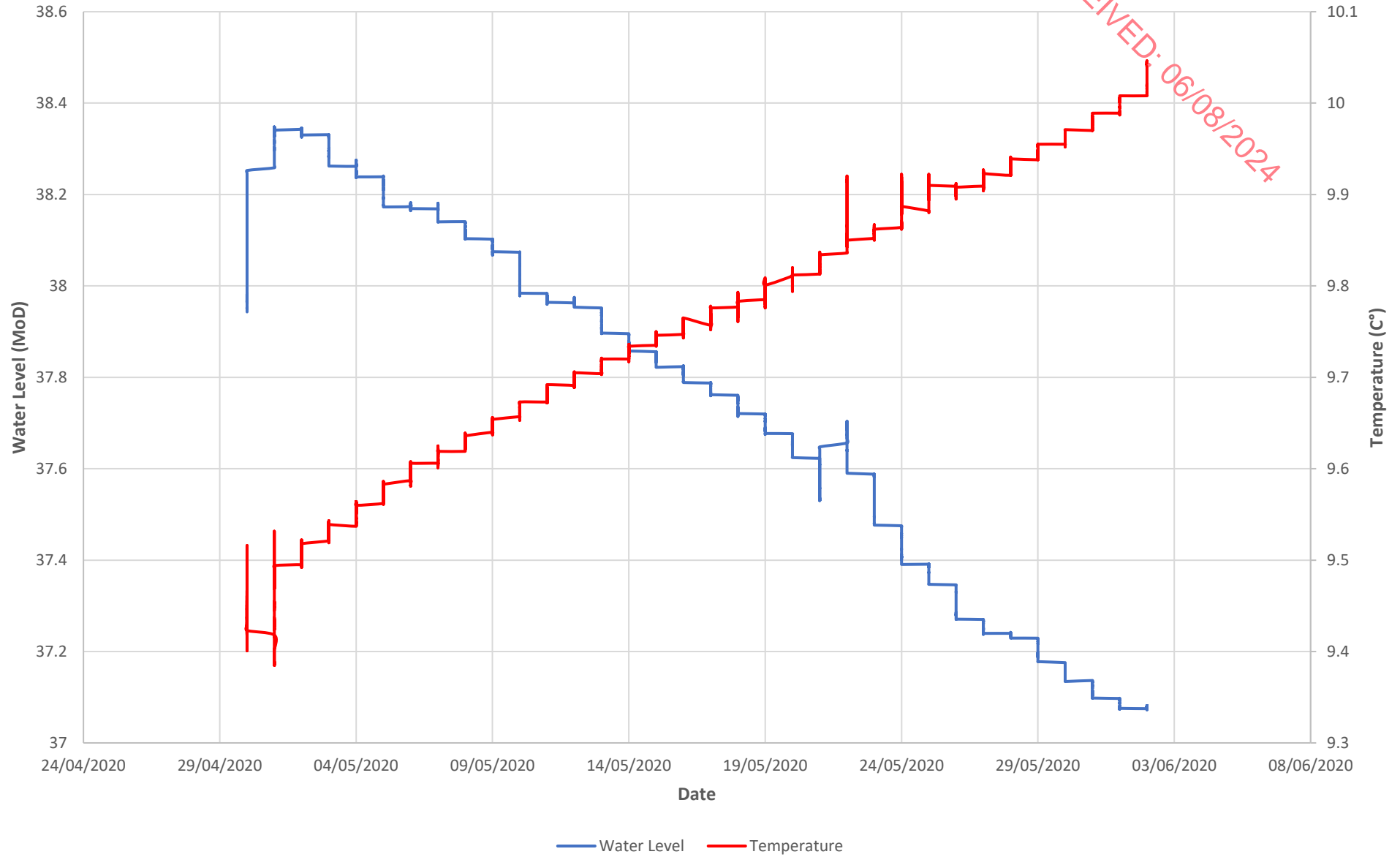
GROUNDWATER MONITORING

Balbriggan Phase 3 Rotary Core

BOREHOLE	DATE	GROUNDWATER (m BGL)	Comments
BH-02	03/06/2020	3.80	
BH-03	03/06/2020	1.71	
BH-04	03/06/2020	1.28	

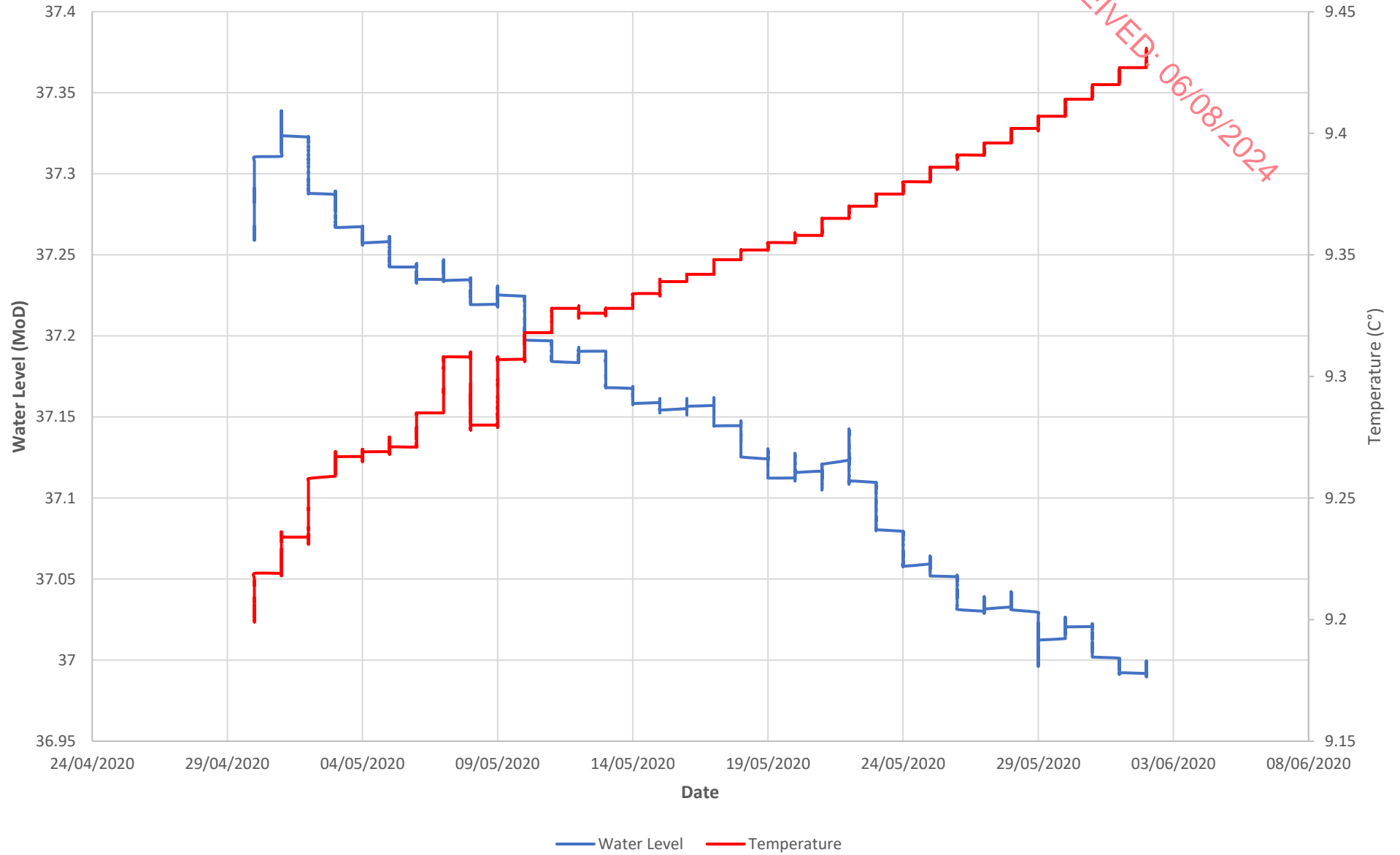
Balbriggan Phase 3 BH02 Level Logger Data

RECEIVED: 06/08/2024



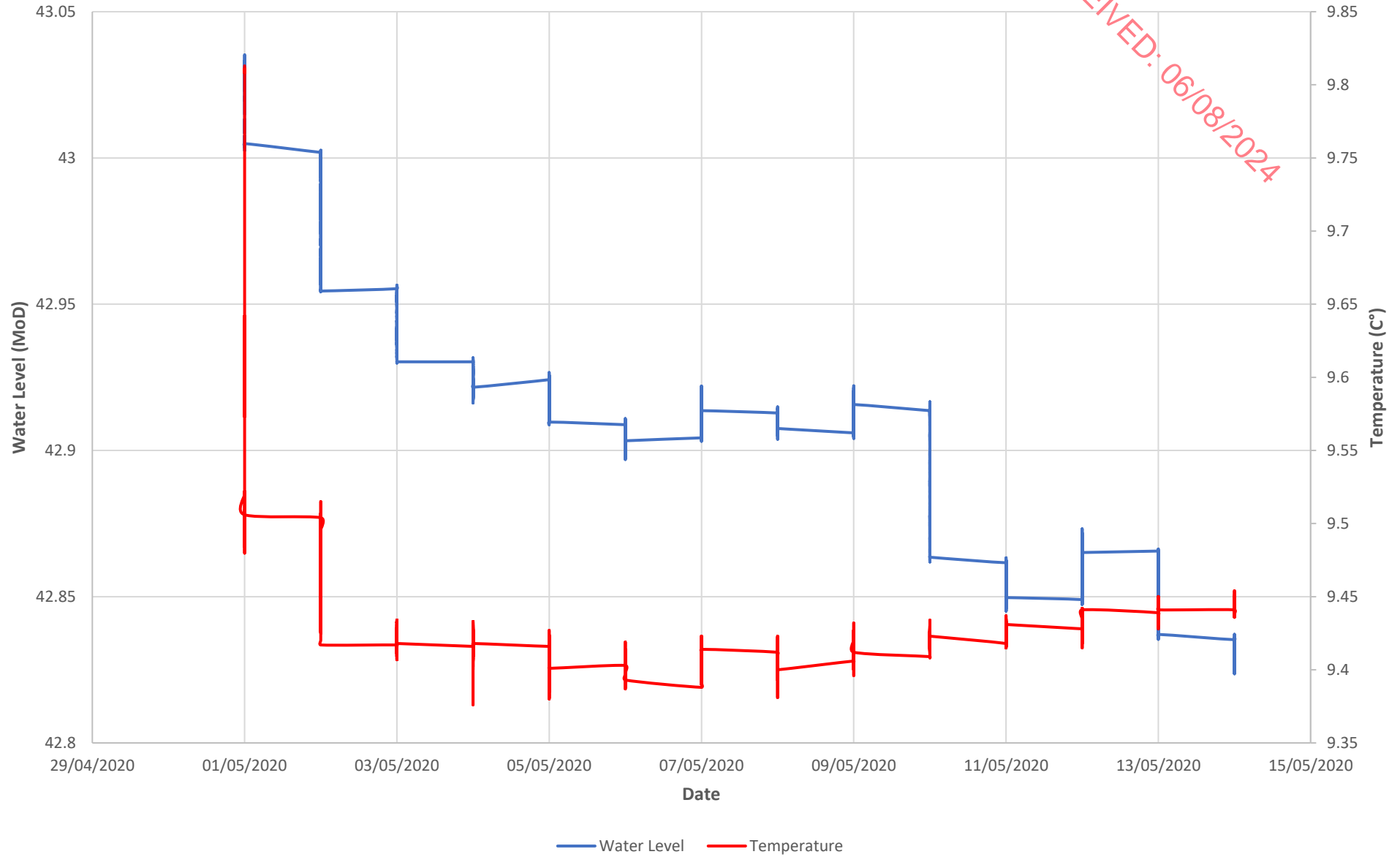
Balbriggan Phase 3 BH03 Level Logger Data

RECEIVED: 06/08/2024



Balbriggan Phase 3 RC04 Level Logger Data

RECEIVED: 06/08/2024



Appendix 5.2 List of Soils Generic Assessment Criteria (GAC)

RECEIVED: 06/08/2024

Box 4.1: CRITERIA FOR RATING SITE ATTRIBUTES - Estimation of Importance of Soil and Geology Attributes

Importance	Criteria	Typical Examples
Very High	<p>Attribute has a high quality, significance or value on a regional or national scale</p> <p>Degree or extent of soil contamination is significant on a national or regional scale</p> <p>Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale*</p>	<p>Geological feature rare on a regional or national scale (NHA)</p> <p>Large existing quarry or pit</p> <p>Proven economically extractable mineral resource</p>
High	<p>Attribute has a high quality, significance or value on a local scale</p> <p>Degree or extent of soil contamination is significant on a local scale</p> <p>Volume of peat and/or soft organic soil underlying route is significant on a local scale*</p>	<p>Contaminated soil on site with previous heavy industrial usage</p> <p>Large recent landfill site for mixed wastes</p> <p>Geological feature of high value on a local scale (County Geological Site)</p> <p>Well drained and/or highly fertility soils</p> <p>Moderately sized existing quarry or pit</p> <p>Marginally economic extractable mineral resource</p>
Medium	<p>Attribute has a medium quality, significance or value on a local scale</p> <p>Degree or extent of soil contamination is moderate on a local scale</p> <p>Volume of peat and/or soft organic soil underlying route is moderate on a local scale*</p>	<p>Contaminated soil on site with previous light industrial usage</p> <p>Small recent landfill site for mixed wastes</p> <p>Moderately drained and/or moderate fertility soils</p> <p>Small existing quarry or pit</p> <p>Sub-economic extractable mineral resource</p>
Low	<p>Attribute has a low quality, significance or value on a local scale</p> <p>Degree or extent of soil contamination is minor on a local scale</p> <p>Volume of peat and/or soft organic soil underlying route is small on a local scale*</p>	<p>Large historical and/or recent site for construction and demolition wastes</p> <p>Small historical and/or recent landfill site for construction and demolition wastes</p> <p>Poorly drained and/or low fertility soils</p> <p>Uneconomically extractable mineral resource</p>

* relative to the total volume of inert soil disposed of and/or recovered

**Guidelines on Procedures for Assessment and Treatment of
Geology, Hydrology and Hydrogeology for National Road Schemes**

**Box 4.2: CRITERIA FOR RATING SITE ATTRIBUTES - Estimation of Importance
of Hydrology Attributes**

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities
High	Attribute has a high quality or value on a local scale	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

RECEIVED: 06/08/2024

Box 4.3: CRITERIA FOR RATING SITE ATTRIBUTES - Estimation of Importance of Hydrogeology Attributes

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers Locally important potable water source supplying >1000 homes Outer source protection area for regionally important water source Inner source protection area for locally important water source
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes Outer source protection area for locally important water source
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes

**Guidelines on Procedures for Assessment and Treatment of
Geology, Hydrology and Hydrogeology for National Road Schemes**

**Box 4.4: CRITERIA FOR RATING IMPACT SIGNIFICANCE AT ROUTE SELECTION STAGE -
Rating of Significant Environmental Impacts at Route Selection Stage**

Impact Level	Attribute Importance				
	Extremely High **	Very High	High	Medium	Low
Profound	Any permanent impact on attribute	Permanent impact on significant proportion of attribute			
Significant	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute		
Moderate	Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute	
Slight		Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute
Imperceptible			Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute

**** In rating impacts on an 'European site' account must be taken of Article 6(3) and 6(4) of the Habitats Directive (Council Directive 92/43/EEC). Also see guidance contained within Guidelines for Assessment of Ecological Impacts of National Road Schemes (Rev 2, National Roads Authority, 2008)**

RECEIVED: 06/08/2024

Appendix 5.3 GII Site Investigations June 2024

RECEIVED: 06/08/2024



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

RECEIVED 06/08/2024

Ground Investigations Ireland

Balbriggan Phase 4

Glenveagh

Ground Investigation Report

June 2024

Directors:

Fergal McNamara (MD), Conor Finnerty, Aisling McDonnell, Barry Sexton, Stephen Kealy & Michael Sutton
Ground Investigations Ireland Limited | Registered in Ireland Company Registration No.: 405726



www.gii.ie



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

RECEIVED: 06/08/2024

DOCUMENT CONTROL SHEET

Project Title	Balbriggan Phase 4
Engineer	Paul McGrail
Client	Glenveagh
Project No	13625-03-24
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Final	G Rocha	S Kealy	C Finnerty	Dublin	11 June 2024

Ground Investigations Ireland Ltd. present the results of the fieldworks and laboratory testing in accordance with the specification and related documents provided by or on behalf of the client. The possibility of variation in the ground and/or groundwater conditions between or below exploratory locations or due to the investigation techniques employed must be taken into account when this report and the appendices inform designs or decisions where such variation may be considered relevant. Ground and/or groundwater conditions may vary due to seasonal, man-made or other activities not apparent during the fieldworks and no responsibility can be taken for such variation. The data presented and the recommendations included in this report and associated appendices are intended for the use of the client and the client's geotechnical representative only and any duty of care to others is excluded unless approved in writing.



www.gii.ie



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

RECEIVED: 06/08/2024

CONTENTS

1.0	Preamble.....	1
2.0	Overview.....	1
2.1.	Background.....	1
2.2.	Purpose and Scope	1
3.0	Subsurface Exploration	1
3.1.	General	1
3.2.	Soakaway Testing	2
3.3.	Cable Percussion Boreholes.....	2
3.4.	Laboratory Testing	2
4.0	Ground Conditions.....	3
4.1.	General	3
4.2.	Groundwater	3
4.3.	Laboratory Testing	4
4.3.1.	Geotechnical Laboratory Testing	4
4.3.1.	Chemical Laboratory Testing	4
5.0	Recommendations & Conclusions	5
5.1.	General	5
5.2.	Foundations	5
5.3.	Excavations.....	5
5.4.	Soakaway Design	6

APPENDICES

Appendix 1	Site Location Plan
Appendix 2	Soakaway Records
Appendix 3	Cable Percussion Borehole Records
Appendix 4	Laboratory Testing



www.gii.ie

1.0 Preamble

On the instructions of Paul McGrail Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., in March 2024 at the site of the proposed residential development in Balbriggan, Co. Dublin.

2.0 Overview

2.1. Background

It is proposed to construct a new residential development with associated services, access roads and car parking at the proposed site. The northern portion of the site is currently under construction with parts of the site being used as compound and the southern section is greenfield. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant.

2.2. Purpose and Scope

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

- Visit project site to observe existing conditions
- Carry out 2 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Carry out 3 No. Cable Percussion boreholes to a maximum depth of 3.10m BGL
- Installation of 2 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. Soakaway Testing

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

3.3. Cable Percussion Boreholes

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

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

3.4. 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 pH and sulphate testing was carried out by Element Materials Technology Laboratory in the UK.

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

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

4.0 Ground Conditions

4.1. General

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

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

- Topsoil
- Made Ground
- Cohesive Deposits

TOPSOIL: Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.3m BGL. Tarmac surfacing was present typically to a depth of 0.05m BGL.

MADE GROUND: Made Ground deposits were encountered from ground level at the location of BH01, BH01A and SA01 to a maximum depth of 0.60m BGL. These deposits were described generally as a *Grey slightly clayey sandy fine to coarse angular to sub angular Gravel or grey coarse angular cobbles*

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Made Ground and were described typically as *brown sandy gravelly CLAY with a low angular to subangular cobble content*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits typically increased with depth and was firm or stiff below 1.0m BGL in the majority of the exploratory holes. These deposits had some, occasional or frequent cobble and boulder content, where noted on the exploratory hole logs.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in BH01A and BH02 to allow the equilibrium groundwater level to be determined.

4.3. Laboratory Testing

4.3.1. 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 16% and 44.9% generally with fines contents of 30 to 41.6%.

4.3.1. 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.

The results from the completed laboratory testing are included in Appendix 4 of this report.

5.0 Recommendations & Conclusions

5.1. General

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

5.2. Foundations

An allowable bearing capacity of 100 kN/m² is recommended for conventional strip or pad foundations on the firm or stiff cohesive deposits at a depth of 1.0m BGL at the location of BH01 and BH02. We would also recommend a higher bearing capacity of 200 kN/m² for conventional strip or pad foundations on the very stiff cohesive deposits at the location of BH02.

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

Due to the shallow refusal in the cable percussion boreholes and possibility for shallow rock at the location of the boreholes we would further recommend carrying out rotary coring to prove bedrock or to prove the stiffness of the overburden at a deeper depth.

A ground bearing floor slab is recommended to be based on the firm or 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.

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. 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.

5.4. Soakaway Design

At the locations of SA01 and SA02 the water level dropped too slowly to allow calculation of 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.

RECEIVED: 06/08/2024

APPENDIX 1 - Site Location Plan



www.gii.ie

718200E

718300E

763600N

763500N

763400N

763600N

763500N

763400N

BH01A BH01

SA01

BH02

SA02

RECEIVED: 06/08/2024



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176

Client:



Project Title:

Balbriggan Phase 4

Drawing Title:

Figure 1 Site Location

GII Project Reference:

13625-03-24



Soakaway



Borehole

0 20 40 60 m



Drawn By:
SK

Date:
06/06/2024

RECEIVED: 06/08/2024

APPENDIX 2 – Soakaway Records



www.gii.ie



Site	Balbriggan Phase 4
-------------	--------------------

**Trial Pit
Number**
SA01

Excavation Method	
Trial Pit	

Dimensions
2.00m x 0.40m x 1.90m (L x W x D)

Ground Level (mOD)

Client	Glenveagh
---------------	-----------

Job Number 13625-03-24

Location

Dates	29/03/2024
--------------	------------

Engineer
Paul McGrail

Sheet
1/1

Depth
(m)

Sample / Tests

Water
Depth
(m)

Field Records

Level
(mOD)Depth
(m)
(Thickness)

Description

Legend

Water

MADE GROUND: Grey slightly clayey sandy fine to coarse angular to sub angular Gravel (crushed rock fill) with geotextile at 0.60m BGL

(0.60)

0.6

(0.50)

1.1)

(0.40)

1.5

(0.40)

1.9

Slow(1) at 1.80m.

Complete at 1.90m

Plan

Remarks

Groundwater encountered at 1.80m BGL
Trial pit side walls stable
Trial pit backfilled upon completion

Scale (approx)

1:25

Logged By

GGR

Figure No.

13625-03-24.SA01



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

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

RECEIVED: 06/08/2024

SA01

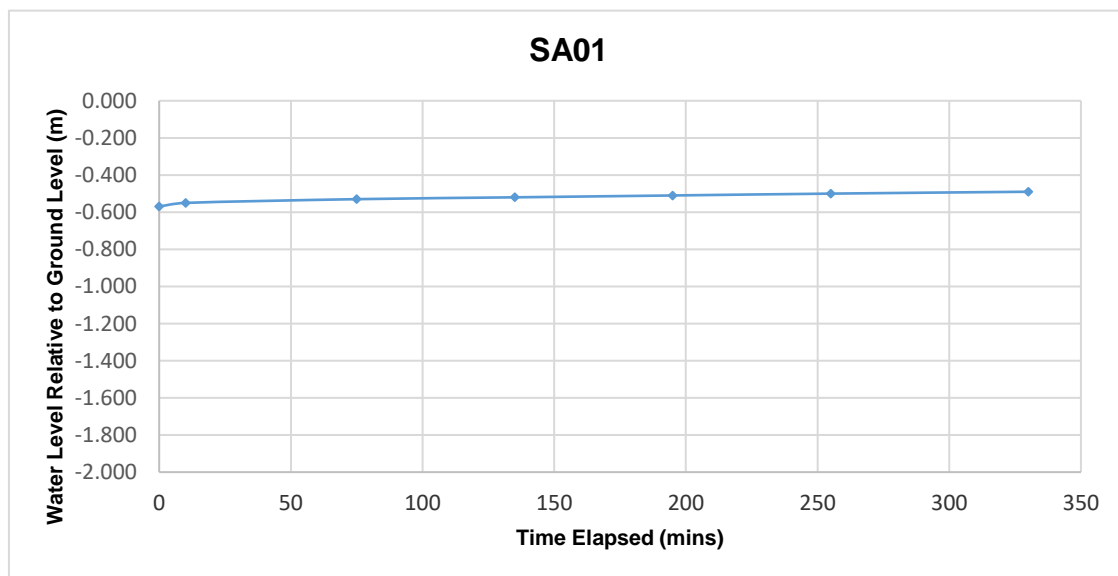
Soakaway Test to BRE Digest 365

Trial Pit Dimensions: 2.00m x 0.40m x 1.90m (L x W x D)

Date	Time	Water level (m bgl)
29/03/2024	0	-0.570
29/03/2024	10	-0.550
29/03/2024	75	-0.530
29/03/2024	135	-0.520
29/03/2024	195	-0.510
29/03/2024	255	-0.500
29/03/2024	330	-0.490

*Soakaway failed - Pit backfilled

Start depth	Depth of Pit	Diff	75% full	25%full
0.57	1.900	1.330	0.9025	1.5675





Ground Investigations Ireland Ltd
www.gii.ie

Site
Balbriggan Phase 4

Trial Pit
Number
SA02

Excavation Method Trial Pit	Dimensions 1.90m x 0.40m x 1.70m (L x W x D)	Ground Level (mOD)	Client Glenveagh	Job Number 13625-03-24
	Location	Dates 29/03/2024	Engineer Paul McGrail	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						Brown slightly sandy slightly gravelly TOPSOIL with grass and rootlets		
					0.30 (0.30)	Soft to firm brown slightly sandy gravelly CLAY with occasional sub angular to sub rounded cobbles		
					0.60 (0.60)	Stiff brown slightly sandy gravelly CLAY with some sub angular to sub rounded cobbles		
					1.20 (0.50)	Firm to stiff brown mottled orange slightly sandy gravelly CLAY with occasional sub angular to sub rounded cobbles		
					1.70	Complete at 1.70m		

Plan	Remarks No groundwater encountered Trial pit side walls stable Trial pit backfilled upon completion						
	Scale (approx) 1:25		Logged By GGR		Figure No. 13625-03-24.SA02		



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

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

RECEIVED: 06/08/2024

SA02

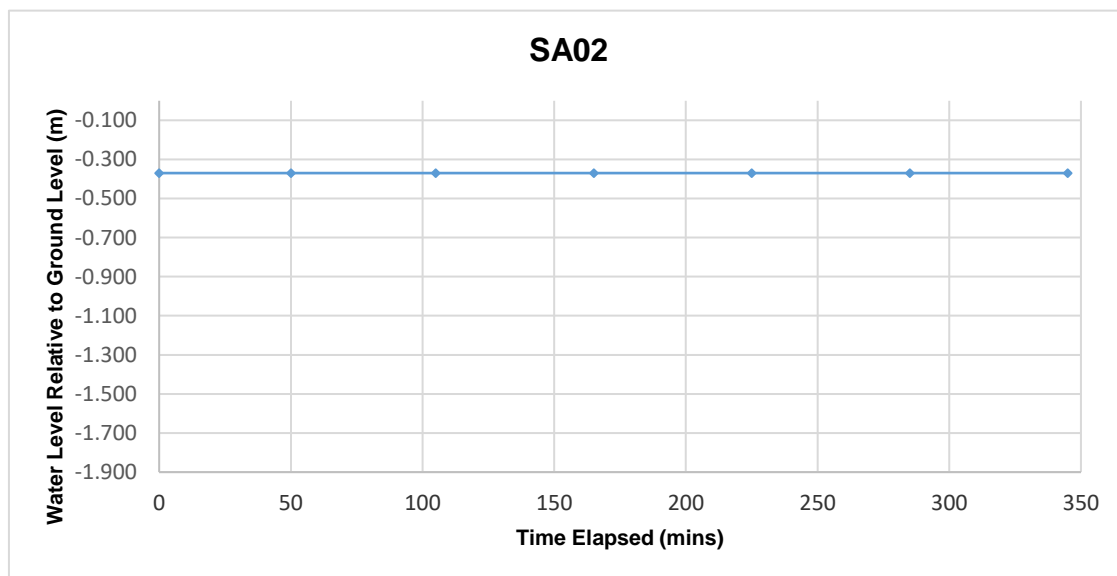
Soakaway Test to BRE Digest 365

Trial Pit Dimensions: 1.90m x 0.40m x 1.70m (L x W x D)

Date	Time	Water level (m bgl)
29/03/2024	0	-0.370
29/03/2024	50	-0.370
29/03/2024	105	-0.370
29/03/2024	165	-0.370
29/03/2024	225	-0.370
29/03/2024	285	-0.370
29/03/2024	345	-0.370

*Soakaway failed - Pit backfilled

Start depth	Depth of Pit	Diff	75% full	25%full
0.37	1.700	1.330	0.7025	1.3675



Balbriggan Phase 4

IT01

RECEIVED: 06/08/2024



Balbriggan Phase 4

IT02

RECEIVED: 06/08/2024



RECEIVED: 06/08/2024

APPENDIX 3 –Borehole Records



www.gii.ie



Ground Investigations Ireland Ltd
www.gii.ie

Site
Balbriggan Phase 4

Borehole
Number
BH01

Machine : Dando 2000		Casing Diameter 200mm cased to 2.10m		Ground Level (mOD)		Client Glenveagh		Job Number 13625-03-24	
Method : Cable Percussion		Location		Dates 26/03/2024		Engineer Paul McGrail		Sheet 1/1	

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45 1.00	SPT(C) N=11 B1			Water strike(1) at 0.50m, rose to 0.35m in 20 mins. 4,3/2,2,3,4		(0.50)	Blueish grey coarse angular cobbles fill		▼1
						0.50	Brown slightly sandy gravelly CLAY with low angular to subangular cobble content. Gravel is angular fine to coarse.		▼1
2.00-2.21	SPT(C) 50/55			Water strike(2) at 1.90m, rose to 1.10m in 20 mins. 4,21/50		(0.50)	Firm brown slightly sandy gravelly CLAY with low angular to subangular cobble content. Gravel is angular fine to coarse.		▼2
						1.00			▼2
						(1.00)			
						2.00	OBSTRUCTION: Possible boulders or bedrock		
						2.10	Complete at 2.10m		

Remarks

Cable percussion borehole carried out from ground level to 2.10m BGL
Groundwater encountered at 0.50m and 1.90m BGL
Borehole terminated due obstruction possible boulders or bedrock
Borehole backfilled upon completion.
Chiselling from 2.10m to 2.10m for 1 hour.

Scale
(approx)
1:50

Logged
By
GGR

Figure No.
13625-03-24.BH01



Ground Investigations Ireland Ltd

www.gii.ie

Site Balbriggan Phase 4	Borehole Number BH01A
Client Glenveagh	Job Number 13625-03-24
Engineer Paul McGrail	Sheet 1/1

Machine : Dando 2000	Casing Diameter 200mm cased to 2.20m	Ground Level (mOD)
Method : Cable Percussion	Location	Dates 27/03/2024

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
1.00-1.45 1.00	SPT(C) N=16 B1			2,3/3,4,4,5		(0.45) 0.45	Driller notes: Blueish grey angular cobbles fill			
1.50	B2					(0.55) 1.00	Brown mottled light grey slightly sandy slightly silty gravelly CLAY with low angular to subangular cobble content. Gravel is angular fine to coarse.			
1.90	B3			Water strike(1) at 1.90m, rose to 1.75m in 20 mins. 6,13/50		(0.80) 1.80 (0.30) 2.10 2.20	Stiff brown mottled light grey slightly sandy slightly silty gravelly CLAY with low angular to subangular cobble content. Gravel is angular fine to coarse.			
2.00-2.20	SPT(C) 50/50						Stiff greyish brown slightly sandy very gravelly CLAY with high angular to subangular cobble and boulder content. Gravel is angular fine to coarse.			
							OBSTRUCTION: Due to boulder or bedrock			
							Complete at 2.20m			

Remarks Cable percussion borehole carried out from ground level to 2.20m BGL Groundwater encountered at 1.90m BGL Borehole terminated due to obstruction possible boulders or bedrock Standpipe installed upon completion of borehole; Slotted standpipe installed from 2.20m to 1.00m BGL with a pea gravel surround; Plain standpipe installed from 1.00m BGL to ground level with bentonite seal and a raised cover. Chiselling from 2.20m to 2.20m for 1 hour.	Scale (approx) 1:50	Logged By GGR
	Figure No. 13625-03-24.BH01A	



Ground Investigations Ireland Ltd

www.gii.ie

Site Balbriggan Phase 4	Borehole Number BH02
Client Glenveagh	Job Number 13625-03-24
Engineer Paul McGrail	Sheet 1/1

Machine : Dando 2000	Casing Diameter 200mm cased to 3.10m	Ground Level (mOD)
Method : Cable Percussion	Location	Dates 27/03/2024

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
1.00-1.45 1.00	SPT(C) N=10 B1			2,2/2,3,2,3		(1.00)	Brownish grey slightly sandy slightly silty gravelly CLAY with low angular to subangular cobble content. Gravel is angular fine to coarse.			
1.50	B2					(0.80)	Firm brownish grey slightly sandy slightly silty gravelly CLAY with low angular to subangular cobble content. Gravel is angular fine to coarse.			
2.00-2.45	SPT(C) N=20			2,3/3,4,5,8		2.00	Firm orangish brown mottled light grey slightly sandy slightly silty slightly gravelly CLAY with low angular to subangular cobble content. Gravel is angular fine to coarse.			
2.60	B3					(1.00)	Stiff brown slightly sandy gravelly CLAY with medium angular to subangular cobble content. Gravel is angular fine to coarse.			
2.90 3.00-3.18	B4 SPT(C) 50/30			18,7/50		3.00 3.10	OBSTRUCTION: Due to boulder or bedrock Complete at 3.10m			

Remarks Cable percussion borehole carried out from ground level to 3.10m BGL No groundwater encountered Borehole terminated due to obstruction possible boulder or bedrock Standpipe installed upon completion of borehole; Slotted standpipe installed from 3.10m to 1.00m BGL with a pea gravel surround; Plain standpipe installed from 1.00m BGL to ground level with bentonite seal and a raised cover. Chiselling from 3.10m to 3.10m for 1 hour.	Scale (approx) 1:50	Logged By GGR
Figure No. 13625-03-24.BH02		

RECEIVED: 06/08/2024

APPENDIX 4 - Laboratory Testing



www.gii.ie

Tests	Lab	
Train at	Vane	
Failure %	kPa	

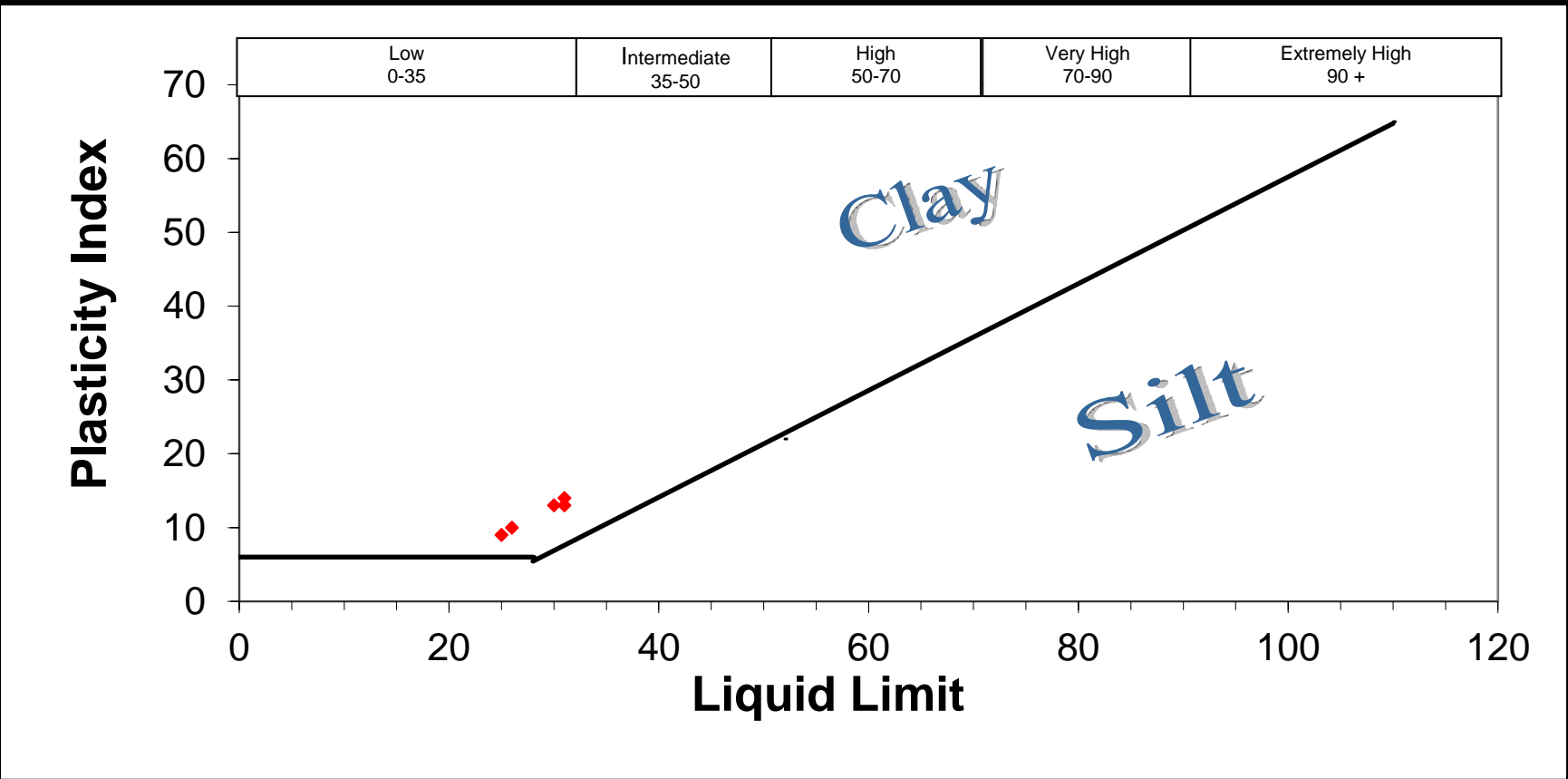
National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

National Materials Testing Laboratory Ltd.														
SUMMARY OF TEST RESULTS														
				Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Lab	
BH/TP	Depth	Sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
BH01	1.00	B	14.0		48.4	25	16	9						
BH01A	1.00	B	16.6		56.6	26	16	10						
BH01A	1.90	B	17.8		34.2	30	17	13						
BH02	1.50	B	18.5		57.0	31	18	13						
BH02	2.60	B	13.9		51.1	31	17	14						

RECEIVED: 06/08/2024

NMTL LTD Unit 18c, Tullow Industrial Estate Tullow County Carlow Tel: 00353 59 9180822 Mob: 00353 872575508 billa@nmtl.ie	Contract: Balbriggan Phase 4 Client: Ground Investigations Ireland Ltd Engineer: Stephen Kealy GII Project ID 13625-03-24 Date: 26/04/2024 Tested By: Js Job ref No. NMTL 3746	Checked: Bc
--	---	--------------------



RECEIVED: 06/08/2024

[illegible]

Ltd

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

--	--	--	--	--	--

Project No. NMTL 3746

Sample No	B
-----------	---

GII PROJECT ID:13625-03-24

4	Depth	1.00
---	-------	------

Date sample tested	23/04/2024	Depth	1.00m
--------------------	------------	-------	-------

RECEIVED: 06/08/2024

[illegible]

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

[illegible]

Project No. NMTL 3746

Sample No.	B
------------	---

GII PROJECT ID:13625-03-24

4	Depth	1.00
---	-------	------

Js

Js

Nc

Bc

23/04/2024

4 Depth

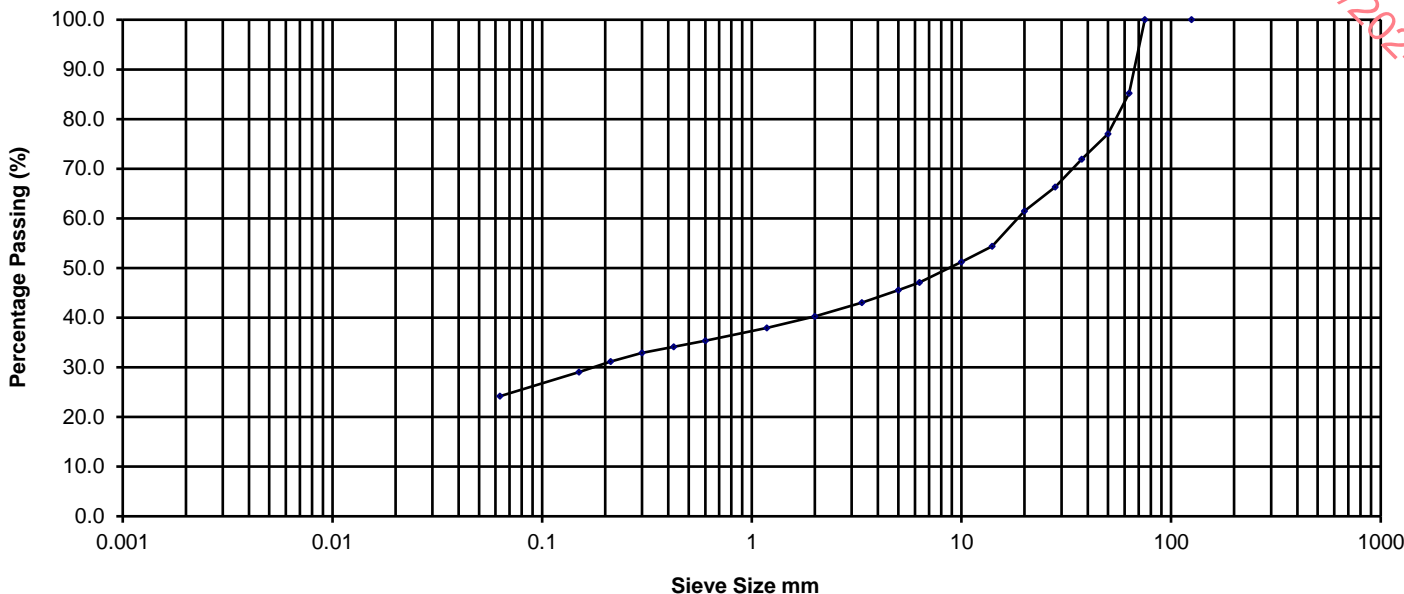
1.00m

NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	85.2
50.000	77.0
37.500	71.9
28.000	66.3
20.000	61.4
14.000	54.4
10.000	51.2
6.300	47.1
5.000	45.5
3.350	43.0
2.000	40.3
1.180	38.0
0.600	35.4
0.425	34.2
0.300	32.9
0.212	31.1
0.150	29.0
0.063	24.2

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	24.2			16.1			44.9			14.8	0.0

Sample Description Brown slightly sandy gravelly silty CLAY.

Project No. NMTL 3746

BH/TP No. BH01A

Project Balbriggan Phase 4

GII PROJECT ID:13625-03-24

Sample No.	B
------------	---

Operator	Js	Checked	Nc	Approved	Bc	Date sample tested	23/04/2024	Depth	1.90m
----------	----	---------	----	----------	----	--------------------	------------	-------	-------

NM***TL***

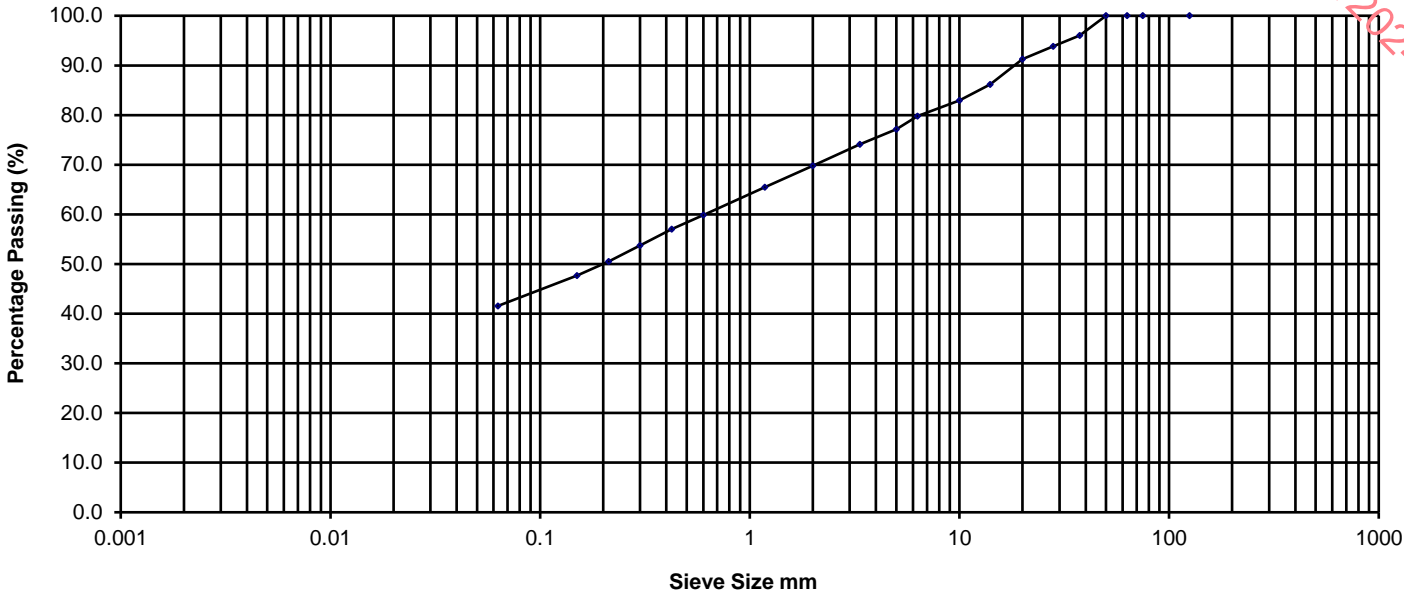
Ltd

RECEIVED: 06/08/2024

NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	96.0
28.000	93.8
20.000	91.3
14.000	86.2
10.000	83.0
6.300	79.8
5.000	77.2
3.350	74.1
2.000	69.8
1.180	65.4
0.600	59.9
0.425	57.0
0.300	53.7
0.212	50.5
0.150	47.6
0.063	41.6

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel			0.0	0.0
	41.6			28.2			30.2				

Sample Description Light brown grey slightly sandy slightly gravelly silty CLAY.

Project No. NMTL 3746

BH/TP No. BH02

Project Balbriggan Phase 4

GII PROJECT ID:13625-03-24

Sample No. B

NMTL Ltd

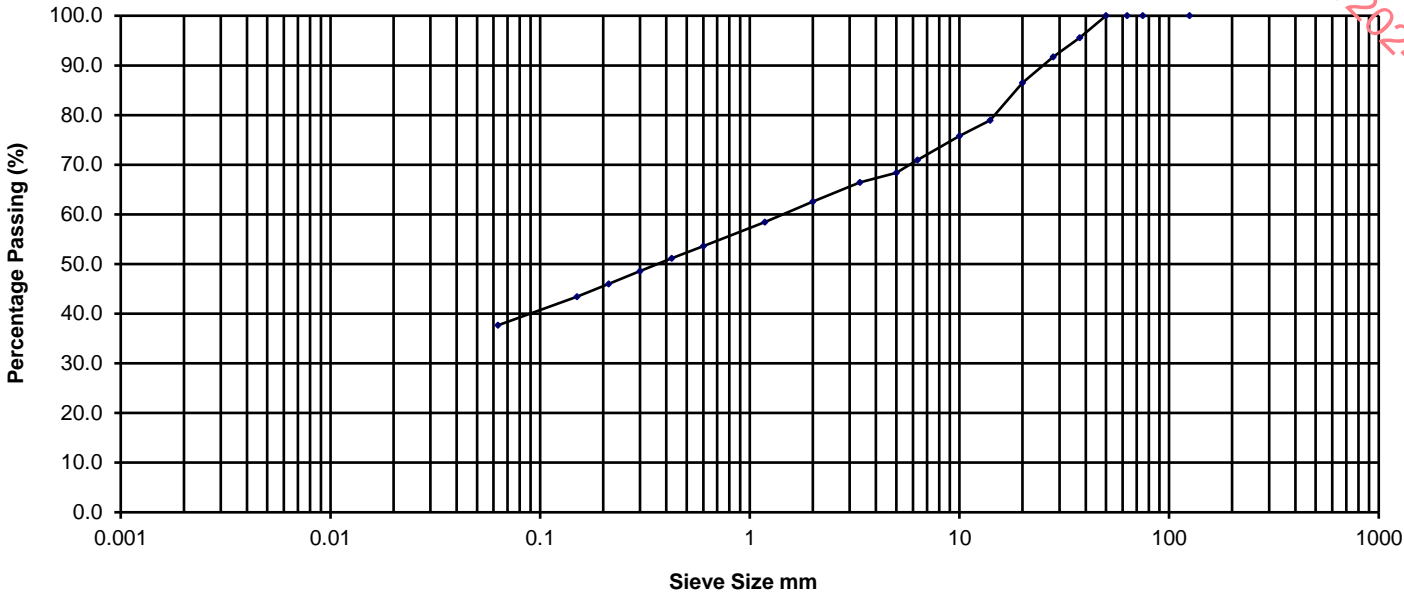
Operator	Js	Checked	Nc	Approved	Bc	Date sample tested	23/04/2024	Depth	1.50m
----------	----	---------	----	----------	----	--------------------	------------	-------	-------

RECEIVED: 06/08/2024

NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	95.6
28.000	91.7
20.000	86.5
14.000	79.0
10.000	75.8
6.300	71.0
5.000	68.4
3.350	66.4
2.000	62.6
1.180	58.4
0.600	53.6
0.425	51.1
0.300	48.6
0.212	46.0
0.150	43.4
0.063	37.7

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel			0.0	0.0
	37.7			24.9			37.4				

Sample Description Brown slightly sandy gravelly silty CLAY.

Project No. NMTL 3746

BH/TP No. BH02

Project Balbriggan Phase 4

GII PROJECT ID:13625-03-24

Sample No. B

NMTL Ltd

Operator	Js	Checked	Nc	Approved	Bc	Date sample tested	23/04/2024	Depth	2.602m
----------	----	---------	----	----------	----	--------------------	------------	-------	--------

Ground Investigations Ireland
Catherinstown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland
D22 K5P8



Attention : Stephen Kealy
Date : 1st May, 2024
Your reference : 13625-03-24
Our reference : Test Report 24/6850 Batch 1
Location : Balbriggan Phase 4
Date samples received : 22nd April, 2024
Status : Final Report
Issue : 202405011330

Three samples were received for analysis on 22nd April, 2024 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

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

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 2.389 kg of CO2

Scope 1&2&3 emissions - 5.646 kg of CO2

Authorised By:



Phil Sommerton BSc

Senior Project Manager

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland
Reference: 13625-03-24
Location: Balbriggan Phase 4
Contact: Stephen Kealy
EMT Job No: 24/6850

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

Please see attached notes for all abbreviations and acronyms

QF-PM 3.1.2 v11

Client Name: Ground Investigations Ireland

Reference: 13625-03-24

Location: Balbriggan Phase 4

Contact: Stephen Kealy

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 24/6850

SOILS and ASH

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

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

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

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

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

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

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 35°C ±5°C.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

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

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

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

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

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

WATERS

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

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

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

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

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

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

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

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

Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).

Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitatively, with a matrix specific limit of detection.

Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

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

RECEIVED: 06/08/2024

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

RECEIVED: 06/08/2024

EMT Job No: 24/6850

[illegible]