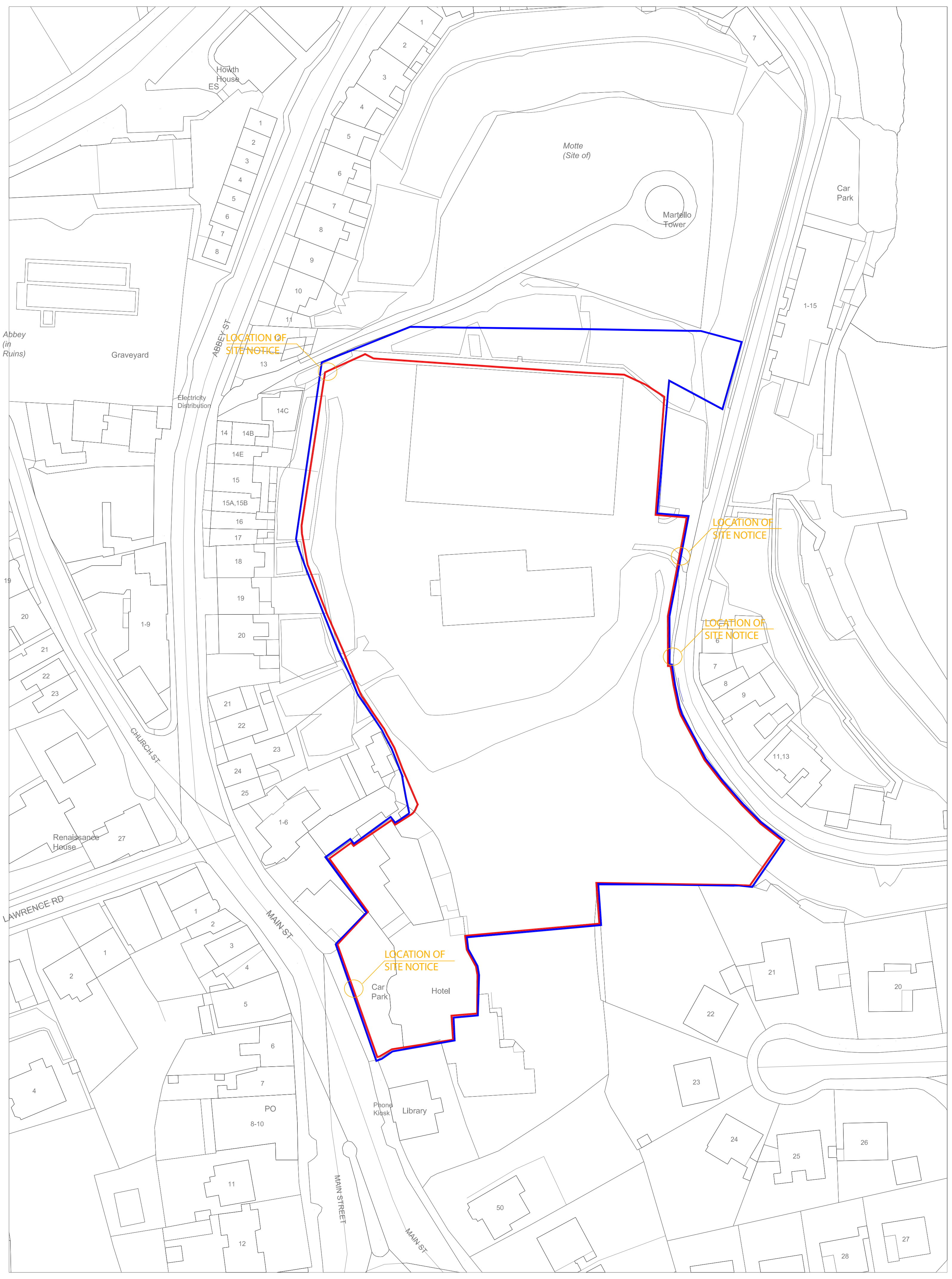
Appendix A



OSI AUTHORISED INTERNET MAP
RECEIPT NO. 50187625

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Digital Cartographic Model (DCM)

Publisher / Source:
====================================================
Ordnance Survey Ireland (OSi)

Data Source / Reference:
====================================================
PRIME2

File Format:
====================================================
Autodesk AutoCAD (DWG_R2013)

File Name:
====================================================
v_50187625_1.dwg


Clip Extent / Area of Interest (AOI):
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Projection / Spatial Reference:
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Centre Point Coordinates:
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Reference Index:
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Map Series | Map Sheets
1:1,000 | 3135-11
1:1,000 | 3135-16
1:1,000 | 3135-17
1:1,000 | 3135-12

Data Extraction Date:
====================================================
Date= 23-Apr-2021

Source Data Release:
====================================================
DCLMS Release V1.139.112

Product Version:
====================================================
Version= 1.3

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The representation on this map of a road, track or footpath is not evidence of the existence of a right of way.

Ordnance Survey maps never show legal property boundaries, nor do they show ownership of physical features.

Ní hionann bóthar, bealach nó cosán a bheith ar an léarscáil seo agus fianaise ar chead slí.

Ní thaispeánann léarscail de chuid Ordanáis Shuirbheireacht na hÉireann teorann phointí dleathúil de mhaoin riamh, ná úinéireacht de ghnéithe fhisiciúla.

1

SITE LOCATION MAP

1 : 1000

Drafting Note:

The redline and blue line boundary extents are drafted correctly and based upon the detailed topographic site survey undertaken for the lands. The Ordnance Survey Map depiction of the site extent is not fully accurate. The Ordnance Survey Map cannot been altered, therefore the red line and blue line boundaries appear mis-matched to the Ordnance Survey map, but are correct and consistent with the detailed topographic survey and all other depictions of the red line and blue line in drawings submitted as part of this planning application.

NOTES:

REV.	DATE:	DETAILS:	INITIALS:

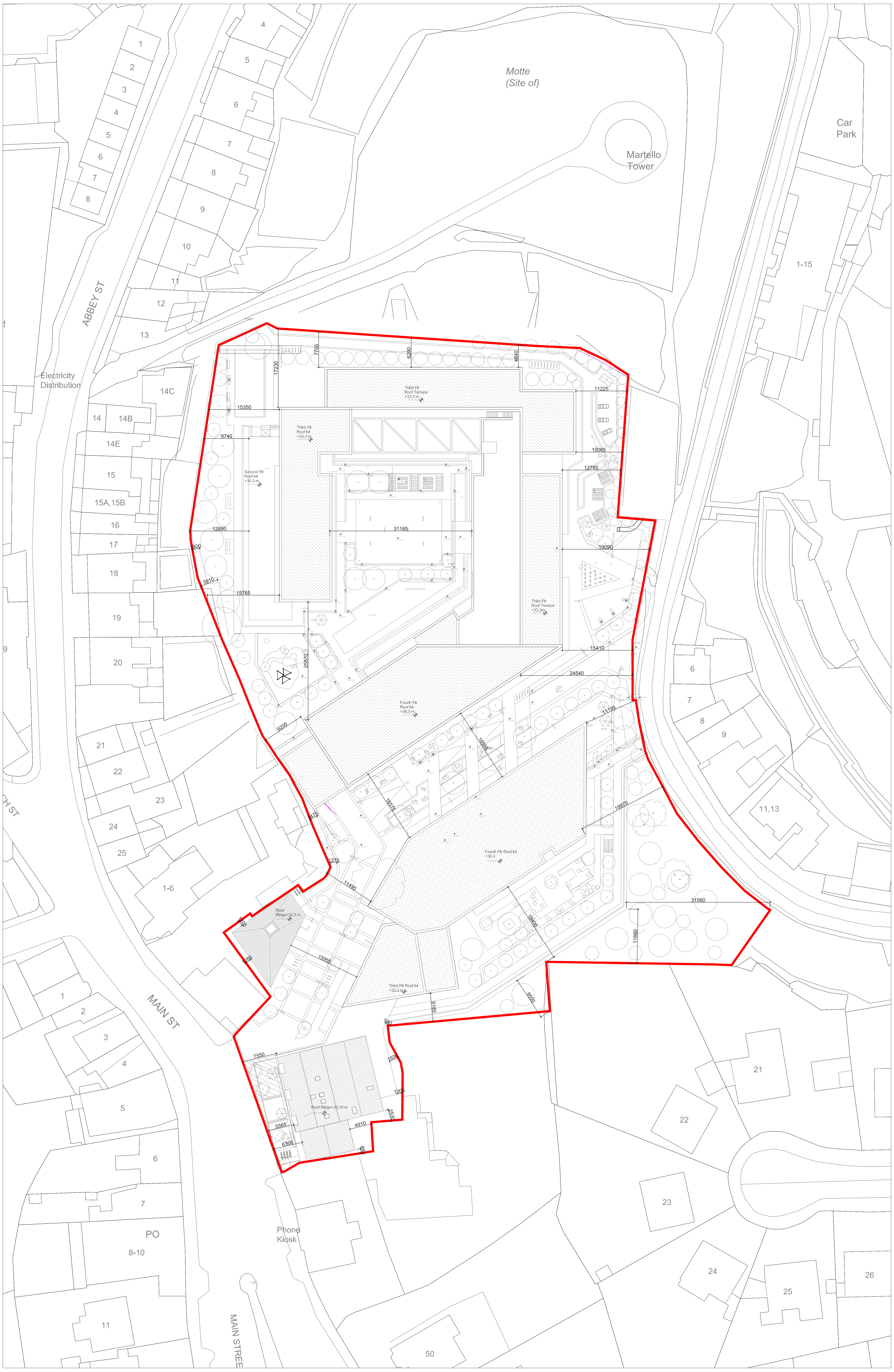
NORTH POINT:

KEY PLAN:

PLUS ARCHITECTURE

Chancery Lane, Dublin 8, D08 C98X, Ireland. W: www.plusarchitecture.ie T: 353 (0) 1 521 3378

PROJECT:	Balscadden	PROJECT:	486	DATE:	22/03/2022
CLIENT:	Balscadden GP3 Ltd.	DRAWING NO.:	486_01_01	REVISION NO.:	
TITLE:	Site Location Map	DRAWN BY.:	AW	SCALE AT A0 (Long).:	1 : 1000
ISSUE TYPE:	Planning	CHECKED BY.:	DT	SCALE AT A3 (Long).:	



1

Proposed Site Layout Plan

1 : 500

NOTES:	REV.	DATE:	DETAILS:	INITIALS:

NORTH POINT:

N

KEY PLAN:

PLUS ARCHITECTURE

Chancery Lane, Dublin 8, D08 C98X, Ireland. W: www.plusarchitecture.ie T: 353 (0) 1 521 3378

PROJECT: Balscadden	PROJECT: 486	DATE: 22/03/22
CLIENT: Balscadden GP3 Ltd.	DRAWING NO.: 486_01_02	REVISION NO.:
TITLE: Proposed Site Layout Plan	DRAWN BY.: AW	SCALE AT A0 (Long).: 1 : 500
ISSUE TYPE: For Information Only	CHECKED BY.: DT	SCALE AT A3 (Long).:

Appendix B

JV TIERNEY & CO

MECHANICAL ELECTRICAL & SUSTAINABLE ENGINEERS

BALSCADDEN SHD DEVELOPMENT
HOWTH COUNTY DUBLIN
SUSTAINABILITY AND ENERGY REPORT

JV TIERNEY & CO
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BALSCADDEN SHD RESIDENTIAL DEVELOPMENT

HOWTH COUNTY DUBLIN

SUSTAINABILITY & ENERGY REPORT

FOR

PLANNING

Rev:	Issue Date:	Prepared By:	Checked By:
3	16-03-2022	DB	RB

Directors: J.Lee, S.Walsh, R.Burke, N.Tobin, C.Saul, A.Clifford, C.Kelly, D.Conaty.
Associate Director: M.Downey.
J.V. Tierney and Company (2002) Limited Trading as J.V. Tierney & Co. Registration No. 359680
Registered Office: 5 Clarinda Park North, Dun Laoghaire, Co Dublin, A96 W6N1.
ACEI Member of the Association of Consulting Engineers of Ireland
JVT 1948

CONTENTS

2. Introduction

The proposed development relates to lands located to the south of the Martello Tower on Balscadden Road & the former Baily Court Hotel, Main Street, Howth, County Dublin. The development will consist of the demolition of existing structures on the proposed site including the disused sports building and the former Baily Court Hotel buildings and the construction of a residential development set out in 4 no. residential blocks, ranging in height from 2 to 5 storeys to accommodate 180 no. apartments with associated internal residential tenant amenity and external courtyards and roof terraces, 1 no. retail unit and 2 no. café/retail units. The site will accommodate car parking spaces at basement level and bicycle parking spaces at basement and surface level. Landscaping will include new linear plaza which will create a new pedestrian link between Main St and Balscadden Rd to include the creation of an additional 2 no. new public plazas and also maintains and upgrades the pedestrian link from Abbey Street to Balscadden Road below the Martello Tower. Please see the accompanying Statutory Notices for a more detailed description.

The sustainability and energy approach for the Balscadden SHD development site in Howth, County Dublin will employ a strategy that will demonstrate how each apartment will achieve NZEB compliance based on the Part L 2021 Building Regulations. The Part L 2021 – Dwellings, sets out the definition of a Near Zero Energy Building (NZEB)-

"Nearly Zero Energy Building means a building that has a very high energy performance, as determined in accordance with Annex I to Directive 2010/31/EU of the European Parliament and the Council of 19 May 2010 on the energy performance of buildings (recast)(O.J. No. L 153, 18.6.2010, page 13). The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby."

This strategy will use efficient passive and active measures coupled with the appropriate renewable technology to deliver a robust, cost effective, efficient and healthy environment within the development site. The development provides an opportunity to create environmentally sound and energy efficient apartments, by using an integrated approach to design, planning, construction and operation.

Sustainable and energy efficient development promotes resource conservation of our limited natural resources. The design strategies employed will include a whole life cycle approach to management and planning of the development, energy efficiency with specific focus on reducing the carbon footprint and delivering the NZEB criteria, improving the environmental quality of the building spaces, material selection and use, waste management, water management and conservation and enhancing the ecological value of the site.

There are many significant drivers for energy and sustainable design; -

- The increasing cost required to provide services such as energy and water.
- Stricter energy targets set under the Building Regulations now and into the future i.e. the NZEB/Part L 2021 criteria.
- The desire to provide an energy efficient building development to demonstrate energy awareness and efficiency of use.
- Requirements for building lifecycle considerations for all new residential developments.
- Fingal County Development Plan 2017-2023 to reduce carbon emissions in line with Council objective En04.

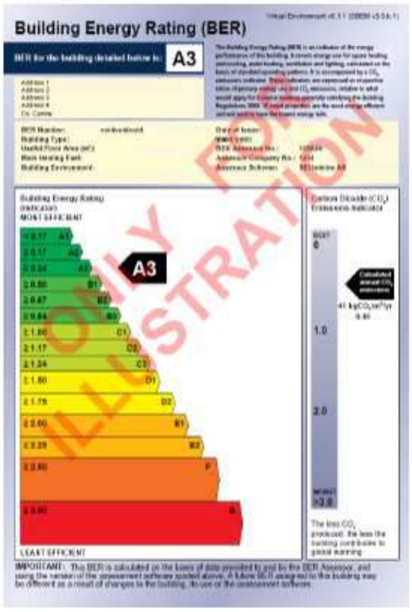
This sustainable and energy report is submitted to demonstrate that the proposed development will achieve a very high level of environmental and energy efficiency and will meet the objectives of the Fingal County Development Plan 2017-2023 and the Building Regulations Part L 2021.

Figure 1 - Building development approach

3. Energy Strategy Approach

In developing the energy strategy for the Balscadden SHD development in Howth County Dublin, the incorporation of energy efficient strategies into the project deliverables will encourage the commitment to sustainable design at a very early stage with all concerned to ensure a ‘best in class’ development for the site. The energy strategy approach has considered and applied the guidelines and regulations pertaining to energy efficiency amongst them;

- The Government’s ‘National Climate Policy’
- Fingal County Development Plan 2017-2023 and the aim to reduce carbon emissions in line with Council objective En04
- Sustainable Urban Housing: Design Standards for New Apartments December 2020
- Site Layout Planning for Daylight and Sunlight 2011: A Guide to Good Practice, Second Edition by Paul Littlefair
- The NZEB criteria as set out in the Part L Regulations 2021 with the aim to reduce Carbon Dioxide (CO_2) emissions thus demonstrating the commitment to Climate Change.



Building Energy Rating (BER)

A3

MOST EFFICIENT

LEAST EFFICIENT

ONLY FOR ILLUSTRATION

Figure 2 - Example BER Certificate

The strategy approach will be to firstly maximise the passive benefits of the buildings fabric, orientation, etc. followed by the inclusion of highly efficient M&E systems to achieve a design that will meet the Renewable Energy Ratio (RER) target of 20% outlined in the Part L 2021 Regulations. This 20% RER figure is outlined under the Part L Regulations on the basis that the building has a Maximum Permitted Energy Performance Coefficient (MPEPC) of ≤ 0.3 with a corresponding Maximum Permitted Carbon Performance Coefficient (MPCPC) of ≤ 0.35.

Definitions of EPC, CPC and RER

- Energy Performance Coefficient (EPC) = Primary Energy of Actual Building/Primary Energy of reference building and must be equal to or less than MPEPC = 0.30
- Carbon Performance Coefficient (CPC) = Primary Carbon Dioxide emissions of Actual Building/Primary Carbon Dioxide emissions of reference building and must be equal to or less than MPCPC =0.35
- Renewable Energy Ratio (RER) is the ratio of the primary energy from renewable energy technologies to total primary energy as defined and calculated in DEAP. The Renewable Energy Ratio (RER) should be as follows:

Where the MPEPC of 0.30 and MPCPC of 0.35 are achieved, an RER of 0.20 represents a very significant level of energy provision from renewable energy technologies.

Strategy Approach

I. Maximise the passive elements of the design:

  - Specifying building fabric insulation u-values better than the Part L/ NZEB specification (See Table 1)
  - Using dynamic thermal modelling to optimise the façade using differing glazing u-values, light transmittance and solar gain (‘g’ values).
  - Targeting natural daylight factors that meet BRE Guidelines. Good natural daylight creates a positive living environment and contributes to the well-being of the occupants. The provision on the elevations of high-performance glazing for the apartments that meet with the NZEB and BER requirements, will maximise the use of natural daylight and will enhance the visual comfort for the occupants. The high-performance glazing will also ensure that the thermal performance of the apartments is not compromised, while allowing the building occupants to enjoy the benefit of the glazed views.

  - Façade studies in conjunction with the Design Team using computer modelling techniques to maximise the daylight factors, ventilation and solar benefits specific to the Balscadden SHD development site. The efficient use of natural light will help to offset the use of artificial light.
  - Ensuring particular detailing of linear thermal bridging.

Table 1

Item	Part L 2021 Dwellings	NZEB Reference Values	Proposed Outline Specification (Range)
Roof	0.16 W/m²K	0.15 W/m²K	≤ 0.14 W/m²K
Walls	0.18 W/m²K	0.18 W/m²K	≤ 0.14 W/m²K
Floor	0.18W/m²K	0.15 W/m²K	≤ 0.14 W/m²K
Windows	1.4 W/m²K	1.4 W/m²K	≤1.30 W/m²K
Air Permeability	5m³/m².h @50Pa	5m³/m².h @50Pa	≤3m³/m².h @50Pa

II. Maximising the Active elements of the design:

  - Heat Source – Please refer to Table 2 below. The heating source will be based on the optimum sustainable approach with the proposed solution coming from one of the following:
    - Centralised plantroom using combination of boilers/Combined Heat and Power(CHP)/ Heat Pump technology linked to HIU's/Radiators/Mechanical Ventilation Heat Recovery (MVHR) systems within the apartments
    - Exhaust Air Heat Pumps within the apartments
    - Electric Radiators with Hot Water Heat pump and MVHR solution.
  - Specifying the use of high efficiency light fittings, LED lights, etc. for use in dimming, presence/ absence detection, occupancy and daylight controls in Landlord areas.
  - Specifying lighting designs that deliver > 90 lumen/ circuit watt.
  - Specifying high efficiency Heating systems.
  - Minimise the specific fan power where applicable.
  - Use of M&E systems and plant that are high efficiency and registered on the SEAI Triple E register of products

III. The renewable technology employed will again be based on the most optimum technology from an operational and maintenance viewpoint and the ability of the technology to meet the RER target projected (See Table 2). The approach will be to address the electrical energy usage in the first instance as this has the highest primary energy factor and technologies such as Heat Pumps, CHP, Exhaust Air

Heat Pumps, etc. will be considered to meet the renewable source produced on-site or nearby as per the NZEB definition.

Table 2 Heat Source and Renewable Energy Solution

Item	Type	Energy Source	Source (from either)
1	Apartments	Individual	Exhaust Air Heat Pump Electric Heating Solution with Heat Pumps/MVHR
		Centralised	Heat Pumps/ CHP/ Boilers – Combination of

IV. Additional items for consideration in supporting the delivery of the energy and sustainable strategy and will be considered during the detailed design stage of the project.

- Development of a flexible design to enhance each apartments longevity.
- Computer analysis of the natural ventilation strategy will be carried out for the impact of climate change using approved CIBSE 2020/2050 weather files. This will ensure that there will be no need to alter the ventilation strategy of the buildings where a natural ventilation strategy is employed.
- During design and construction phases, environmental assessment methodology will be used to ensure that the buildings are developed holistically.
- An integrated Water Management and Conservation approach that incorporates the use of low water consumption equipment to ensure the minimal use of potable water, efficient sanitary appliances (low water WC cisterns, push spray taps).
- Extend the sustainable approach from the Building to the Site throughout the construction and handover process.
- Reduce Reuse and Recycle throughout the design, construction and operational phases of the development.

- Provision of electric car charging facilities in line with Part L 2021 Regulations and Fingal County Council policy.
- All public and amenity lighting will use low energy LED light fittings and be installed in line with Fingal County Council specifications.
- Whole life cycle approach to the selection of materials and equipment used in the buildings with specific regard to the impact on the carbon footprint.
- During the design and construction stages of the project environmental assessment methodologies will be used to assist in the development of a life cycle approach, in which approach the principles of IS0 15686 – Building and Constructed Assets – Service Life Planning – Life Cycle Costing (LCC) will be used (see Figure 1). The life cycle analysis will assess the long-term operation of the development of a 60year timeframe and will consider all aspects of the development from maintenance costs to running costs to replacement costs and noting that certain M&E elements especially those with moving parts will have a typical life cycle of 10 - 15 years and this will be accounted for in the LCC analysis.

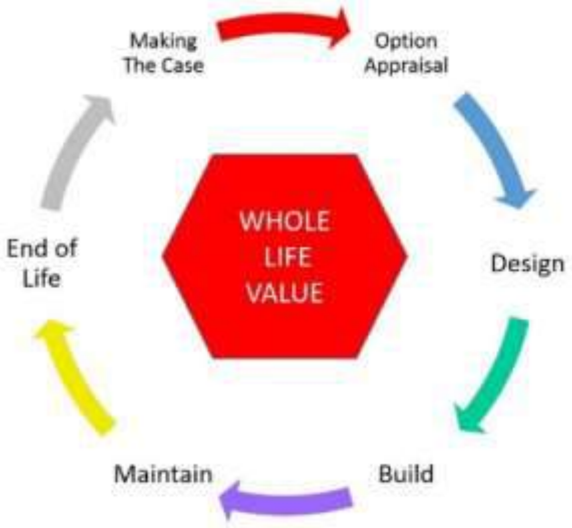


Figure 3 - Whole Life Cycle Approach

The additional investment required to deliver an energy efficient and climate change adaptive design in line with the Fingal County Development Plan 2017-2023 will add benefit to the sustainability of the Balscadden SHD development and holistically forms part of an industry wide approach to reduce carbon consumption and emissions and to comply with regulations. These benefits ensure less energy, less services and therefore less resources are needed to operate and will make the apartment buildings more energy and environmentally efficient and will ensure that it is a more sustainable development into the future.

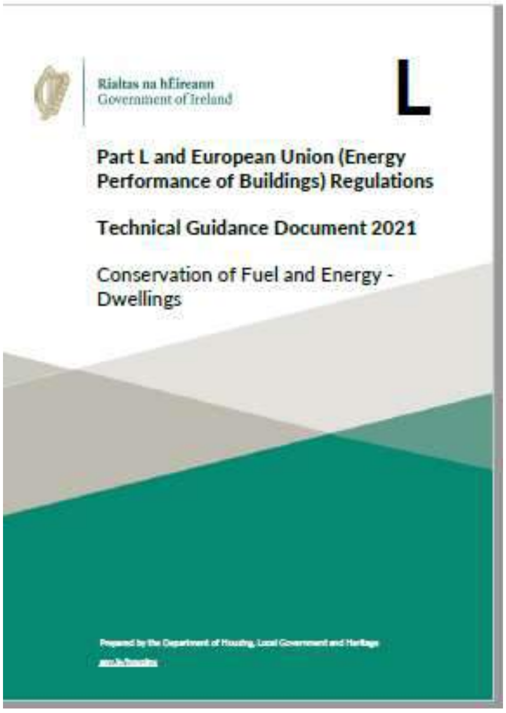
Appendix 1

a. Report on Preliminary Design BER/ NZEB Building Compliance

Introduction

This report outlines a design stage preliminary Part L compliance assessment for the apartments in the Balscadden SHD development project. The apartment buildings are designed to exceed the provisions of the Building Regulations Part L 2021 and will offer a sustainable and adaptable design to meet future provisions to these standards.

The strategy approach to the design of the facilities is firstly to maximise the passive measures of the buildings (insulation, solar gains, daylight, etc.) and then apply the most efficient active measures (Heat Pumps, LED lighting, etc) and then include the optimum renewable technology appropriate to the design.



Rialtas na hÉireann
Government of Ireland

L

Part L and European Union (Energy Performance of Buildings) Regulations

Technical Guidance Document 2021

Conservation of Fuel and Energy - Dwellings

Prepared by the Department of Housing, Local Government and Heritage

Figure 4: Building Design Standards

The following key elements will be included in the design parameters:

V. Maximise the passive elements of the design in the first instance by:
  - Specifying building fabric insulation u-values better than the Part L 2021 Regulations.
  - Targeting the air permeability to be ≤ $3m^3/m^2/hr$ @ 50Pa
  - Using the Dwelling Energy Assessment Procedure (DEAP) Software used to determine BER/Part L and can be used to optimise the façade using differing glazing u-values, light transmittance and solar gain (‘g’ values).
  - Ensuring particular detailing of linear thermal bridging.

Maximising the Active elements of the design by:

  - Specifying lighting designs that deliver > 90 lumen/ circuit watt
  - Specifying lighting systems with occupancy and daylight controls in Landlord areas.
  - Specifying high efficiency Heating systems
  - Minimise the specific fan power where applicable.

By addressing the passive and active elements of the building design as outlined above, the strategy will achieve a design that exceeds the Renewable Energy Ratio target of 20% as outlined in the Part L Regulations 2021 on the basis that the building has a Maximum Permitted Energy Performance Coefficient ≤ 0.3 with a corresponding Maximum Permitted Carbon Performance Coefficient ≤ 0.35.

The renewable technology employed will target the highest primary energy factor and technologies such as Exhaust Air Heat Pumps, CHP, etc. will be assessed to meet the renewable source produced on-site or nearby as per the NZEB definition.

Renewable Options Considered

The following renewable energy sources have been considered as outlined in the Energy Performance Directive for alternate energy systems for the development. The most feasible technologies currently that will achieve the criteria for NZEB is the use of PV Solar Panels, Exhaust Air Heat Pumps, Air Source Heat Pumps, CHP on their own or in combination, based on the final developed design:

	Feasibility			
Technology	High	Med	Low	Comments
Ground Source Heat Pumps (GSHP) Closed Loop 	√			GSHP technology uses seasonal differences between ground and air temperatures to provide heating in winter and cooling in summer. GSHP provide low temperature heating and high temperature cooling suitable for underfloor heating or chilled beams. Site restrictions would be a consideration with vertical boreholes been most practical but also more capital intensive. Impact on the Primary Energy factor can be significant with Heat Pumps but additional capital and area required is a constraint.

Table 3: GSHP Feasibility

	Feasibility			
Technology	H	M	L	Comments
Air Source Heat Pump (ASHP) 	√			ASHP technology uses seasonal differences between external air temperatures and refrigerant temperatures to provide heating in winter and cooling in summer. As most of the energy is taken from the air they produce less greenhouse gas than a conventional heating system over the heating season. Most efficient when used as a pre-heat mechanism as the COP remains high and therefore has a major impact on the RER % and NZEB criteria.

Table 4: ASHP Feasibility

	Feasibility			
Technology	H	M	L	Comments
Exhaust Air Heat Pump (EAHP) 	√			Hot water for space and hot water heating is generated via. an exhaust air heat pump. Part L compliance is met through generating space heating and hot water from heat recovered from hot air within the apartment. Ventilation is provided by exhaust air working on differential pressure. Very efficient when the COP of the unit is high and therefore has a major impact on the RER % and NZEB criteria. Can be used to heat hot water only.

Table 5: EAHP Feasibility

	Feasibility			
Technology	H	M	L	Comments
Combined Heat & Power (CHP) 	√			Combined heat and power (CHP) refers to the local simultaneous generation of electricity and heat. CHP works best in areas that have a constant “round the clock” demands for heat. CHP systems typically run on oil or gas with biomass also used. Key to a CHP installation is to ensure that the demand load for heating and electricity usage are utilized, i.e. to size the unit correctly on a base load basis. Can assist in meeting the RER requirement under NZEB but energy load dependent.

	Feasibility			
Technology	H	M	L	Comments
Wind Power 			√	Micro wind turbines can be fitted to roofs but do not supply much energy. Full scale turbines need open space and are capital intensive but deliver large energy savings. Good impact from a Primary Energy perspective but the site would not be suitable for a large scale turbine given proximity of existing infrastructure.

Table 6: CHP & Wind Power Feasibility

	Feasibility			
Technology	H	M	L	Comments
Solar Photovoltaic 	√			Solar PV collectors absorb the sun's energy and converts it into electricity. PV Panels can be discrete roof-mounted units or embedded in conventional facades, etc. The ideal location for locating the PV system is facing a southerly direction. Good impact from a Primary Energy perspective and RER% under NZEB.

Table 7: Solar PV Feasibility

	Feasibility			
Technology	H	M	L	Comments
Solar Thermal 		√		Solar collectors absorb the sun's energy and provide energy for space heating and hot water generation. The ideal location for locating the solar system is southerly direction. Solar systems are usually designed to meet only a portion of the heating load. Available roof area is better utilised with PV Panels as these have a higher Primary Energy impact and hence if roof space available PV Solar Panels would be the preferred option.
	Feasibility			
Technology	H	M	L	Comments
Biomass Heating 			√	Biomass boilers combust wood chips or pellets and is considered carbon neutral. The technology requires significant plant space and ongoing maintenance.

Table 8: Solar Thermal & Biomass Heating Feasibility

NZEB Details for Apartments at Balscadden SHD Howth County Dublin

We have carried out an NZEB analysis on a typical Mid-Level Apartment type building proposed for the Balscadden SHD development to demonstrate that the NZEB strategy approach outlined by the Design Team will deliver compliant apartments in line with the provisions of the Building Regulations Part L 2021. The mid-floor apartment is a fair representative of a majority of the apartment types. This report provides a preliminary design stage energy assessment, using the DEAP 4.2 Software tool as issued by the Sustainable Authority of Ireland (SEAI). The Dwelling Energy Assessment Procedure (DEAP) is a software tool and manual which calculates energy consumption and carbon dioxide emissions. It considers space heating, ventilation, water heating, and lighting in a dwelling.

The Dwelling Energy Assessment Procedure (DEAP) is the methodology for demonstrating compliance with specific aspects of Part L of the Building Regulations. DEAP is also used to generate the Building Energy Rating (BER) and advisory report for new and existing domestic buildings. DEAP calculates the energy consumption and CO_2 emissions associated with a standardised use of a building. The energy consumption is expressed in terms of kilowatt hours per square meter floor area per year ($kWh/m^2/yr$) and the CO_2 emissions expressed in terms of kilograms of CO_2 per square meter floor per year ($kg\ CO_2/m^2/yr$).

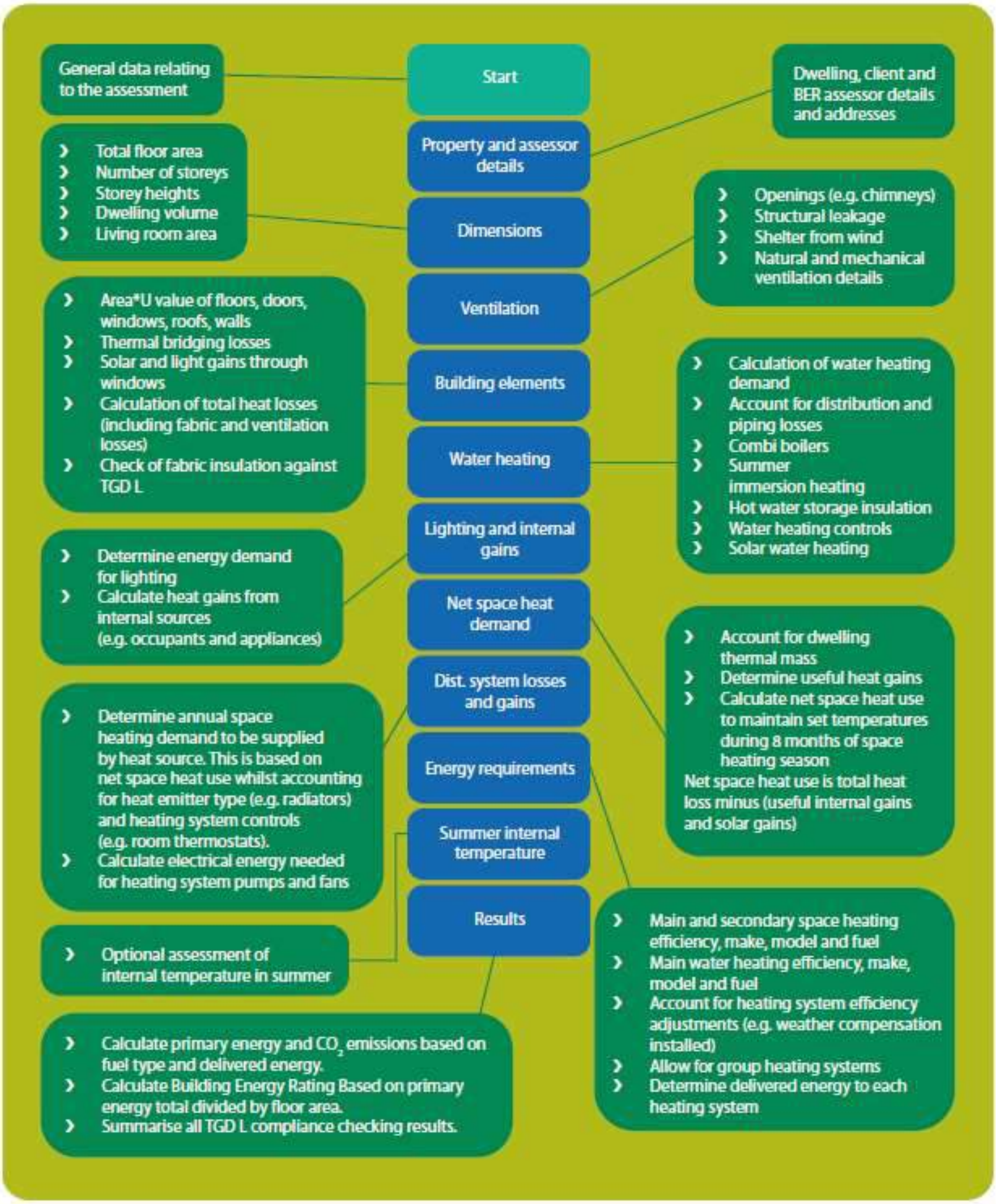
Buildings assessed

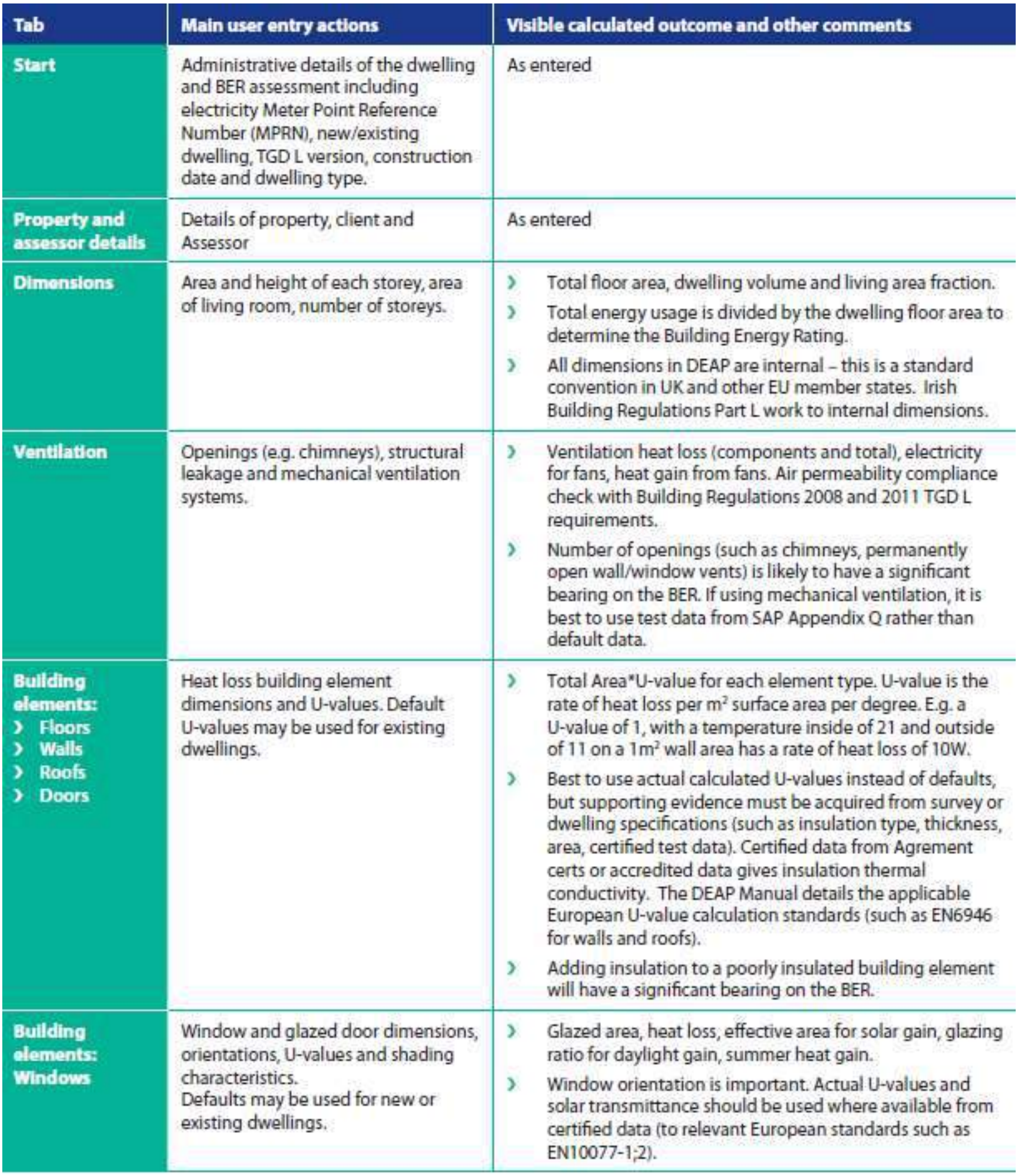
The DEAP assessment was carried out on the following building types:

- Middle Floor 2 Bed Apartment. The middle floor was chosen as a representative example of the apartments in the development as most of the apartments would have a heated space above and below them.

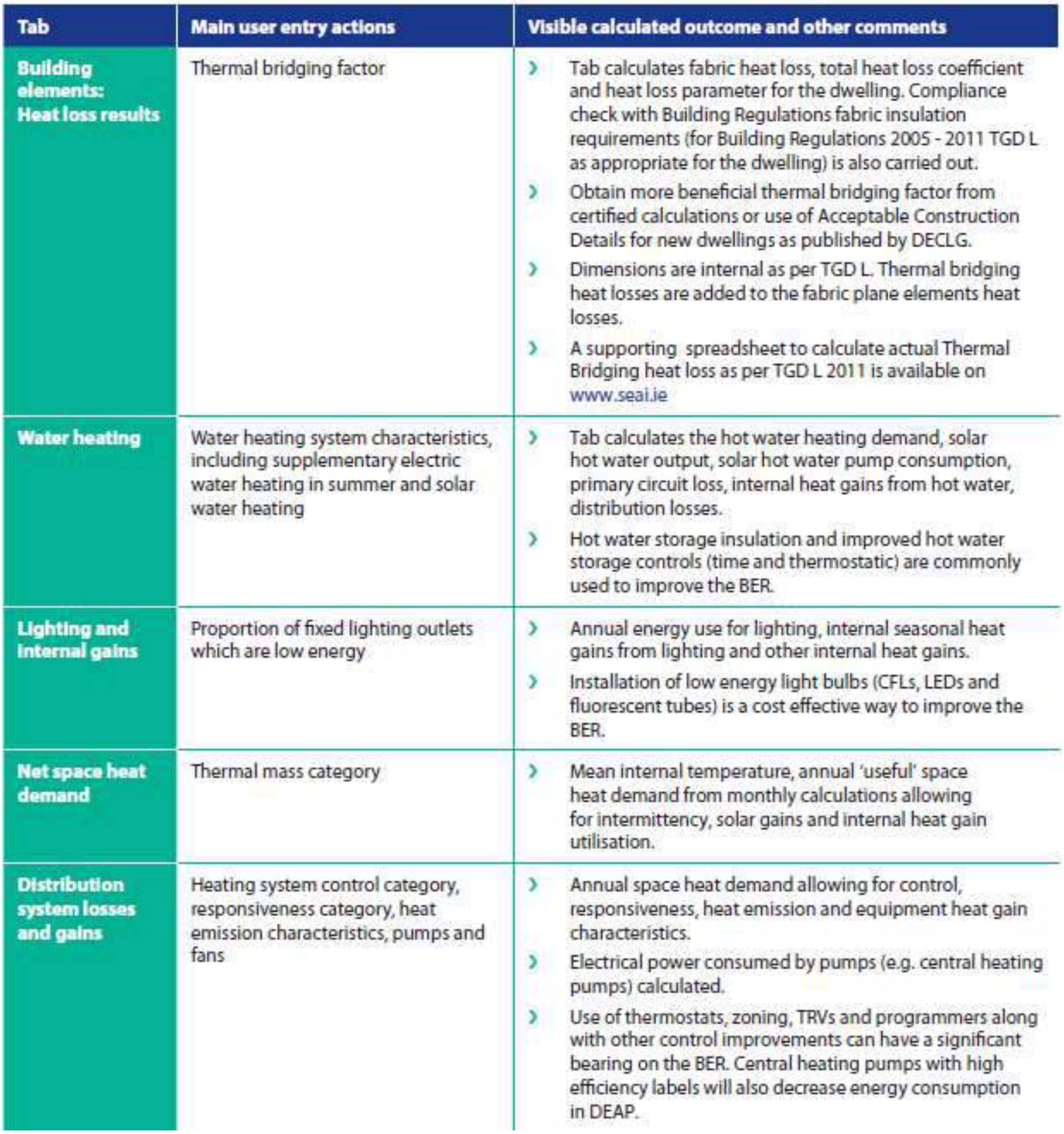
DEAP Procedure (source: www.seai.ie).

The following flowchart (Figure 5) outlines the DEAP Procedure as outlined by the Sustainable Energy Authority of Ireland (SEAI) to carry out a Building Energy Rating (BER) assessment.

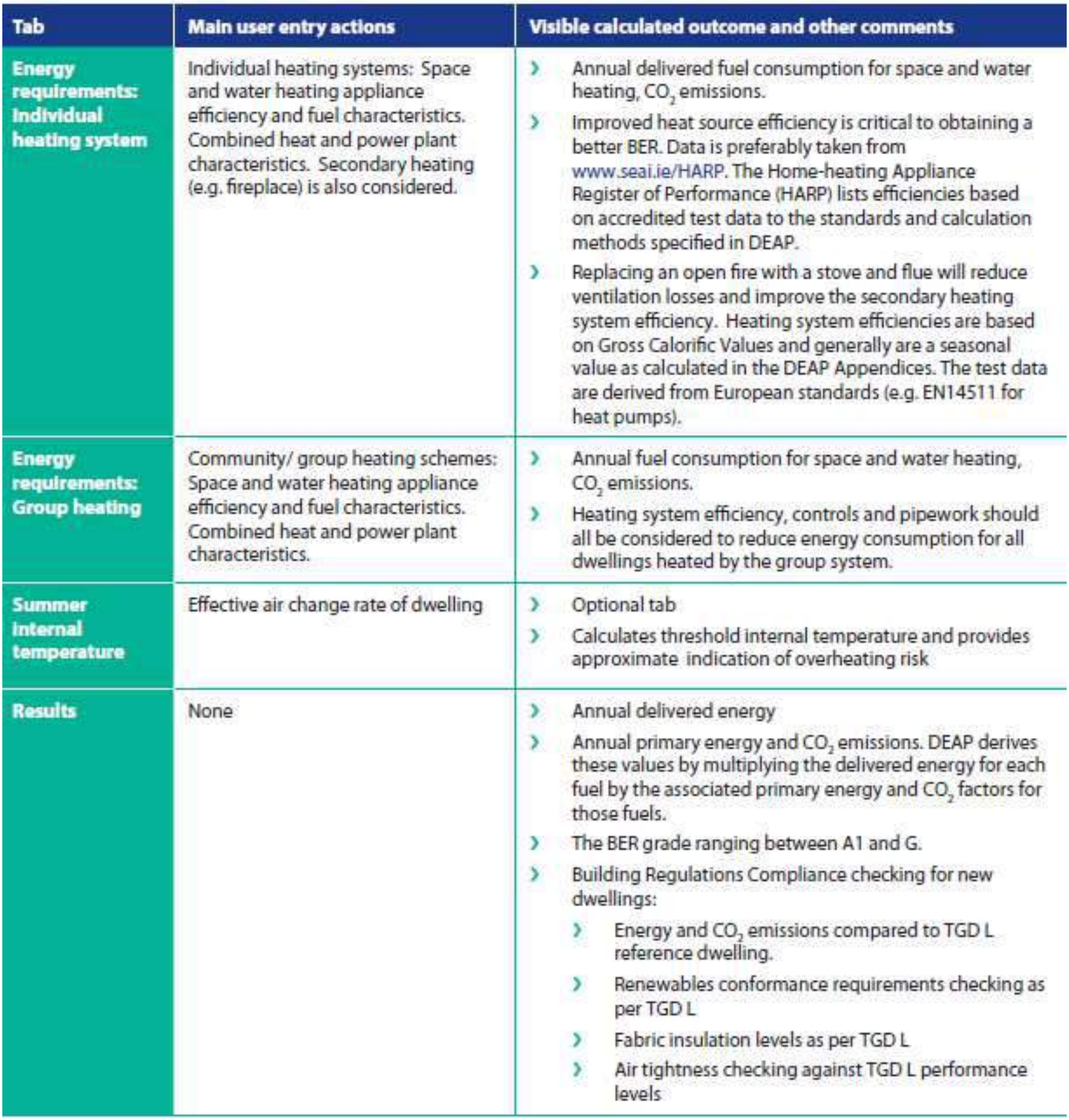




Tab	Main user entry actions	Visible calculated outcome and other comments
Start	Administrative details of the dwelling and BER assessment including electricity Meter Point Reference Number (MPRN), new/existing dwelling, TGD L version, construction date and dwelling type.	As entered
Property and assessor details	Details of property, client and Assessor	As entered
Dimensions	Area and height of each storey, area of living room, number of storeys.	› Total floor area, dwelling volume and living area fraction. › Total energy usage is divided by the dwelling floor area to determine the Building Energy Rating. › All dimensions in DEAP are internal – this is a standard convention in UK and other EU member states. Irish Building Regulations Part L work to internal dimensions.
Ventilation	Openings (e.g. chimneys), structural leakage and mechanical ventilation systems.	› Ventilation heat loss (components and total), electricity for fans, heat gain from fans. Air permeability compliance check with Building Regulations 2008 and 2011 TGD L requirements. › Number of openings (such as chimneys, permanently open wall/window vents) is likely to have a significant bearing on the BER. If using mechanical ventilation, it is best to use test data from SAP Appendix Q rather than default data.
Building elements: **› Floors** **› Walls** **› Roofs** **› Doors**	Heat loss building element dimensions and U-values. Default U-values may be used for existing dwellings.	› Total Area*U-value for each element type. U-value is the rate of heat loss per m^2 surface area per degree. E.g. a U-value of 1, with a temperature inside of 21 and outside of 11 on a $1m^2$ wall area has a rate of heat loss of 10W. › Best to use actual calculated U-values instead of defaults, but supporting evidence must be acquired from survey or dwelling specifications (such as insulation type, thickness, area, certified test data). Certified data from Agrement certs or accredited data gives insulation thermal conductivity. The DEAP Manual details the applicable European U-value calculation standards (such as EN6946 for walls and roofs). › Adding insulation to a poorly insulated building element will have a significant bearing on the BER.
Building elements: Windows	Window and glazed door dimensions, orientations, U-values and shading characteristics. Defaults may be used for new or existing dwellings.	› Glazed area, heat loss, effective area for solar gain, glazing ratio for daylight gain, summer heat gain. › Window orientation is important. Actual U-values and solar transmittance should be used where available from certified data (to relevant European standards such as EN10077-1;2).



Tab	Main user entry actions	Visible calculated outcome and other comments
Building elements: Heat loss results	Thermal bridging factor	› Tab calculates fabric heat loss, total heat loss coefficient and heat loss parameter for the dwelling. Compliance check with Building Regulations fabric insulation requirements (for Building Regulations 2005 - 2011 TGD L as appropriate for the dwelling) is also carried out. › Obtain more beneficial thermal bridging factor from certified calculations or use of Acceptable Construction Details for new dwellings as published by DECLG. › Dimensions are internal as per TGD L. Thermal bridging heat losses are added to the fabric plane elements heat losses. › A supporting spreadsheet to calculate actual Thermal Bridging heat loss as per TGD L 2011 is available on www.seai.ie
Water heating	Water heating system characteristics, including supplementary electric water heating in summer and solar water heating	› Tab calculates the hot water heating demand, solar hot water output, solar hot water pump consumption, primary circuit loss, internal heat gains from hot water, distribution losses. › Hot water storage insulation and improved hot water storage controls (time and thermostatic) are commonly used to improve the BER.
Lighting and internal gains	Proportion of fixed lighting outlets which are low energy	› Annual energy use for lighting, internal seasonal heat gains from lighting and other internal heat gains. › Installation of low energy light bulbs (CFLs, LEDs and fluorescent tubes) is a cost effective way to improve the BER.
Net space heat demand	Thermal mass category	› Mean internal temperature, annual 'useful' space heat demand from monthly calculations allowing for intermittency, solar gains and internal heat gain utilisation.
Distribution system losses and gains	Heating system control category, responsiveness category, heat emission characteristics, pumps and fans	› Annual space heat demand allowing for control, responsiveness, heat emission and equipment heat gain characteristics. › Electrical power consumed by pumps (e.g. central heating pumps) calculated. › Use of thermostats, zoning, TRVs and programmers along with other control improvements can have a significant bearing on the BER. Central heating pumps with high efficiency labels will also decrease energy consumption in DEAP.



Tab	Main user entry actions	Visible calculated outcome and other comments
Energy requirements: Individual heating system	Individual heating systems: Space and water heating appliance efficiency and fuel characteristics. Combined heat and power plant characteristics. Secondary heating (e.g. fireplace) is also considered.	› Annual delivered fuel consumption for space and water heating, CO_2 emissions. › Improved heat source efficiency is critical to obtaining a better BER. Data is preferably taken from www.seai.ie/HARP. The Home-heating Appliance Register of Performance (HARP) lists efficiencies based on accredited test data to the standards and calculation methods specified in DEAP. › Replacing an open fire with a stove and flue will reduce ventilation losses and improve the secondary heating system efficiency. Heating system efficiencies are based on Gross Calorific Values and generally are a seasonal value as calculated in the DEAP Appendices. The test data are derived from European standards (e.g. EN14511 for heat pumps).
Energy requirements: Group heating	Community/ group heating schemes: Space and water heating appliance efficiency and fuel characteristics. Combined heat and power plant characteristics.	› Annual fuel consumption for space and water heating, CO_2 emissions. › Heating system efficiency, controls and pipework should all be considered to reduce energy consumption for all dwellings heated by the group system.
Summer internal temperature	Effective air change rate of dwelling	› Optional tab › Calculates threshold internal temperature and provides approximate indication of overheating risk

Results	None	› Annual delivered energy
		› Annual primary energy and CO_2 emissions. DEAP derives these values by multiplying the delivered energy for each fuel by the associated primary energy and CO_2 factors for those fuels.
		› The BER grade ranging between A1 and G.
		› Building Regulations Compliance checking for new dwellings:
		  › Energy and CO_2 emissions compared to TGD L reference dwelling.
		  › Renewables conformance requirements checking as per TGD L
		  › Fabric insulation levels as per TGD L
		  › Air tightness checking against TGD L performance levels

Figure 5 DEAP Procedure as per SEAI

Building Performance

The DEAP assessment of the apartment's energy performance is based on the architect's drawings, façade details/performance and the Mechanical & Electrical outline specifications issued to date using an Exhaust Air Heat Pump solution (See Table 5) for the delivery of heating to each apartment.

The construction details assumed in the assessment were as modelled as follows:

External wall area weighted average U-value – ≤ 0.14 W/m^2.K

Ground floor area weighted average U-value – ≤ 0.14 W/m^2.K

External roof area weighted average U-value – ≤ 0.14 W/m^2.K

Window area average U-value (incl. frame) – ≤ 1.30 W/m^2.K

Door area average U-value – 1.6 W/m^2.K

Vertical glazing total solar transmittance (g-value) – 0.6 (Typical value assumed)

Glazing light transmittance – 71% (Typical value assumed – to be confirmed by architect and window manufacturer)

Air permeability/Tightness – ≤3 (m^3/ (m^2.hr)) at 50 Pa.

Mechanical & Electrical Services

Mechanical Systems

- System Type:
  - Radiators
  - DHW System
    - 180 litre DHW storage built into Exhaust Heat Pump
- Fuel Type – Electricity

Electrical Systems

- Power factor correction ≥0.95

Lighting Systems

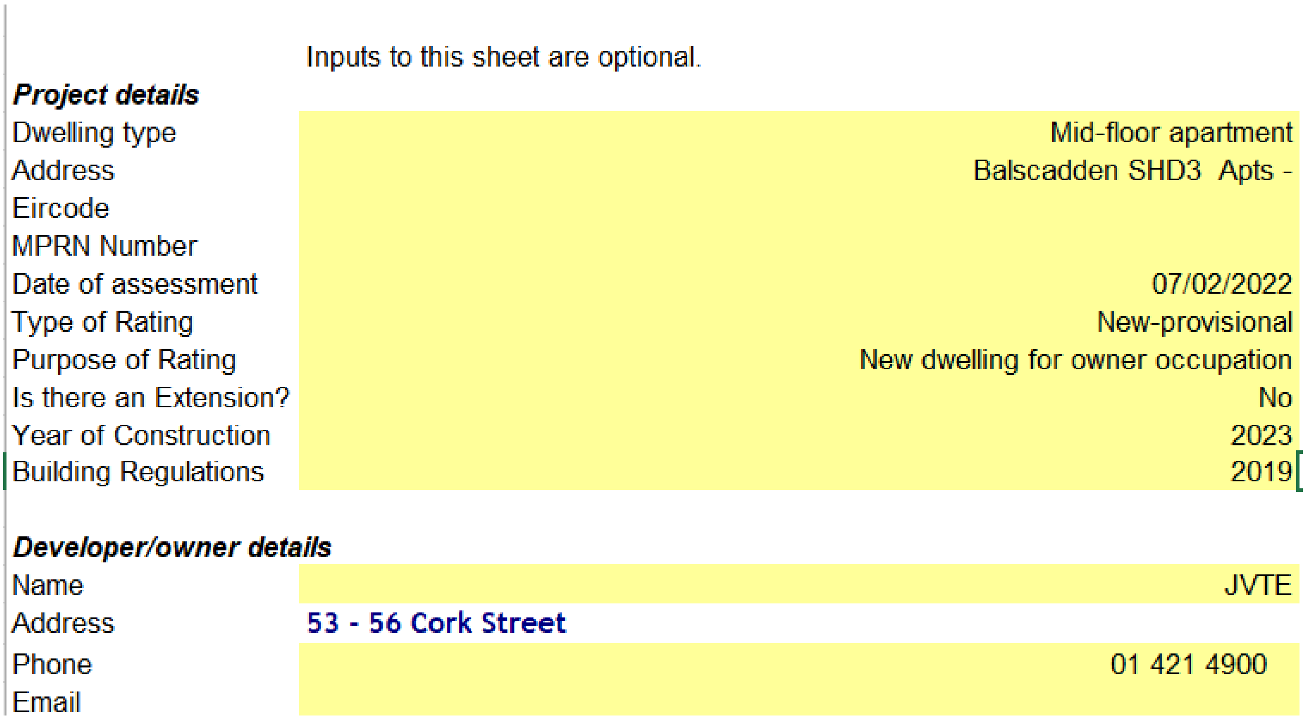
- Energy metering for lights

Renewable Technologies

Exhaust Heat Pump:

- Fuel Type – Electricity
- Heat Pump Heating Efficiency – sCOP >3.5
- Fraction of Heating Supplied by Heat Pump – 100%
- Fraction of DHW Supplied by Heat Pump – 60%

1. 2 Bed Apartment



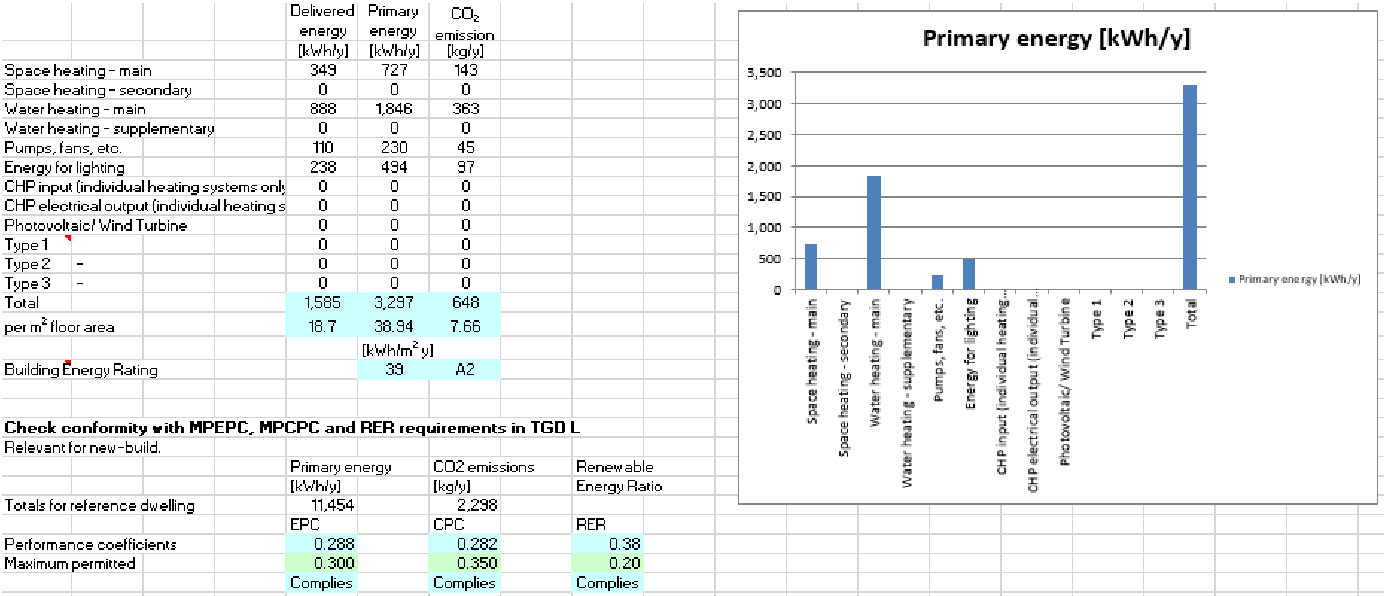
Inputs to this sheet are optional.

Project details

Dwelling type	Mid-floor apartment
Address	Balscadden SHD3 Apts -
Eircode	
MPRN Number	
Date of assessment	07/02/2022
Type of Rating	New-provisional
Purpose of Rating	New dwelling for owner occupation
Is there an Extension?	No
Year of Construction	2023
Building Regulations	2019

Developer/owner details

Name	JVTE
Address	**53 - 56 Cork Street**
Phone	01 421 4900
Email	



	Delivered energy [kWh/y]	Primary energy [kWh/y]	CO_2 emission [kg/y]
Space heating - main	349	727	143
Space heating - secondary	0	0	0
Water heating - main	888	1,846	363
Water heating - supplementary	0	0	0
Pumps, fans, etc.	110	230	45
Energy for lighting	238	494	97
CHP input (individual heating systems onl	0	0	0
CHP electrical output (individual heating s	0	0	0
Photovoltaic/ Wind Turbine	0	0	0
Type 1	0	0	0
Type 2 -	0	0	0
Type 3 -	0	0	0
Total	1,585	3,297	648
per m^2 floor area	18.7	38.94	7.66
		[kWh/m^2 y]	
Building Energy Rating		39	A2

Check conformity with MPEPC, MPCPC and RER requirements in TGD L

Relevant for new-build.

	Primary energy [kWh/y]	CO2 emissions [kg/y]	Renewable Energy Ratio
Totals for reference dwelling	11,454	2,298	
	EPC	CPC	RER
Performance coefficients	0.288	0.282	0.38
Maximum permitted	0.300	0.350	0.20
	Complies	Complies	Complies

Figure 6 – Summary result from DEAP for Mid-Floor Apartment

Conclusion

The preliminary DEAP assessment of the mid-floor apartment shows an indicative EPC and CPC compliant apartment building in accordance with the Part L of the Building Regulations 2021 and has an indicative Building Energy Rating (BER) of A2 (See Figure 6 & Table 8).

In our opinion, the energy strategy outlined in this report will deliver an energy and sustainable development in line with the objectives of the Fingal County Development Plan 2017-2023 and the Building Regulations Part l 2021.

Category	**APARTMENT 2 BED**
EPC RATING	0.288
CPC RATING	0.282
BER RATING	A2
PRIMARY ENERGY (kWh/m^2/yr)	39
CARBON DIOXIDE EMISSIONS (CO$_2$)	7.66

Table 8 -Summary of DEAP Results

Signed:

Rory Burke, Chartered Engineer

Director

J.V. Tierney & Co.

Date: 08-03-2022

Appendix C

2022

Bat Assessment: Balscadden, Howth, Co. Dublin.

Dr Tina Aughney

Bat Eco Services

Bat Eco Services, Ulex House, Drumheel, Lisduff, Virginia, Co. Cavan. A82 XW62.

Licenced Bat Specialist: Dr Tina Aughney (tina@batecoservices.com, 086 4049468)
NPWS licence C13/2020 (Licence to handle bats, expires 31st December 2022)
NPWS licence 08/2020 (Licence to photograph/film bats, expires 31st December 2022)
NPWS licence DER/BAT 2019-138 on expiry (Survey licence, expires 29th March 2022).

Statement of Authority: Dr Aughney has worked as a Bat Specialist since 2000 and has undertaken extensive survey work for all Irish bat species including large scale development projects, road schemes, residential developments, wind farm developments and smaller projects in relation to building renovation or habitat enhancement. She is a monitoring co-ordinator and trainer for Bat Conservation Ireland. She is a co-author of the 2014 publication *Irish Bats in the 21st Century.* This book received the 2015 CIEEM award for Information Sharing. Dr Aughney is a contributing author for the Atlas of Mammals in Ireland 2010-2015.

All analysis and reporting is completed by Dr Tina Aughney. Data collected and surveying is completed with the assistance of a trained field assistant.

Mr. Shaun Boyle (Field Assistant) NPWS licence DER/BAT 2021-19 (Survey licence, expires 15th March 2022).

Client: Enviroguide Consulting on behalf of Marlet Property Group.

Project Name & Location: Balscadden, Howth, Co. Dublin.

Report Revision History

Date of Issue	Draft Number	Issued To (process of issuing)
22nd February 2022	Draft 1	By email to Enviroguide Consulting
9th March 2022	Final	By email to Enviroguide Consulting

Purpose

This document has been prepared as a Report for Enviroguide Consulting. Only the most up to-date report should be consulted. All previous drafts/reports are deemed redundant in relation to the named site.

Bat Eco Service accepts no responsibility or liability for any use that is made of this document other than by the client for the purposes for which it was originally commissioned and prepared.

Carbon Footprint Policy

It is the policy of Bat Eco Services to provide documentation digitally in order to reduce carbon footprint. Printing of reports etc. is avoided, where possible.

Bat Record Submission Policy

It is the policy of Bat Eco Services to submit all bat records to Bat Conservation Ireland database one year post-surveying. This is to ensure that a high level bat database is available for future desktop reviews. This action will be automatically undertaken unless otherwise requested, where there is genuine justification.

Executive Summary

Project Name & Location: Balscadden, Howth, Co. Dublin.

Proposed work: Proposed residential development.

Bat Survey Results - Summary

Bat Species	Roosts	Foraging	Commuting
Common pipistrelle *Pipistrellus pipistrellus*		√	√
Soprano pipistrelle *Pipistrellus pygmaeus*		√	√
Nathusius' pipistrelle *Pipistrellus nathusii*			
Leisler's bat *Nyctalus leisleri*		√	√
Brown long-eared bat *Plecotus auritus*		√	√
Daubenton's bat *Myotis daubentonii*			
Natterer's bat *Myotis nattereri*			
Whiskered bat *Myotis mystacinus*			
Lesser horseshoe bat *Rhinolophus hipposideros*			

Bat Survey Duties Completed (Indicated by red shading)

Tree PBR Survey	●	Daytime Building Inspection	●
Static Detector Survey	●	Daytime Bridge Inspection	○
Dusk Bat Survey	●	Dawn Bat Survey	●
Walking Transect	●	Driving Transect	○
Trapping / Mist Netting	○	IR Camcorder filming	○
Endoscope Inspection	●	Other	●
		Thermal Imagery filming	

Citation: Bat Eco Services (2022) Bat Assessment: Balscadden, Howth, Co. Dublin. Unpublished report prepared for Enviroguide Consulting.

Contents

1. Introduction

Bat Eco Services was commissioned by Enviroguide Consulting to undertake a bat survey of buildings within the proposed development site on Balscadden Road and Main Street, Howth, Co. Dublin. An array of derelict buildings are located within the proposed development site.

1.1 Relevant Legislation & Bat Species Status in Ireland

1.1.1 Irish Statutory Provisions

A small number of these are protected under Irish legislation (Nelson, *et al.,* 2019). The principal statutory provisions for the protection of animal and plant species are under the Wildlife Act 1976 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011, as amended. The Flora (Protection) Order 2015 (S.I. no. 356 of 2015) lists the plant species protected by Section 21 of the Wildlife Acts. See www.npws.ie/ legislation for further information.

The codes used for national legislation are as follows:

- WA = Wildlife Act, 1976, Wildlife (Amendment) Act, 2000 and other relevant amendments
- FPO = Flora (Protection) Order, 2015 (S.I. No. 356 of 2015)

1.1.2 EU Legislation

The Birds Directive (Directive 2009/147/EC) and Habitats Directive (Council Directive 92/43/EEC) are the legislative instruments which are transposed into Irish law, *inter alia,* by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) ('the 2011' Regulations), as amended.

The codes used for the Habitats Directive (Council Directive 92/43/EEC) are:

- Annex II Animal and plant species listed in Annex II
- Annex IV Animal and plant species listed in Annex IV
- Annex V Animal and plant species listed in Annex V

The main aim of the Habitats Directive is the conservation of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status. These annexes list habitats (Annex I) and species (Annexes II, IV and V) which are considered threatened in the EU territory. The listed habitats and species represent a considerable proportion of biodiversity in Ireland and the Directive itself is one of the most important pieces of legislation governing the conservation of biodiversity in Europe.

Under Article 11 of the Directive, each member state is obliged to undertake surveillance of the conservation status of the natural habitats and species in the Annexes and under Article 17, to report to the European Commission every six years on their status and on the implementation of the measures taken under the Directive. In April 2019, Ireland submitted the third assessment of conservation status for 59 habitats and 60 species. There are three volumes with the third listing details of the species assessed.

Article 12 of the Habitats Directive requires Member States to take measures for the establishment of a strict protection regime for animal species listed in Annex IV(a) of the Habitats Directive within the whole territory of Member States. Article 16 provides for derogation from these provisions under defined conditions. These provisions are implemented under Regulations 51 and 54 of the 2011 Regulations.

1.1.3 IUCN Red Lists

The International Union for the Conservation of Nature (IUCN) coordinates the Red Listing process at the global level, defining the categories so that they are standardised across all taxa. Red Lists are also produced at regional, national and subnational levels using the same IUCN categories (IUCN 2012, 2019). Since 2009, Red Lists have been produced for the island of Ireland by the National Parks and Wildlife Service (NPWS) and the Northern Ireland Environment Agency (NIEA) using these IUCN categories. To date, 13 Red Lists have been completed. The Red Lists are an assessment of the risk of extinction of each species and not just an assessment of their rarity. Threatened species are those species categorised as Critically Endangered, Endangered or Vulnerable (IUCN, 2019) – also commonly referred to as 'Red Listed'.

1.1.4 Irish Red List - Mammals

Red Lists in Ireland refer to the whole island, i.e. including Northern Ireland, and so follow the guidelines for regional assessments (IUCN, 2012, 2019). The abbreviations used are as follows:.

- RE Regionally Extinct
- CR Critically Endangered
- EN Endangered
- VU Vulnerable
- NT Near Threatened
- DD Data Deficient
- LC Least Concern
- NA Not Assessed
- NE Not Evaluated

There are 27 terrestrial mammals species in Ireland, which includes the nine resident bat species listed. The terrestrial mammal, according to Marnell *et al.,* 2019, list for Ireland consists of all terrestrial species native to Ireland or naturalised in Ireland before 1500. The IUCN Red List categories and criteria are used to assess that status of wildlife. This was recently completed for the terrestrial mammals of Ireland. Apart from the two following two mammal species (grey wolf *Canis lupus* (regionally extinct) and black rat *Rattus rattus* (Vulnerable)), the remaining 25 species were assessed as least concern in the most recent IUCN Red List publication by NPWS (Marnell *et al*., 2019).

1.1.5 Irish Bat Species

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Acts (2000 and 2010). Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. All Irish bats are listed in Annex IV of the Habitats Directive and the lesser horseshoe bat *Rhinolophus hipposideros* is further listed under Annex II. Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

Also, under existing legislation, the destruction, alteration or evacuation of a known bat roost is an offence. The most recent guidance document is "Guidance document on the strict protection of animal species of Community interest un the Habitats Directive (Brussels, 12.10.2021 C(2021) 7391 final. In this document, the following is stated:

Regulation 51(2) of the 2011 Regulations provides –

(2) Notwithstanding any consent, statutory or otherwise, given to a person by a public authority or held by a person, except in accordance with a licence granted by the Minister under *Regulation 54,* a person who in respect of the species referred to in *Part 1* of the *First Schedule*—

(*a*) deliberately captures or kills any specimen of these species in the wild, (*b*) deliberately disturbs these species particularly during the period of breeding, rearing, hibernation and migration,

(*c*) deliberately takes or destroys eggs of those species from the wild,

(*d*) damages or destroys a breeding site or resting place of such an animal, or

(*e*) keeps, transports, sells, exchanges, offers for sale or offers for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive,

shall be guilty of an offence.

Any works interfering with bats and especially their roosts, may only be carried out under a derogation licence granted by National Parks and Wildlife Service (NPWS) pursuant to Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 (which transposed the EU Habitats Directive into Irish law).

There are eleven recorded bat species in Ireland, nine of which are considered resident. Eight resident bat species and one of the vagrant bat species are vesper bats and all vespertilionid bats have a tragus (cartilaginous structure inside the pinna of the ear). Vesper bats are distributed throughout the island. Nathusius' pipistrelle *Pipistrellus nathusii* is a recent addition while the Brandt's bat has only been recorded once to-date (Only record confirmed by DNA testing, all other records has not been genetically confirmed). The ninth resident species is the lesser horseshoe bat *Rhinolophus hipposideros*, which belongs to the Rhinolophidea and has a complex nose leaf structure on the face, distinguishing it from the vesper bats. This species' current distribution is confined to the western seaboard counties of Mayo, Galway, Clare, Limerick, Kerry and Cork. The eleventh bat species, the greater horseshoe bat, was only recorded for the first time in February 2013 in County Wexford and is therefore considered to be a vagrant species. A total of 41 SACs have been designated for the Annex II species lesser horseshoe bat (1303), of which nine have also been selected for the Annex I habitat 'Caves not open to the public' (8310).

Irish bat species list is presented in Table 1 along with their current status.

Table 1: Status of the Irish bat fauna (Marnell *et al.,* 2019).

Species: Common Name	Irish Status	European Status	Global Status
Resident Bat Species ^			
Daubenton's bat *Myotis daubentonii*	Least Concern	Least Concern	Least Concern
Whiskered bat *Myotis mystacinus*	Least Concern	Least Concern	Least Concern
Natterer's bat *Myotis nattereri*	Least Concern	Least Concern	Least Concern
Leisler's bat *Nyctalus leisleri*	Least Concern	Least Concern	Least Concern
Nathusius' pipistrelle *Pipistrellus nathusii*	Least Concern	Least Concern	Least Concern

Common pipistrelle *Pipistrellus pipistrellus*	Least Concern	Least Concern	Least Concern
Soprano pipistrelle *Pipistrellus pygmaeus*	Least Concern	Least Concern	Least Concern
Brown long-eared bat *Plecotus auritus*	Least Concern	Least Concern	Least Concern
Lesser horseshoe bat *Rhinolophus hipposideros*	Least Concern	Least Concern	Least Concern
Possible Vagrants ^			
Brandt's bat Myotis brandtii	Data deficient	Least Concern	Least Concern
Greater horseshoe bat *Rhinolophus ferrumequinum*	Data deficient	Near threatened	Near threatened

^ Roche *et al.,* 2014

1.2 Relevant Guidance Documents

This report will draw on guidelines already available in Europe and will use the following documents:

- National Roads Authority (2006) Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes
- Collins, J. (Editor) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). Bat Conservation Trust, London
- McAney, K. (2006) A conservation plan for Irish vesper bats, Irish Wildlife Manual No. 20 National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- The status of EU protected habitats and species in Ireland: Conservation status in Ireland of habitats and species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government.
- Bat Conservation Trust (2018) Bats and artificial lighting in the UK: bats and the built environment series. Guidance Note 08/2019. BCT, London.
- Guidance document on the strict protection of animal species of Community interest un the Habitats Directive (Brussels, 12.10.2021 C(2021) 7391 final.

Collins (2016) is the principal document used to provide guidance in relation to bat survey effort required but the level of surveying is assessed on a case-by-case basis taking into consideration the historical bat records for the survey area, presence of built, structures and trees potentially suitable for roosting bats and the presence of suitable bat habitats for foraging and commuting. Additional reference is made to this document in relation to determining the value of buildings, trees etc. as bat roosts. The tables referred to from this document are described in the following section and in the section on methodology.

Kelleher & Marnell (2006) is referred to for guidance in relation to survey guidance (timing and survey design), derogation licences and mitigation measures.

1.2.1 *Bat Survey Requirements & Timing*

With reference to Collins (2016) and Kelleher & Marnell (2006), the information presented in this section is used to determine the bat survey requirements for the proposed development site. Collins (2016) provides a trigger list in relation to determining if a bat survey is required and this is presented Appendix 3 (Figure B) for reference. In addition, Chapter 2 of Collins (2016) discusses that a bat survey is required when proposed activities are likely to impact on bats and their habitats. The level of surveying is to be determined by the ecologist and these are influenced by the following criteria:

- Likelihood of bats being present;
- Type of proposed activities;
- Scale of proposed activities;
- Size, nature and complexity of the site;
- Species concerned;
- No. of individuals.

Collins (2016) also provides the following table detailing when different survey components should be undertaken.

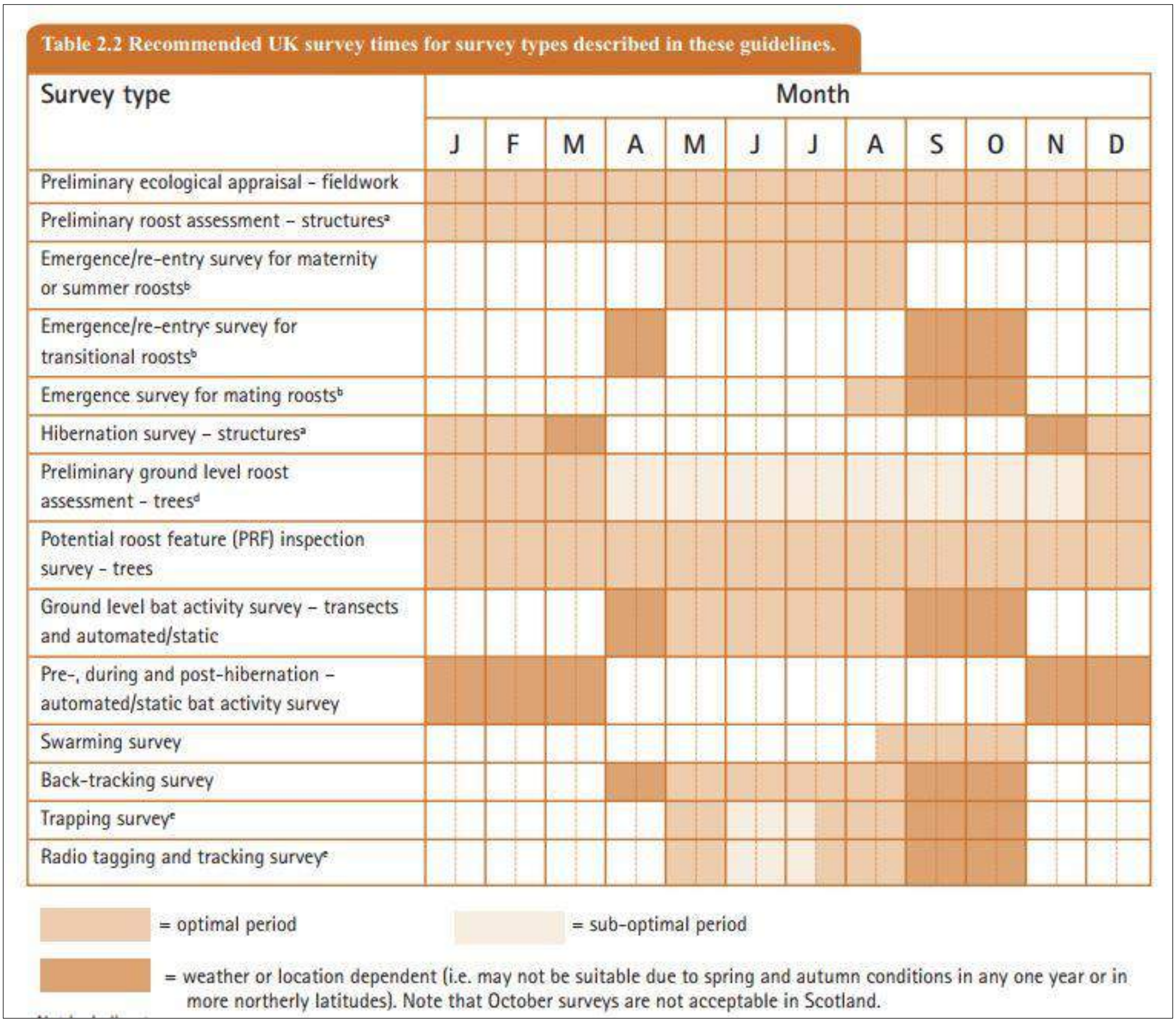


Table 2.2 Recommended UK survey times for survey types described in these guidelines.

Survey type	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Preliminary ecological appraisal – fieldwork	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
Preliminary roost assessment – structures[a]	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
Emergence/re-entry survey for maternity or summer roosts[b]					▒	▒	▒	▒				
Emergence/re-entry[c] survey for transitional roosts[b]				▓					▓	▓		
Emergence survey for mating roosts[b]								▒	▓	▓		
Hibernation survey – structures[a]	▒	▒	▓								▓	▒
Preliminary ground level roost assessment – trees[d]	▒	▒	▒	░	░	░	░	░	░	░	░	▒
Potential roost feature (PRF) inspection survey – trees	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
Ground level bat activity survey – transects and automated/static				▓	▒	▒	▒	▒	▓	▓		
Pre-, during and post-hibernation – automated/static bat activity survey	▓	▓	▓								▓	▓
Swarming survey								▒	▒	▒		
Back-tracking survey				▓	▒	▒	▒	▒	▓	▓		
Trapping survey[e]					▒	░	░▒	▒	▓	▓		
Radio tagging and tracking survey[e]					▒	░	░▒	▒	▓	▓		

▒ = optimal period

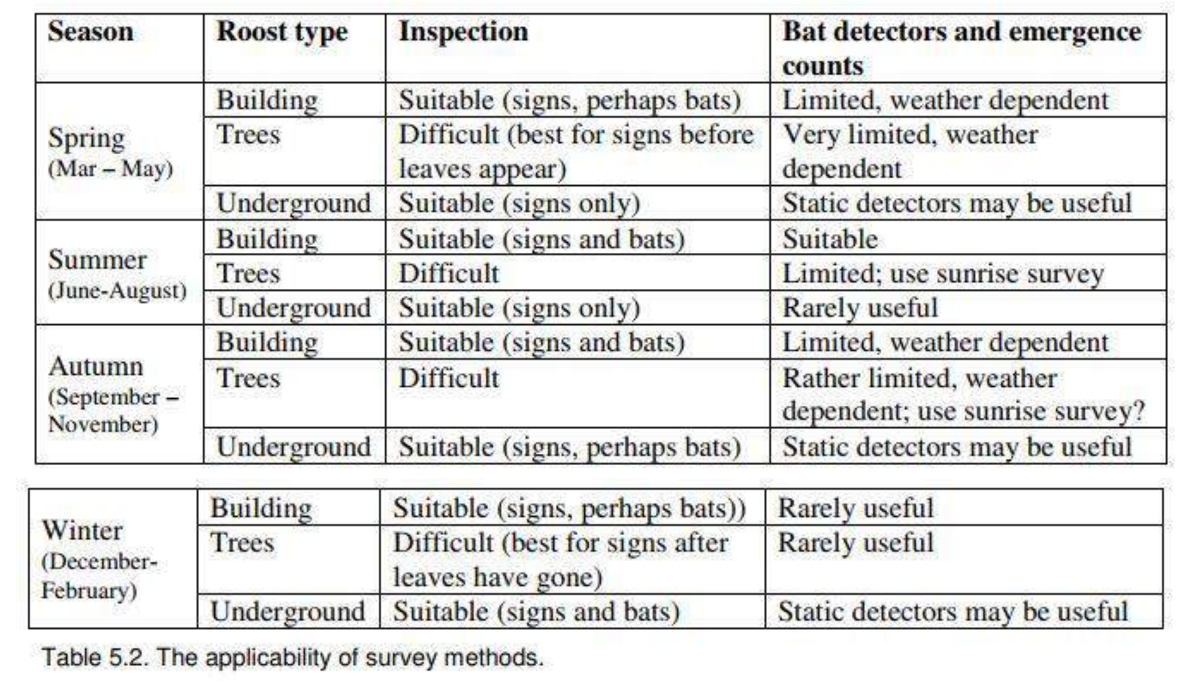
░ = sub-optimal period

▓ = weather or location dependent (i.e. may not be suitable due to spring and autumn conditions in any one year or in more northerly latitudes). Note that October surveys are not acceptable in Scotland.

Figure 1a: Table 2.2 reproduced from Collins (2016).

1.2.1.1 Buildings

In Kelleher & Marnell (2006), Table 5.2 (The applicability of survey methods) provides information on the type of surveys that can be undertaken according to the different seasons.



Season	Roost type	Inspection	Bat detectors and emergence counts
Spring (Mar – May)	Building	Suitable (signs, perhaps bats)	Limited, weather dependent
	Trees	Difficult (best for signs before leaves appear)	Very limited, weather dependent
	Underground	Suitable (signs only)	Static detectors may be useful
Summer (June-August)	Building	Suitable (signs and bats)	Suitable
	Trees	Difficult	Limited; use sunrise survey
	Underground	Suitable (signs only)	Rarely useful
Autumn (September – November)	Building	Suitable (signs and bats)	Limited, weather dependent
	Trees	Difficult	Rather limited, weather dependent; use sunrise survey?
	Underground	Suitable (signs, perhaps bats)	Static detectors may be useful
Winter (December-February)	Building	Suitable (signs, perhaps bats))	Rarely useful
	Trees	Difficult (best for signs after leaves have gone)	Rarely useful
	Underground	Suitable (signs and bats)	Static detectors may be useful

Table 5.2. The applicability of survey methods.

Figure 1b: Table 5.2 reproduced from Kelleher & Marnell, 2006.

Kelleher & Marnell (2006) states that it is more suitable to survey buildings in the summer months. The following is a summary of the principal points:

1. The presence of a significant bat roost (invariably a maternity roost) can normally be determined on a single visit at any time of year, provided that the entire structure is accessible and that any signs of bats have not been removed by others. However, a visit during the summer or autumn has the advantage that bats may be seen or heard.
2. Roosts used by a small number of bats, as opposed to maternity sites, can be particularly difficult to detect and may require extensive searching backed up (in summer) by bat detector surveys or emergence counts.
3. If the entire building is not accessible or signs of bats may have been removed by others, or by the weather, bat detector or exit count methodologies may be required to back up a limited search.

The following table is used to determine the level and timing of surveys for buildings/structures with reference to the surrounding habitat. Buildings are assessed to determine their suitability as a bat roost and are described using the parameters Negligible, Low, Medium or High suitability in view of Table 5.1 of Kelleher & Marnell (2006). The level of suitability informs the level of surveying and timing of surveys required based on Table 7.3 of Collins, 2016 (Note: These two tables are presented in Appendix 3 but a summary is provided in the table below).

Table 2a: Building Bat Roost Classification System & Survey Effort (Adapted from Collins, 2016 and Kelleher & Marnell, 2006).

Suitability Category	Description (examples of criteria)	Survey Effort (Timings)
Negligible	Building have no potential as a roost site Urban setting, heavily disturbed, building material unsuitable, building in poor condition etc.	No surveys required.
Low	Building has a low potential as a roost site. No evidence of bat usage (e.g. droppings)	One dusk or dawn survey.
Medium	Building with some suitable voids / crevices for roosting bats. Some evidence of bat usage Suitable foraging and commuting habitat present.	At least one survey in May to August, minimum of two surveys (one dusk and one dawn).
High	Building with many features deemed suitable for roosting bats. Evidence of bat usage. Largely undisturbed setting, rural, suitable foraging and commuting habitat, suitable roof void and building material.	At least two surveys in May to August, with a minimum of three surveys (at least one dusk survey and one dawn survey).

1.2.1.2 Trees

Kelleher & Marnell (2006) states the following in relation to detecting roosts in trees:

1. The best time to carry out surveys for suitable cavities is between November and April, when the trunk and branches are not obscured by leaves. If inspection suggests that the tree has suitable cavities or roost sites, a bat detector survey at dusk or dawn during the summer may produce evidence of bats, though the nomadic nature of most tree-dwelling species means that the success rate is very low. It can also be difficult to pinpoint exactly which tree a bat emerged from. A dawn survey is more likely to be productive than a dusk one as swarming bats returning to the roost are much more visible than those leaving the roost.

As a consequence, the BTHK (2018) Potential Roost Features (PRFs) list and the classification system adapted from Collins (2016) is recommended as part of the daytime inspection of trees to determine their PBR or Potential Bat Roost value. Details of the methodology followed is presented in Section 3.2.2.

1.2.1.3 Underground Structures

Kelleher & Marnell (2006) states the following in relation to underground structures:

1. Underground structures are used mainly for hibernation, so surveys should generally be carried out during the winter.

1.2.2 *Evaluation & Assessment Criteria*

Based on the information collected during the desktop studies and bat surveys, an ecological value is assigned to each bat species recorded based on its conservation status at different geographical scales (Table 2b). For example, a site may be of national ecological value for a given species if it supports a significant proportion (e.g. 5%) of the total national population of that species.

Table 2b: The six-level ecological valuation scheme used in the CIEM Guidelines (2016) Ecological Value

Ecological Value	Geographical Scale of Importance
International	International or European scale
National	The Republic of Ireland or the island of Ireland scale (depending on the bat species)
Regional	Province scale: Leinster
County	County scale: County Dublin
Local	Proposed development and immediate surroundings
Negligible	None, the feature is common and widespread

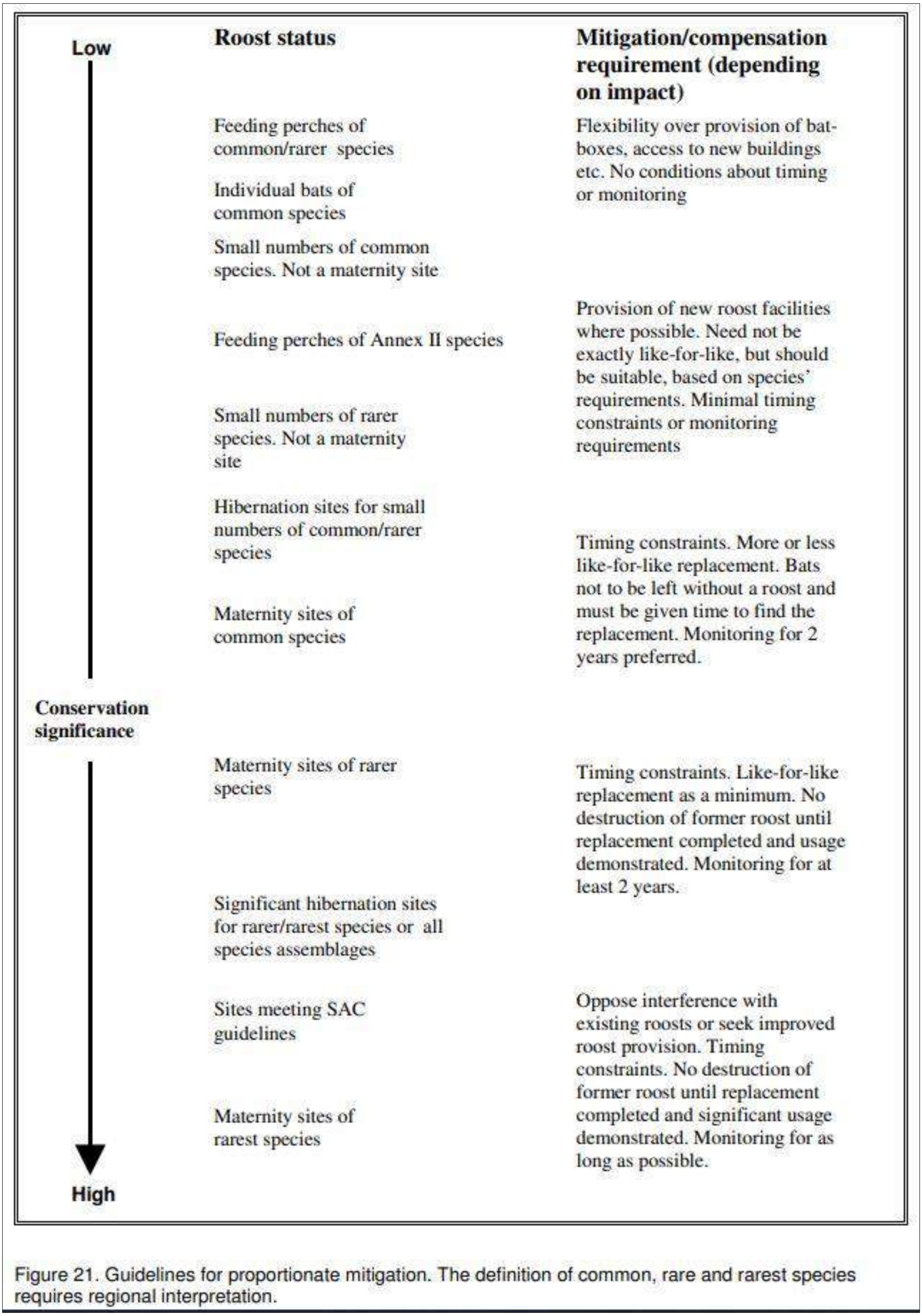
If bat roosts are recorded, their roost status is determined using Figure 21 from Kelleher & Marnell (2006). This figure is presented below (Figure 1c). This figure is also used to determine the conservation significance of the roost in order to prepare appropriate bat mitigation measures.

Impacts on bats can arise from activities that may result in:

- Physical disturbance of bat roosts e.g. destruction or renovation of buildings
- Noise disturbance e.g. increase human presence, use of machinery etc.
- Lighting disturbance
- Loss of roosts e.g. destruction or renovation of buildings
- Modifications of commuting or foraging habitats
- Severance or fragmentation of commuting routes
- Loss of foraging habitats.

It is recognised that any development will have an impact on the receiving environment, but the significance of the impact will depend on the value of the ecological features that would be affected. Such ecological features will be those that are considered to be important and potentially affected by the proposed development.

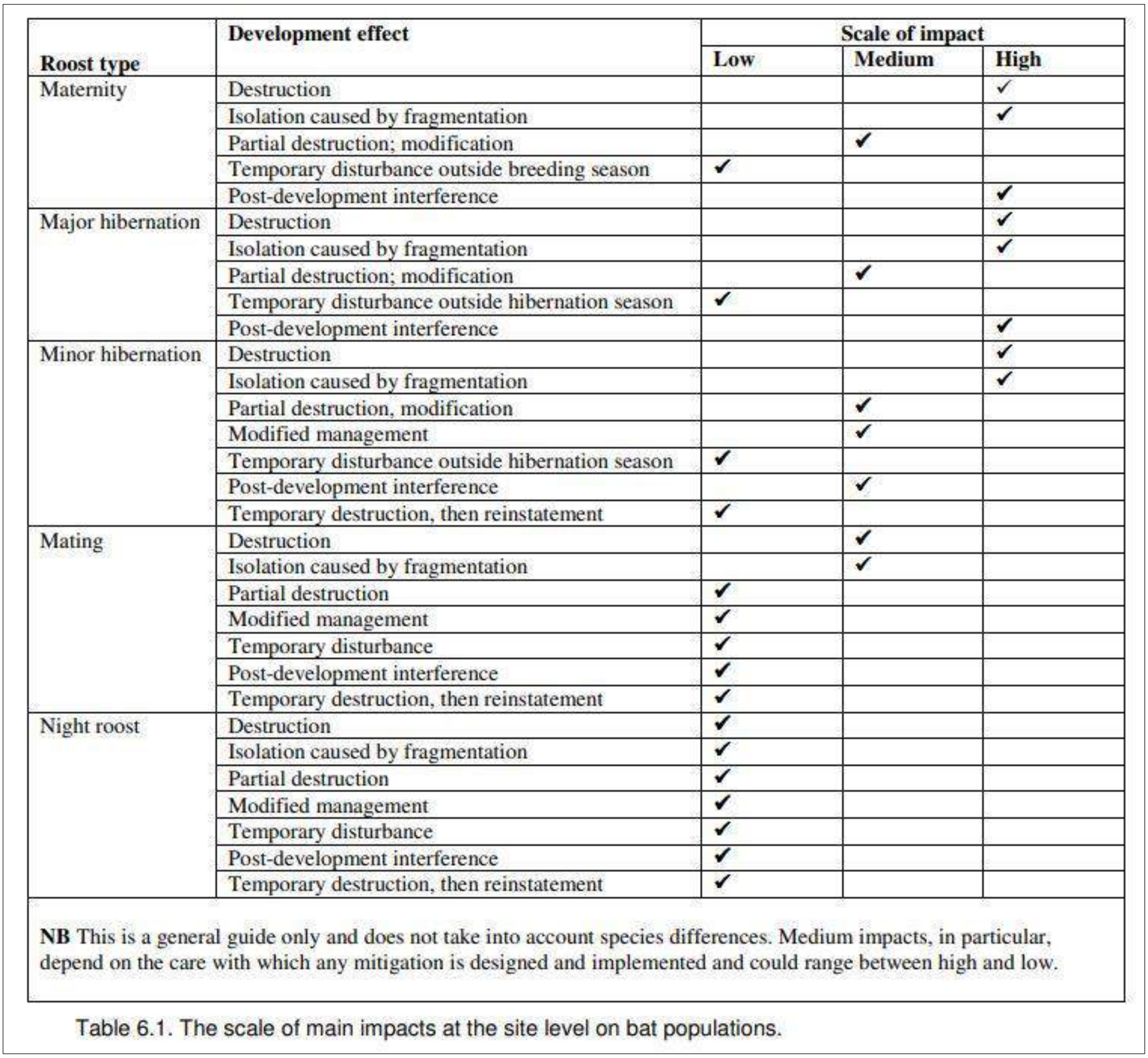
The guidelines consulted recommend that the potential impacts of a proposed development on bats are assessed as early as possible in the design stage to determine any areas of conflicts. In particular the Table 6.1 (presented as Figure 1d below) and Figure 21 (presented as Figure 1c) from Kelleher & Marnell (2006) are referenced during this process.



	Roost status	Mitigation/compensation requirement (depending on impact)
Low	Feeding perches of common/rarer species Individual bats of common species Small numbers of common species. Not a maternity site	Flexibility over provision of bat-boxes, access to new buildings etc. No conditions about timing or monitoring
	Feeding perches of Annex II species Small numbers of rarer species. Not a maternity site	Provision of new roost facilities where possible. Need not be exactly like-for-like, but should be suitable, based on species' requirements. Minimal timing constraints or monitoring requirements
	Hibernation sites for small numbers of common/rarer species Maternity sites of common species	Timing constraints. More or less like-for-like replacement. Bats not to be left without a roost and must be given time to find the replacement. Monitoring for 2 years preferred.
Conservation significance	Maternity sites of rarer species Significant hibernation sites for rarer/rarest species or all species assemblages	Timing constraints. Like-for-like replacement as a minimum. No destruction of former roost until replacement completed and usage demonstrated. Monitoring for at least 2 years.
High	Sites meeting SAC guidelines Maternity sites of rarest species	Oppose interference with existing roosts or seek improved roost provision. Timing constraints. No destruction of former roost until replacement completed and significant usage demonstrated. Monitoring for as long as possible.

Figure 21. Guidelines for proportionate mitigation. The definition of common, rare and rarest species requires regional interpretation.

Figure 1c: Figure 21 (p 49) Reproduced from Kelleher & Marnell (2006).



Roost type	Development effect	Scale of impact		
		Low	Medium	High
Maternity	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction; modification		✓	
	Temporary disturbance outside breeding season	✓		
	Post-development interference			✓
Major hibernation	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction; modification		✓	
	Temporary disturbance outside hibernation season	✓		
	Post-development interference			✓
Minor hibernation	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction, modification		✓	
	Modified management		✓	
	Temporary disturbance outside hibernation season	✓		
	Post-development interference		✓	
	Temporary destruction, then reinstatement	✓		
Mating	Destruction		✓	
	Isolation caused by fragmentation		✓	
	Partial destruction	✓		
	Modified management	✓		
	Temporary disturbance	✓		
	Post-development interference	✓		
	Temporary destruction, then reinstatement	✓		
Night roost	Destruction	✓		
	Isolation caused by fragmentation	✓		
	Partial destruction	✓		
	Modified management	✓		
	Temporary disturbance	✓		
	Post-development interference	✓		
	Temporary destruction, then reinstatement	✓		

NB This is a general guide only and does not take into account species differences. Medium impacts, in particular, depend on the care with which any mitigation is designed and implemented and could range between high and low.

Table 6.1. The scale of main impacts at the site level on bat populations.

Figure 1d: Table 6.1 (p 47) Reproduced from Kelleher & Marnell (2006).

Different parameters are considered for the overall assessment of the potential impact(s) of a proposed development on local bat populations.

The overall impacts proposed project on local bat populations is assessed using the following criteria:

- Impact Quality using the parameters Positive, Neutral or Negative Impact (based on EPA, 2017)

Table 2c: Criteria for assessing impact quality based on EPA, 2017,

Quality of Effect	Criteria
Positive	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).

Neutral	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

- Impact Significance of potential impact parameters on specific bat species in relation to particular elements (e.g. roosting sites, foraging area and commuting routes) are assessed with reference to the following:
  - Table 6.1 of Kelleher & Marnell, 2006 (Figure 1a);
  - the known ecology and distribution of the bat species in Ireland;
  - bat survey results including type of roosts (if any recorded), pattern of bat usage of the survey area, level of bat activity recorded etc.
  - and bat specialist experience.

- Impact Significance of the proposed development on local bat populations maybe determine, where applicable, using the parameters listed in Table 2d (based on EPA, 2017).

Table 2d: Criteria for assessing significance of effects based on EPA, 2017,

Significance of Effects	Definition
Imperceptible	An effect capable of measurement but without significant consequences.
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics

The following terms will be used, where possible and applicable, when quantifying the duration of the potential effects (selected from EPA, 2017):

- Temporary – effects lasting less than a year
- Short-term – effects lasting 1 to 7 years
- Medium term – effects lasting 7 to 15 years
- Long term – effects lasting 15 to 60 years
- Permanent – effects lasting over 60 years
- Reversible – effects that can be undone, for example through remediation or restoration

1.2.3 Bats & Lighting

One area of importance that is required to be assessed is the potential impact of outdoor lighting on local bat populations. All European bat species, including Irish bat species, are nocturnal. Light levels as low as typical full moon levels, i.e. around 0.1 LUX, can alter the flight activity of bats (Voigt *et al.* 2018). Any level of artificial light above that of moonlight can mask the natural rhythms of lunar sky brightness and, thus, can disrupt patterns of foraging and mating and might, for instance, interfere with entrainment of the circadian system.

Artificial light pollution is an increasing global problem (Rich and Longcore, 2006) and Artificial light at night (ALAN) is considered a major threat to biodiversity, especially to nocturnal species. As urbanisation expands into the landscape, the degree of street lighting also expands. Its ecological impacts can have a profound affect the behaviour of nocturnal animals including impacts on reproductive behaviours, orientation, predator-prey interaction and competition among others, depending on the taxon and ecosystem in question (Longcore and Rich 2004). It is considered by Hölker *et al.* (2010) to be a key biodiversity threat to biodiversity conservation. In relation to bats, the potential impacts of artificial night lighting can result in habitat fragmentation (Hanski, 1998), delay in roost emergence (Downs *et al.,* 2003) and a reduction in prey items.

In the context of behavioural ecology, lights can work to attract or repel certain animals. Many groups of insects, including moths, lacewings, beetles, bugs, caddisflies, crane flies, midges, hoverflies and wasps, can be attracted to artificial light (Eisenbeis and Hassel 2000; Frank 1988; Kolligs 2000). Attraction depends on the spectrum of light. In the context of street lights, white (mercury vapour) lamps emit a white light that includes ultraviolet. High pressure sodium lights (yellow) emit some ultraviolet, while low pressure sodium lamps (orange) emit no ultraviolet light (e.g. Rydell 2006). As a result of the attractiveness of lights to aerial invertebrates, swarms of insects often occur in and around street lights and, particular bat species such as aerial insect predators, can exploit the swarming insects to their advantage. Such attraction can also take prey items away from dark zones where light sensitive species are foraging, thus reducing their likelihood of feeding effectively.

Rydell (2006) divides bats into four categories in terms of their characteristic behaviours at street lamps. The four categories are based on bat size, wing morphology and echolocation call characteristics which were highlighted by Norberg and Rayner (1987) to determine flight speed, manoeuvrability, and prey detection capabilities of bats. Rydell (2006) stated that the large, fast flying bats, which are confined to open airspace, fly high over lit areas and are rarely observed near ground level. None of these, typically large free-tailed bats (e.g. large species of the family Molossidae), are found in Ireland. The second category are the medium-sized fast flying species, including the *Nyctalus* species, which patrol the street well above the lights and can be seen occasionally as they dive for prey into the light cone. This group includes the Leisler's bat, which is found in Ireland. Rydell's third category describes the small but fast flying bats that are manoeuvrable enough to forage around light posts or under the lights, and includes the small *Pipistrellus* species of the old world, three of which are found in Ireland. The fourth category includes broad-winged slow flyers, most of which are seldom or never observed at lights. Slow flying bat species may be more vulnerable to predation by diurnal birds of prey and this may restrict their exploitation of insects around artificially illuminated areas (e.g. Speakman 1991). There are also the concerns that some bat species are more light sensitive and therefore actively avoid lit up areas. This is particularly relevant for lesser horseshoe bats. Therefore from this, we can categorise the suite of Irish bats species as follows (please note that the sensitivity category is the author's description):

Table 3: Potential light sensitivity of the Irish bat fauna using categories described by Rydell, 2006.

Species: Common Name	Rydell Category	Sensitivity
Daubenton's bat *Myotis daubentonii*	Category 4	Light sensitive
Whiskered bat *Myotis mystacinus*	Category 4	Light sensitive
Natterer's bat *Myotis nattereri*	Category 4	Light sensitive
Leisler's bat *Nyctalus leisleri*	Category 2	Light tolerant
Nathusius' pipistrelle *Pipistrellus nathusii*	Category 3	Semi-tolerant
Common pipistrelle *Pipistrellus pipistrellus*	Category 3	Semi-tolerant
Soprano pipistrelle *Pipistrellus pygmaeus*	Category 3	Semi-tolerant
Brown long-eared bat *Plecotus auritus*	Category 4	Light sensitive
Lesser horseshoe bat *Rhinolophus hipposideros*	Category 4	Light sensitive

In the context of terrestrial ecosystems, the impact of street lights may appear to be positive for some bats but over the long term impacts may be negative even for those species that seem to gain from exploiting insect swarms. As Rydell (2006) points out, there has been no research into whether or how bat predation at lights affects the size of moth populations. Moths that normally exhibit evasive responses to bats have been shown to be unable to avoid capture by bats under bright street lights (Svensson and Rydell 1998) and some bats that feed at street lights increase their consumption of moths compared with their normal catch in other habitats (Rydell 1992). By disorientating insects that would normally be feeding or engaging in reproductive behaviours, as well as increasing predation by bats, overall reproductive rates may well decrease for insects that are within range of light pollution sources. Therefore resulting in long-term overall decreased availability or diversity of prey species.

The ability of different bat species to exploit insects gathered around street lights varies greatly. Gleaning species such as *Myotis* bats rarely forage around street lights (Rydell and Racey, 1995). The ecological effects of illuminating aquatic habitats are also poorly known. Moore *et al.* (2006) found that light levels in an urban lake, subject simply to sky glow and not direct illumination from lights, reached the same order of magnitude as full moonlight.

The potential impacts of street lighting can be summarised as follows:

- Attracting Prey Items;
- Reducing Foraging Habitat;
- Fragmenting The Landscape;
- Reducing Drinking Sites.

1.3 Project Description

1.3.1 Site Location

The proposed development site is located on the Balscadden Road (former sport's hall) and Main Street (former Baily Court Hotel). The buildings are currently vacant.

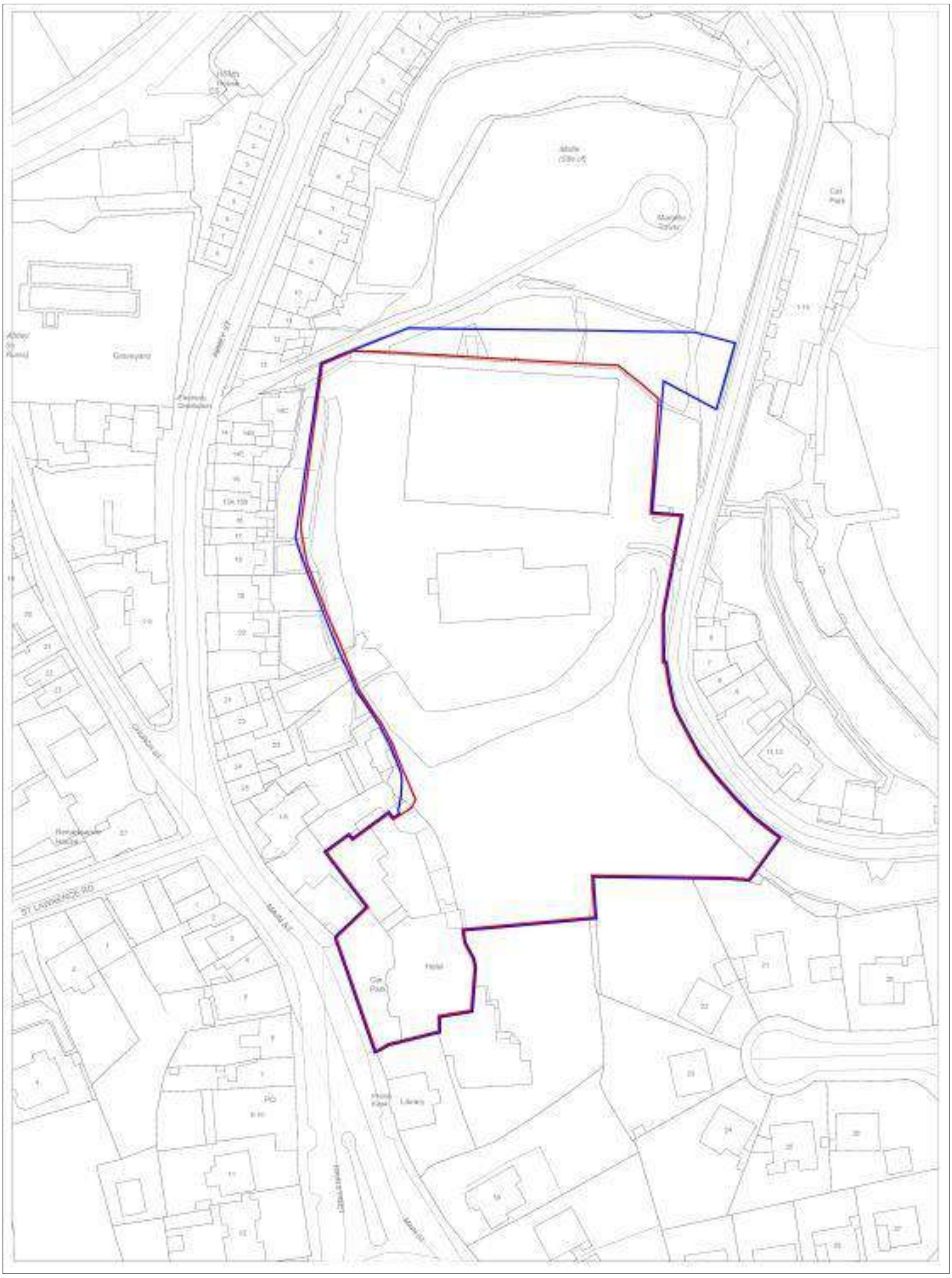


Figure 2a: Location of proposed development (Source: Enviroguide Consulting).

1.3.2 Proposed Project

The development will consist of the demolition of existing structures on site including the disused sports building (c. 604 sq m) on the Balscadden Rd. site and the Former Baily Court Hotel Buildings on Main St (c. 2051 sq m) and the construction of a residential development set out in 4 no. residential blocks, ranging in height from 2 to 5 storeys to accommodate 180 no. apartments and duplexes with associated residential tenant amenity, 1 no. retail unit and 2 no. café/retail units. The site will accommodate a total of 139 no. car parking spaces and 410 no. bicycle parking spaces. Landscaping will include a new linear plaza which will create a new pedestrian link between Main St and Balscadden Rd to include the creation of an additional 2 no. new public plazas and also maintains and upgrades the pedestrian link from Abbey Street to Balscadden Road below the Martello Tower. This is set out as follows:

1. The 4 no. residential buildings range in height from 2 storeys to 5 storeys, accommodating 180 no. apartments comprising 4 no. studios, 62 no. 1 bed units, 89 no. 2 bed units and 25 no. 3 bed units. The breakdown of residential accommodation is as follows:
    - Block A is a 3 storey building, including balconies, accommodating 2 no. units;
    - Block B is a 2 to 5 storey building, including setbacks, balconies, and external roof terraces at 3rd and 4th floors accommodating 126 no. units;
    - Block C is a 3 to 5 storey building, including setbacks and balconies, accommodating 43 no. units;
    - Block D is a 3 storey building, including balconies , accommodating 9 no. units;
    - Residential Tenant Amenity Space is provided in Blocks B and C, totalling c.496.3 sq.m and Communal External Amenity Space is provided at throughout the scheme including at roof level on Block B, totalling c.3,447 sq.m.

2. Non-residential uses retail unit of c. 106.4 sq.m in Block A at ground level, café/retail unit of c.142.7 sq.m in Block C at ground and first floor, café/retail unit of c. 187.7 sq.m in Block D resulting in a total of c. 436.8 sq.m of non-residential other uses.

3. The development will include a single level basement under Block B, containing 139 car spaces including 7 accessible spaces, plant, storage areas, waste storage areas and other associated facilities. A total of 410 cycle parking spaces are provided for at both basement and ground level, comprising 319 resident spaces and 91 visitor spaces.

4. The scheme provides for a new linear plaza which will create a new pedestrian link between Main St and Balscadden Rd to include the creation of an additional 2 no. new public plazas and also maintains and upgrades the existing pedestrian link from Abbey Street to Balscadden Road below the Martello Tower.

5. All other ancillary site development works to facilitate construction and the provision of the basement car park, site services, piped infrastructure, a sub-station, public lighting, plant, signage, bin stores, bike stores, boundary treatments and hard and soft landscaping.

6. It is proposed to reduce the ground levels on the site from c. 34.5m OD to c. 19.975m OD locally under Block C. A single storey basement is proposed under Block B with the existing ground level reduced from c.20m OD to c.17.1m OD. occurring at formation level.

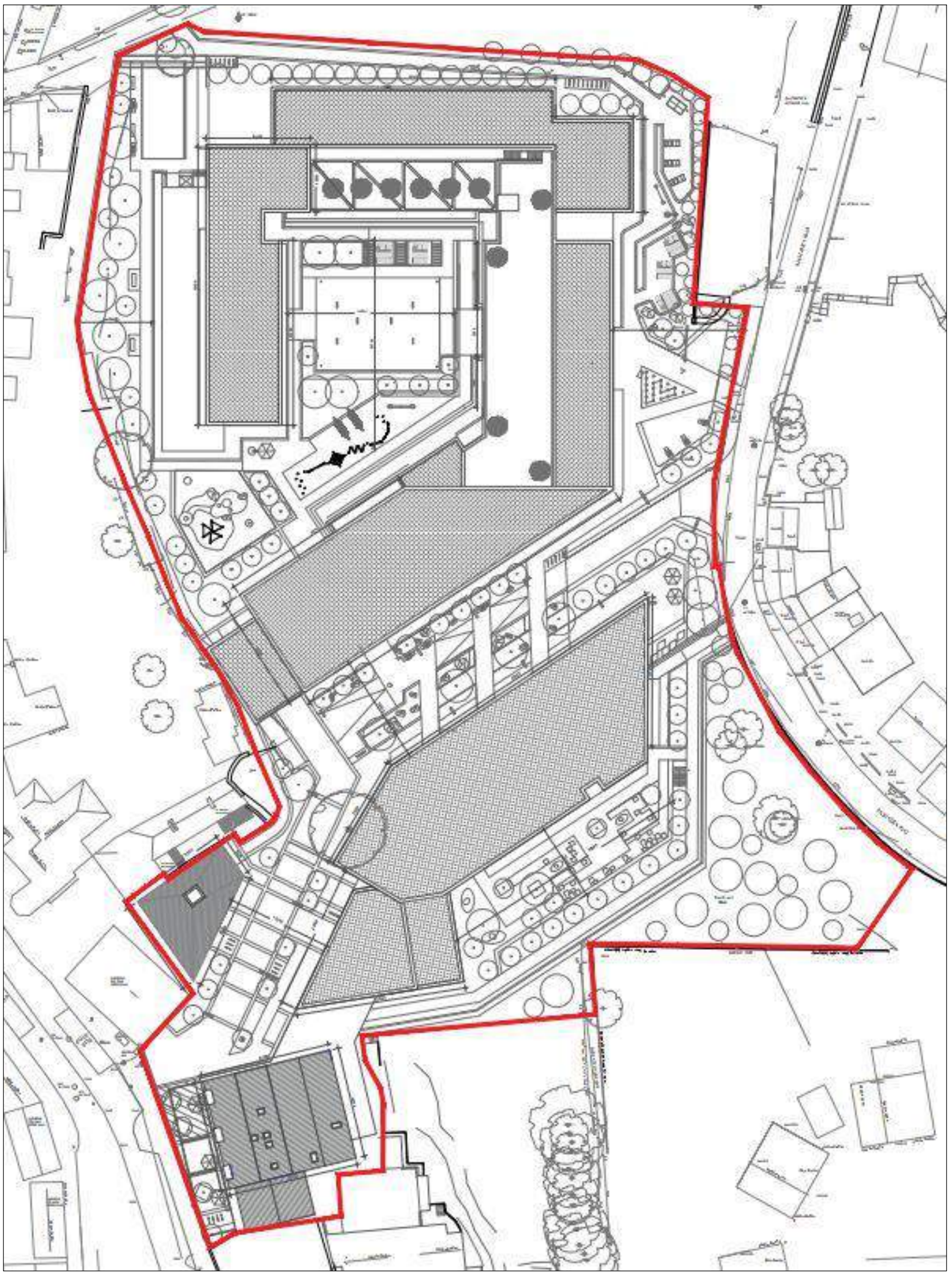


Figure 2b: Layout of proposed development.

2. Bat Survey Methodology

2.1 Daytime Inspections

One purpose of daytime inspections is to determine the potential of bat roosts within the survey area. Due to the transient nature of bats and their seasonal life cycle, there are a number of different type of bat roosts. Where possible, one of the objectives of the surveys is to be able to identify the types of roosts present, if any. However, the determination of the type of roost present depends on the timing of the survey and the number of bat surveys completed. Consequently, the definition of roost types, in this report, will be based on the following:

Table 5a: Bat Roost Types (adapted from Collins 2016).

Roost Type	Definition	Time of Survey
Day Roost	A place where individual bats or small groups of males, rest or shelter in the daytime but are rarely found by night in the summer.	Anytime of the year
Night Roost	A place where bats rest or shelter in the night but are rarely found in the day. May be used by a single bat on occasion or it could be used regularly by the whole colony.	Anytime of the year
Feeding Roost	A place where individual bats or a few bats rest or feed during the night but are rarely present by day.	Anytime of the year
Transitional Roost	A place used by a few individuals or occasionally small groups for generally short periods of time on waking from hibernation or in the period prior to hibernation.	Outside the main maternity and hibernation periods.
Swarming Site	Where large numbers of males and females gather. Appear to be important mating sites.	Late summer and autumn
Mating Site	Where mating takes place.	Late summer and autumn
Maternity Site	Where female bats give birth and raise their young to independence.	Summer months
Hibernation Site	Where bats are found, either individually or in groups in the winter months. They have a constant cool temperature and humidity.	Winter months in cold weather conditions
Satellite Roost	An alternative roost found in close proximity to the main nursery colony and is used by a few individuals throughout the breeding season.	Summer months

2.1.1 Building & Structure Inspection

Structures, buildings and other likely places that may provide a roosting space for bats are inspected during the daytime for evidence of bat usage. Evidence of bat usage is in the form of actual bats (visible or audible), bat droppings, urine staining, grease marks (oily secretions from glands present on stonework) and claw marks. In addition, the presence of bat fly pupae (bat parasite) also indicated that bat usage of a crevice, for example, has occurred in the past. Inspections are undertaken visually with the aid of a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope).

Buildings were assessed to determine their suitability as a bat roost (12th August 2021) and described using the parameters Negligible, Low, Medium or High suitability in view of Table 5.1 of Kelleher & Marnell (2006). The level of suitability informs the level of surveying required.

Table 5b: Building Bat Roost Classification System & Survey Effort (Adapted from Collins, 2016 and Kelleher & Marnell, 2006).

Suitability Category	Description (examples of criteria)	Survey Effort (Timings)
Negligible	Building have no potential as a roost site Urban setting, heavily disturbed, building material unsuitable, building in poor condition etc.	No surveys required.
Low	Building has a low potential as a roost site. No evidence of bat usage (e.g. droppings)	One dusk or dawn survey.
Medium	Building with some suitable voids / crevices for roosting bats. Some evidence of bat usage Suitable foraging and commuting habitat present.	At least one survey in May to August, minimum of two surveys (one dusk and one dawn).
High	Building with many features deemed suitable for roosting bats. Evidence of bat usage. Largely undisturbed setting, rural, suitable foraging and commuting habitat, suitable roof void and building material.	At least two surveys in May to August, with a minimum of three surveys (at least one dusk survey and one dawn survey).

2.1.2 *Tree Potential Bat Roost (PBRs) Inspection*

Trees that may provide a roosting space for bats were classified using the Bat Tree Habitat Key (BTHK, 2018) and the classification system adapted from Collins (2016). The Potential Roost Features (PRFs) listed in this guide were used to determine the PBR value of trees.

Evidence of bat usage is in the form of actual bats (visible or audible), bat droppings, urine staining, grease marks (oily secretions from glands present on stonework) and claw marks. In addition, the presence of bat fly pupae (bat parasite) also indicated that bat usage of a crevice, for example, has occurred in the past.

Daytime inspections were undertaken of all of the trees within the proposed development site. These inspections followed the Phase 1 guidance (Collins, 2016) in order to make a list of trees within the proposed development site that may be suitable as roosting sites for bats. Inspections were undertaken visually, from the ground, with the aid of a strong torch beam (LED Lenser P14.2) during the daytime searching for PRFs. To aid these Phase 1 inspections, tree reports were also consulted to supplement that data collected. This was also coupled with night-time surveys (See Section 2.2).

Table 5d: Tree Bat Roost Category Classification System (adapted from Collins, 2016).

Tree Category	Description
1 High	Trees with multiple, highly suitable features (Potential Roosting Features = PRFs) capable of supporting larger roosts
2 Moderate	Trees with definite bat potential but supporting features (PRFs) suitable for use by individual bats;
3 Low	Trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features (PRFs) which may have limited potential to support bats;
4 Negligible	Trees have no potential.

2.1.3 *Bat Habitat & Commuting Routes Mapping*

The survey site was assessed during daytime walkabout surveys (12th August 2021), in relation to potential bat foraging habitat and potential bat commuting routes. Such habitats were classified according to Fossit, 2000 (Appendix 1, Table 1.B) while hedgerows were classified according to BATLAS 2020 classification (Bat Conservation Ireland, 2015) (Appendix 1, Table 1.A). Bat habitats and commuting routes identified were considered in relation to the wider landscape to determine landscape connectivity for local bat populations through the examination of aerial photographs.

2.2 Night-time Bat Detector Surveys

2.2.1 Dusk & Dawn Bat Surveys

Dusk Emergence Surveys were completed on the 12th and 24th August 2021 from 10 minutes before sunset to 110 minutes post sunset and the surveyors position themselves within the proposed development site to determine if bats were roosting in the mature trees, within the buildings and also the general bat activity of the proposed development site. A Dawn Survey was completed on the 25th August 2021 from 110 minutes prior to sunrise and 10 minutes after sunrise.

The following equipment was used:

Surveyor 1: Anabat Walkabout Full Spectrum Bat Detector and Pettersson D200 Heterodyne Bat Detector.

Surveyor 2: Bat Logger M2 Full Spectrum Bat Detector and Pettersson D200 Heterodyne Bat Detector.

Surveyor 3: Anabat Scout Full Spectrum Bat Detector and Pettersson D200 Heterodyne Bat Detector.

Walking transects were completed post Dusk Emergence Surveys on the 12th and 24th August 2021 and involved the surveyor walking the local roads and the area within ownership of the client. Validation of bat records was completed by the principal bat surveyor prior to mapping.

2.2.2 Thermal Imagery Filming

A Guide TrackIR Pro25 thermal imagery scope filming was also deployed to capture potential emerging bats from the sports hall and hotel roof on the 12th, 24th and 25th August 2021. This was completed from 10 minutes before sunset till at least 120 minutes after sunset and 100 minutes before sunrise to 10 minutes after sunrise. Captured film was watched post-survey and any emerging bats were noted.

2.2.3 Passive Static Bat Detector Survey

A Passive Static Bat Surveys involves leaving a static bat detector unit (with ultrasonic microphone) in a specific location and set to record for a specified period of time (i.e. a bat detector is left in the field, there is no observer present and bats which pass near enough to the monitoring unit are recorded and their calls are stored for analysis post surveying). The bat detector is effectively used as a bat activity data logger. This results in a far greater sampling effort over a shorter period of time. Bat detectors with ultrasonic microphones are used as the ultrasonic calls produced by bats cannot be heard by human hearing.

The microphone of the unit was position horizontally to reduce potential damage from rain. Wildlife Acoustics Song Meter SM4 Bat FS and SM3 BAT Platform Units use Real Time recording as a technique to record bat echolocation calls and using specific software, the recorded calls are identified. It is these sonograms (2-d sound pictures) that are digitally stored on the SD card (or micro SD cards depending on the model) and downloaded for analysis. These results are depicted on a graph showing the number of bat passes per species per hour/night. Each bat pass does not correlate to an individual bat but is representative of bat activity levels. Some species such as the pipistrelles will continuously fly around a habitat and therefore it is likely that a series of bat passes within a similar time frame is one individual bat. On the other hand, Leisler's bats tend to travel through an area quickly and therefore an individual sequence or bat pass is more likely to be indicative of individual bats.

The recordings are analysed using Wildlife Acoustics Kaleidoscope Pro. Each sequence of bat pulses are noted as a bat pass to indicate level of bat activity for each species recorded. This is either expressed as the number of bat passes per hour or per survey night. The following static units were deployed during this static bat detector survey (12th to 20th August 2021):

Table 6: Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Unit Code	Bat Detector Type	Recording Function	Microphone
SM Mini Bat Units 5, 6, 9 and 10	Wildlife Acoustics SongMeter Mini Bat	Passive Full Spectrum	SMM-U2

2.3 Desktop Review

2.3.1 *Bat Conservation Ireland Database*

Bat Conservation Ireland acts as the central depository for bat records for the Republic of Ireland. Its' bat database is comprised of >60,000 bat records. The database primarily contains bat records from the following datasets:

- Irish Bat Monitoring Programme

The Irish Bat Monitoring Programme is comprised of four surveys (Car-based Bat Monitoring Scheme (2003-), All Ireland Daubenton's Bat Waterways Survey (2006-), Brow Long-eared Bat Roost Monitoring Scheme (2007-) and Lesser Horseshoe Bat Monitoring Scheme (1980s-). Apart from the latter survey, all monitoring data is stored on the BCIreland database.

- BATLAS 2020 & 2010

BCIreland has undertaken two all-Ireland species distribution surveys (2008-2009 for BATLAS 2010 and 2016-2019 for BATLAS 2020) of four target bat species (Common and soprano pipistrelle, Leisler's bats and Daubenton's bat).

- Ad Hoc Bat Records

Ad hoc bat records from national bat groups, ecological consultants and BCIreland members are also stored on the BCIreland database.

- Roost Records

These records are only report at a 1km level to protect the location of private dwellings and to protect such important bat records.

A 1km and 10km radius search was requested for the Irish Grid Reference O2881739126.

2.3.2 *Bat Conservation Ireland Bat Landscape Favourability Model*

Bat Conservation Ireland produced a landscape conservation guide for Irish bat species using their database of species records collated during the 2000 - 2009 survey seasons. An analysis of the habitat and landscape associations of all bat species deemed resident in Ireland was undertaken and reported in Lundy *et al*., 2011. The geographical area suitable for individual species was used to identify the core favourable areas of each species. This was produced as a GIS layer for local authorities and planners in order to provide a guide to the consideration of bat conservation. The island is divided into 5km squares and the landscape favourability of each 5km square for each species of bat was modelled. A caveat is attached to the model and it is that the model is based on records held on the BCIreland database, while core areas have been identified, areas outside the core area should not be discounted as unimportant as bats are a landscape species and can travel many kilometres between roosts and foraging areas nightly and seasonally. This model was used as part of the desktop study for this report.

2.4 Photographic Record

A photographic record is completed for the survey and is presented throughout the report.

3. Bat Survey Results

3.1 Daytime Inspections – Spring & Summer

3.1.1 Building & Structure Inspection

The following buildings / structures were inspected on the 12th August 2021. Internal rooms, where possible, were examined for bat usage. No evidence of bat usage was recorded.

Table 7: Buildings / Structures inspection results.

Building Code	Description	Roost Type / Suitability	Bat Species
Sports Hall (A)	Large modern structure comprised of concrete blocks and corrugated iron.	Low	No evidence recorded
Main Hotel (B)	Large derelict building, fire damage. Ground floor only safe to access during daytime inspection. Slate roof.	Low to Medium	No evidence recorded
Extension (C)	2-storey extension, slate roof. All of it was accessible for inspection.	Low to Medium	No evidence recorded
Vaults (D)	Ground floor stone and brick vaults – sealed and not accessible during inspection.	Low to Medium	No evidence recorded

Figure 3: Aerial photograph (Source: Enviroguide Consulting).

Plate 1: Front view of former Baily Hotel, Howth, Co. Dublin.

Plate 2: Side view of former Baily Hotel, Howth, Co. Dublin.

Plate 3: Vaults of former Baily Hotel, Howth, Co. Dublin.

Plate 4: Spots Hall, Howth, Co. Dublin.

3.1.2 *Tree Potential Bat Roost (PBRs) Inspection*

There are no trees within the proposed development site deemed as Potential Bat Roosts (PBRs). In addition, bat surveys did not recorded bats foraging along existing treeline of Monterey Cypress trees thereby confirming there value for local bat populations.

3.1.3 *Bat Habitat & Commuting Routes Mapping*

The habitat types, with reference to Fossit (2000) were recorded both within the survey area and adjacent to the survey area. The proposed development site is primarily comprised of hard surfaces associated with the hotel and sports hall surrounded by disturbed ground. There is an elevated area of grassland to the south of the sports hall. There are small sections of treelines and scrub with some individual trees.

Table 9a: Habitat types present within survey area.

Habitat	Yes	Habitat	Yes	Habitat	Yes	Habitat	Yes
Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land	√	Brackish waters		Caves		Grasslands	√
Coastal structures	√	Springs		Freshwater marsh		Scrub	
Shingle/gravel		Swamps		Lakes/ponds		Hedges/treelines	√
Sea cliffs/islets		Disturbed ground	√	Heath		Conifer plantation	
Sand dunes		Watercourse		Bog		Woodland	

Table 9b: Habitat types present adjacent to survey area.

Habitat	Yes	Habitat	Yes	Habitat	Yes	Habitat	Yes
Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land	√	Brackish waters		Caves		Grasslands	√
Coastal structures	√	Springs		Freshwater marsh		Scrub	
Shingle/gravel		Swamps		Lakes/ponds		Hedges/treelines	√
Sea cliffs/islets		Disturbed ground	√	Heath		Conifer plantation	
Sand dunes		Watercourse		Bog		Woodland	

3.2 Night-time Bat Detector Surveys

The buildings within the proposed development area are considered to have a Low to Medium suitability for bat roosts and as a consequence two dusk surveys (2-3 people) and one dawn survey (2 people) was undertaken coupled with Thermal Imagery filming on all three survey dates.

3.2.1 Dusk Bat Survey & Walking Transects

Bat detector surveys completed on 12/8/2021 (Dusk Survey - Weather conditions: 14oC, patchy cloud cover, calm and dry), 24/8/2021 (Dusk Survey - Weather conditions: 17oC, clear sky, calm and dry) and 25/8/2021 (Dawn Survey – Weather conditions: patchy cloud cover, 10oC, dry and calm).

The surveyors, over the course of the three surveys were located as indicated on the aerial photograph below: Dusk Survey (12/8/2021 – Orange Circles); Dusk Survey (24/8/2021 – Blue Circles) and Dawn Survey (25/8/2021 – Red Circles). While the buildings were the primary focus of the surveys in order to record roosting sites, surveyors documented any bat activity presented within the survey area (i.e. commuting and foraging activity).

Figure 4: Aerial photograph (Source: Enviroguide Consulting).

The Thermal Imagery scope recorded the roof of the hotel, rear of the sports hall and side of sports hall.

Plate 5: Rear of sports hall surveyed by Thermal Imagery during Dusk Survey 12/8/2021.

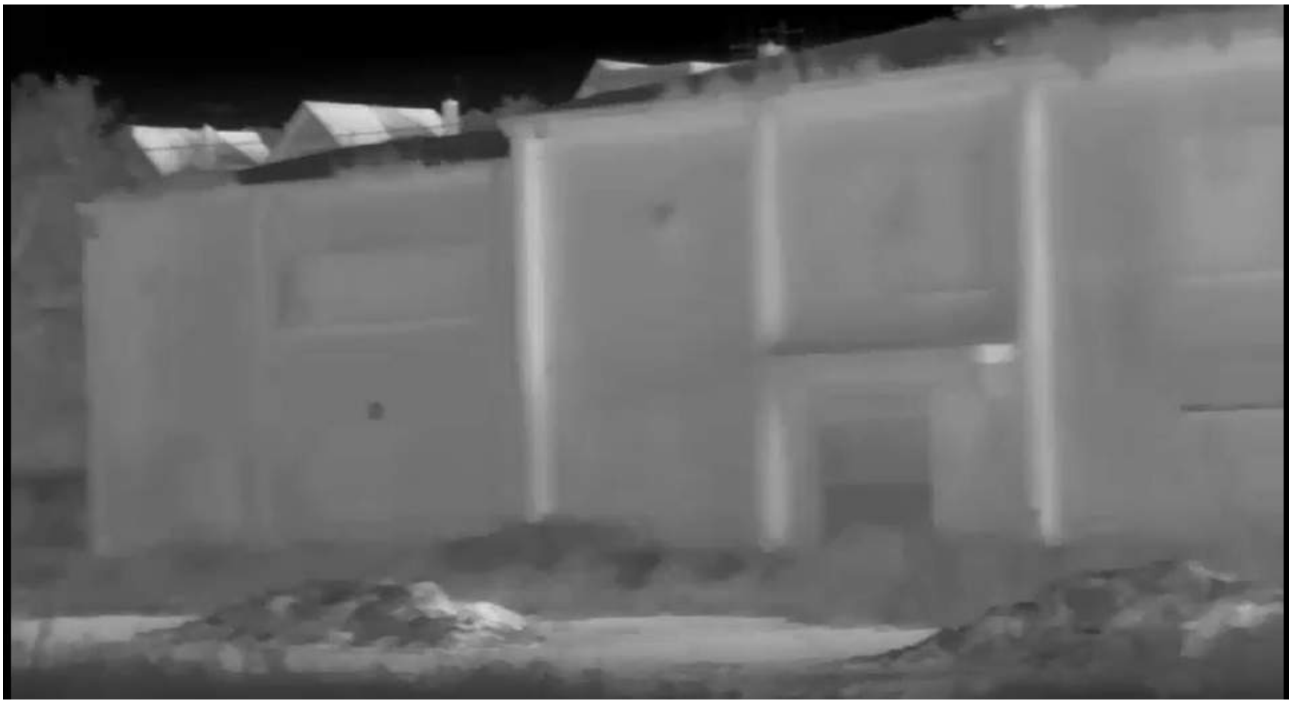


Plate 6: Side of sports hall surveyed by Thermal Imagery during Dawn Survey 25/8/2021.

3.2.1.1 Dusk Survey & Walking Transect 12/8/2021

No bats were recording emerging from the sports hall or hotel extension / vaults during the dusk survey. The following bat activity was recorded:

Surveyor 1: courtyard of hotel beside extension and vaults

Surveyor 3: On Main Street

21:28 hrs Common pipistrelle, heard but not seen.

21:32 hrs Two common pipistrelle recorded commuting through the survey area, over the hotel and towards the sports hall (See commuting routes on Figure .

22:06 hrs Common pipistrelle commuted through the survey area and an additional individual foraged within the courtyard before commuting to rear of site.

There is likely to be a roost in buildings across the main street from the survey area.

Surveyor 2: Sports Hall

21:30 hrs Common pipistrelles foraging around the sports hall continuously during dusk survey. This activity was principally to the front (Balscadden Road) and side (adjacent to elevated grassland area) of the building where there was sufficient shelter for insects to accumulate.

21:36 Leisler's bat (x2 individuals) commuted towards the sport hall and foraged for approximately 10 minutes before flying towards the coast.

The walking transect was undertaken along the road network in a large loop around the proposed survey area. Only soprano pipistrelles were recorded and these were located along the coast road.

3.2.1.2 Dusk Survey & Walking Transect 24/8/2021

No bats were recorded emerging from the main hotel building or sports hall.

Surveyor 1: Sports hall

Surveyor 3: Front of main building of hotel

20:43 hrs Leisler's bat flew over the hotel commuting to the coast.

21:48 to 21:52 hrs Leisler's bat (x2 individuals) foraged over the elevated area of the proposed development site.

22:06 hrs Common pipistrelle commuted through the survey area and an additional individual foraged within the courtyard before commuting to rear of site.

22:10 hrs Common pipistrelles foraging around the sports hall continuously during dusk survey. This activity was principally to the front (Balscadden Road) and side (adjacent to elevated grassland area) of the building where there was sufficient shelter for insects to accumulate.

There is likely to be a roost in buildings across the main street from the survey area.

Surveyor 3: Front of main building of hotel

21:30 hrs Common pipistrelles foraging around the sports hall continuously during dusk survey.

21:36 Leisler's bat (x2 individuals) commuted towards the sport hall and foraged for approximately 10 minutes before flying towards the coast.

The walking transect was undertaken along the road network in a large loop around the proposed survey area. Only soprano pipistrelles were recorded and these were located along the road through the housing estates.

3.2.1.3 Dawn Survey 25/8/2021

Surveyor 1: Sports hall

Surveyor 3: Front/Gable of main building of hotel from Main Street

No bats were recording swarming around the hotel or the sports hall. The following bat activity was recorded:

06:13 hrs Leisler's bat foraging over the elevated grassland area within the proposed development site.

06:18 hrs Leisler's bat commuting through survey area in a southerly direction.

The following maps are a combination of the three survey dates (dusk and dawn surveys and walking transects) to indicate the location of bat encounters (the three survey dates were combined due to the low level of bat encounters recorded overall).

Figure 5a: Leisler's bat encounters during bat surveys. Yellow Arrow – direction of commuting bats.

Figure 5b: Common pipistrelle bat encounters during bat surveys. Yellow Arrows: direction of commuting bats.

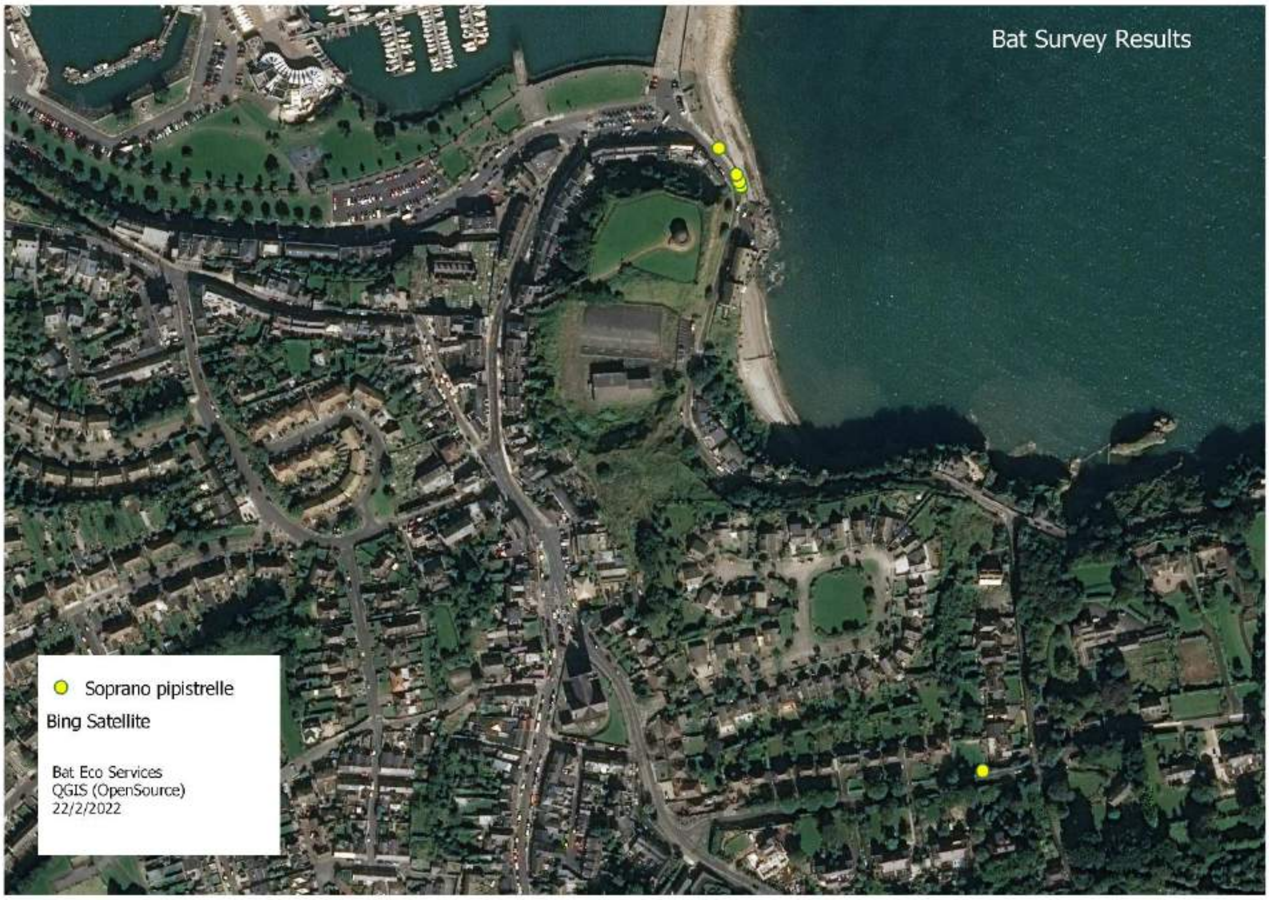


Figure 5c: Soprano pipistrelle bat encounters during bat surveys.

3.2.2 Passive Static Bat Detector Survey

The following tables provides details with regards to the static units deployed (Please see Figure 3) during the bat survey. Four static units were deployed for 8 nights. Three static units were located within buildings and the purpose of these was to document bat species potentially entering the building and therefore potentially roosting within the building. In a confined space, if calls of the quieter echolocating bats are recorded, then it is more likely that such bat species are roosting or entering the buildings for shelter during inclement weather conditions. The structure and the shape of the species echolocation calls can also provide clues as to whether the individual bat is flying within the building (e.g. *Myotis* bats produced a longer FM call when inside a confined space compared to outside a building). In addition, the time stamp of the echolocation calls were examined to determine if bats are only briefly entering during the night or are returning at dawn and emerging the following dusk (therefore providing evidence of roosting bats).

The remaining static unit was located on the timber hoarding fence between the hotel and sport's hall to collate data on local bat populations and the level of foraging and/or commuting bat activity level in surrounding habitat. Therefore the data from this unit is summarised as nightly data to give an indication of bat activity levels.

A total of four species of bat was recorded during the static surveillance: common pipistrelle, soprano pipistrelle, Leisler's bat and brown long-eared bat and this was primarily on the static unit located on the timber hoarding (See Table 10). The static units confirm that there were bats entering the Sports Hall and loft room of the extension of the building. Examination of the data indicates that a brown long-eared bat individual entered the sports hall space briefly on the 13/8/2021 @ 03:34 to 03:39 hrs (5 passes). This was the only bat species recorded internally in the Sports hall and the timing indicates that the individual bat entered the space but did not roost within the building as there were no recordings at dusk (i.e. during emergence) the following night to indicate that the bat roosted during the daytime and emerged the following nigth. If there were recordings during emergence the following night it would indicate that the individual roosted in the building during the day from the time of entering the building @ 03:34 hrs on the 13/8/2021. An example of one of the sonograms is presented below.

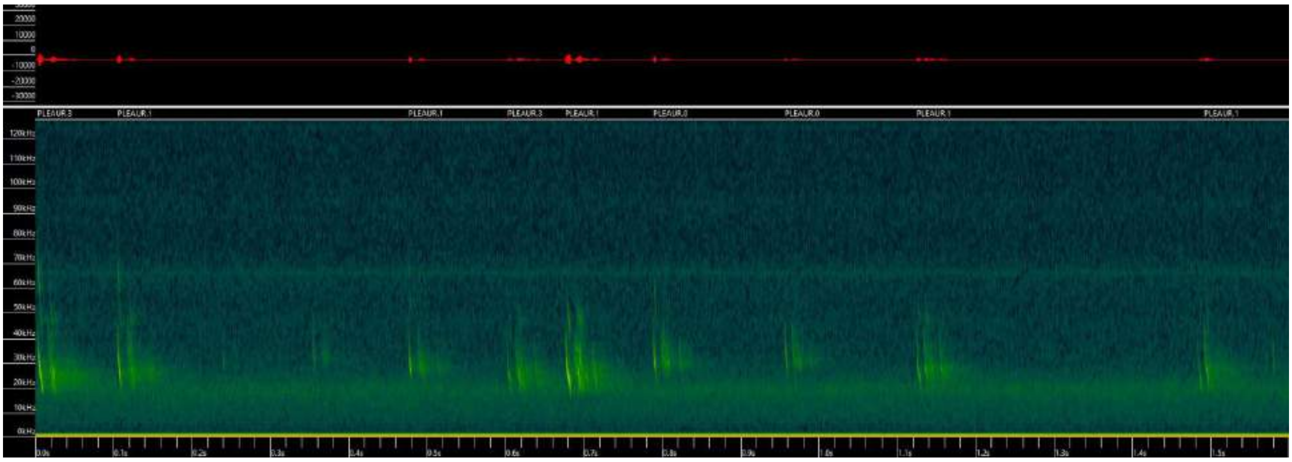


Figure 6a: Sonogram of brown long-eared bat recorded on Static unit Mini 9 located in the Sports Hall (Analysis – Kaleidoscope Pro).

In addition, the recordings of common pipistrelle on the static unit located within the loft space of the extension of the hotel building was also indicative of an individual bat entering the space but not roosting within. A single bat pass, considered to be an individual within the internal space of the loft room, was recorded at 04:32 hrs on the 17/8/2021. The long FM portion of the echolocation pulses and the intensity of the calls are indicative of the individual bat was located within the loft space close to the static unit. However, there was only one such recording thereby indicating that the individual bat briefly entered the space but left soon after (therefore it did not roost in the building). In addition, there were no calls recorded on the static unit located on the ground floor of the hotel which is connected to the loft room. This further provided proof that the recording is not indicative of a roosting bat and that the bat did not travel to another section of the hotel to roost.

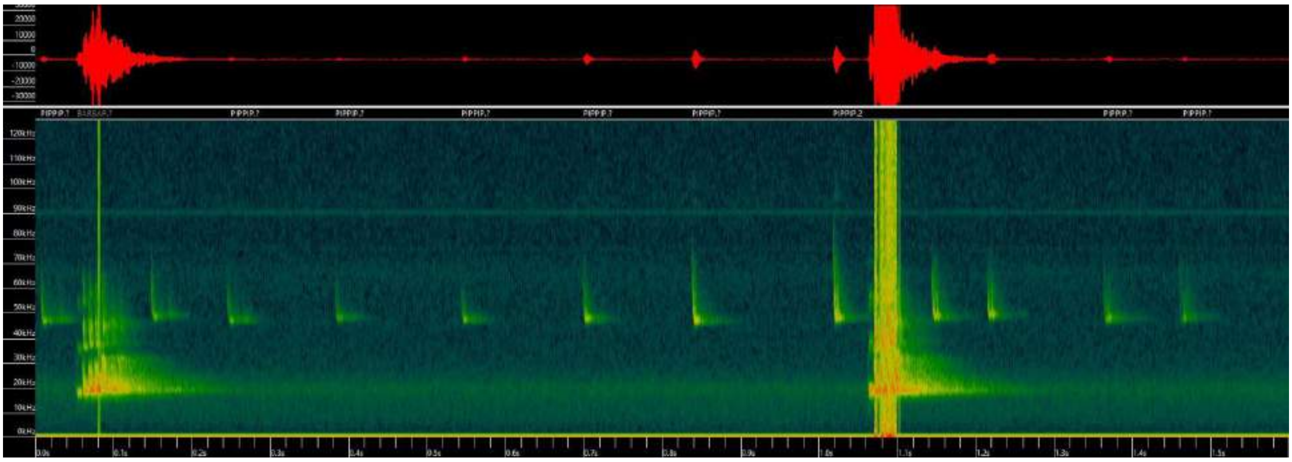


Figure 6b: Sonogram of common pipistrelle recorded on Static unit Mini 5 located in the Loft Room (Analysis – Kaleidoscope Pro).

Table 10: Results of Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Code	Location Description	Survey Period	Results
Mini 5	Loft room of extension of hotel building	12/8/2021 to 20/8/2021 (8 nights)	Common pipistrelle – 1 recording
Mini 6	Ground floor of main hotel building	12/8/2021 to 20/8/2021 (8 nights)	No bats recorded
Mini 9	Interior of sports hall	12/8/2021 to 20/8/2021 (8 nights)	Brown long-eared bat – 5 recordings within a five minute period
Mini 10	On hoarding within the proposed development site	12/8/2021 to 20/8/2021 (8 nights)	Common pipistrelle, soprano pipistrelle and Leisler's bat

Common pipistrelles were the most frequently recorded species on the static unit located on timber hoarding. Leisler's bat were recorded frequently over the surveillance period while soprano pipistrelles were infrequently recorded. Brown long-eared bat was recorded only on two of the eight nights of surveillance.

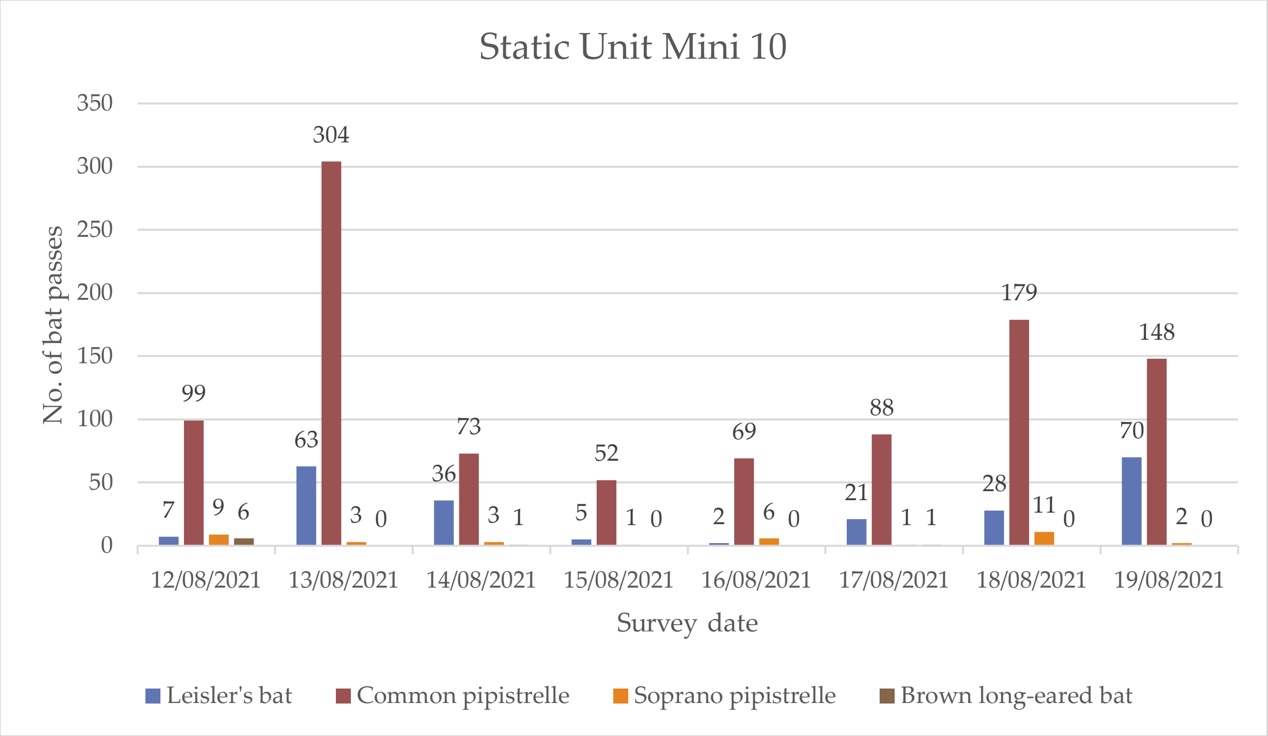


Figure 6c: Static surveillance results for each bat species recorded on Static Unit Mini 10.

As a general guide, activity level is determined by the author as follows: Low = <10 bat passes/hr; Medium = >10 - <50 bat passes/hr; High = >50 bat passes/hr). At this time of the year, 9 hours per night are available to foraging bats (21:00 hrs to 06:00 hrs). (Please see tables in Appendices for nightly breakdown of activity).

NOTE: The behaviour of bats during commuting and foraging greatly influences the level of bat passes recorded on static units. The number of bat passes do not equate to the number of bats flying past the static unit. Pipistrellus species tended to foraging as they commute and therefore are regularly observed flying up and down a treeline or hedgerow before moving on in the landscape. Leisler's bats fly high in the sky and therefore can be observed flying fast through the landscape, occasionally foraging over treetops as they commute. As a consequence, Pipistrellus species bat activity tends to result in a higher number of bat passes recorded on static units compared to Leisler's bats. In relation to other bat species recorded, as they tend to be less common in the landscape compared to common pipistrelles, soprano pipistrelles and Leisler's bats, their recorded presence is notable. Exceptions to this would include Daubenton's bats on a waterway or a static located adjacent to a known bat roost.

Over the course of the surveillance period, a Medium level of common pipistrelle bat activity was recorded while a Low level of bat activity was recorded for the remaining bat species. When the static surveillance data is examined, the majority of Leisler's bat passes were recorded in the first hour of surveillance which supports the dusk survey results. While the timing of the bat encounters for the *Pipistrellus* species varied throughout the night and it is indicative of occasional commuting and foraging individuals.

3.3 Desktop Review

3.3.1 Bat Conservation Ireland Database

There was one bat record within a 1km radius of the proposed development on the Bat Conservation Ireland database: brown long-eared bat. The search was widened to 10km and this dataset consists of 96 bat records (10 roost records, 0 transect records and 15 ad hoc bat detector records. The number of records for each species is as follows:

Lesser horseshoe bat	0 records;
Common pipistrelle	13 records;
Soprano pipistrelle	11 records;
Pipistrellus species	1 records;
Leisler's bat	15 records;
Myotis species	10 records;
Daubenton's bat	0 records;
Natterer's bat	0 records;
Whiskered bat	1 records;
Brown long-eared bat	8 records and
Nathusius' pipistrelle	0 records.

3.3.2 Bat Conservation Ireland Bat Landscape Favourability Model

Figure 7 depicts the BCIreland Bat Landscape Favourability Model (Lundy *et al.,* 2011) for all bat species (individual species values are presented in Section 10.10). The country is divided into 5km squares and the darker the shading of the square, the higher favourability of the 5km square for bats. This GIS layer is hosted on the NBDC website www.biodiversityireland.ie. The proposed development site is approximately location in the Blue Box.

Figure 7: Bat Landscape Favourability Model (All Bats) (Source: NBDC).

3.4 Survey Effort, Constraints & Survey Assessment

The following table details any Survey Constraints encountered and a summary of Scientific Assessment completed.

Table 11: Survey Effort, Constraints & Survey Assessment Results.

Category	Discussion
Timing of surveys	Summer bat survey: 12th to 25th August 2021 Surveying meets Collins, 2016 guidelines.
Survey Type Full suite of surveys completed to ensure sufficient information was collated for bat assessment. Surveys completed according Collins, 2016 guidelines.	Bat Survey Duties Completed (Indicated by red shading) Tree PBR Survey 🟥 Daytime Building Inspection 🟥 Static Detector Survey 🟥 Daytime Bridge Inspection ○ Dusk Bat Survey 🟥 Dawn Bat Survey 🟥 Walking Transect 🟥 Driving Transect ○ Trapping/Mist Netting ○ IR Camcorder filming ○ Endoscope Inspection 🟥 Other (Thermal Imagery) 🟥
Weather conditions	Suitable for bat surveys.
Survey Constraints	Only the ground floor of the main hotel building was accessible. Fire damage prevented the upper floors being inspected. However, the static surveillance provided the required information to determine if this area was used by bats.
Survey effort Daytime – 2 hrs Bat surveys – 18 hrs Static surveillance – 360 hrs TOTAL = 380 hrs	Summer bat survey: Daytime inspection – 2 hrs Dusk Surveys (x2, 2-3 surveyors) – 10 hrs Dawn Surveys (x1, 2 surveyors) – 4 hrs Walking Transects (x2, 1 surveyor) – 4 hrs Static Surveillance (x5 units, 8 nights) – 360 hrs
Extent of survey area	Summer bat survey: proposed development area and local road network
Equipment	Full suite of bat survey equipment as list under Section 2.2. All in good working order.

The extent of the surveys undertaken has achieved to determine:

- Presence / absence of bat within the survey area;
- A bat species list for the survey area;
- Extent and pattern of usage by bats within the survey area.

It is therefore deemed that the Scientific Assessment completed is Appropriate in order to completed the aims of the bat survey.

3.5 Bat Survey Results Summary

Four species of bat was recorded within the survey area: Leisler's bat, common pipistrelle, brown long-eared bat and soprano pipistrelle.

No bat roosts were recorded roosting in the buildings surveyed. As buildings tend to be used as more stable roosting sites for bats, particularly in the summer months, the survey results indicate that the buildings are not used as bat roosts. While a brown long-eared bat was recorded in the sports hall briefly, it is deemed that this building is not being used as a bat roost, due to the brief number of bat passes recorded during one of the night's surveillance. This is same conclusion for a single common pipistrelle recording in the loft room of the hotel extension. The timing and duration of calls recorded are indicative of a bat flying within the space but not roosting within the space.

There are no trees deemed as Potential Bat Roosts within the proposed survey area.

A Low to Medium level of bat activity was recorded for common pipistrelles. A low level of bat activity was recorded for the remaining bat species.

The proposed development site is used as a foraging and commuting habitat for local bat populations. However, the level of bat activity and the number of bat encounters do not indicate that the proposed development site is an important area for local bat populations.

4. Bat Ecological Evaluation

4.1 Bat Species Recorded & Sensitivity

Four bat species were recorded: common pipistrelle, Leisler's bat, brown long-eared bat and soprano pipistrelle. Three of these are the most common bat species in Ireland. The forth bat species, brown long-eared bat, is less common but widespread. This represents four of the nine resident bat species on the island and four of the eight resident bat species for County Dublin.

No bat roosts were recorded roosting in the buildings surveyed. As buildings tend to be used as more stable roosting sites for bats, particularly in the summer months, the survey results indicate that the buildings are not used as bat roosts. While a brown long-eared bat was recorded in the sports hall briefly, it is deemed that this building is not being used as a bat roost, due to the brief number of bat passes recorded during one of the night's surveillance. This is same conclusion for a single common pipistrelle recording in the loft room of the hotel extension.

There are no trees deemed as Potential Bat Roosts within the proposed survey area.

A Low to Medium level of bat activity was recorded for common pipistrelles. A low level of bat activity was recorded for the remaining bat species.

The proposed development site is used as a foraging and commuting habitat for local bat populations. However, the level of bat activity and the number of bat encounters do not indicate that the proposed development site is an important area for local bat populations.

Leisler's bat

- Leisler's bat is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national Leisler's bat population is considered to be significantly increasing trend (Aughney *et al.,* 2021).
- The modelled Core Area for Leisler's bats is a relatively large area that covers much of the island of Ireland (52,820km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Leisler's bat habitat preference has been difficult to define in Ireland. Habitat modelling for Ireland shows an association with riparian habitats and woodlands (Roche *et al.,* 2014). The landscape model emphasised that this is a species that cannot be defined by habitats preference at a local scale compared to other Irish bat species but that it is a landscape species and has a habitat preference at a scale of 20.5km.

Common pipistrelle

- Common pipistrelle is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national common pipistrelle population is considered to be significantly increasing trend (Aughney *et al.,* 2021).
- The modelled Core Area for common pipistrelle is a relatively large area that covers much of the island of Ireland (56,485km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Common pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanization (<30%) (Roche *et al.,* 2014).

Soprano pipistrelle

- Soprano pipistrelle is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national soprano pipistrelle population is considered to be significantly increasing trend (Aughney *et al.,* 2021).
- The modelled Core Area for soprano pipistrelle is a relatively large area that covers much of the island of Ireland (62,020km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the soprano pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.,* 2014).

Brown long-eared bat

- Brown long-eared bat is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national brown long-eared bat population is considered to be stable (Aughney *et al.,* 2021).
- The modelled Core Area for brown long-eared bat is a relatively large area that covers much of the island of Ireland (49,929 km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the brown long-eared bat habitat preference is for areas with broadleaf woodland and riparian habitats on a small scale of 0.5km emphasising the importance of local landscape features for this species (Roche *et al.,* 2014).

4.2 Bat Foraging Habitat & Commuting Routes

There is suitable bat foraging and commuting habitat within the proposed development site. The principal foraging habitat is located adjacent to the sport's hall.

4.3 Zone of Influence – Bat Landscape Connectivity

The proposed development site is located in the urban zone of Howth, Co. Dublin. The proposed development site is located on the peninsula of Howth Head, which forms the northern boundary of Dublin Bay. The central part of the peninsula is woodland and landscape primarily associated with golf courses and Howth Hill. As a consequence there is landscape connectivity for local bat populations to move to and from the proposed development site.

4.4 Landscape Plan

The proposed landscape plan report states the following (Source, Landscape Design Statement prepared by Plus Architecture Ltd.):

The southern boundary of the proposed development site will consist of a native hedgerow planting along with planting of a semi-natural tree covered embankment. The western boundary will also have a new native treeline planted. These will have a positive impact on local bat populations by providing native tree planting and a potential area to erect bat mitigation measures.

Figure 8: Landscape Plan for proposed development site.

4.5 Lighting Plan

Bats are light sensitive bats species, hence their nocturnal activities. The three bat species recorded commuting and foraging within the survey area are Light Tolerant or Semi-tolerant bat species. However the forth bat species is light sensitive (i.e. brown long-eared bat). Therefore it is important that strict lighting guidelines are implemented to reduce the potential impact of the proposed development on local bat populations.

Luminaire design is extremely important to achieve an appropriate lighting regime. Luminaires come in a myriad of different styles, applications and specifications which a lighting professional can help to select. The following should be considered when choosing luminaires. This is taken from the most recent BCT Lighting Guidelines (BCT, 2018).

- All luminaires used will lack UV/IR elements to reduce impact.
- LED luminaires will be used due to the fact that they are highly directional, lower intensity, good colour rendition and dimming capability.
- A warm white spectrum (<2700 Kelvins will be used to reduce the blue light component of the LED spectrum).
- Luminaires will feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
- Column heights should be carefully considered to minimise light spill. The shortest column height allowed should be used where possible.
- Only luminaires with an upward light ratio of 0% and with good optical control will be used.
- Luminaires will be mounted on the horizontal, i.e. no upward tilt.
- Any external security lighting will be set on motion-sensors and short (1min) timers.
- As a last resort, accessories such as baffles, hoods or louvres will be used to reduce light spill and direct it only to where it is needed.

Any external lighting for the proposed development will strictly follow the above guidelines and these will be strictly implemented during construction and operation phase of the proposed development.

In addition, there should not be any lighting along the southern boundary and within the semi-mature planting area and particularly within the area of the proposed locations of the rocket bat boxes. It is important that there are dark zones to allow local bat populations to continue to commuting and foraging within the proposed development area.

The Lighting Report will take into consideration the “Bats and artificial lighting in the UK: bats and the built environment series. Guidance Note 09/2018”.

Table 12: Assessment of proposed lighting plan in relation to Bats and artificial lighting in the UK: bats and the built environment series. Guidance Note 08/2019" (BCT, 2018).

BCT (2018) Recommendations	Applied to Proposed Lighting Plan
All luminaires used will lack UV/IR elements to reduce impact.	Yes
LED luminaires will be used due to the fact that they are highly directional, lower intensity, good colour rendition and dimming capability.	Yes
A warm white spectrum (<2700 Kelvins will be used to reduce the blue light component of the LED spectrum).	Yes
Luminaires will feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.	Yes
Column heights should be carefully considered to minimise light spill. The shortest column height allowed should be used where possible. Ballard lighting should be considered for pedestrian and greenway areas, if deemed necessary.	6m poles & 1200mm bollards
Only luminaires with an upward light ratio of 0% and with good optical control will be used.	Yes
Luminaires will be mounted on the horizontal, i.e. no upward tilt.	Yes
Any external security lighting will be set on motion-sensors and short (1min) timers. The intensity of external lighting should be limited to ensure that skyglow does not occur in order to reduce light pollution.	Yes

In addition, there are no lighting planned for the biodiversity landscape area along the southern boundary. This will ensure that this is a dark zone for foraging bats.

5. Impact Assessment & Mitigation

The bat species diversity of the proposed development site is of medium value as 4 of the 8 resident bat species known for County Dublin were recorded during the 2021 bat surveys. In addition, the level of bat activity within the proposed development site is considered to be Low to Medium for the bat species recorded during the bat surveys and static surveillance. Therefore, it is deemed that the proposed development site has Negligible geographic scale of importance (According to Table 2, Section 1.2) for local bat populations.

The proposed development would result in the following:

- Loss of potential bat habitats for foraging and commuting (Construction Impacts)
- An increase in human activity (noise and light levels) (Operational Impacts)

Therefore the potential impact of the proposed development is, overall, considered to have a scale of impact of **Slight Negative** on named bat species (according to criteria set out in Tables 4a,b, Section 1.2.2). This is in consideration of the fact that no bat roosts were recorded in the buildings during the bat surveys.

The operational impacts of the proposed development will likely be **Long-term** (as per the duration of the operation of the proposed development).

Bat mitigation measures are provided to provide alternative roosting (bat boxes) and additional were recommended in relation to lighting (as a consequence the Lighting plan will adhere to BCT guidelines) and landscaping to further reduce the potential impact of the proposed development on commuting and foraging local bat populations.

Taking into consideration of above, the potential impact of the proposed development will be reduced to **Not Significant Negative** impact.

5.1 Bat Mitigation Measures

In order to reduce the potential negative impact of the proposed development commuting and foraging resources within the proposed development site on local bat populations, the following mitigation measures are recommended to be fully implemented. The Bat Mitigation Guidelines (Kelleher & Marnell, 2006) are the principal guidance in relation to bat mitigation in Ireland and therefore for this report.

5.1.1 Bat Box Scheme

The total number of bat boxes required to mitigate for general conservation of local bat populations:

- 2 rocket bat boxes (See Appendices for source) to be erected along the native hedgerow / semi-mature embankment proposed to bel located along the southern boundary. These are to be located on 5m steel poles in 1m^3 of 40 newtons cement. It is recommended that the tree species proposed to planted are Irish native tree species.

5.1.2 Building Demolition

It is recommended that demolition work is undertaken outside the main bat activity season of May to August. If this is not possible, as a precaution, prior to demolition of the Sports Hall and extension of the hotel, undertaken a static surveillance for a minimum of 5 days to ensure that there are not bats present. This should be planned at least 2 weeks prior to demolition.

5.1.3 Lighting Plan

Lighting Plan has taken into consideration recommendations and will therefore comply with BCT (2018) guidelines. In addition there are no lighting planned for the biodiversity landscape area along the southern boundary. This will ensure that this is a dark zone for foraging bats.

5.1.4 Landscape Plan

Native tree and shrub plant species are recommended for planting. In addition, night-scented planting along with scented herbs are recommended to attract insects as a feeding resource for bats.

5.1.5 Monitoring

Monitoring is recommended post-construction works. This monitoring should involve the following aspects:

- Inspection of rocket bat boxes within one year of erection of bat box scheme/rocket box. Register bat box scheme with Bat Conservation Ireland. This should be undertaken for a minimum of 2 years.
- Monitoring of any other bat mitigation measures. All mitigation measures should be checked to determine that they were successful. A full summer bat survey is recommended post-works.

6. Survey Conclusions

The bat species diversity of the proposed development site is of medium value as 4 of the 8 resident bat species known for County Dublin were recorded during the 2021 bat surveys. In addition, the level of bat activity within the proposed development site is considered to be Low to Medium for the bat species recorded during the bat surveys and static surveillance. Therefore, it is deemed that the proposed development site has Negligible geographic scale of importance (According to Table 2, Section 1.2) for local bat populations.

The proposed development would result in the following:

- Loss of potential bat habitats for foraging and commuting (Construction Impacts)
- An increase in human activity (noise and light levels) (Operational Impacts)

Therefore the potential impact of the proposed development is, overall, considered to have a scale of impact of **Slight Negative** impact on named bat species (according to criteria set out in Tables 4a,b, Section 1.2.2). This is in consideration of the fact that no bat roosts were recorded in the buildings during the bat surveys.

The operational impacts of the proposed development will likely be long-term (as per the duration of the operation of the proposed development).

The Lighting Plan fully complies with guidelines to reduce potential impact on local bat populations. The Landscape Plan consists of planted boundaries and a biodiversity area that will provided foraging and commuting habitat post construction for local bat populations.

Bat mitigation measures are provided to provide alternative roosting (bat boxes) and landscaping to further reduce the potential impact of the proposed development on commuting and foraging local bat populations. Therefore the potential impact of the proposed development will be reduced to **Not Significant Negative** impact.

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8. Appendices

8.1 Appendix 1 Bat Habitat & Commuting Route Classifications

Table 1.A: Hedgerow Category (Bat Conservation Ireland, 2015)

Type of Hedgerow / Treeline	Code	Description / Bat Potential
Small Hedgerow	**SH**	Hedgerow is less than approximately 1.5 m high, there are no, or very few, protruding bushes or trees. This type of hedgerow would provide little shelter to bats. 
Medium Hedgerow	**MH**	Hedgerow is approximately 1.5 to 3 m high. This type of hedgerow will provide foraging and commuting potential for bats. 
Sparse Treeline Hedgerow	**ST**	Hedgerow, low or medium in height, with individuals trees (where tree canopies, for the most part, do not touch).

		
Dense Treeline Hedgerow	**DT**	Large uncut hedgerows or treelines, dominated by mainly large tree or very tall scrub species (e.g. tall hawthorn, blackthorn or hazel), where the canopies are mostly touching. 

Table 1.B: Habitat Classification (Bat Conservation Ireland, 2015, based on Fossit, 2000)

Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land		Brackish waters		Caves		Grasslands	
Coastal structures		Springs		Freshwater marsh		Scrub	
Shingle/gravel		Swamps		Lakes/ponds		Hedges/treelines	
Sea cliffs/islets		Disturbed ground		Heath		Conifer plantation	
Sand dunes		Watercourse		Bog		Woodland	

8.2 Appendix 2 – Static Surveillance

Mini 10	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat
12/08/2021	7	99	9	6
13/08/2021	63	304	3	0
14/08/2021	36	73	3	1
15/08/2021	5	52	1	0
16/08/2021	2	69	6	0
17/08/2021	21	88	1	1
18/08/2021	28	179	11	0
19/08/2021	70	148	2	0
	232	1012	36	8
Average	**29**	**126.5**	**4.5**	**1**
	Low	Medium	Low	Low

8.3 Appendix 3 Rocket Bat Boxes

An Irish supplier of this type of bat box is:

Shop - Eire Ecology – Rocket Bat Box (Please note that these are made to order).

9. Bat Species Profile

9.1 Leisler's bat

Ireland's population is deemed of international importance and the paucity of knowledge of roosting sites, makes this species vulnerable. However, it is considered to be widespread across the island. The modelled Core Area for Leisler's bats is a relatively large area that covers much of the island of Ireland (52,820km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Leisler's bat habitat preference has been difficult to define in Ireland. Habitat modelling for Ireland shows an association with riparian habitats and woodlands (Roche *et al.,* 2014). The landscape model emphasised that this is a species that cannot be defined by habitats preference at a local scale compared to other Irish bat species but that it is a landscape species and has a habitat preference at a scale of 20.5km. In addition, of all Irish bat species, Leisler's bats have the most specific roosting requirements. It tends to select roosting habitat with areas of woodland and freshwater.

Irish Status	Near Threatened
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	73,000 to 130,000 (2007-2013) Ireland is considered the world stronghold for this species
Estimate Core Area (Lundy *et al. 2011*)	52,820 km^2

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

The principal concerns for Leisler's bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

- Selection of maternity sites is limited to specific habitats;
- Relative to the population estimates, the number of roost sites is poorly recorded;
- Tree felling, especially during autumn and winter months; and
- Increasing urbanisation.

9.2 Common pipistrelle

This species is generally considered to be the most common bat species in Ireland. The species is widespread and is found in all provinces. The modelled Core Area for common pipistrelles is a large area that covers much of the island of Ireland (56,485km^2) which covers primarily the east and south east of the area (Roche *et al.,* 2014). The Bat Conservation Ireland Irish Landscape Model indicated that the Common pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanization (<30%) (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	1.2 to 2.8 million (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011*)	56,485

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Common pipistrelles in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements
- This species has complex habitat requirements in the immediate vicinity of roosts. Therefore, careful site specific planning for this species is required in order to ensure all elements are maintained.
- Renovation or demolition of derelict buildings.
- Tree felling
- Increasing urbanisation (e.g. increase in lighting)

9.3 Soprano pipistrelle

This species is generally considered to be the second most common bat species in Ireland. The species is widespread and is found in all provinces, with particular concentration along the western seaboard. The modelled Core Area for soprano pipistrelle is a large area that covers much of the island of Ireland (62,020km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the soprano pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	0.54 to 1.2 million (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011)*	62,020

Taken from Roche *et al.*, 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Soprano pipistrelles in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosts;
- Renovation or demolition of structures;
- Tree felling; and
- Increasing urbanisation (e.g. increase in lighting).

9.4 Brown long-eared Bat

This species is generally considered to be widespread across the island. The modelled Core Area for Brown long-eared bats is a relatively large area that covers much of the island of Ireland (52,820km^2) with preference suitable areas in the southern half of the island. The Bat Conservation Ireland Irish Landscape Model indicated that the Brown long-eared bat habitat preference is for areas with broadleaf woodland and riparian habitats on a small scale of 0.5km emphasising the importance of local landscape features for this species (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2008-2013 Stable
Estimated Irish Population Size	64,000 -115,000 (2007-2012)
Estimate Core Area (Lundy *et al. 2011)*	49,929 km^2

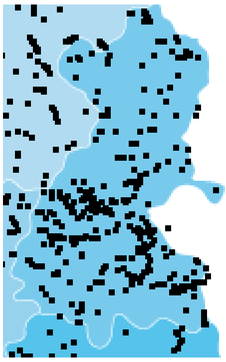
Taken from Roche *et al.*, 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for brown long-eared bats are poorly known in Ireland, but those that are relevant for this survey area are as follows:

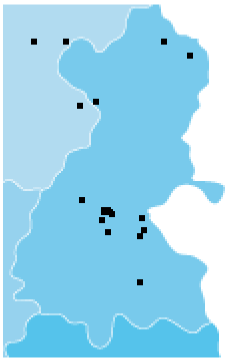
- Selection of maternity sites is limited to specific habitats;
- Lack of knowledge of winter roosts;
- Loss of woodland, scrub and hedgerows;
- Tree surgery and felling;
- Increasing urbanisation; and
- Light pollution.

9.5 Bat Conservation Ireland Bat Species Maps

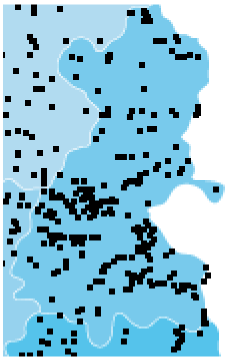
Bat records for County Dublin (Source: www.batconservationireland.org)



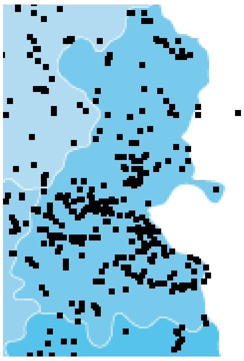
Common pipistrelle



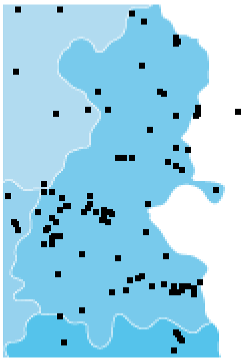
Nathusius' pipistrelle



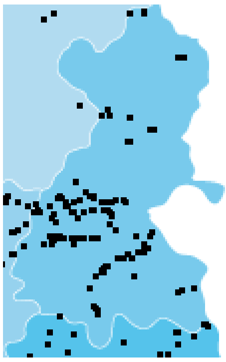
Soprano pipistrelle



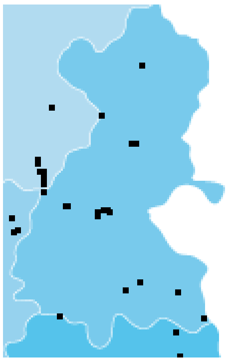
Leisler's bat



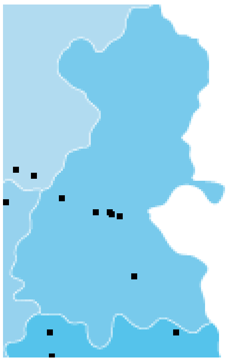
Brown long-eared bat



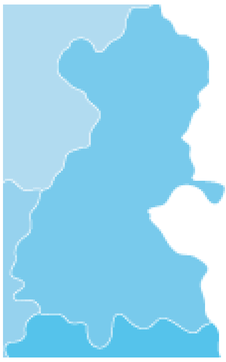
Daubenton's bat



Natterer's bat



Whiskered bat



Lesser horseshoe bat

9.6 Bat Conservation Ireland Bat Landscape Favourability Model

Table 1C: 5km Square Landscape Favourability value for individual bat species.

Bat species	Western 5km Square
Common pipistrelle	45% (Medium to High)
Soprano pipistrelle	55% (High)
Nathusius' pipistrelle	12% (Low to Medium)
Leisler's bat	47% (High)
Brown long-eared bat	39% (Medium to High)
Daubenton's bat	21% (Low to Medium)
Natterer's bat	12% (Low to Medium)
Whiskered bat	21% (Low to Medium)
Lesser horseshoe bat	0%

Appendix D

Balscadden Development, Howth, Co. Dublin

Geotechnical Report

Balscadden GP3 Ltd.

Report No. B1800-GEO-R001
21 March 2022
Revision **05**

MARLET

BYRNELOOBY

IRELAND | UK | UAE | BAHRAIN | KSA

Document Control

Document: Geotechnical Report

Project: Balscadden Development, Howth, Co. Dublin

Client: Balscadden GP3 Ltd.

Report Number: B1800-GEO-R001

Document Checking:

Revision	Revision/ Review Date	Details of Issue	Authorised		
			Prepared By	Checked By	Approved By
05	21 March 2022	Final	NP	MR	MR
04	16 March 2022	Information	NP	MR	MR
03	08 March 2022	Information	NP	MR	MR
02	21 February 2022	Draft	NP	MR	MR
01	04 February 2022	Draft	NP	MR	MR
00	08 November 2021	Draft	NP	POB	MR

Disclaimer: Please note that this report is based on specific information, instructions and information from our Client and should not be relied upon by third parties.

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Contents

1 Introduction

1.1 Summary

ByrneLooby have been requested by Balscadden GP3 Ltd. to provide geotechnical design services for the proposed development at Balscadden Road. The engineer for the scheme is Waterman Moylan Consulting Engineers.

These services include the specimen design of two embedded retaining walls, located along the southern and western elevations. The proposed solution for each of the retaining walls is a secant pile wall with an additional row of buttress piles installed on the southern elevation. The secant pile walls have been designed to serve the following purposes:

- A temporary works element to facilitate the construction of the basement/topographical changes by providing temporary lateral support, accommodating soil, groundwater and any temporary surcharge pressures;
- A permanent works element to support long term lateral soil and surcharge pressures.

The design requirements of the secant pile wall have been determined in accordance with the design principles of *IS EN 1997-1:2004 Eurocode 7: Geotechnical Design – Part 1: General Rules* and with respect to the Irish National Annex to this document which was published in 2005. Guidance, where relevant, will be sought from CIRIA C760 and the ICE Specification for Piling and Embedded Retaining Walls which are recognised by EC7 as non-conflicting complementary information (NCCI). The design of the secant pile walls is subject to construction detailed design.

Additional services include an assessment of ground movements and building impact assessments along the southern, western and northern elevation, where an open cut excavation is proposed to form the basement, an assessment of the change in stresses applied to an existing sewer that runs through the site and an assessment of recommended remedial works along the southeastern elevation. All of the above assessments and designs are subject to construction stage detailed design.

1.2 Limitations

The information, views and conclusions drawn concerning the site are based, in part, on information supplied to ByrneLooby by other parties. ByrneLooby have proceeded in good faith on the assumption that this information is accurate. ByrneLooby accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to ByrneLooby by others.

The designs outlined in this report are subject to a construction detailed design in advance of the construction works.

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1.3 Layout of Report

As outlined above, this report has been produced to outline the geotechnical aspects of the proposed development.

The structure of this report corresponds to the various elements outlined above, and the key tasks summarised below:

- Section 4 describes the ground conditions at the site including a desk based study and a review of the various phases of ground investigation;
- Section 5 describes the design of the Southern Boundary Retaining Wall including a summary of ground movement predictions;
- Section 6 describes the design of the Western Boundary Retaining Wall including a summary of ground movement predictions;
- Section 7 describes the open cut excavation along the northern boundary, required to facilitate the construction of the Block B Basement;
- Section 8 describes the Building Impact Assessment completed on adjacent properties to the proposed Southern Boundary Embedded Retaining Wall, Western Boundary Embedded Retaining Wall and the Northern Boundary open cut excavation;
- Section 9 describes proposed remedial works along the eastern elevation;
- Section 10 covers an assessment of the proposed foundation loadings on the Howth Sewer Tunnel.

1.4 References Used

The following is a non-exhaustive list of technical guidance documentation used on the assessment:

- CIRIA C760 Guidance on Embedded Retaining Wall Design
- Burland, J.B., and Wroth, C.P. (1974) *Settlement of buildings and associated damage*, State of the art review. Conf on Settlement of Structures, Cambridge, Pentech Press, London
- Boscardin, M.D., and Cording, E.G., (1989). *Building response to excavation induced settlement*. J Geotech Eng, ASCE
- Burland, Standing J.R., and Jardine F.M. (eds) (2001), *Building response to tunnelling, case studies from construction of the Jubilee Line Extension London*, CIRIA Special Publication 200.

2 Site Location, Description and Development History

2.1 Site Location

The site is located between Abbey Street and Balscadden Road in Howth, as shown in Figure 2.1, in the north of Howth. The area surrounding the site is a mixture of residential and commercial premises.

Figure 2.1: Site Location (ref. Google Maps)

Balscadden Road is located to the east of the site and Balscadden Bay Beach is located to the east of this. Asgard Park, a residential development of two-storey developments, is located directly to the south of the site. Residential dwellings are located to the west of the site along Abbey Street. Martello Tower is located directly north of the site. North of this are a number of commercial premises on East Pier and north of this is Howth Pier.

2.2 Site Description

The site is partially developed with a former leisure centre and hardstanding area to the middle and north of the site.

There are significant topographical changes across the site, with the site sloping steeply from an elevation of approximately +20m OD across the site to approximately +35m OD to the rear of the sports hall. These topographical changes will require significant earthworks and retaining walls, the design of which are outlined in this report.

Additionally, the historical Howth Sewer Tunnel passes under the site.

Figure 2.2: Topographical Changes Across the site

3 Proposed Development

The proposed development relates to lands located to the south of the Martello Tower on Balscadden Road & the former Baily Court Hotel, Main Street, Howth, County Dublin. The development will consist of the demolition of existing structures on the proposed site including the disused sports building and the former Baily Court Hotel buildings and the construction of a residential development set out in 4 no. residential blocks, ranging in height from 2 to 5 storeys to accommodate 180 no. apartments with associated internal residential tenant amenity and external courtyards and roof terraces, 1 no. retail unit and 2 no. café/retail units. The site will accommodate car parking spaces at basement level and bicycle parking spaces at basement and surface level. Landscaping will include new linear plaza which will create a new pedestrian link between Main St and Balscadden Rd to include the creation of an additional 2 no. new public plazas and also maintains and upgrades the pedestrian link from Abbey Street to Balscadden Road below the Martello Tower. Please see the accompanying Statutory Notices for a more detailed description.

The schedule of accommodation is set out in the Table below.

Table 3.1: Schedule of Accommodation

Apartment Type	1 - Bed	2 - Bed	3 - Bed	Studio	**Total**
Block A	-	2	-	-	2
Block B	51	57	18	-	126
Block C	8	28	7	-	43
Block D	3	2	-	4	9
Total	62	89	25	4	180

The proposed development and blocks are shown in Figure 3.1.

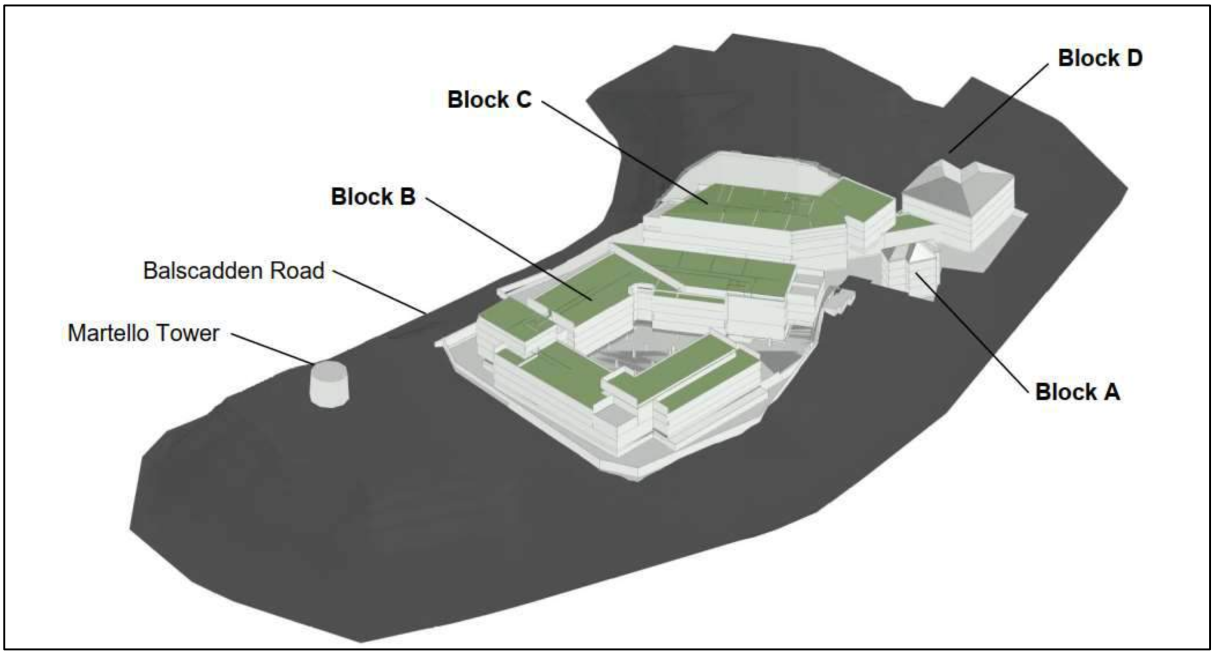


Figure 3.1: Proposed Development

As shown in the Figure above, it is proposed to reduce ground levels throughout the site. To allow this, retaining walls will be required in the south and west of the site.

In the south of the site, ground level will be reduced from +35m OD to a SSL of +24.3m OD.

4 Ground Conditions

4.1 Desk Study

ByrneLooby have carried out a desk-based study to establish the quaternary and bedrock geology and the hydrogeology. The following sources were consulted during the desk-based study:

The Geological Survey of Ireland (GSI) online data set public viewer to find:

- Bedrock Map 1:100,000
- Quaternary Sediments Map
- Historical Ground Investigation

4.1.1 Bedrock Geology

The GSI generalised 1:100,000 bedrock map shown in Figure 4.1 identifies the bedrock at the north of the site to be The Ballysteen Formation, while the bedrock in the south of the site is identified as the Elsinore Formation. A fault runs through the site in an east to west direction.

The Ballysteen Formation is described as irregularly bedded and nodular bedded argillaceous limestones with calcareous shales, while the Elsinore Formation is described as a polymict melange of quartzite, greywacke, siltstone, mudstone and sandstone.

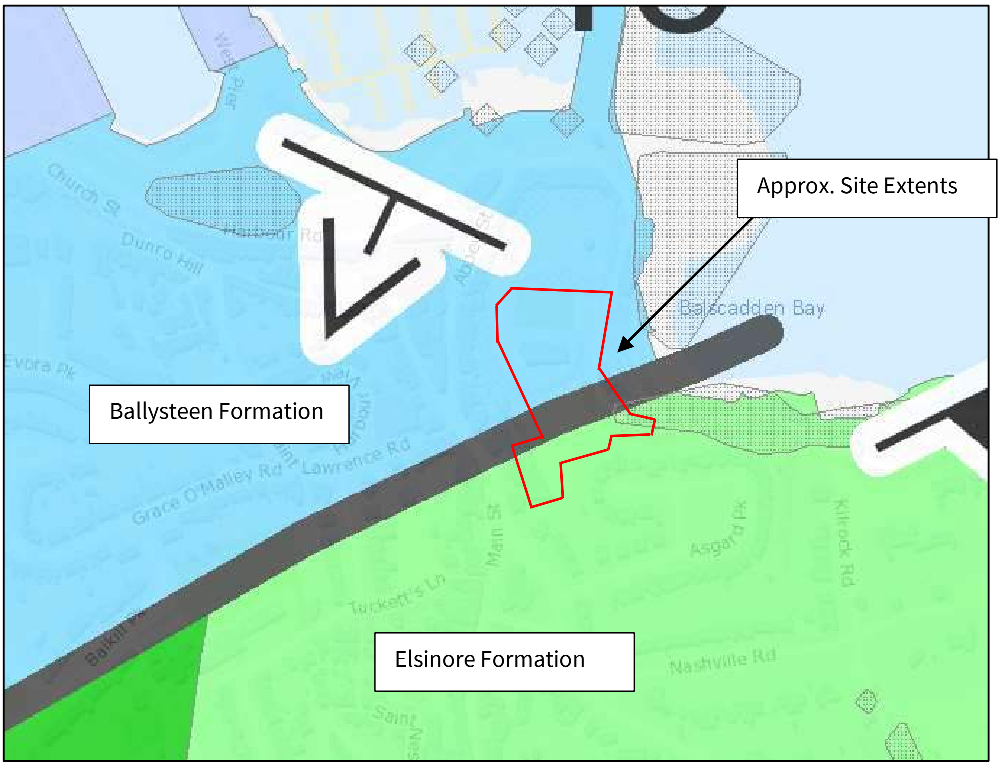


Figure 4.1: Bedrock Geology 1:100,000 Map (ref. GSI)

4.1.2 Quaternary Sediments

The GSI Quaternary Sediments map, Figure 4.2, identifies Gravels derived from Limestones throughout the site. The area to the south is identified as Till derived from Limestones and the area to the west is identified as Gravels derived from Lower Palaeozoic sandstones and shales.

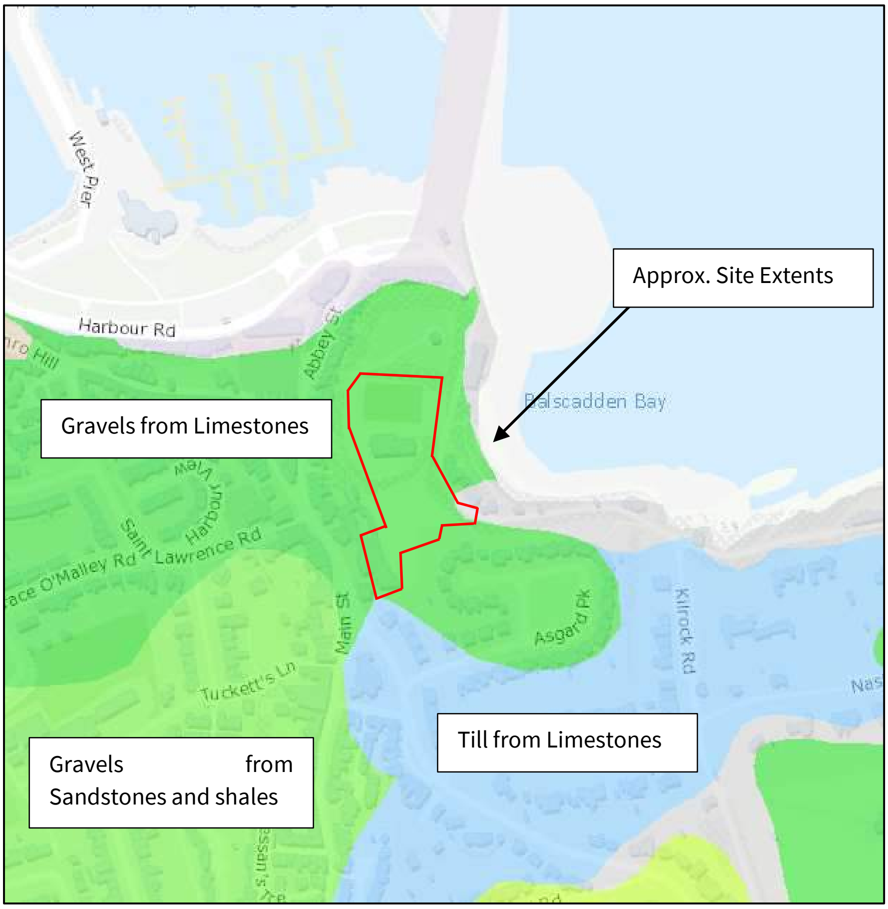


Figure 4.2: Quaternary Sediments Map (ref. GSI)

4.1.3 Historical Ground Investigations

Consultation of the GSI website has been carried out to review historical exploratory holes carried out in the vicinity. This has been shown in Figure 4.3.

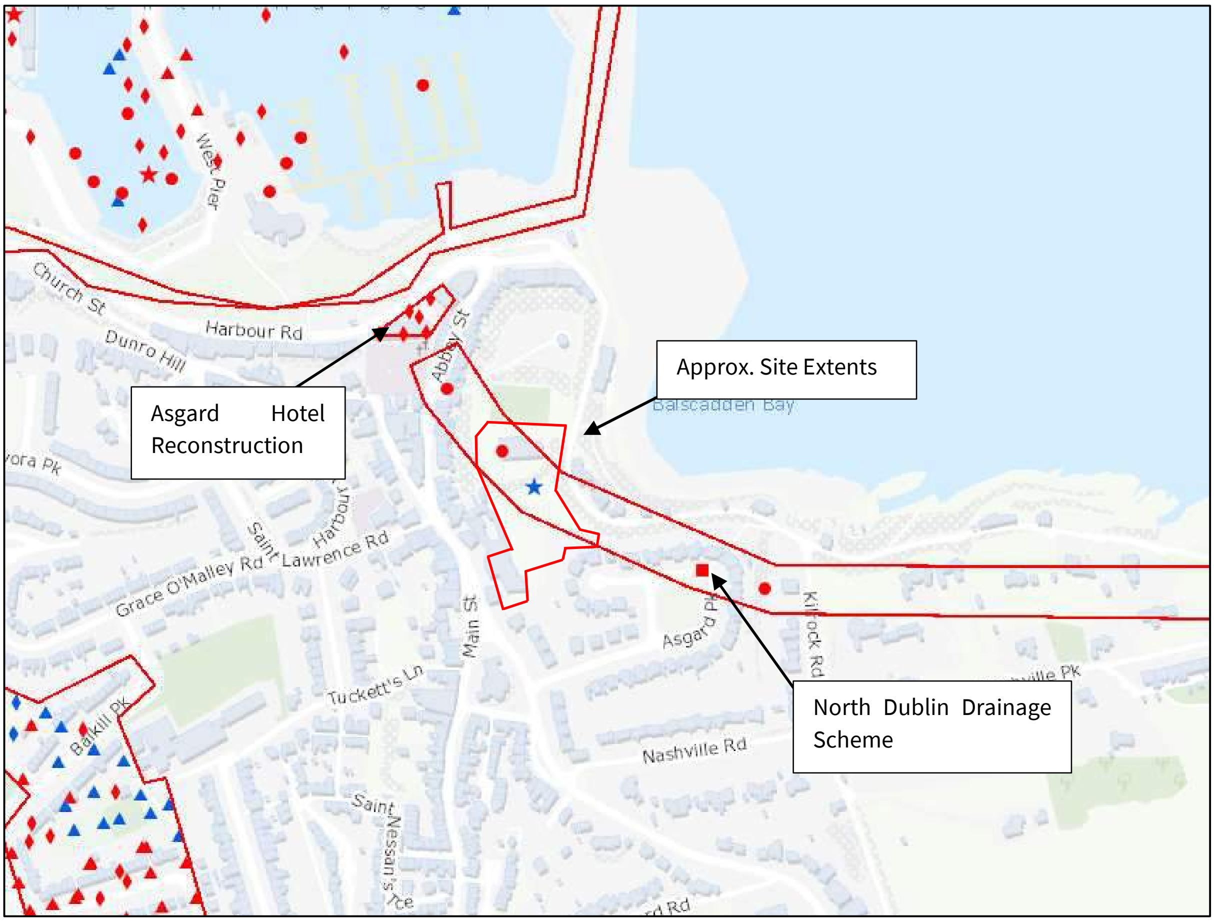


Figure 4.3: Historical SI

The boreholes completed on the site as part of the North Dublin Drainage Scheme encountered ground conditions comprising GRAVEL overlying CLAY overlying LIMESTONE Bedrock.

4.2 Site Specific Ground Investigations

The following site specific ground investigations carried out at the site have been made available to ByrneLooby for review:

- Site Investigations Ltd., Balscadden Howth, Dublin 13, Site Investigation (July 2021)
- Site Investigations Ltd., Balscadden Howth, Dublin 13, Site Investigation (November 2017)
- Ground Investigations Ireland., Balscadden Howth Ground Investigation Report (November 2017)
- Site Investigations Ltd., Howth – Cluxton Site Investigation (July 2015)

4.2.1 Site Investigations Ltd, Balscadden Howth – 2021

Site Investigations Ltd. completed a ground investigation with fieldwork taking place in July 2021. The ground investigation consisted of:

- 3No. Cable Percussion Boreholes to a depth of 17.2m bgl;
- 3No. Trial Pits; and
- Geotechnical Laboratory Testing.

The exploratory hole plan is shown as Figure 4.4.

Figure 4.4: Site Investigation 2021 Exploratory Hole Plan

4.2.2 Site Investigations Ltd, Balscadden Howth - 2017

Site Investigations Ltd. completed a ground investigation with fieldwork taking place in September and October 2017. The ground investigation consisted of:

- 1No. Cable Percussion Borehole to a depth of 20m bgl; and
- Geotechnical Laboratory Testing.

The exploratory hole plan is shown as Figure 4.5.

Figure 4.5: Site Investigation 2017 Exploratory Hole Plan

4.2.3 Ground Investigations Ireland, Balscadden Howth – 2017

Ground Investigations Ireland completed a ground investigation with fieldwork taking place in November 2017. The ground investigation consisted of:

- 3No. Trial Pits
- 3No. Soakaways

The exploratory hole plan is shown as Figure 4.6.

Figure 4.6: Ground Investigations Ireland 2017 Exploratory Hole Plan

4.2.4 Site Investigations Ltd, Balscadden Howth - 2015

Site Investigations Ltd. completed a ground investigation with fieldwork taking place in July 2015. The ground investigation consisted of:

- 4No. Trial Pits
- 4No. Boreholes
- Geotechnical Laboratory Testing.

The exploratory hole plan is shown as Figure 4.7.

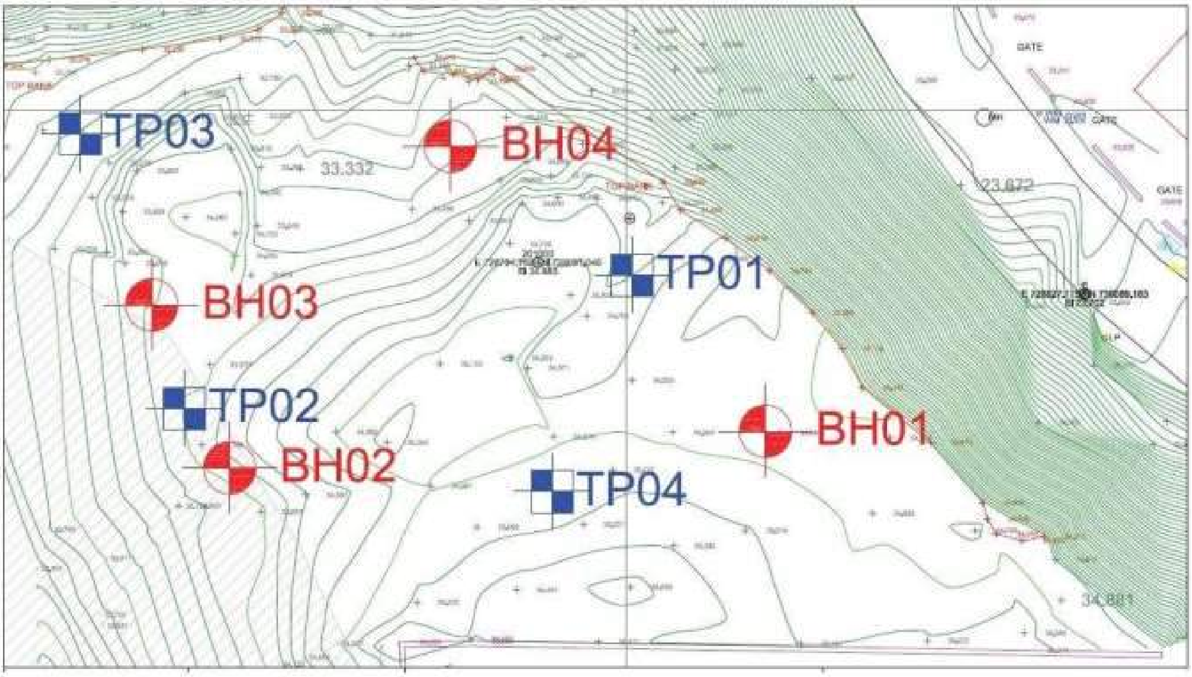


Figure 4.7: Site Investigation 2015 Exploratory Hole Plan

4.3 Ground Conditions

The ground conditions encountered during the ground investigations generally comprised Topsoil overlying medium dense SAND overlying very stiff CLAY. A 1.2m thick layer of stiff CLAY was encountered underlying the topsoil in BH-GDG-01 (Site Investigations 2017).

The medium dense SAND was described as medium dense silty very gravelly SAND with bands of sandy gravel. The very stiff CLAY was described as very stiff slightly sandy slightly gravelly silty CLAY.

Bedrock was not proven in any of the boreholes.

4.4 General Ground Profiles

The following ground profiles have been used as part of the design of the various elements.

Table 4.1: Design Ground Profile 1 – Southern Extents

Strata	Depth (m bgl)	Elevation (m OD)	Thickness (m)
Medium Dense SAND	0	+35.0*	19.5
Very Stiff CLAY	19.5	+15.5	N/A

*Ground Level varies

Table 4.2: Design Ground Profile 2 – Northern Extents

Strata	Depth (m bgl)	Elevation (m OD)	Thickness (m)
Loose to Medium Dense SAND/ GRAVEL	0	+20.0	6.0
Medium Dense SAND	6.0	+14.0	4.0
Very Stiff CLAY	10.0	+10.0	N/A

Table 4.3: Design Ground Profile 3 – Western Extents

Strata	Depth (m bgl)	Elevation (m OD)	Thickness (m)
Loose to Medium Dense SAND/ GRAVEL	0	+27.5	2.5
Medium Dense SAND	2.5	+25.0	12.0
Very Stiff CLAY	17.5	+10.0	N/A

4.5 Groundwater

Groundwater strikes were not encountered in any of the boreholes completed as part of the previous phases of investigation.

As part of the 2017 investigation, a groundwater installation was installed into BH-GDG-01 with four groundwater monitoring visits completed in October 2017. However, the installation was dry on each visit.

Minerex were engaged to prepare a Hydrogeological Assessment Report for the proposed development. This assessment included groundwater monitoring through a combination of manual measurements and continuous monitoring with the use of data loggers. As outlined in their report, included as Appendix B, Borehole BH-GDG-01 was dry throughout the monitoring period. The recorded groundwater levels in BH01 and BH02 are shown as Figure 4.8.

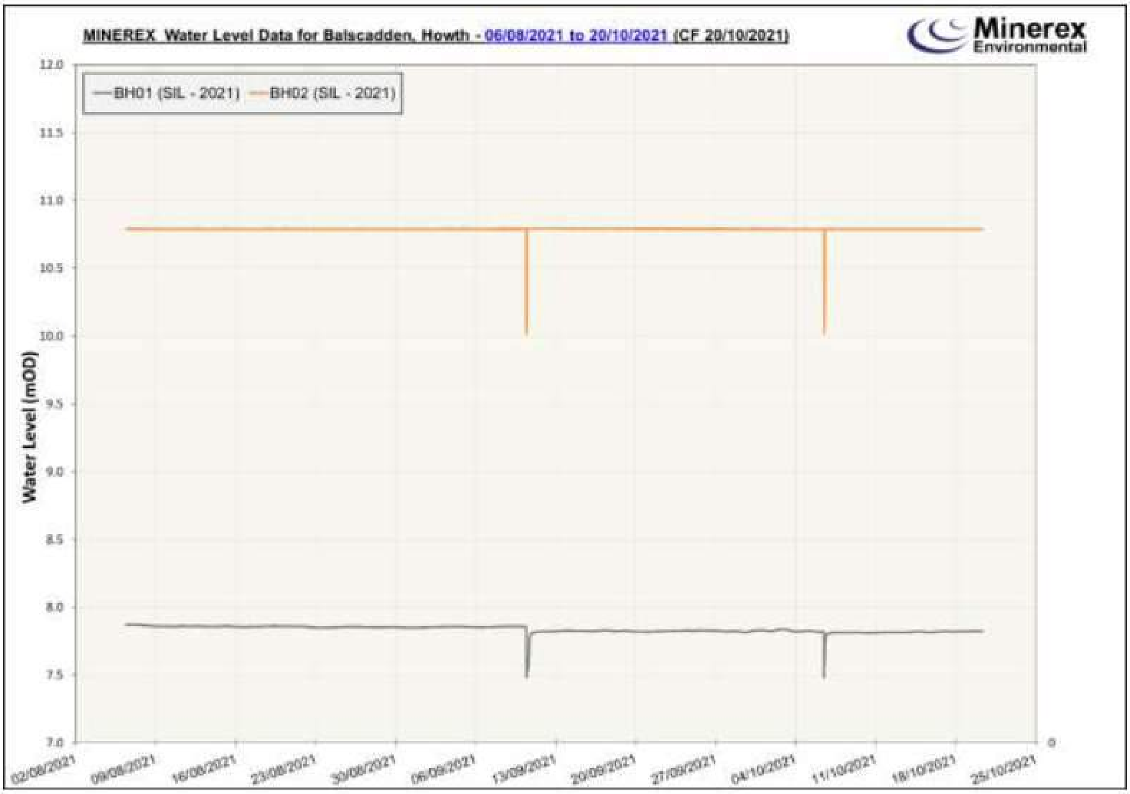


Figure 4.8: Groundwater Monitoring

Based on the above groundwater monitoring, a conservative groundwater level of 12m OD has been proposed as a design groundwater level.

Further information regarding groundwater levels can be found in Appendix B.

4.6 Soil Testing

4.6.1 Standard Penetration Testing (SPT)

The SPT ‘N’ values have been plotted against elevation. These have been split out into two separate plots based on the topographical changes across the site and are shown in Figure 4. and Figure 4.. The characteristic soil parameters can be estimated by correlating the SPT ‘N’ values recorded in the boreholes with various soil parameters, based on published relationships.

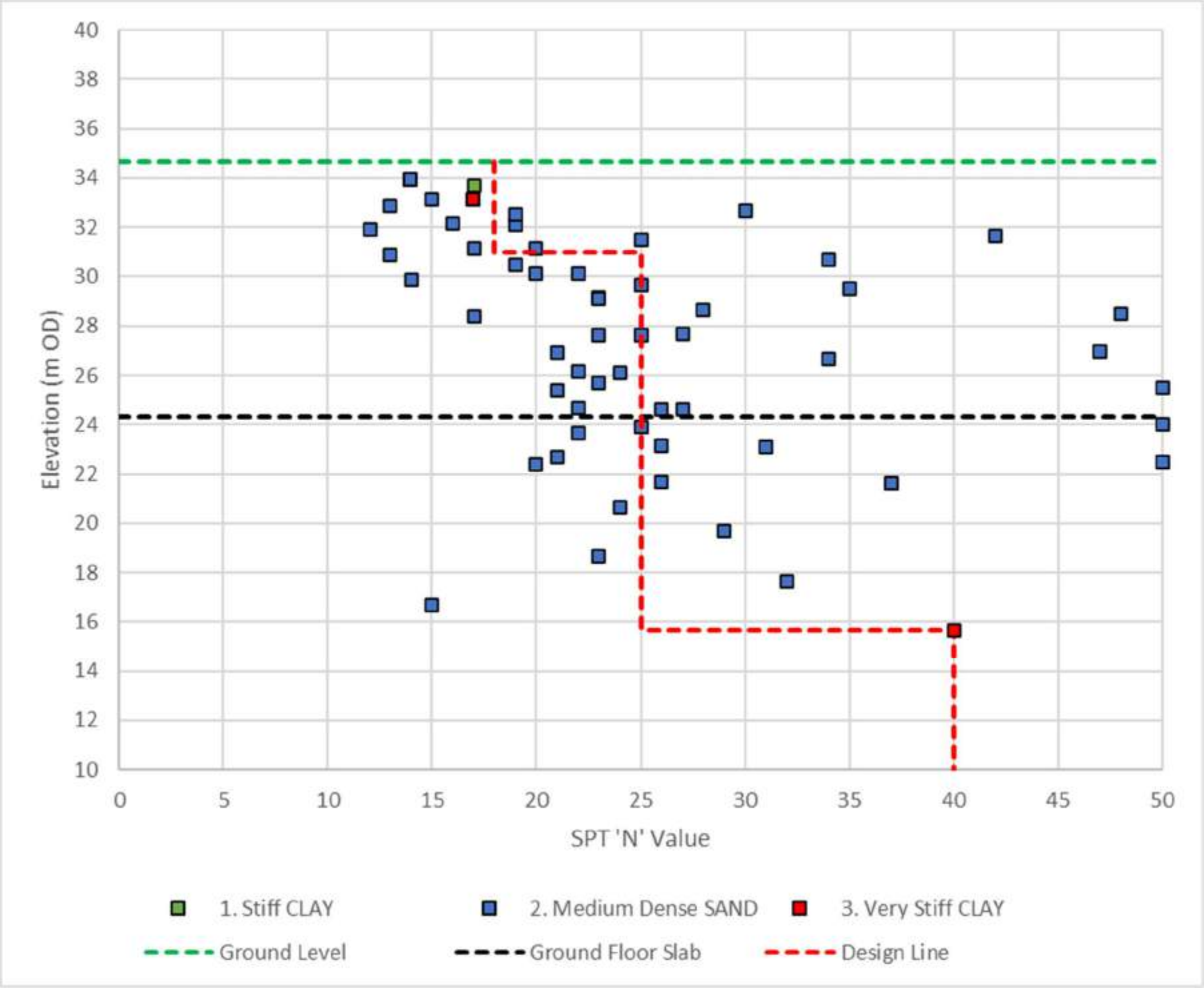


Figure 4.9: SPT Data – Southern Elevation

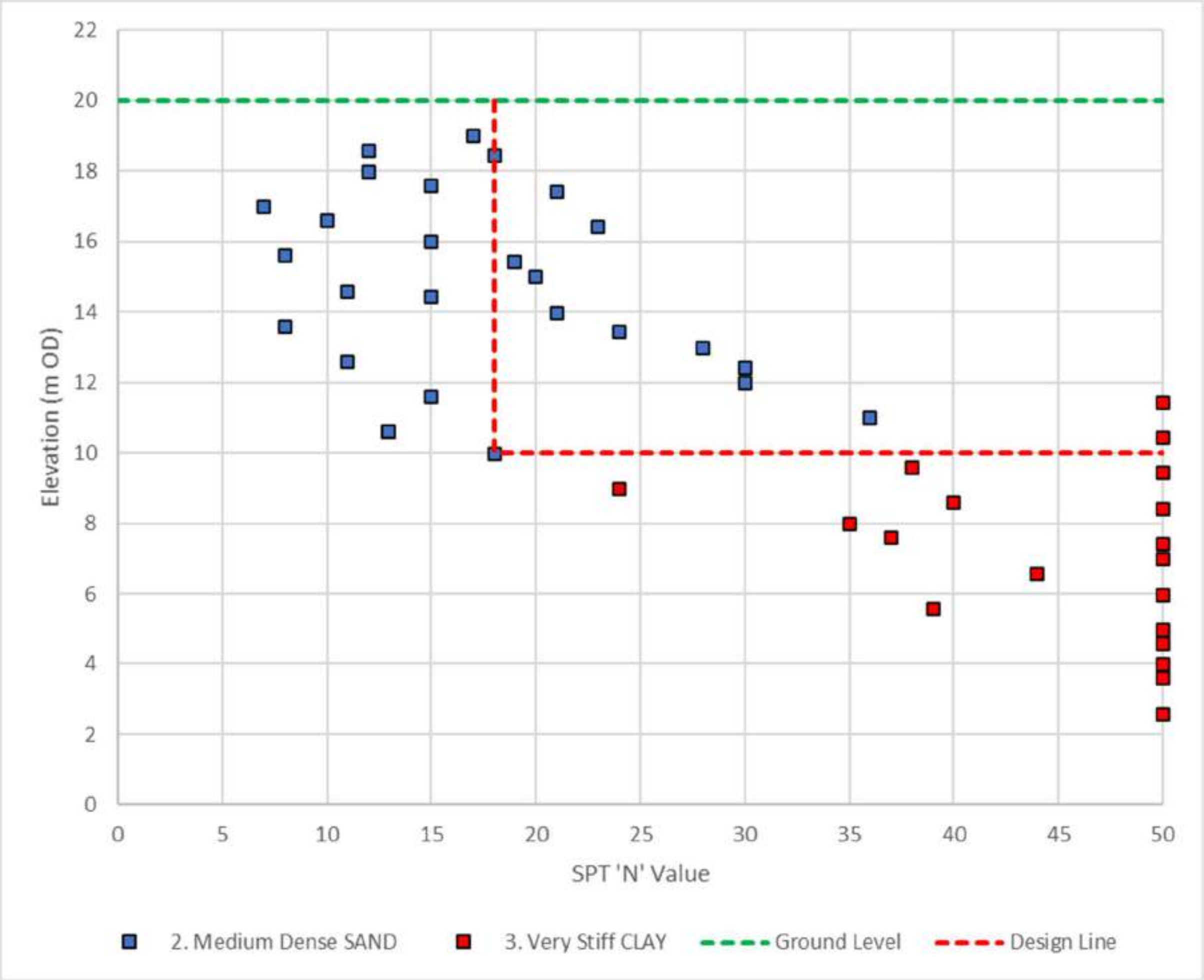


Figure 4.10: SPT Data – Northern Elevation

The following correlations were made:

- The internal angle of friction of the granular materials can be calculated after the relationship published by Peck, with Figure 4. below detailing Peck's relationship between SPT 'N' values and the angle of shearing resistance.

- The undrained shear strength of the cohesive material can be calculated based on the Stroud correlation, $C_u = f_1N$, shown in Figure 4.. The parameter f_1 is related to the plasticity index of the material. In the absence of Atterberg limit tests, f_1 is to be taken as 5.

- The stiffness of cohesive soils can also be approximated using relationships as set out in CIRIA C760. The soil stiffness modulus is based on 600 × C_u for the undrained case and 66% of this value for the drained case. For granular soils, the stiffness has been taken as 2000 × 'N'.

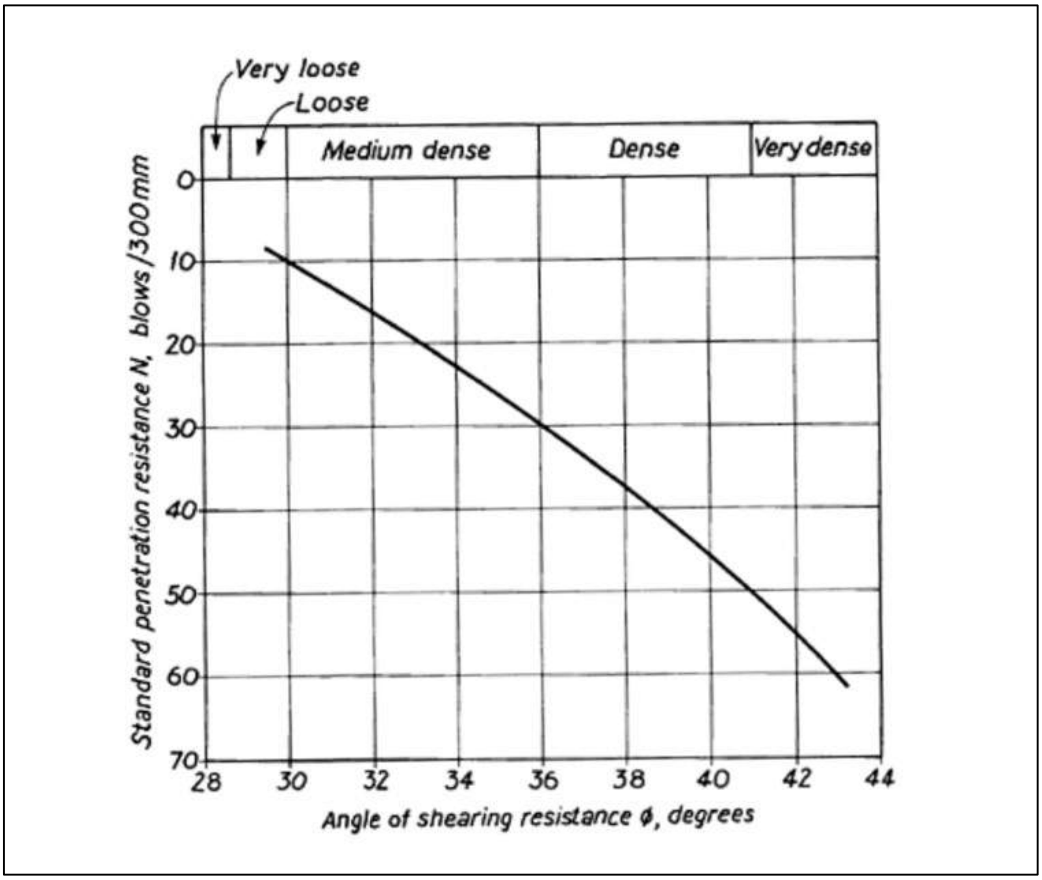


Figure 4.11: Peck's Relationship between SPT 'N' and angle of Shearing Resistance

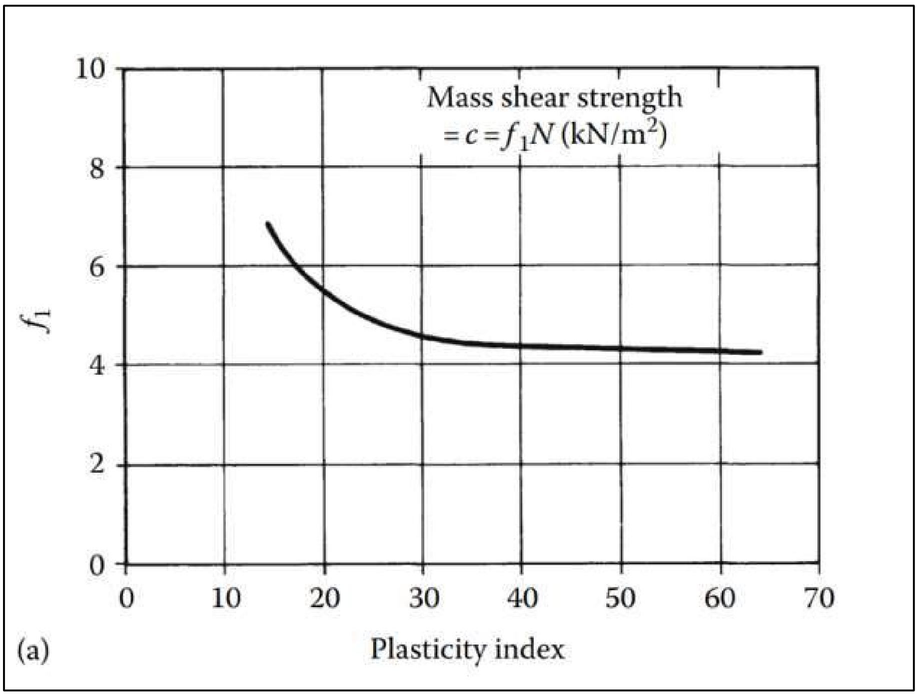


Figure 4.8: Stroud's (1975) Relationship between SPT 'N' and undrained shear strength.

4.6.2 Particle Size Distribution Tests (PSDs)

A series of particle size distribution tests were completed as part of the various phases of investigation. The results of the tests are summarised in Figure 4.9.

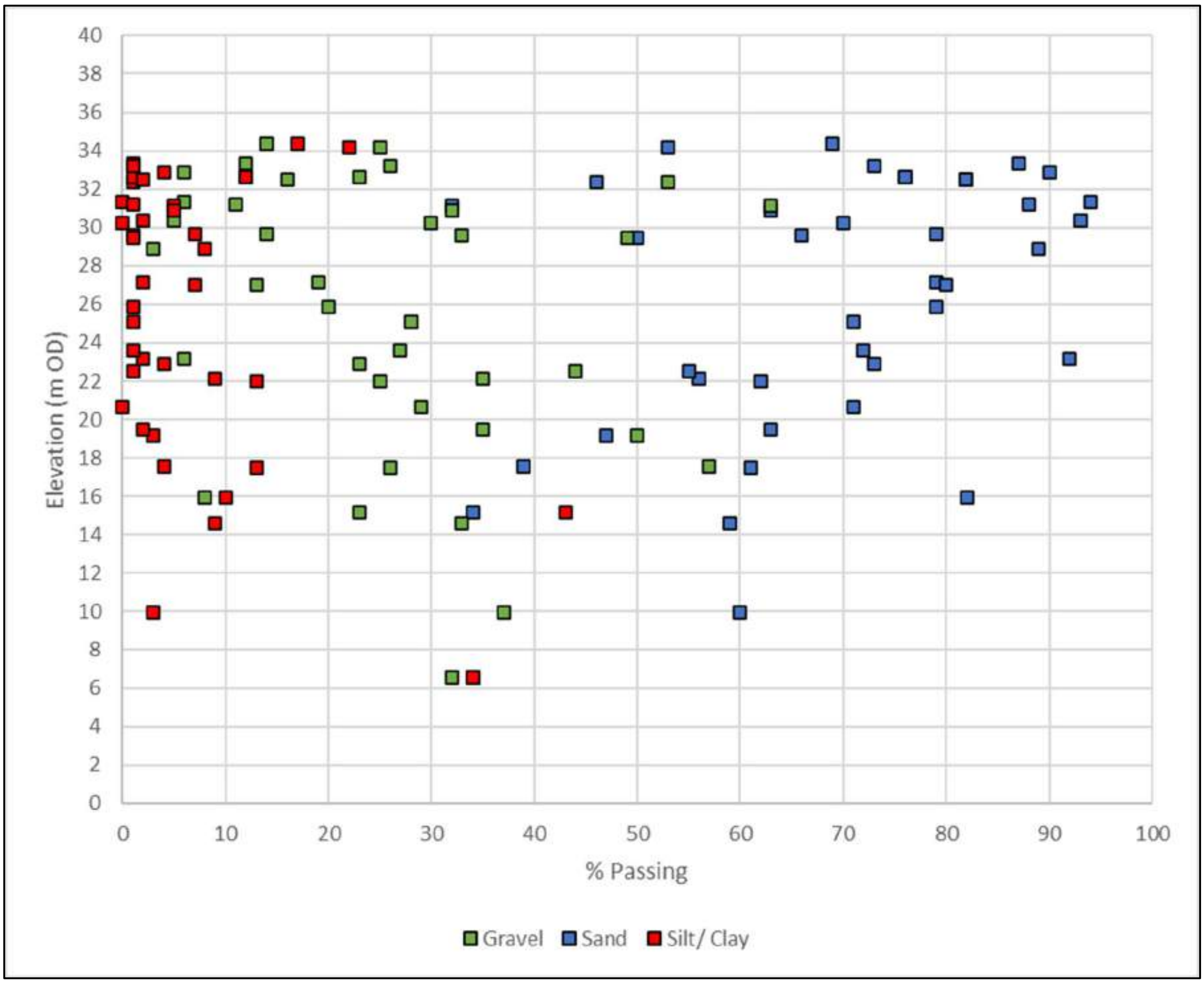


Figure 4.9: Particle Size Distribution Test Results

4.7 Characteristic Geotechnical Parameters

Based on the interpretation of the above ground investigation data, the following characteristic geotechnical parameters have been calculated and used in the subsequent analysis.

Table 4.4: Characteristic Geotechnical Parameters

Strata	SPT 'N'	γ (kN/m^3)	ϕ' (Degrees)	c' (kPa)	c_u (kPa)	E' (MPa)	Eu (MPa)
Medium Dense SAND 1	18	18	32	-	-	35	-
Medium Dense SAND 2	25	18	34	-	-	50	-
Very Stiff CLAY 1	40	19	38	-	200	80	120
Very Stiff CLAY 2	50	19	38	-	250	100	150

5 Southern Boundary Retaining Wall

5.1 Summary

Based on significant elevation changes across the site, a retaining wall will be required along the southern elevation. An indicative section is shown as Figure 5.1 and proposed layout shown as Figure 5.2. The proposed retaining wall solution is a secant pile wall with additional buttress piles installed to the rear of the secant pile wall to limit pile wall deflections.

The secant pile wall is to be supported in the permanent condition by the ground floor slab. Although a step is shown in the below section, it is understood that the slab will be continuous from Block C at a level of +24.3mOD. In the temporary condition raking props will be installed. The SSL of the basement slab is +24.3m OD and is 500mm thick. Based on this the design has been based on a formation level of +23.7m OD.

The basement of Block C is to be formed by additional temporary works such as an embedded retaining wall. This is to be completed rather than an open cut excavation so as to maintain the passive resistance of the secant pile wall. The proposed offset from the secant pile wall to the Block C basement is in the order of 15m.

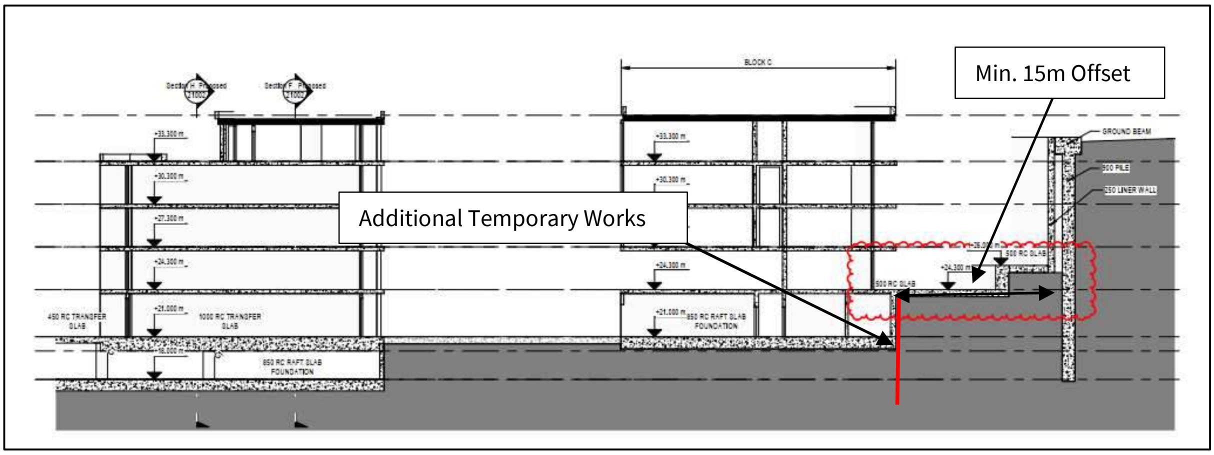


Figure 5.1: Southern Boundary Indicative Section

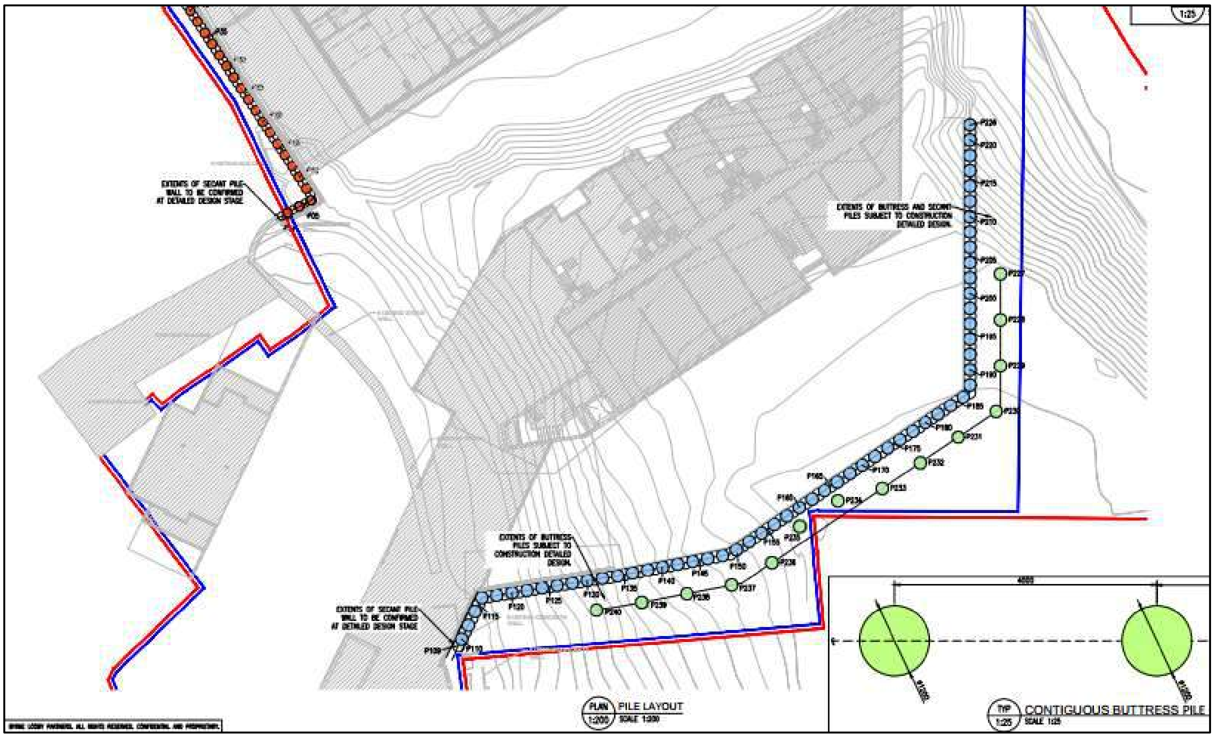


Figure 5.2: Proposed Secant Pile Wall Layout

5.2 Wall Sections

The secant pile wall has been designed based on the following pile arrangement, in a hard-firm pile arrangement:

- 1,200mm diameter reinforced male piles, installed at 1,500mm centres;
- 1,200mm diameter unreinforced female piles, installed at 1,500mm centres;
- 1,200mm diameter reinforced buttress piles, installed at 4,500mm centres offset at 3m from the secant pile wall.

The buttress piles have been modelled as being connected with the secant pile wall by a capping beam (with fixity against rotation at the pile heads). The buttress piles act in tension and bending to limit the lateral movement of the secant pile wall.

The ground level along the secant pile wall elevation varies to a maximum level of approximately +35m OD. Based on this, one wall section has been analysed based on the maximum retained height (11.3m in the temporary case). Where the ground level reduces along the west of the wall, a refinement of the design may be completed during the detailed construction design, which will reduce the number of buttress piles.

5.3 Pile Installation Level

The secant pile wall is to be installed from existing ground levels (approximately +35m OD). A suitable piling platform and access to the piling locations will need to be constructed in advance of piling works. This level will be stepped where ground level reduces along the secant pile wall alignment.

5.4 Construction Sequence

The following construction sequence has been modelled in the design of the secant pile wall section for the southern elevation:

1. Construct piling platform and form suitable access for piling rig;
2. Install buttress piles;
3. Install female unreinforced secant piles to design toe lengths;
4. Install male reinforced secant and buttress piles to design toe lengths;
5. Complete initial excavation and construct capping beam;
6. Excavate to underside of temporary prop;
7. Install temporary raking prop and construct thrust blocks;
8. Excavate to formation;
9. Install additional temporary works and construct basement;
10. Construct ground floor slab extending to secant pile wall;
11. Remove temporary raking prop, following approval from structural engineer;
12. Construct crib wall or architectural feature in front of secant pile wall.

Please note the crib wall (or architectural feature) is proposed for architectural purposes and is not designed to provide any additional passive restraint.

5.5 Surcharge

A uniformly distributed variable load of 10kPa over the entire ground surface from the rear face of the retaining wall has been adopted. As per CIRIA C760, this accounts for normal vehicle traffic and for plant up to 30 tonne loaded weight, and is considered conservative.

An additional load case has been carried out to assess the condition whereby the adjacent properties have constructed a development at the end of their gardens in the long-term conditions, within 10m of the secant pile wall. This has been modelled as a strip load over a foundation width of 1m and a load of 100kN/m^2.

However, based on the results the load case where the 10kPa UDL is applied is considered the most onerous case.

5.6 Support

The analysis has been based on a temporary prop being installed at an elevation of +32.5m OD. Following excavation to formation, it is proposed to extend the ground floor slab to support the secant pile wall in the permanent condition. The ground floor slab is shown at an elevation of +24.3m OD.

Following the construction of the secant pile wall, an architectural wall, crib wall or gabion wall etc, is to be constructed in front of the piles. The additional benefit of this support has not been considered in the design of the secant pile wall.

5.7 Groundwater

Based on the findings of the hydrogeological assessment, completed by Minerex, a groundwater level of 12m OD has been used in the analysis.

As per CIRIA C760, when determining groundwater pressures the designer should check the following have also been considered:

- Change to water pressures due to long term climatic variations

Additionally, the designer should determine water pressures representing the most unfavourable values, which could occur in:

- Extreme or accidental circumstances at each of the wall's construction sequence and throughout its design life. An example of an extreme or accidental event may be a burst water main close to the wall.

To account for the above cases, the following measures have been included in the design:

- Firm piles to only extend to 1m below formation. This will allow groundwater flow between the male piles below formation.

- Construction of weep holes through the female piles. Weep holes are to consist of pipes (typically 50mm diameter) through an enlarged opening (in the order of 90mm diameter), with the annulus sealed. A filter stocking is to be installed around the pipe to prevent any migration of fines which could cause additional settlement.

In the analysis, groundwater has been taken as +12m OD. An accidental case, whereby groundwater rises to +22m OD and a minimum equivalent fluid pressure (MEFP) over the full height of the wall has also been considered in the long-term stage (ie. Following construction of slab).

5.8 Pile Wall Stiffness

The stiffness of the pile wall is calculated based on the recommendations provided within CIRIA C760, from the formula K=0.7 x (EI/s) for the short-term stiffness per meter of the wall.

E is the short-term young's modulus of concrete, taken as $30x10^6$ kN/m^2 for the hard piles and $20x10^6$ kN/m^2 for the firm piles (for C8/10 concrete). I is the second moment of area of the piles and s is the centre to centre spacing of the piles. The factor of 0.7 accounts for shrinkage and cracking of the concrete over a short-term period. A factor of 0.5 accounts for the long-term shrinking and cracking effect.

The calculated stiffness values are shown in Table 5.1.

Table 5.1: Southern Boundary Secant Pile Wall Stiffness Values

Wall Type	Pile Type	Design Short Term EI (kNm²/m)	Design Long Term EI (kNm²/m)
Southern Boundary Secant Pile Wall	1,200mm Hard Piles @ 1,500mm c/c	1,425,026	1,017,876
	1,200mm Firm Piles @ 1,500mm c/c	64,960	-
	1,200mm Hard Piles @4,500mm c/c (Buttress)	475,009	339,292
	Combined Stiffness per m run	**1,964,995**	**1,357,168**

5.9 Standards and Software

The geotechnical design of the retaining wall has been carried out in accordance with IS EN 1997-1:2005 Eurocode 7: Geotechnical design – Part 1: General Rules and with respect to the Irish National Annex to this document (INA-EC7), which was published in 2007. The recommendations of CIRIA C760 are also considered. The structural design has been carried out in accordance with IS EN 1992-1-1:2005 and the Irish National Annex.

The Oasys software package FREW has been used to calculate the required minimum toe level and loads of the piled wall. A finite element model analysis has been carried out using the Plaxis 2D software to calculate expected displacements.

The adjacent basement excavation (to be constructed with additional temporary works) has been modelled conservatively in FREW as a sloped batter from the initial excavation level, while in Plaxis the additional temporary works have been modelled as sheet piles to account for any reduction in passive resistance.

5.10 Design Limit States

An Ultimate Limit State (ULS) design has been completed in accordance with IS EN 1997 to assess the stability and loads on the wall. Calculations for Design Approach 1 Combination 1 and Design Approach 1 Combination 2 have been completed as allowed in the Irish National Annex. A serviceability limit state (SLS) analysis has also been carried out to assess likely wall deflections. The following partial factors have been applied as outlined in Table 5.2.

Table 5.2: EC7 Loading Combination and Partial Factors

Limit State / Parameter	ULS C1 Analysis	ULS C2 Analysis	SLS Analysis
Angle of Friction (applied to tan ϕ‘)	1.00	1.25	1.00
Effective Cohesion	1.00	1.25	1.00
Undrained Shear Strength	1.00	1.40	1.00
Soil Stiffness	1.00	1.00	1.00
Reduction in Level of Resisting Ground	Excluded*	Excluded*	Excluded
Passive Softening	Excluded	Excluded	Excluded
Factor on Effects of Surcharge (Variable) Actions	1.11	1.30	N/A
Factor on Effects of Soil and Water Actions	1.35	1.00	N/A

*No allowance for overdig has been included in the ULS analysis. As a result, careful management of the excavation works by the contractor will be required.

5.11 ULS Analysis Results

The results of the ULS analysis are summarised in Table 5.3.

Table 5.3: ULS Analysis Results

Wall Type	Pile Bending Moment (kNm/m Run)		Pile Shear Force (kN/m Run)		Min. Male Pile Toe Level for Stability (m OD)
	ULS C1 Bending	ULS C2 Bending	ULS C1 Shear	ULS C2 Shear	
Southern Boundary Secant Pile Wall	1,453	1,430	385	383	17.0

5.12 SLS Analysis Results

A SLS analysis has been completed using the Finite Element Analysis software Plaxis 2D. The results of the short term analysis are shown as Figure 5.3 and Figure 5.4, with the long term analysis shown in Figure 5.5 and Figure 5.6, which shows pile head movement of less than 40mm.

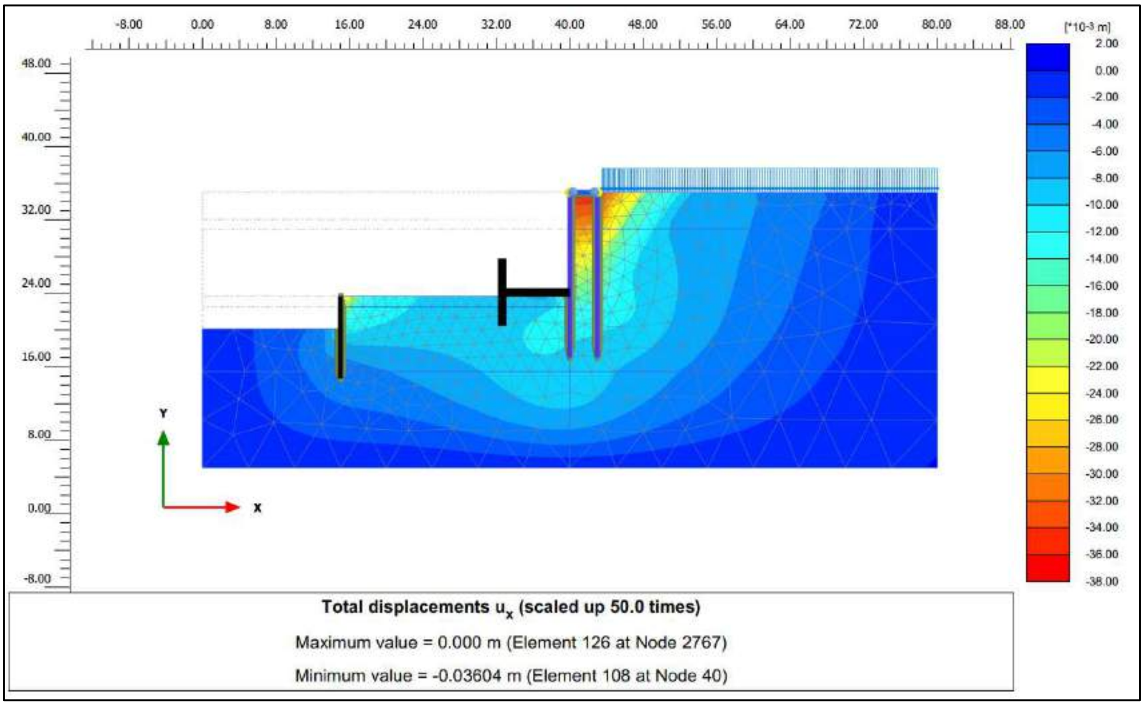


Figure 5.3: Southern Elevation Short Term Horizontal Movement

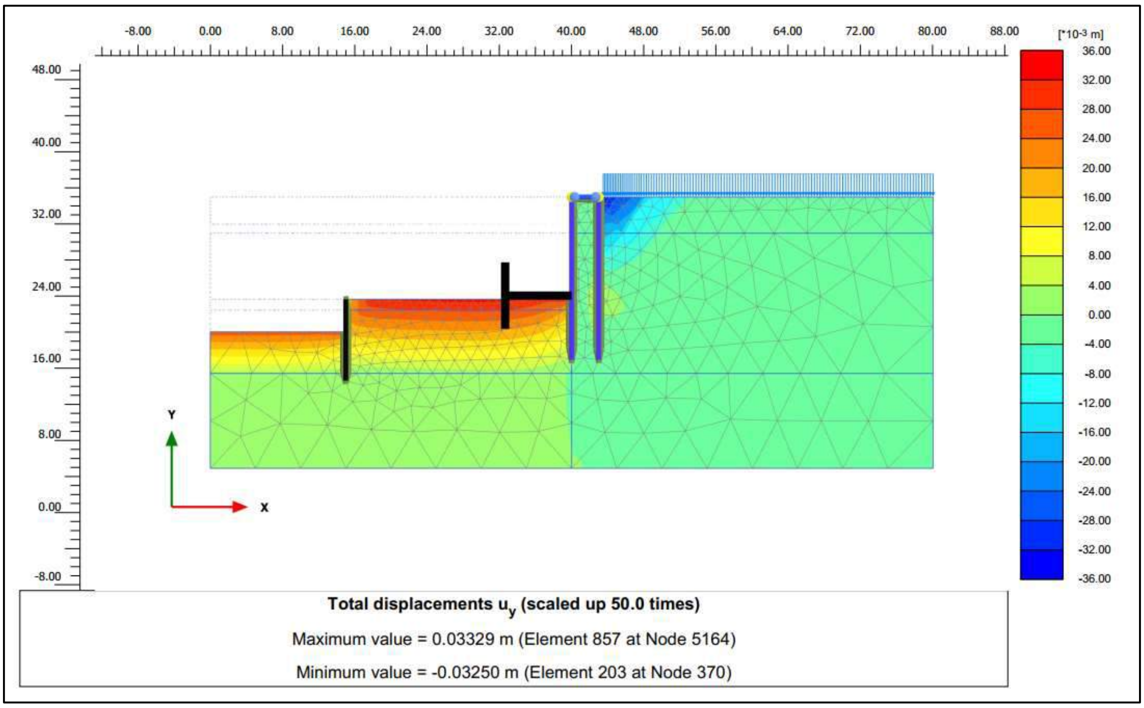
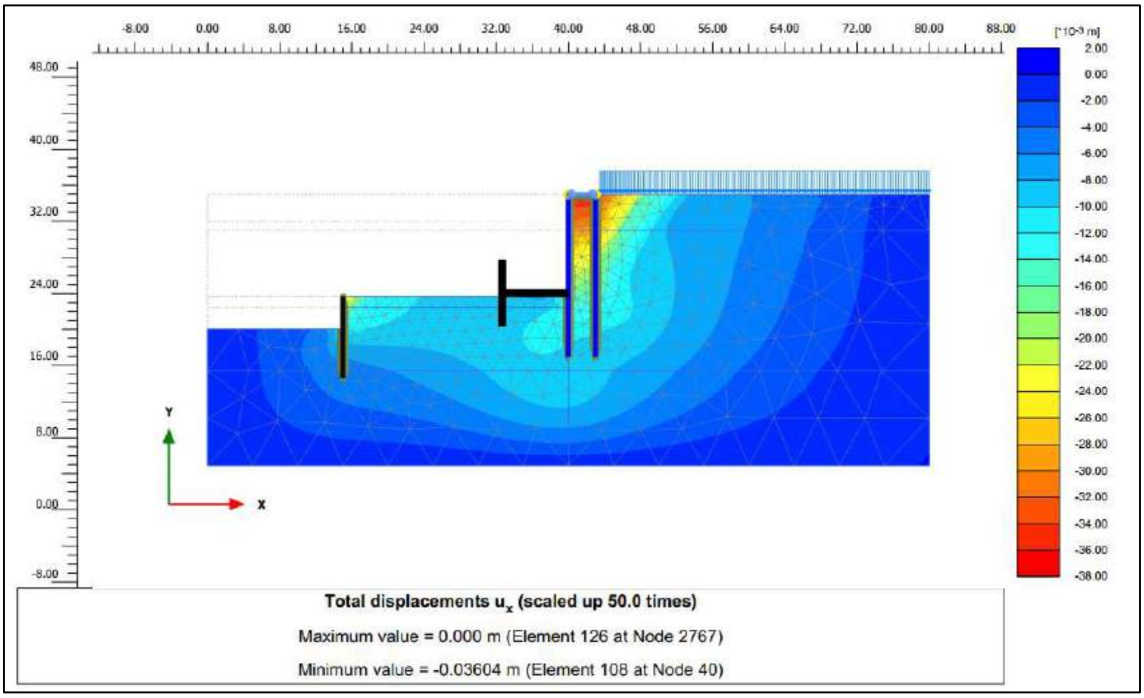


Figure 5.4: Southern Elevation Short Term Vertical Movement

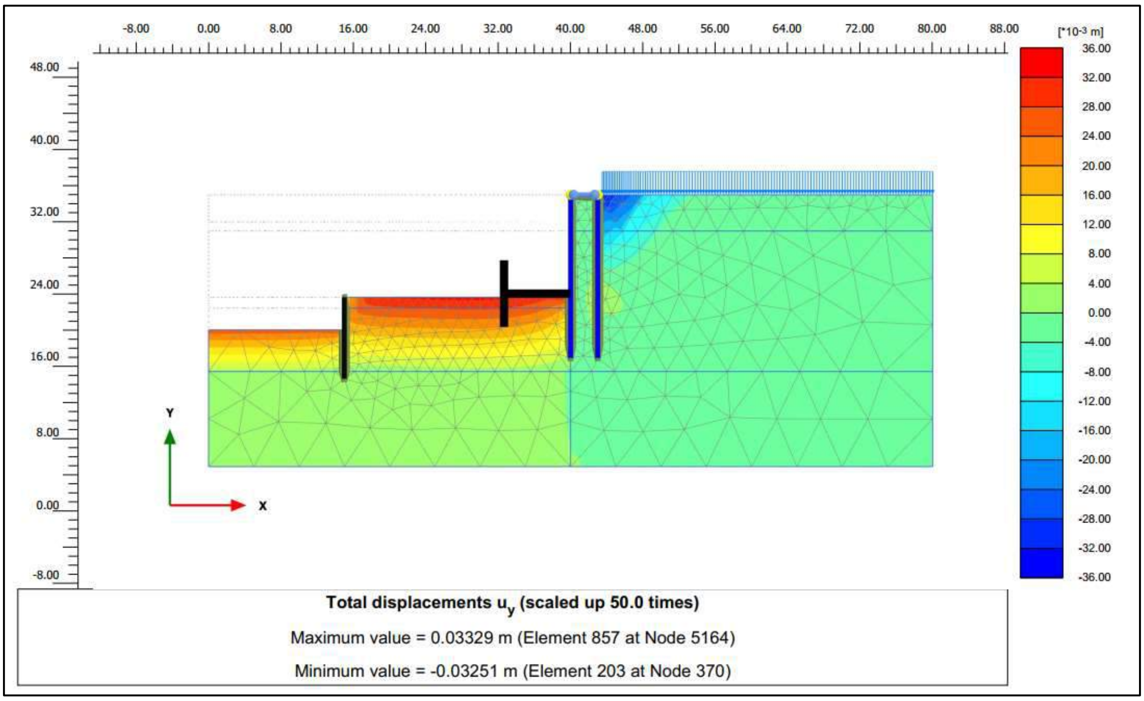


Total displacements u_x (scaled up 50.0 times)

Maximum value = 0.000 m (Element 126 at Node 2767)

Minimum value = -0.03604 m (Element 108 at Node 40)

Figure 5.5: Southern Elevation Long Term Horizontal Movement



Total displacements u_y (scaled up 50.0 times)

Maximum value = 0.03329 m (Element 857 at Node 5164)

Minimum value = -0.03251 m (Element 203 at Node 370)

Figure 5.6: Southern Elevation Short Term Vertical Movement

5.13 Ground Movement Assessment

An assessment of the ground movements and a building damage assessment has been carried out and is outlined in Section 9.

5.14 Main Reinforcement

ByrneLooby have carried out an assessment of the required main reinforcement in accordance with IS EN 1992-1-1:2004, based on the bending moments detailed above. This has calculated that a minimum area of steel of 1.3% for the secant piles and 1.3% for the buttress piles.

The above assessment is considered conservative and may be refined during the construction detailed design.

5.15 Monitoring Methodology

Movement and vibration monitoring shall be implemented for the works as follows:

5.15.1 Vibration Monitoring

The use of a secant pile wall with installation by CFA/Bored piling techniques has the advantage over sheet pile installation as vibration of the sheet piles can cause densification of coarse-grained soils close to the piles which in turn can cause ground surface settlement.

Vibration monitoring will be completed during the pile installation for the duration of the piling works. A pre-determined limit will trigger an alarm alerting the site team and stopping the works. An investigation can then take place to determine what activity caused the levels of vibration to exceed the safe limit. Safeguarding measures can then be implemented to permit the work to progress again safely. A vibration monitoring and inspection plan will be drawn up and implemented at construction stage.

5.15.2 Movement Monitoring

A movement monitoring and inspection plan will be drawn up and implemented at construction stage. It is important to combine a number of techniques to achieve a robust monitoring strategy. The processes recommended include inclinometers and target surveying.

Inclinometers measure the lateral displacement of the piles with a number of inclinometers installed along the wall alignment. An initial set of baseline readings are recorded prior to the excavation works commencing. The movement of the piles relative to the baseline reading is then measured as the excavation progresses.

Target points will also be set up on the piles to monitor the movement as the excavation works progress.

Additionally, settlement monitoring is recommended on the retained side of the wall. A suitable number of settlement points will be regularly monitored to monitor any movement that takes place. It is recommended that settlement monitoring points are extended to all site boundaries adjacent to the secant pile wall.

Trigger limits are to be set for the wall movement with an action plan and contingency measures proposed should the movements exceed the trigger limits. The proposed trigger limits and contingency measures are outlined in Table 5.4 and Table 5.5 and are based on the various stages of the construction sequence.

Table 5.4: Identification of Trigger Levels – Excavate to Formation (Prior to Temp. Prop Removal)

Trigger	Pile Head Movement	Action
Green	<18mm	No Action Required. Proceed with proposed construction sequence.
Amber	<22mm	Contact engineer. Frequency of monitoring to be increased.
Red	>26mm	Contact engineer immediately. Works to be suspended. Contingency Plan to be implemented and construction sequence may need amendment.

Table 5.5: Identification of Trigger Levels – Following Removal of Temp. Prop

Trigger	Movement	Action
Green	<28mm	No Action Required
Amber	>32mm	Contact engineer. Frequency of monitoring to be increased.
Red	>36mm	Contact engineer immediately. Works to be suspended. Contingency Plan to be implemented.

6 Western Boundary Retaining Wall

6.1 Summary

Based on elevation changes, a retaining wall will be required along the western elevation, directly adjacent to the site boundary. An indicative section is shown as Figure 6.1. The proposed wall solution is a secant pile wall.

The secant pile wall is to be supported in the permanent condition by the basement, first floor and second floor slabs. The SSL for the basement slab is +18.0m OD and is 850mm thick. Based on this the design has been based on a formation level of +17m OD. The wall will be support in the temporary condition, until the permanent works have been constructed, by temporary propping.

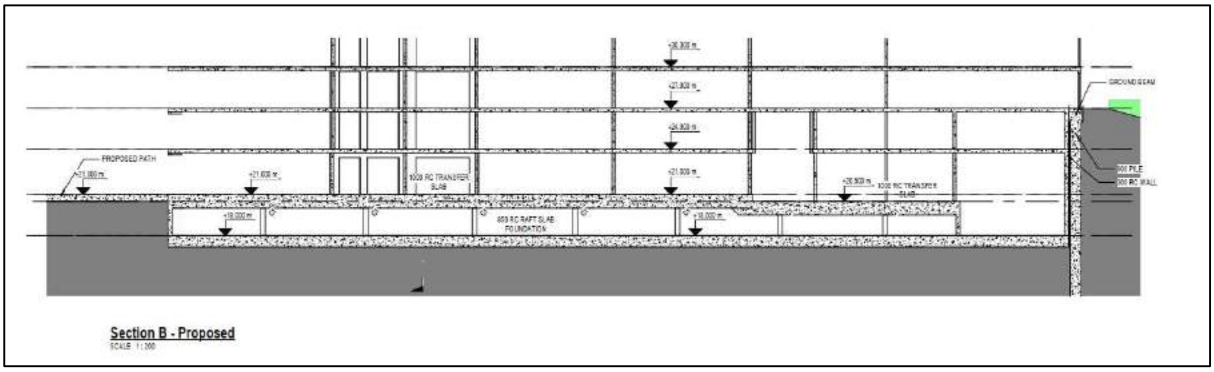


Figure 6.1: Western Boundary Indicative Section

6.2 Wall Sections

The secant pile wall will consist of the following pile arrangement, in a hard-firm pile arrangement:

- 900mm diameter reinforced male piles, installed at 1,300mm centres;
- 900mm diameter unreinforced female piles, installed at 1,300mm centres.

The ground level along the secant pile wall elevation varies to a maximum level of approximately +27.5m OD. Based on this, one wall section has been analysed based on the maximum retained height (11.5m in the temporary case). Where the ground level reduces along the north of the wall, a refinement of the design may be completed during the detailed construction design.

6.3 Pile Installation Level

The secant pile wall is to be installed from existing ground levels (approximately +27.5m OD). This level may reduce along the northern section of the secant pile wall run. A suitable piling platform and access to the piling locations is to be constructed in advance of piling works.

6.4 Construction Sequence

The following construction sequence has been modelled in the design of the secant pile wall for the western elevation:

1. Construct piling platform and form suitable access for piling rig;
2. Install female unreinforced secant piles to design toe lengths;
3. Install male reinforced secant piles to design toe lengths;
4. Complete initial excavation;
5. Install temporary raking prop and construct thrust blocks;
6. Excavate to formation;
7. Construct Basement Raft slab at +18m OD;
8. Construct first floor slab at 24.3m OD;
9. Remove temporary raking prop;
10. Construct second floor slab at 27.3m OD.

Alternatively, the secant pile wall could be back propped with temporary propping following construction of the basement raft slab, to allow removal of the upper temporary prop prior to the construction of the first floor slab at 24.3m OD.

6.5 Topography

The ground level on the retained side reduces to a retaining wall with a top of wall level of approximately +25.5m OD. The retaining wall is located directly adjacent to an existing single storey building. This change in slope on the retained side has been modelled as a surcharge.

6.6 Surcharge

An existing single storey building is located adjacent to the proposed secant pile wall at an offset of approximately 2m. The building has been modelled as having strip footings which have been modelled as having a UDL of 50kN/m^2 spread over a foundation width of 0.6m.

Additionally, a surcharge has been applied to the wall to account for the sloping level between the secant piled wall and the building.

6.7 Support

The analysis has been based on a temporary prop being installed at an elevation of +25m OD. Following excavation to formation, it is proposed to extend the basement floor slab to support the secant pile wall in the permanent condition. The basement floor slab is shown at an elevation of +18m OD. Additionally, the first and second floor slabs will support the secant pile walls in the permanent case.

6.8 Pile Wall Stiffness

The pile wall stiffness has been calculated using the same processes as outlined in Section 5.7.

The calculated stiffness values are shown in Table 6.1.

Table 6.1: Western Boundary Secant Pile Wall Stiffness Values

Wall Type	Pile Type	Design Short Term EI (kNm^2/m)	Design Long Term EI (kNm^2/m)
Western Boundary Secant Pile Wall	900mm Hard Piles @ 1,300mm c/c	520,255	371,611
	900mm Firm Piles @ 1,300mm c/c	32,757	-
	Combined Stiffness per m run	553,012	371,611

6.9 Standards and Software

The same standards and software have been used in the design of the western retaining wall as outlined in Section 5.9.

6.10 Design Limit States

The Same Design Limit States have been used in the design of the western retaining wall as Section 5.10.

6.11 Groundwater

A groundwater level of +12m OD has been used in the analysis, as outlined in the Minerex assessment. It is proposed to install female piles to a minimum depth of 1m below formation. This will allow groundwater flow below this elevation. An additional case has been carried out in the long term to account for an increase in groundwater level to a level of +20m OD and a minimum equivalent fluid pressure (MEFP) over the full height of the wall.

6.12 ULS Analysis Results

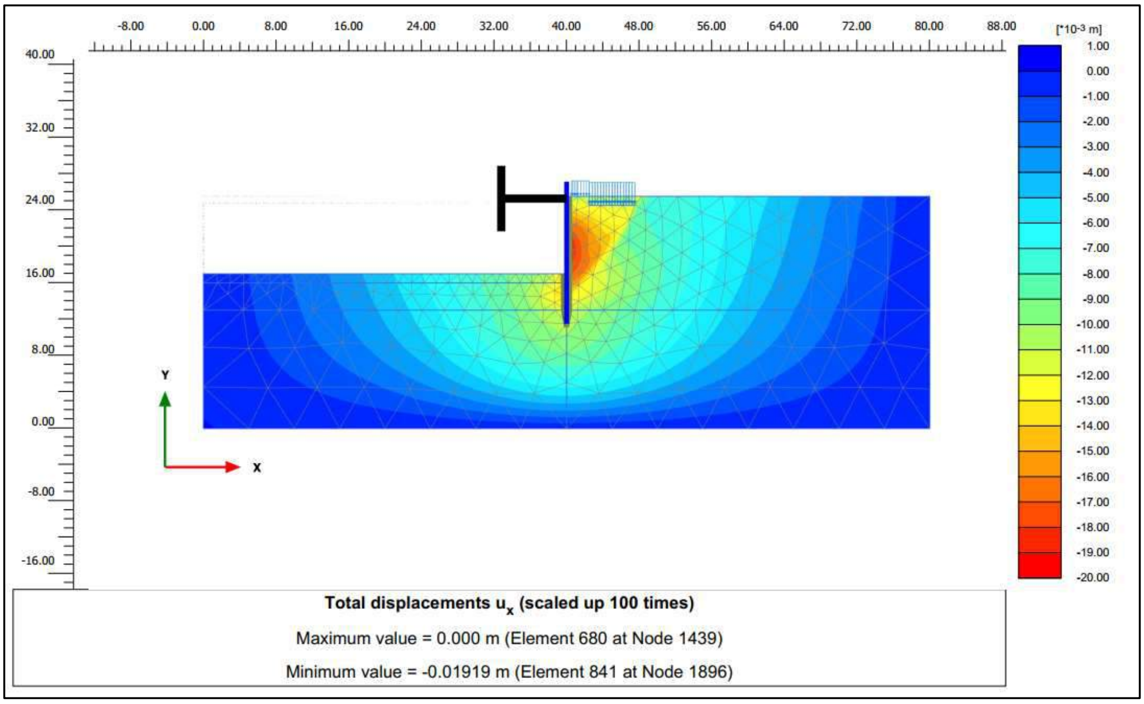
The results of the ULS Analysis are summarised in Table 6.2

Table 6.2: ULS Analysis Results

Wall Type	Pile Bending Moment (kNm/m Run)		Pile Shear Force (kN/m Run)		Min. Male Pile Toe Level for Stability (m OD)
	ULS C1 Bending	ULS C2 Bending	ULS C1 Shear	ULS C2 Shear	
Western Boundary Secant Pile Wall	480	530	173	164	11.5

6.13 SLS Analysis Results

A SLS analysis has been completed using the Finite Element Analysis software Plaxis 2D. The results of the short term analysis (prior to temporary prop removal) are shown as Figure 6.2 and Figure 6.3, with the long term analysis shown in Figure 6.4 and Figure 6.5, which shows pile head movement of less than 20mm.

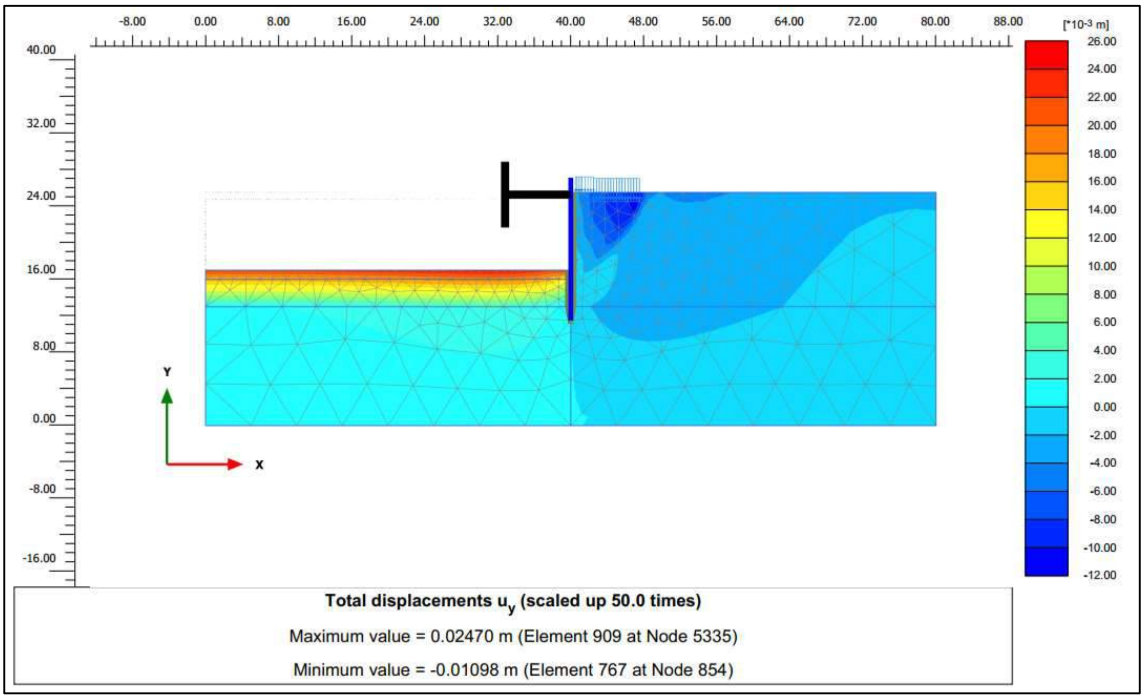


Total displacements u_x (scaled up 100 times)

Maximum value = 0.000 m (Element 680 at Node 1439)

Minimum value = -0.01919 m (Element 841 at Node 1896)

Figure 6.2: Western Elevation Short Term Horizontal Movement



Total displacements u_y (scaled up 50.0 times)

Maximum value = 0.02470 m (Element 909 at Node 5335)

Minimum value = -0.01098 m (Element 767 at Node 854)

Figure 6.3: Western Elevation Short Term Vertical Movement

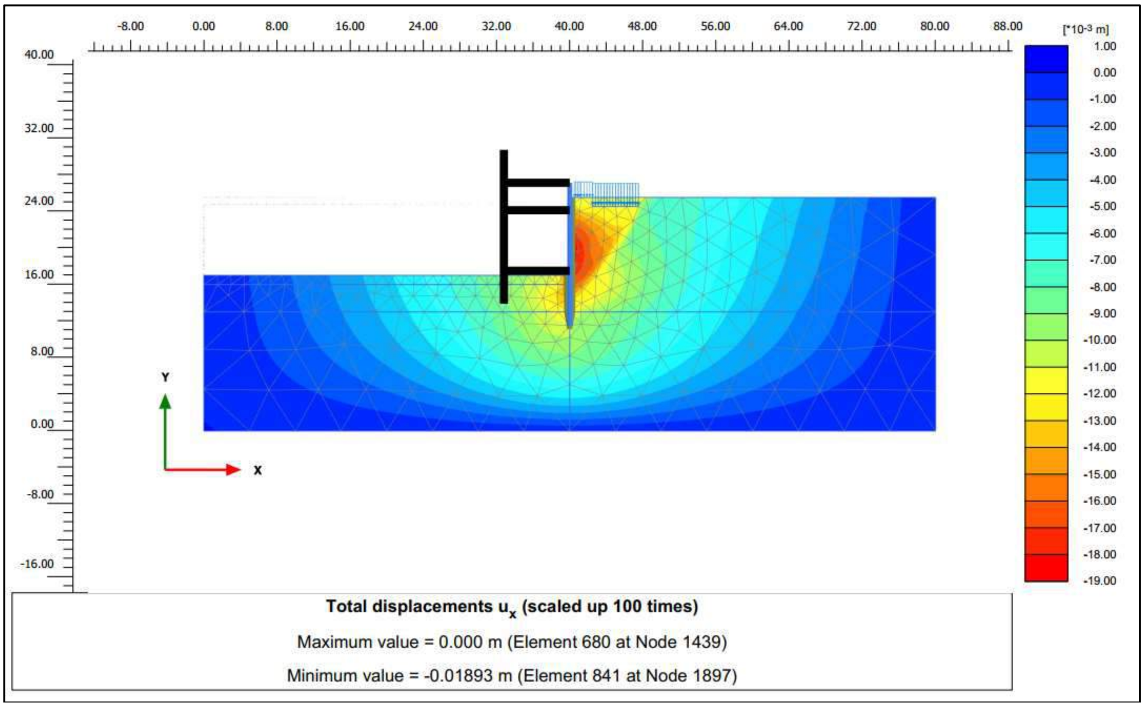


Figure 6.4: Western Elevation Long Term Horizontal Movement

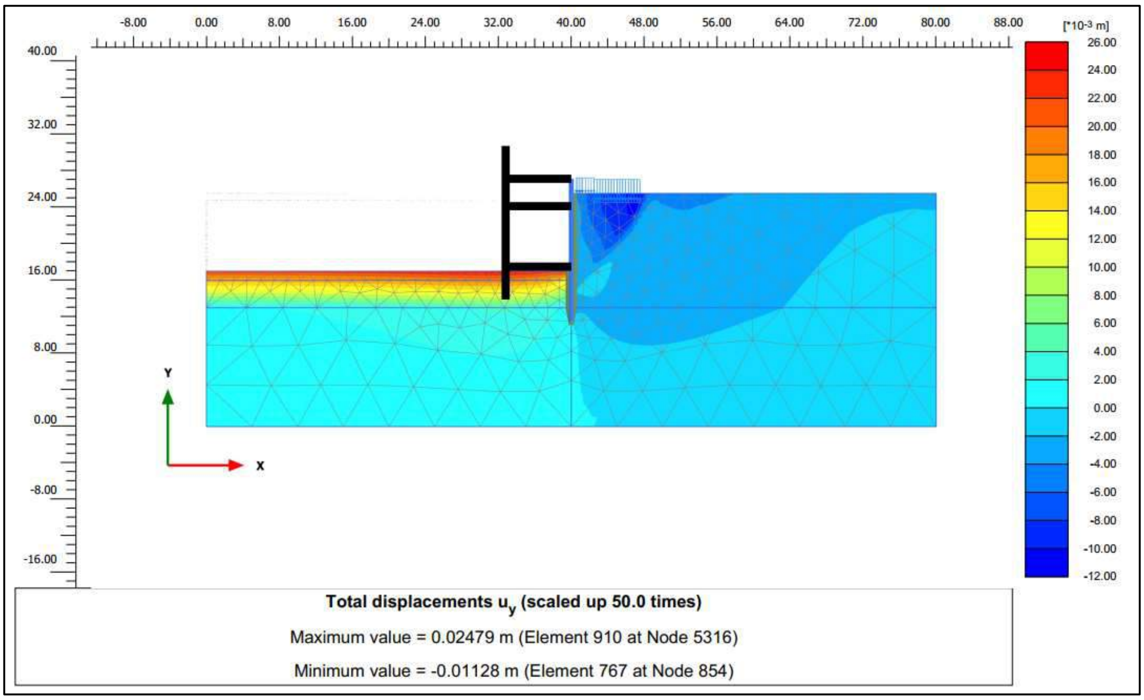


Figure 6.5: Western Elevation Long Term Vertical Movement

6.14 Main Reinforcement

ByrneLooby have carried out an assessment of the required main reinforcement in accordance with IS EN 1992-1-1:2004, based on the bending moments detailed above. This has calculated that a minimum area of steel of 1.0% for the secant piles. The above assessment may be refined during construction detailed design.

6.15 Monitoring Methodology

6.15.1 Vibration Monitoring

The vibration monitoring outlined in Section 5.15.1 is to be implemented for the western wall secant pile wall also.

6.15.2 Movement Monitoring

Like the southern elevation a monitoring programme and trigger levels is to be implemented. The proposed trigger levels for the various stages of the construction sequence are outlined in Table 6. and **Error! Reference source not found.**.

Table 6.4: Identification of Trigger Levels – Excavate to Formation (Prior to Temp. Prop Removal)

Trigger	Movement	Action
Green	<12mm	No Action Required. Proceed with proposed construction sequence.
Amber	>16mm	Contact engineer immediately. Frequency of monitoring to be increased.
Red	>20mm	Contact engineer immediately. Works to be suspended. Contingency Plan to be implemented and construction sequence may need amendment.

Table 6.4: Identification of Trigger Levels – Excavate to Formation (Prior to Temp. Prop Removal)

Trigger	Movement	Action
Green	<12mm	No Action Required. Proceed with proposed construction sequence.
Amber	>16mm	Contact engineer immediately. Frequency of monitoring to be increased.
Red	>20mm	Contact engineer immediately. Works to be suspended. Contingency Plan to be implemented and construction sequence may need amendment.

7 Northern Boundary Open Cut Excavation

7.1 Background

The Martello Tower is a military installation that was constructed over 200 years ago to withstand expected artillery fire. It is understood that the walls of Martello Tower are approximately 8ft thick (2.5m). Arising from concerns regarding the potential impact of the earthworks associated with the proposed development, an assessment of the ground movements on the Martello Tower has been completed.

The revised proposal for Block B is offset from the site boundary. Based on the offset, it is proposed to construct the basement using open cut excavation techniques. The proximity of the Block B basement to the northern site boundary is shown in Figure 7.1 and Figure 7.2, with the red line representing the site boundary and the blue line representing the development boundary.

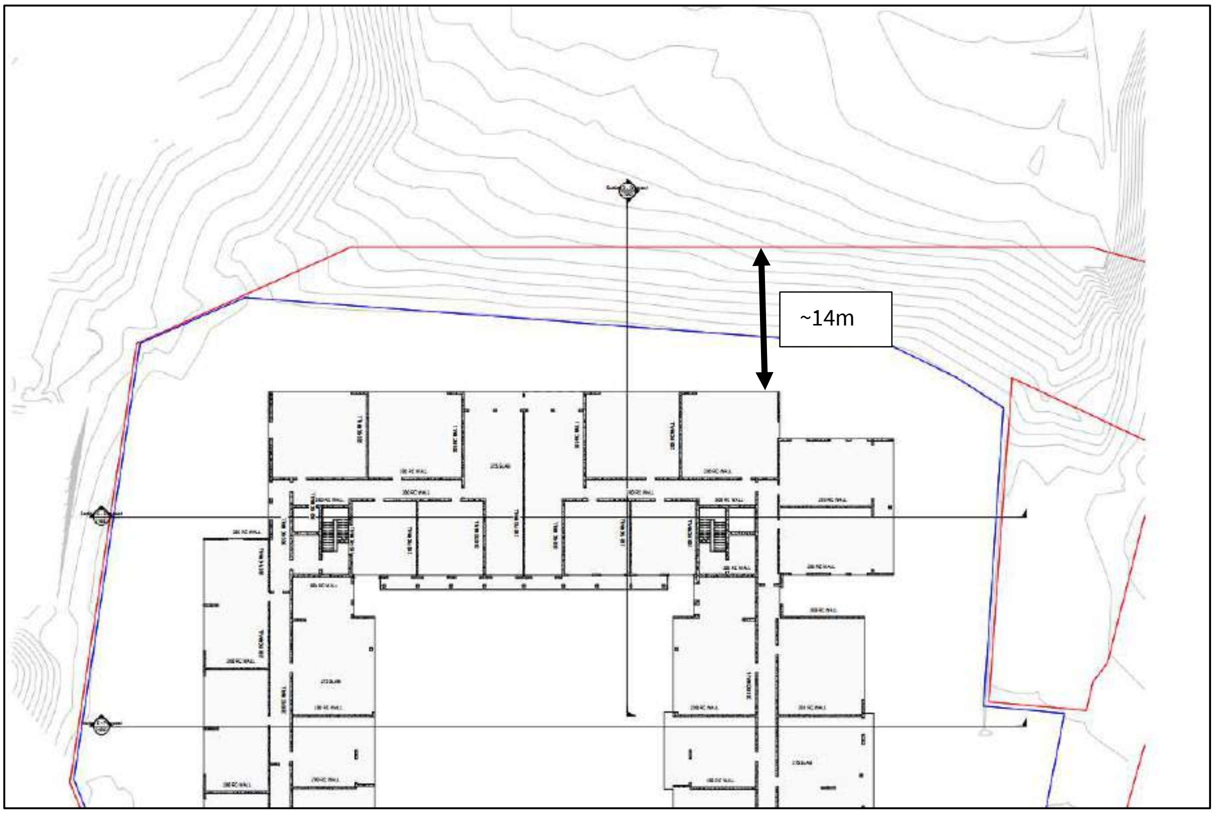


Figure 7.1: Block B Basement Layout

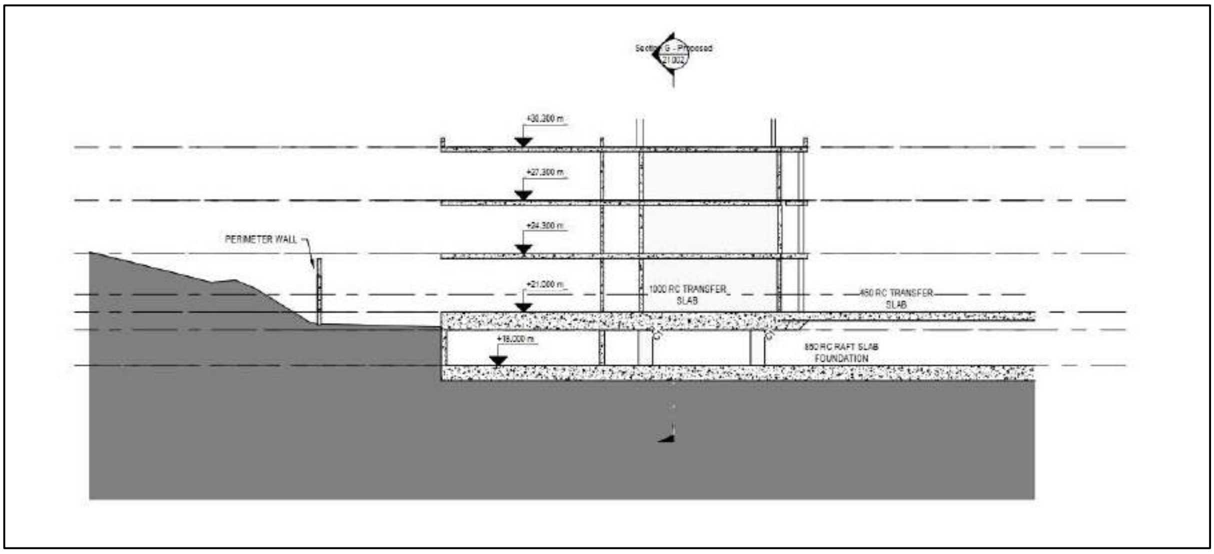


Figure 7.2: Block B Basement Section

7.2 Basement Construction Works

Based on the offset from the proposed basement to the site boundary, it is proposed to construct the basement using open cut excavation techniques along this elevation. The open cut excavation batters will be subject to temporary works detailed design but are expected to be in the order of 1.5H:1V.

7.3 Ground Movements

Based on concerns regarding the basement's construction, ground movements associated with the excavation works and their impact on the adjacent Martello Tower, ByrneLooby have undertaken a building damage assessment. The assessment has been undertaken using ground movement curves caused by the lateral deflection of an embedded retaining wall, which are based on default values within CIRIA C760, which are derived from a number of historic cases. This is considered conservative, as the ground movements generated from open cut excavations will be significantly less and the assessment is considered worst-case. The ground movement curve used in the assessment is the 'Ground Surface Settlement due to excavation in front of a wall in Sand' as shown in Figure 7.3.

Ground level for the assessment has been taken for the higher ground level north of the site boundary (+25m OD), which based on Figure 7.2, has resulted in increased settlements. The predicted ground settlements are shown in Figure 7.4.

The results of the building damage assessment are shown in Section 8.

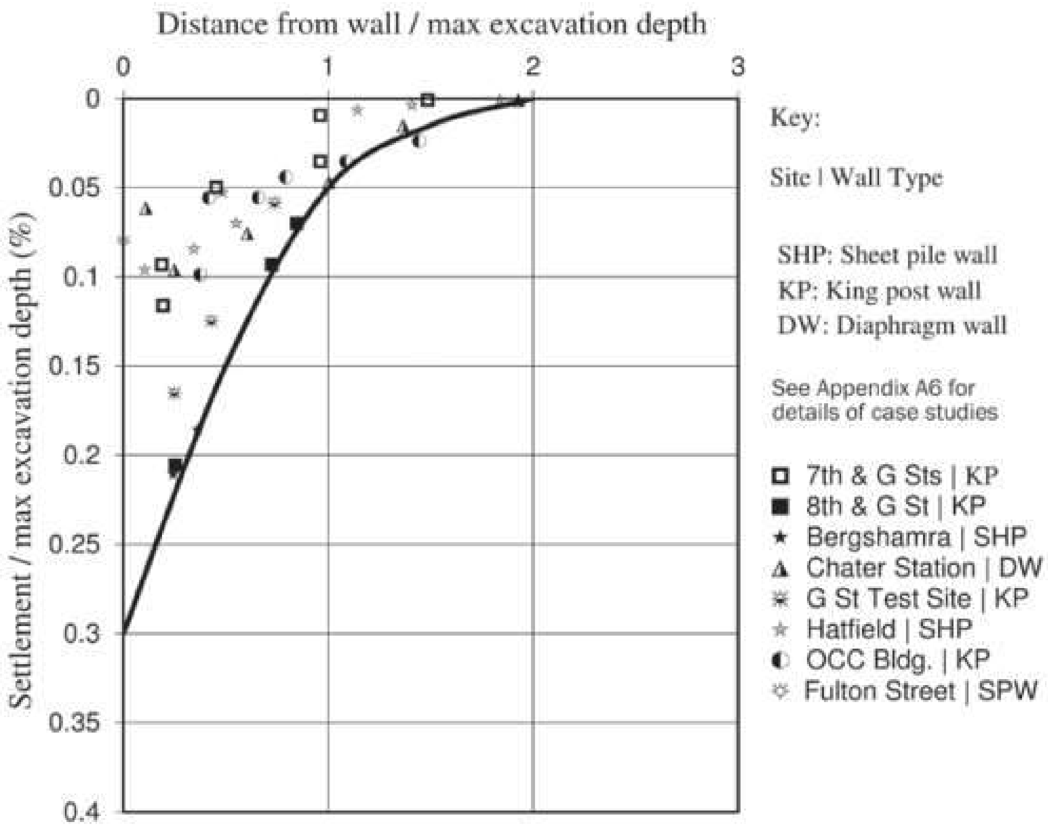


Figure 6.16 Ground surface settlement due to excavation in front of wall in sand

Figure 7.3: Ground Surface Settlement due to excavation in front of wall in sand (CIRIA C760 Fig. 6.16)

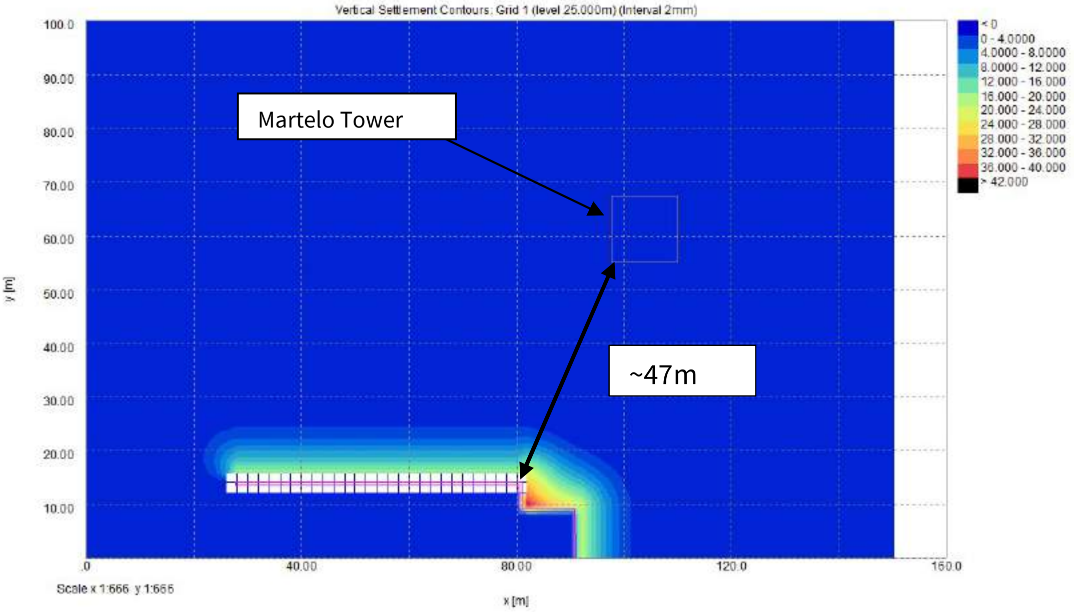


Figure 7.4: Predicted Ground Surface Settlement

8 Building Impact Assessment Methodology

8.1 Basis of Movement

8.1.1 Mechanisms Explored

ByrneLooby have carried out a number of preliminary ground movement assessments associated with the proposed construction techniques at the site. These have been carried out along the southern, western and northern elevations. This section outlines the methodologies used in the assessments with the results of the assessments outlined in the following sections.

The assessments have been based on the ground movements caused by the excavation adjacent to the proposed secant pile wall along the southern and western elevations and the open cut excavation along the northern elevation.

No additional allowance for ground movements caused by wall installation have been included, as per Ciria C760, which details that there are unlikely to be any significant ground movements arising from the installation of a cast in situ wall in stiff ground where the water table is low and workmanship is good.

8.1.2 Software Used

For the southern and western boundaries, the ground movement was assessed by using finite element (FE) software package Plaxis 2D, as outlined earlier in this report.

Following an assessment of the ground movements, the damage impact assessment was undertaken using the X-Disp software package from OASYS. This software is commonly used within the ground engineering industry and is considered to be appropriate tools for this analysis. The X-Disp program has the ability to assess surrounding infrastructure in line with the Burland Damage Impact Assessment (2001) and provide a damage category as necessary. The ground movement obtained by Plaxis 2D were imported into XDisp to allow the damage rating to be assessed.

The ground movements assessed along the northern elevation, caused by open cut techniques, have conservatively been based on empirical ground movements outlined in Ciria C760 caused by embedded retaining walls. This is considered conservative and a worst-case assessment.

8.2 Ground Movement Analysis

8.2.1 Southern Elevation

The predicted ground movements along the southern elevation, adjacent to the secant pile wall have been outlined in Section 5. For the basis of the ground movement analysis only the long-term analysis (worst-case analysis) has been considered. These ground movements have been presented as Figure 8.1 and Figure 8.2. Although, vertical settlements of 2.5mm are recorded at a distance from the wall, these are caused by the application of the 10kPa UDL rather than any impact of the basement excavation.

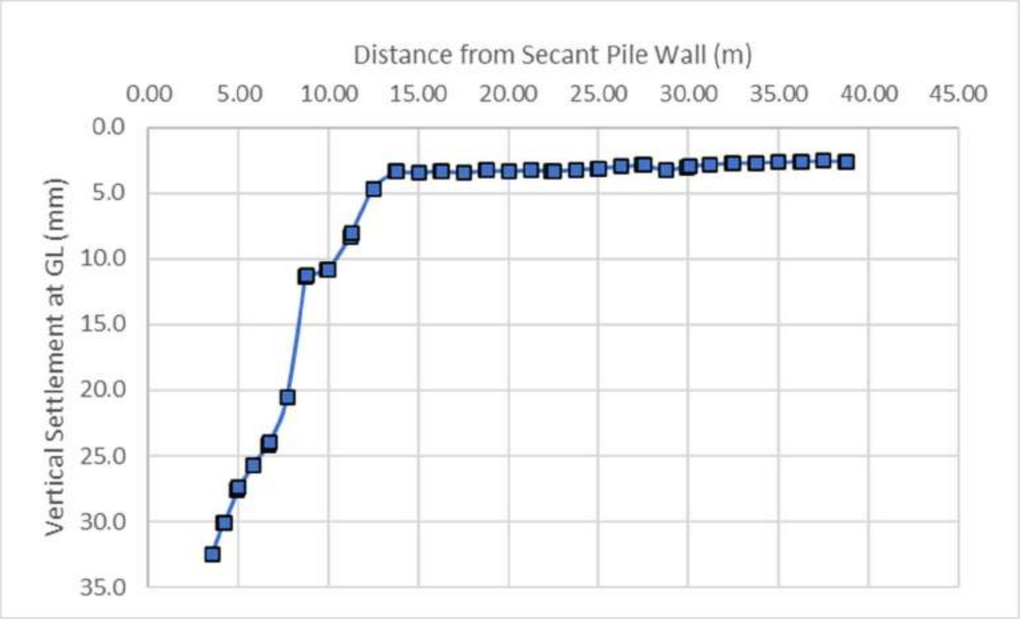


Figure 8.1: Southern Boundary Vertical Settlement

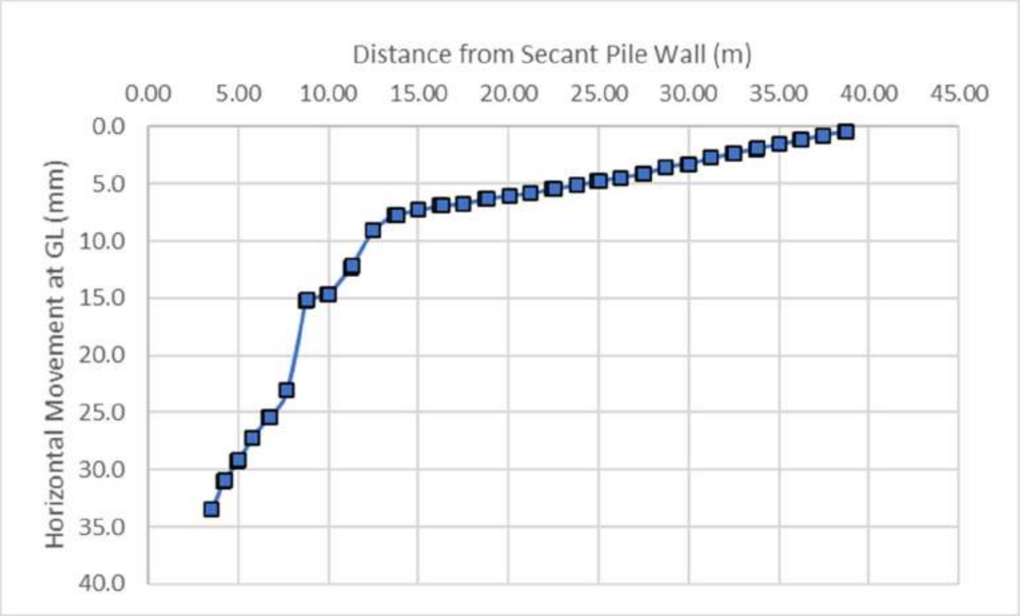


Figure 8.2: Southern Boundary Horizontal Movement

8.2.2 Western Elevation

The predicted ground movements along the western elevation, adjacent to the secant pile wall have been outlined in Section 6. For the basis of the ground movement analysis only the long-term analysis (worst-case analysis) has been considered. These ground movements have been presented as Figure 8.3 and Figure 8.4 and are the calculated movements at the adjacent Building's foundation level, which is assumed as 1m bgl (+24.5m OD).

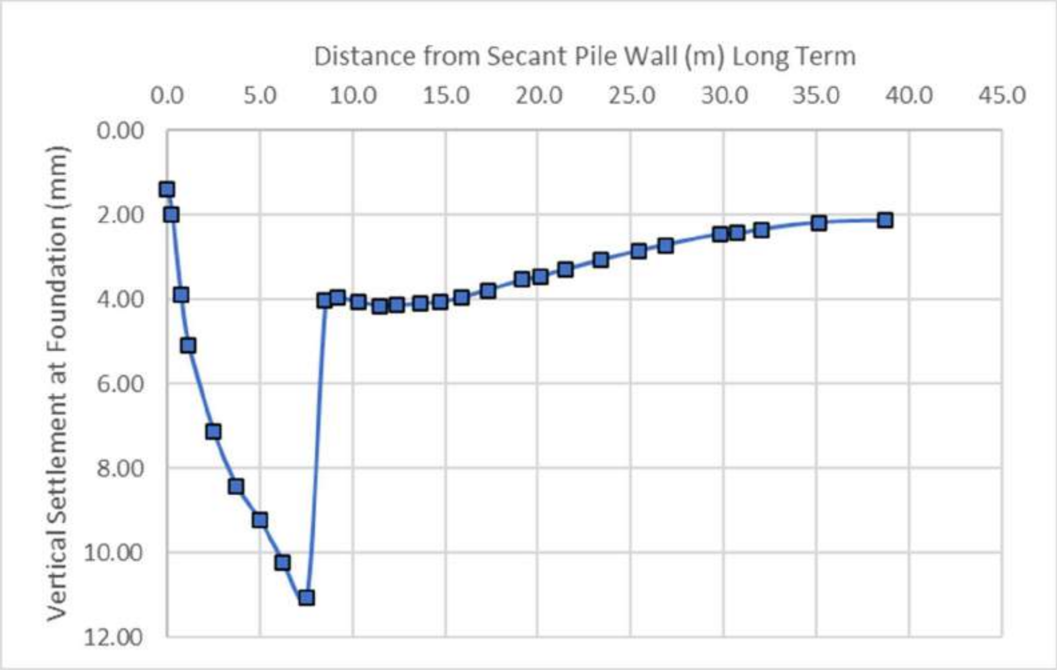


Figure 8.3: Western Boundary Vertical Settlement

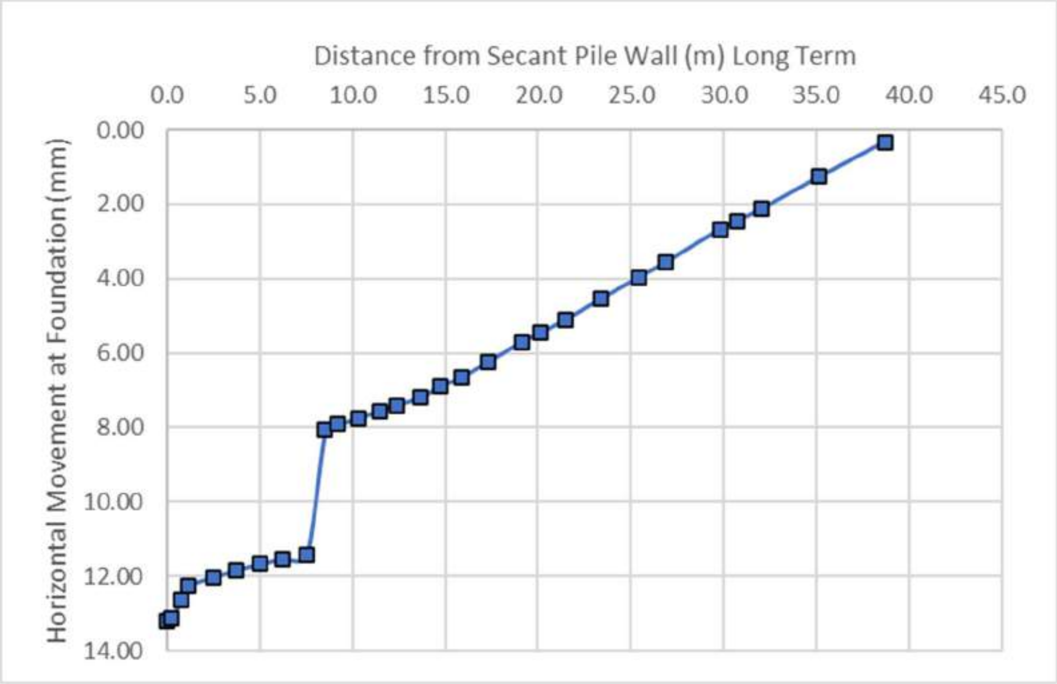


Figure 8.4: Western Boundary Horizontal Movement

8.2.3 Northern Elevation

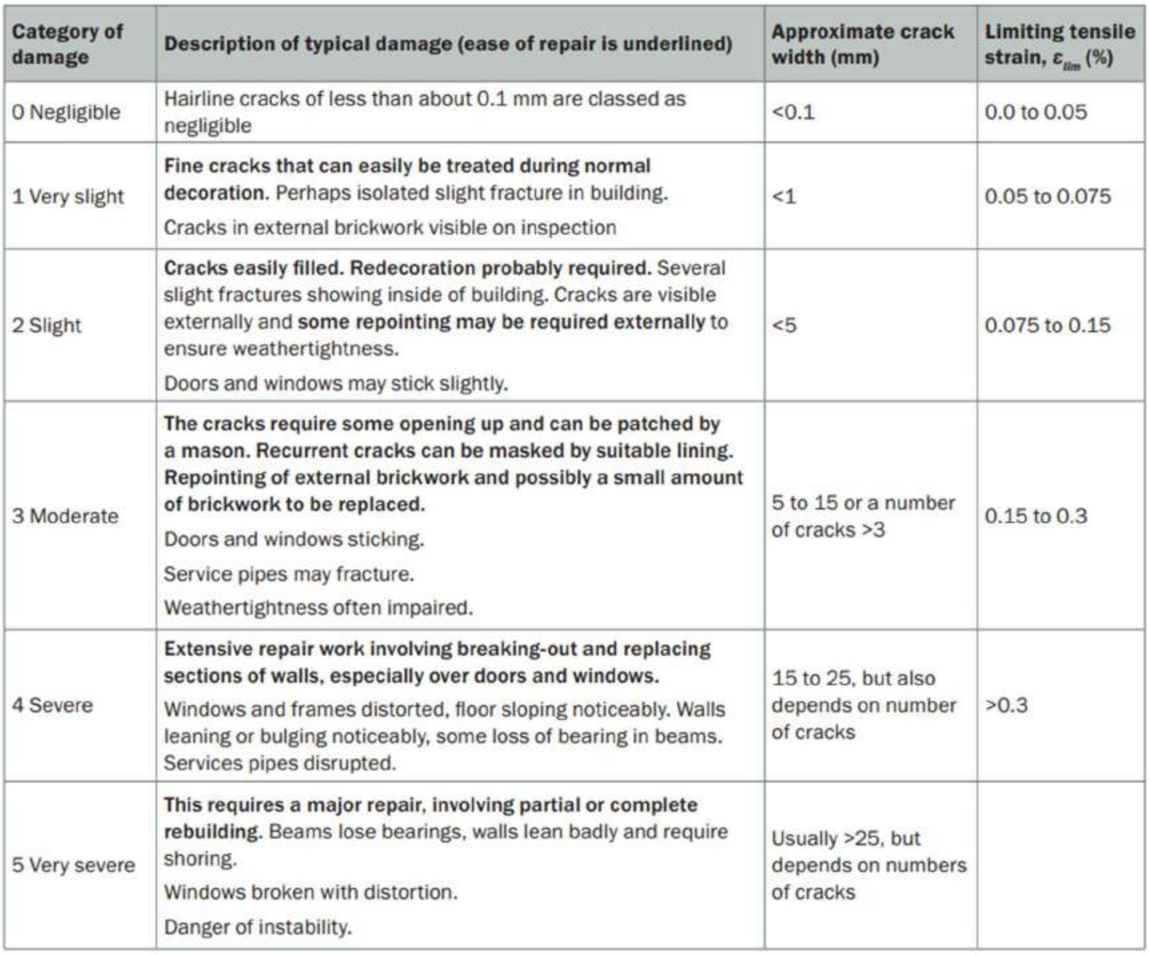
The predicted ground movements along the northern elevation were determined using empirical charts as detailed in Section 7.

8.3 Damage Impact Assessment

ByrneLooby have carried out a Damage Impact Assessment of the neighbouring structures based on the ground movements outlined above and the classifications given in Table 6.4 of CIRIA C760 (formally C580). These classifications, which have been extracted from and shown in the table below are based on the method of damage assessment outlined by Burland et al (1977), Boscardin and Cording (1989) and Burland (2001).

The assessment has been completed using the XDisp software.

Table 8.1: Table 6.4 of CIRIA C760: Classification of visible damage to walls (after Burland et al, 1977, Boscardin and Cording, 1989, and Burland, 2001



Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain, ε_{lim} (%)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible	<0.1	0.0 to 0.05
1 Very slight	**Fine cracks that can easily be treated during normal decoration.** Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection	<1	0.05 to 0.075
2 Slight	**Cracks easily filled. Redecoration probably required.** Several slight fractures showing inside of building. Cracks are visible externally and **some repointing may be required externally** to ensure weathertightness. Doors and windows may stick slightly.	<5	0.075 to 0.15
3 Moderate	**The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable lining. Repointing of external brickwork and possibly a small amount of brickwork to be replaced.** Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5 to 15 or a number of cracks >3	0.15 to 0.3
4 Severe	**Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows.** Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Services pipes disrupted.	15 to 25, but also depends on number of cracks	>0.3
5 Very severe	**This requires a major repair, involving partial or complete rebuilding.** Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	Usually >25, but depends on numbers of cracks	

8.3.1 Southern Elevation

The nearest properties to the southern elevation secant pile wall are 21 and 22 Asgard Park houses, located approximately 40m south of the secant pile wall.

Based on the predicted ground movements, a **Category 0 (Negligible category)** has been determined for the garage of 22 Asgard Park, while 21 and 22 Asgard Park lie outside the zone of sensitivity, as shown in Figure 8.5.

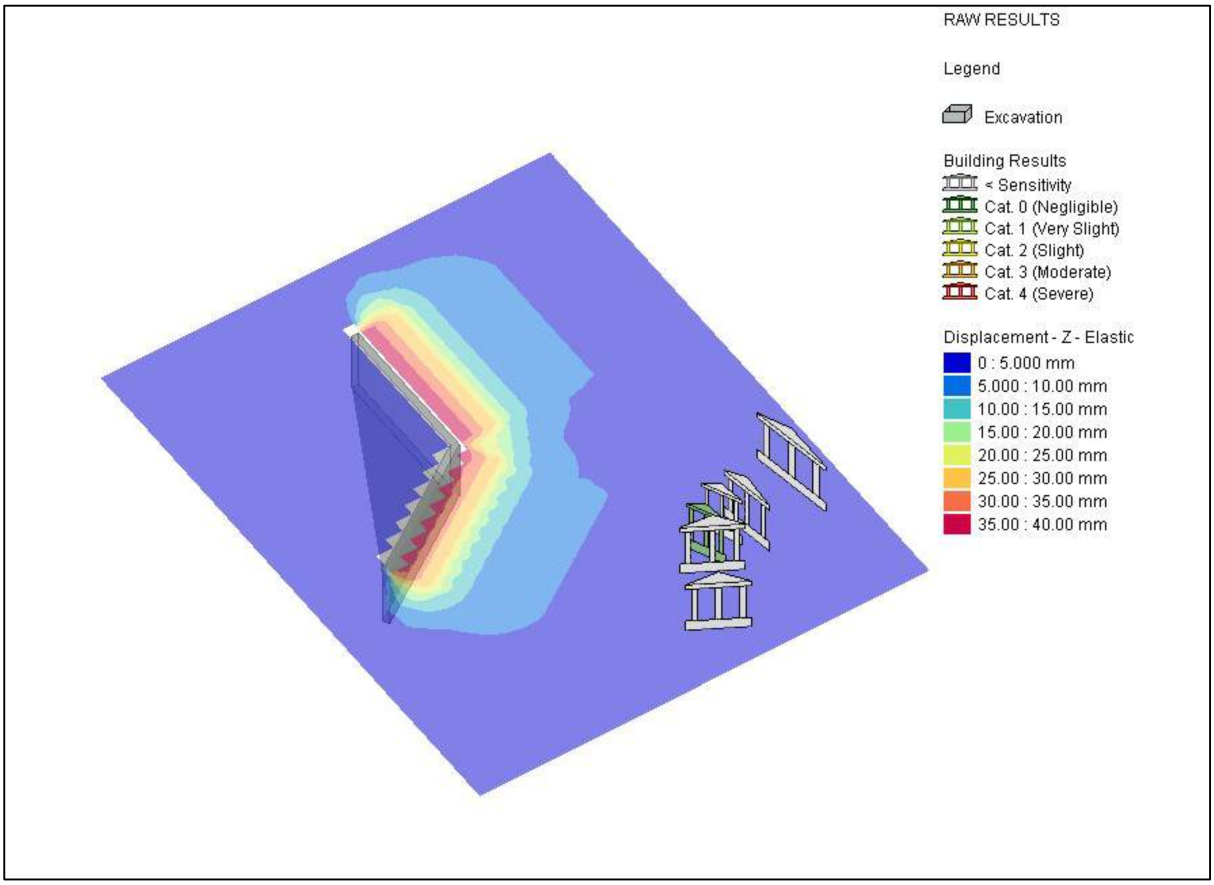


Figure 8.5: Building Damage Assessment – Southern Elevation Secant Pile Wall

8.3.2 Western Elevation

The nearest property to the western elevation secant pile wall is the single level property to the rear of 25 Abbey Street. Based on the proposed alignment of the secant pile wall, the property is located approximately 2m from the secant pile wall.

Based on the predicted movements and proximity of the adjacent building, a **Category 2 (Slight category)** has been determined for the single storey property to the rear of 25 Abbey Street, as shown in Figure 8.6. Category 2 is considered an aesthetic damage category as outlined in Table 8.1.

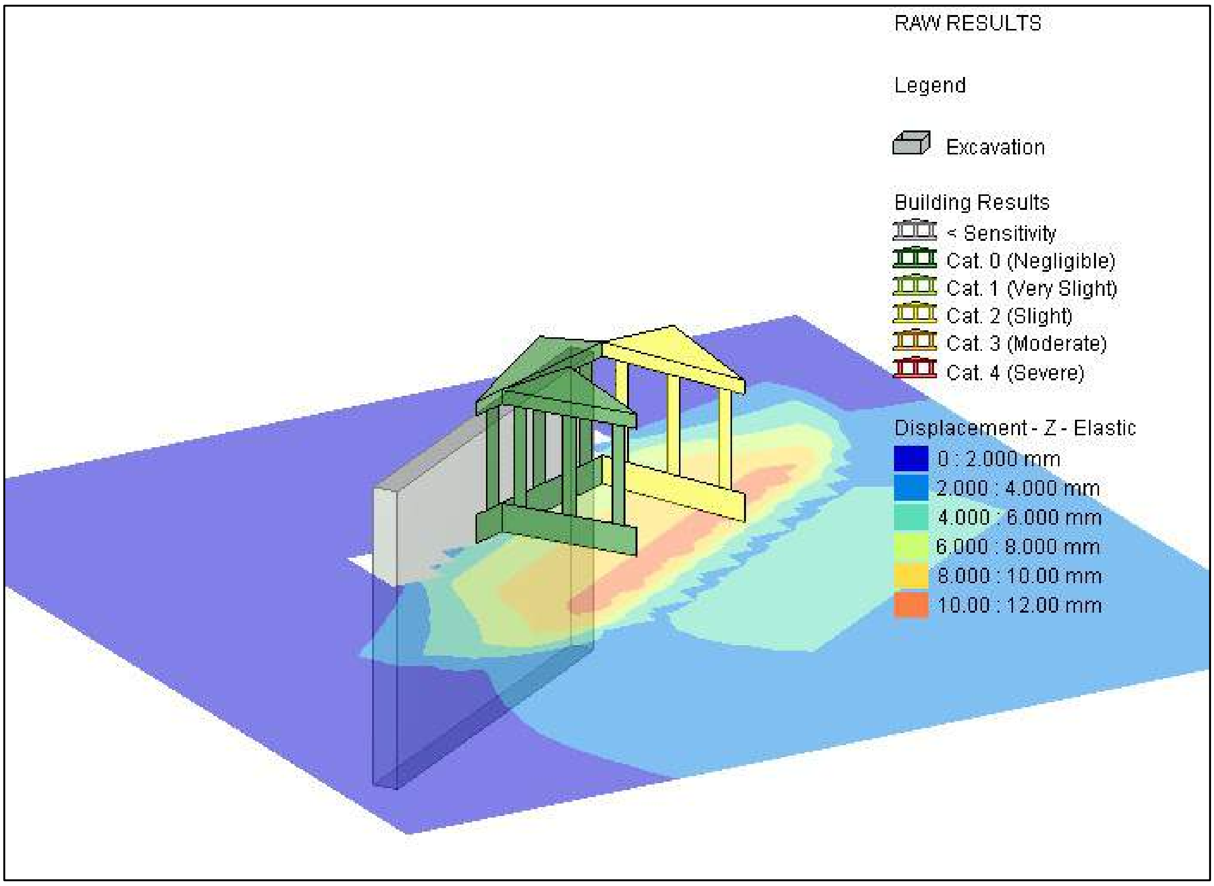


Figure 8.6: Building Damage Assessment – Southern Elevation Secant Pile Wall

8.3.3 Northern Elevation

Martello Tower is located approximately 45m from the basement excavation.

Based on the predicted ground movements and offset to Martello Tower, Martello Tower falls **outside the zone of sensitivity** caused by the basement excavation works.

9 Eastern Elevation Stabilisation Works

9.1 Background

Evidence of local slippages such as scarp and displaced fenceposts are observed to the south-east of the site, adjacent to Martello Tower, as shown in Figure 9.1. This is outside the site boundary and a vibration monitoring regime will be established along this boundary to ensure the proposed works do not cause slippages. All ground works will involve low-vibration methods of construction.

Figure 9.1: Balscadden Road adjacent to Martello Tower (ref. Google Maps) South East of the Site

It is recommended that remedial works are carried out on the eastern elevation adjacent to the site, to prevent any potential future slips occurring. The eastern elevation is shown as Figure 9.2.

The recommended remedial works involve the use of soil nailing and a flexible mesh. Soil nailing is a technique which reinforces the slope by the insertion of tendons. The nails address the global slope stability, which are connected in turn to a facing system which provides surficial stability. A suitable mesh would be selected in the construction which would encourage the growth of vegetation following its construction. It is recommended that the remedial works be completed in advance of the main piling and excavation works in the site.

Figure 9.2: Balscadden Road adjacent to the site

Figure 9.3 Soil Nailing Example, prior to vegetation re-growth

9.2 Basis of Design

ByrneLooby have completed an analysis to assess the suitability of soil nails as a remedial measure along the eastern elevation.

The assessment was completed using the GeoStudio 2021 slope stability software package SLOPE/W. SLOPE/W uses the limit equilibrium method of analysis by dissecting a potential sliding mass into vertical slices. It assesses the factor of safety for both moment and force equilibrium based on various methods, including Janbu (1954), Bishop (1955) and Morgenstern and Price (1965). The Morgenstern-Price method has been used in this instance as it satisfys all equilibrium conditions and can deal with any shape of failure surface.

I.S. EN 1997-1:2004 Eurocode 7 outlines that the practice for the design and execution of reinforced fill structures and soil nailing should utilise the limit equilibrium method and partial factors recommended in ‘BS 8006-2:2011: Code of Practice for Strengthened/Reinforced Soils and Other Fills’. Best practice guidance set out in CIRIA C637 (2005) has also been used where suitable. Table 5 from BS 8006-2:2011 is reproduced below as a summary of the appropriate partial factors.

Table 9.1: Summary of Partial Factors as per BS 8006-2:2011

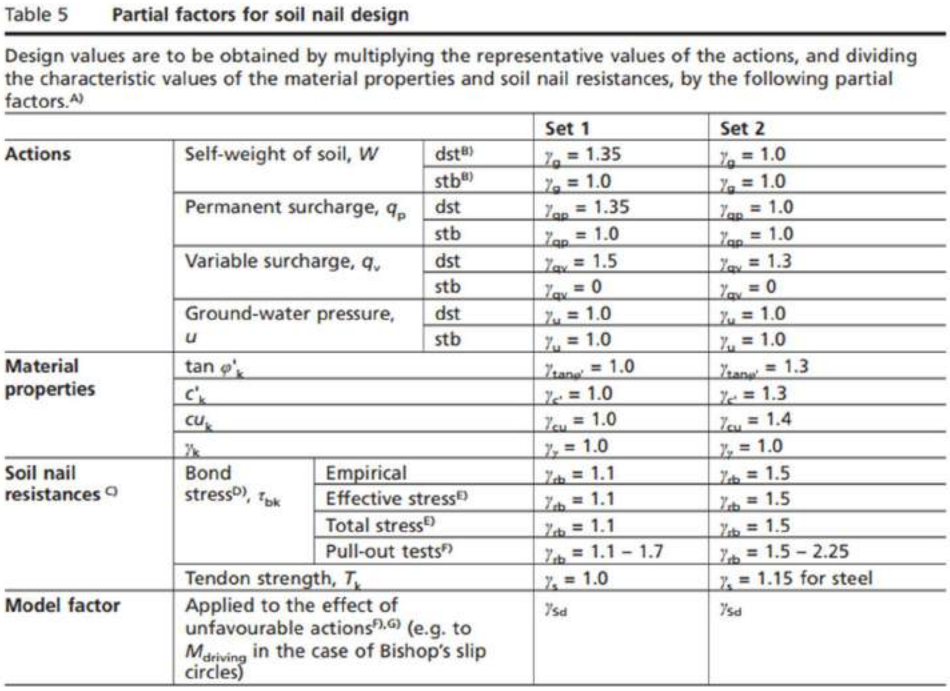


Table 5 **Partial factors for soil nail design**

Design values are to be obtained by multiplying the representative values of the actions, and dividing the characteristic values of the material properties and soil nail resistances, by the following partial factors.$^{A)}$

			Set 1	Set 2
Actions	Self-weight of soil, W	dst$^{B)}$	$\gamma_g = 1.35$	$\gamma_g = 1.0$
		stb$^{B)}$	$\gamma_g = 1.0$	$\gamma_g = 1.0$
	Permanent surcharge, q_p	dst	$\gamma_{qp} = 1.35$	$\gamma_{qp} = 1.0$
		stb	$\gamma_{qp} = 1.0$	$\gamma_{qp} = 1.0$
	Variable surcharge, q_v	dst	$\gamma_{qv} = 1.5$	$\gamma_{qv} = 1.3$
		stb	$\gamma_{qv} = 0$	$\gamma_{qv} = 0$
	Ground-water pressure, u	dst	$\gamma_u = 1.0$	$\gamma_u = 1.0$
		stb	$\gamma_u = 1.0$	$\gamma_u = 1.0$
Material properties	$\tan \varphi'_k$		$\gamma_{\tan\varphi'} = 1.0$	$\gamma_{\tan\varphi'} = 1.3$
	c'_k		$\gamma_{c'} = 1.0$	$\gamma_{c'} = 1.3$
	cu_k		$\gamma_{cu} = 1.0$	$\gamma_{cu} = 1.4$
	γ_k		$\gamma_\gamma = 1.0$	$\gamma_\gamma = 1.0$
Soil nail resistances $^{C)}$	Bond stress$^{D)}$, τ_{bk}	Empirical	$\gamma_{rb} = 1.1$	$\gamma_{rb} = 1.5$
		Effective stress$^{E)}$	$\gamma_{rb} = 1.1$	$\gamma_{rb} = 1.5$
		Total stress$^{E)}$	$\gamma_{rb} = 1.1$	$\gamma_{rb} = 1.5$
		Pull-out tests$^{F)}$	$\gamma_{rb} = 1.1 - 1.7$	$\gamma_{rb} = 1.5 - 2.25$
	Tendon strength, T_k		$\gamma_s = 1.0$	$\gamma_s = 1.15$ for steel
Model factor	Applied to the effect of unfavourable actions$^{F),G)}$ (e.g. to $M_{driving}$ in the case of Bishop’s slip circles)		γ_{Sd}	γ_{Sd}

In order to obtain caharacterisitc bond stress parameters, the partial factors as outlined in Table 6 of BS 8006-2:2011 have been accounted for. Table 6 has been shown below for information.

Table 9.2: Summary of Partial Factors Recommended in BS 8006-2:2011

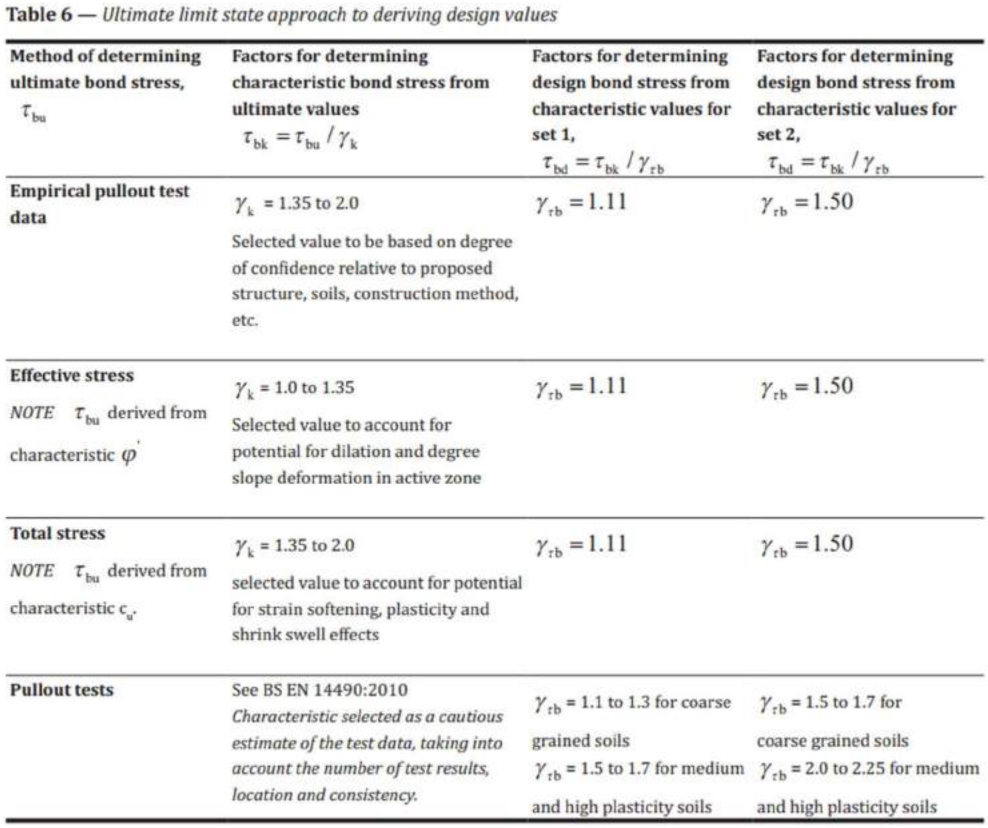


Table 6 — *Ultimate limit state approach to deriving design values*

Method of determining ultimate bond stress, τ_{bu}	Factors for determining characteristic bond stress from ultimate values $\tau_{bk} = \tau_{bu} / \gamma_k$	Factors for determining design bond stress from characteristic values for set 1, $\tau_{bd} = \tau_{bk} / \gamma_{\tau b}$	Factors for determining design bond stress from characteristic values for set 2, $\tau_{bd} = \tau_{bk} / \gamma_{\tau b}$
Empirical pullout test data	γ_k = 1.35 to 2.0 Selected value to be based on degree of confidence relative to proposed structure, soils, construction method, etc.	$\gamma_{\tau b} = 1.11$	$\gamma_{\tau b} = 1.50$
Effective stress *NOTE* τ_{bu} derived from characteristic φ'	γ_k = 1.0 to 1.35 Selected value to account for potential for dilation and degree slope deformation in active zone	$\gamma_{\tau b} = 1.11$	$\gamma_{\tau b} = 1.50$
Total stress *NOTE* τ_{bu} derived from characteristic c_u.	γ_k = 1.35 to 2.0 selected value to account for potential for strain softening, plasticity and shrink swell effects	$\gamma_{\tau b} = 1.11$	$\gamma_{\tau b} = 1.50$
Pullout tests	See BS EN 14490:2010 *Characteristic selected as a cautious estimate of the test data, taking into account the number of test results, location and consistency.*	$\gamma_{\tau b}$ = 1.1 to 1.3 for coarse grained soils $\gamma_{\tau b}$ = 1.5 to 1.7 for medium and high plasticity soils	$\gamma_{\tau b}$ = 1.5 to 1.7 for coarse grained soils $\gamma_{\tau b}$ = 2.0 to 2.25 for medium and high plasticity soils

9.3 Surcharge

A surcharge of 10kPa has been applied to the analysis, which is representative of plant up to 30 tonne loaded weight as per recommendations in Ciria C760.

9.4 Design Sections

Based on the topographical survey a single design section has been taken. The design section taken is summarised in the table below. Please note the assessment is subject to detailed construction design which may lead to a refinement change in the number and spacing of soil nails.

Table 9.3: Design Sections for Soil Nail Design

Design Section	Slope Height (m)	Slope Angle (deg)	Row of Nails (No.)	Angle of Nails (deg)	Horizontal Spacing (m)	Vertical Spacing (m)
1	10	40	6	15	1.5	1.5

9.5 Soil Nail Parameters

9.5.1 Tensile Strength of Nails

The maximum value of the design tensile strength has been calculated using Section 4.5.1 of BS 8006-2:2011:

$$R_{td} = \frac{R_{tk}}{\gamma_s} = \frac{A_{s,nom}\, f_{yk}}{\gamma_s}$$

Where:

- R_{td} is the design tensile strength
- γ_s is the partial factor on steel strength, taken as 1.15
- $A_{s,nom}$ is the nominal cross-sectional area of the reinforcement taking account of corrosion
- f_{yk} is the characteristic yield strengths of the tendon

ByrneLooby have carried out the analysis based on Dywidag R32-250 DYWI Drill Hollow Bar Type Soil Nail. Based on this, the design strength has been calculated as:

Design Strength, R_{td} = (302 × 510) / 1.15 = 164,086N = 134kN

9.5.2 Borehole Diameter

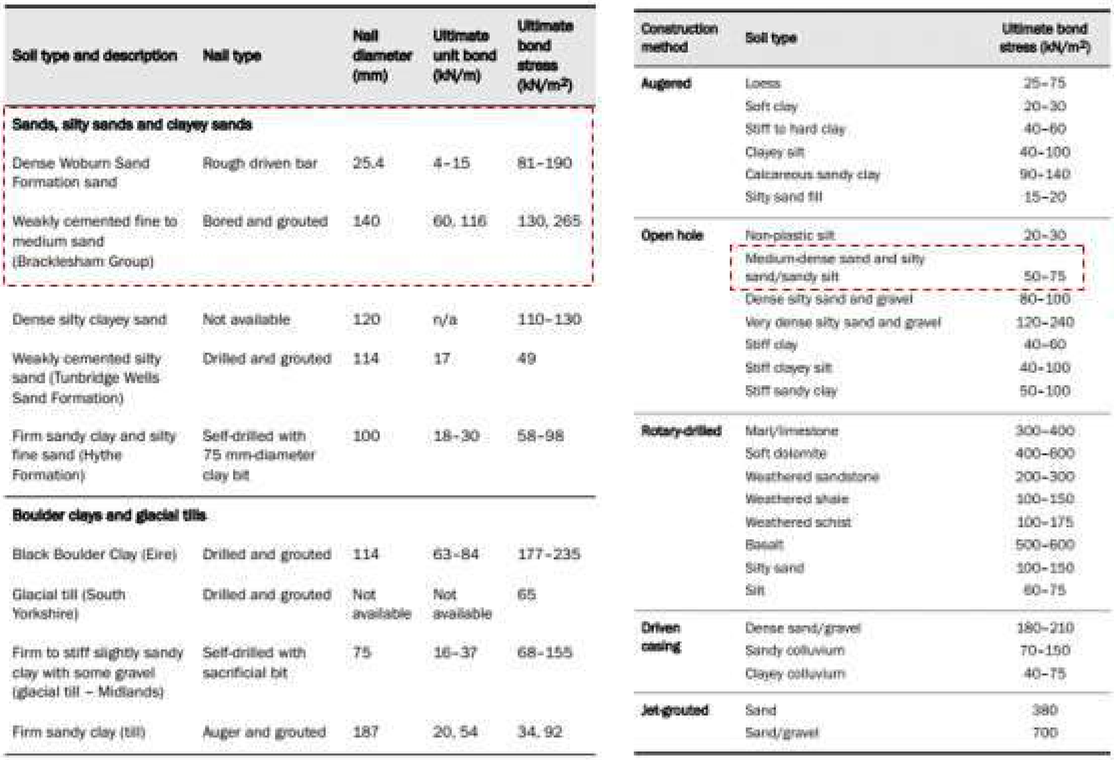
ByrneLooby have carried out the analysis based on a drill bit of 115mm.

9.5.3 Bond Stress of Soil Nails

Recommendations outlined in CIRIA C637 in relation to ultimate bond stress between the grouted soil nail and the surrounding ground have been used to estimate the bond stress for design purposes. Table 8.4 of CIRIA C637 summarises typical soil nail test results and bond stress values observed for various British and Irish soils – extracts from this table have been shown below.

Based on the below and the ground conditions encountered on site an ultimate bond stress of 50kPa has been used in the analysis.

Table 9.4: Typical Values of Ultimate Bond Stress (ref. CIRIA C637)



Soil type and description	Nail type	Nail diameter (mm)	Ultimate unit bond (kN/m)	Ultimate bond stress (kN/m^2)
Sands, silty sands and clayey sands				
Dense Woburn Sand Formation sand	Rough driven bar	25.4	4–15	81–190
Weakly cemented fine to medium sand (Bracklesham Group)	Bored and grouted	140	60, 116	130, 265
Dense silty clayey sand	Not available	120	n/a	110–130
Weakly cemented silty sand (Tunbridge Wells Sand Formation)	Drilled and grouted	114	17	49
Firm sandy clay and silty fine sand (Hythe Formation)	Self-drilled with 75 mm-diameter clay bit	100	18–30	58–98
Boulder clays and glacial tills				
Black Boulder Clay (Eire)	Drilled and grouted	114	63–84	177–235
Glacial till (South Yorkshire)	Drilled and grouted	Not available	Not available	65
Firm to stiff slightly sandy clay with some gravel (glacial till – Midlands)	Self-drilled with sacrificial bit	75	16–37	68–155
Firm sandy clay (till)	Auger and grouted	187	20, 54	34, 92

Construction method	Soil type	Ultimate bond stress (kN/m^2)
Augered	Loess	25–75
	Soft clay	20–30
	Stiff to hard clay	40–60
	Clayey silt	40–100
	Calcareous sandy clay	90–140
	Silty sand fill	15–20
Open hole	Non-plastic silt	20–30
	Medium-dense sand and silty sand/sandy silt	50–75
	Dense silty sand and gravel	80–100
	Very dense silty sand and gravel	120–240
	Stiff clay	40–60
	Stiff clayey silt	40–100
	Stiff sandy clay	50–100
Rotary-drilled	Marl/limestone	300–400
	Soft dolomite	400–600
	Weathered sandstone	200–300
	Weathered shale	100–150
	Weathered schist	100–175
	Basalt	500–600
	Silty sand	100–150
	Silt	60–75
Driven casing	Dense sand/gravel	180–210
	Sandy colluvium	70–150
	Clayey colluvium	40–75
Jet-grouted	Sand	380
	Sand/gravel	700

9.6 Analysis Results

The results of the SLOPE/W analysis of the soil nailed slope are shown in the table below, with the graphical outputs included in the figures below.

Table 9.5: Slope/W Soil Nail Slope Analysis Results

Section	Vertical Spacing (m)	Horiz. Spacing (m)	Total No. of Rows	FoS / ODF		
				SLS	ULS Set 1	ULS Set 2
1	1.5	1.5	6	1.509	1.410	1.130

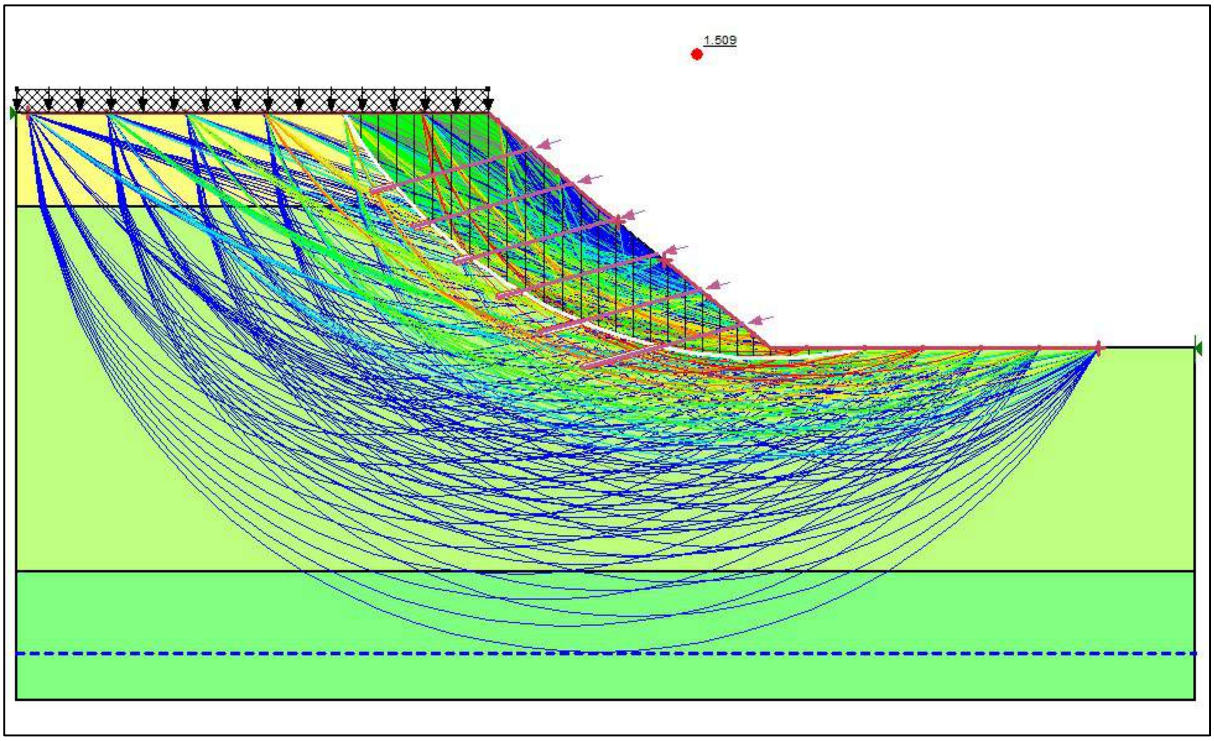


Figure 9.4: Slope/W SLS Analysis Results

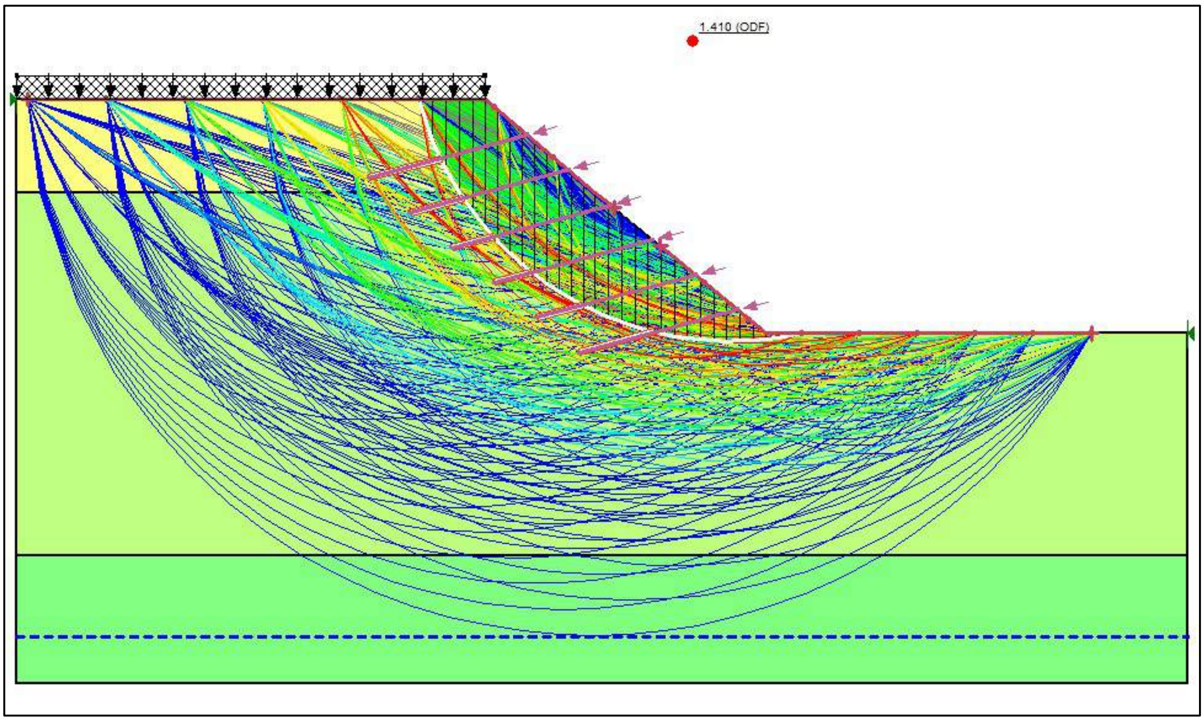


Figure 9.5: Slope/W ULS Set 1 Analysis Results

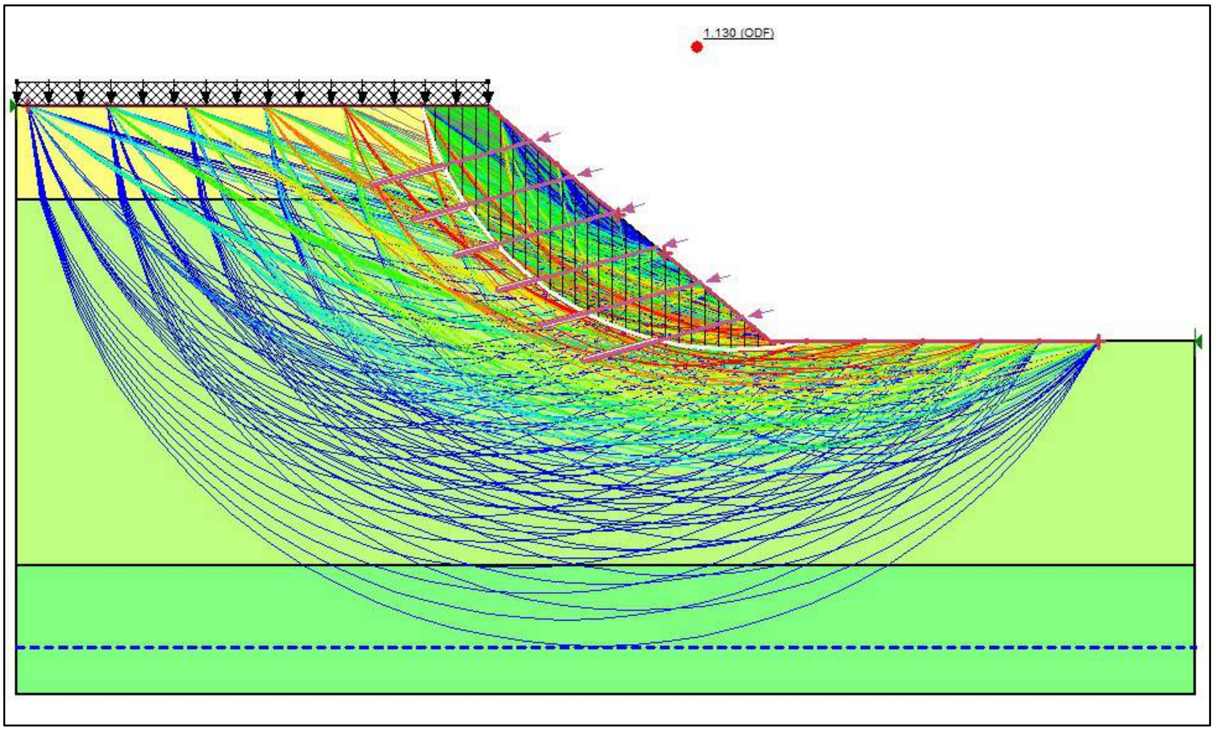


Figure 9.6: Slope/W ULS Set 2 Analysis Results

10 Howth Sewer Tunnel Assessment

10.1 Howth Sewer Description

As part of the North Dublin Drainage Scheme, a tunnel was constructed through the site in the 1950s. The location of the tunnel is shown as Figure 10.1. The approximate site location has been imposed onto the drawing and is shown as Figure 10.2. The tunnel is understood to be 6ft in diameter and consists of a high and low level tunnel. The depth to the tunnel invert is believed to range from 20m to 35m below the site's ground level.

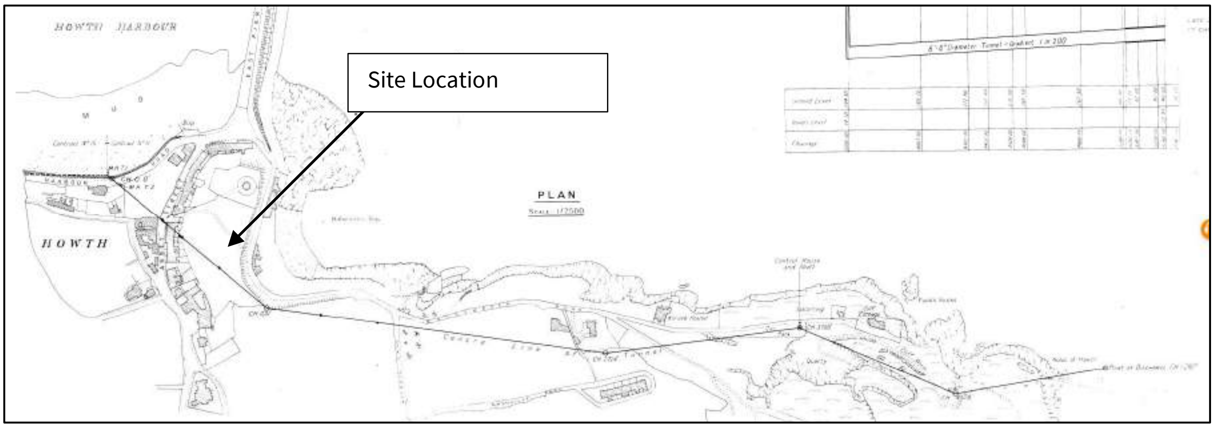


Figure 10.1: North Dublin Drainage Scheme – Howth Tunnel

Figure 10.2: North Dublin Drainage Scheme – Howth Tunnel

10.2 Raft Foundations

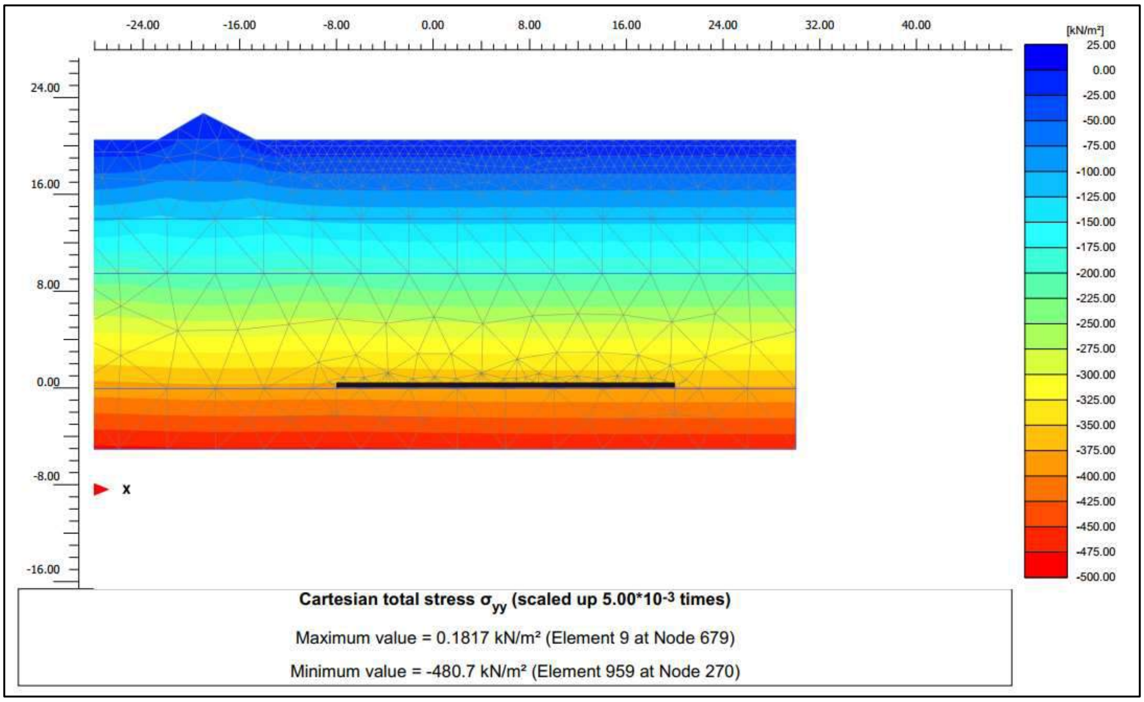
The foundations proposed for this development are raft foundations. The raft area of the deepest, Block B, is approximately 5,300m^2 in area and 69m in width (based on latest Architectural plans). The basement proposed formation level is approximately +17.5m OD (which is approximately 3m below existing ground level) and the raft foundation will have a bearing pressure of 80kN/m^2 as confirmed by Waterman Moylan.

10.3 Stress Induced by Applied Loads

ByrneLooby have carried out an assessment to assess the change in stress applied to the sewer tunnel using Plaxis 2D. The analysis has been carried out for Block B, where the excavation shall be least. In areas north of Block B, where excavation depths are greater there will be a net reduction on stress on the tunnel, despite the raft foundation loadings.

The assessment has modelled the initial stresses on the tunnel and modelled the construction sequence through bulk excavation works and construction of raft slab and building loading.

Based on the above information, the stress on the tunnel prior to any construction works has been calculated as 373kN/m^2. Following bulk excavation works, construction of the basement raft slab and the building, the stress on the tunnel has been calculated as 387kN/m^2, resulting in an increase in stress of 14kN/m^2 (4% increase in stress), with the results shown in Figure 10.3 and Figure 10.4. It is noted that the tunnel sewer has been presented as a line indicating the assumed level of the tunnel invert. Based on the limited stress increase on the tunnel, and that the initial tunnel stresses being greater north of this section (where the overburden over the tunnel is significantly greater) than the net stresses under Block B, the above increase in stress is considered acceptable.

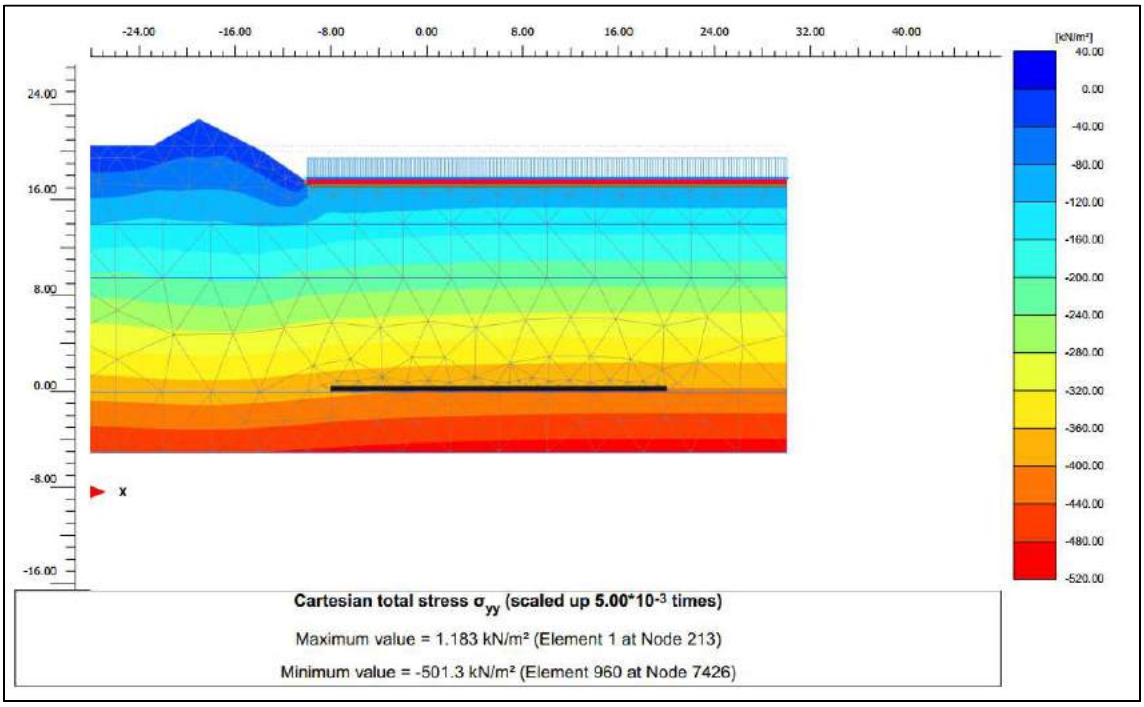


Cartesian total stress σ_{yy} (scaled up 5.00*10^{-3} times)

Maximum value = 0.1817 kN/m² (Element 9 at Node 679)

Minimum value = -480.7 kN/m² (Element 959 at Node 270)

Figure 10.3: Sewer Assessment – Short Term



Cartesian total stress σ_{yy} (scaled up 5.00*10^{-3} times)

Maximum value = 1.183 kN/m² (Element 1 at Node 213)

Minimum value = -501.3 kN/m² (Element 960 at Node 7426)

Figure 10.4: Sewer Assessment– Long Term

11 Conclusion

ByrneLooby have been requested by Balscadden GP3 to provide geotechnical design services for the proposed development at Balscadden Road, Howth. The engineer for the scheme is Waterman Moylan Consulting Engineers.

This report has been produced to detail the various geotechnical aspects covered in ByrneLooby's assessment. These include:

- Design of a secant pile wall with buttress piles along the southern elevation and building damage assessment based on predicted ground movements. Arising from the Damage Impact Assessment of neighbouring structures based on ground movements along this elevation, a Category 0 (Negligible Category) has been determined for the garage of 22 Asgard Park, while 21 and 22 Asgard Park lie outside the zone of sensitivity;

- Design of secant pile wall along the western elevation and building damage assessment based on predicted ground movements. Arising from the Damage Impact Assessment of neighbouring structures based on ground movements along this elevation, a Category 2 (Slight Category) has been determined for the for the single storey property to the rear of 25 Abbey Street. As outlined, Category 2 is considered an aesthetic damage category;

- Assessment of ground movements along northern elevation for open cut basement excavation. Arising from the Damage Impact Assessment of neighbouring structures based on ground movements along this elevation, it has been determined that the Martello Tower falls out of the zone of sensitivity caused by the basement excavation works;

- Proposed remedial works along eastern elevation. These proposed remedial works have been outlined as a soil nailing solution; and

- Assessment of raft slab foundation pressures on Howth Sewer Tunnel. The assessment has calculated an increase in stress on the sewer of 4%. As areas to the south of the assessed area are currently applying greater stresses than the calculated increased value, this increase in stress is considered acceptable.

Full details of the assessments are found within this report.

Appendix A – Designers Risk Assessment

Project Risk Assessment of Safety and Health Hazards / Risks

Engineers Ireland

Designer’s Assessment of Safety and Health Hazards / Risks

Project: Balscadden	**Designer: Nick Peters**	**Date:**	04/02/2022
Ref No: B1800-GEO-DRA01	**Checker: Maurice Ryan**	**Date:**	04/02/2022

Design Phase (Concept; Preliminary; Detailed or Redesign): Piling platform design

Note: review previous phase b/f items

No.	Key construction hazards (or risks) identified	Evaluations. Design decisions made (or alternative actions)
1	Unsuitable Wall Design for southern and western elevations	Secant Pile retaining walls designed in accordance with EC7 with recommendations from CIRIA C760. Walls have been designed based on recent site specific ground investigations and groundwater monitoring.
2	Formation Levels	Formation levels have been provided by the Engineer/Architect. Strict control over formation levels are to be implemented by the contractor. Formation levels are not to be exceeded.
3	Unforseen Ground Conditions	Secant Pile retaining wall has been designed in accordance with relevant SI data. Any variations in ground conditions should be communicated to the detailed pile designer.
4	Ground and adjacent building movement	ByrneLooby have outlined predicted movements based on the specimen design and the impact of these movements on adjacent structures/infrastructure.
5	Groundwater Levels	Minerex have completed a Hydrogeological Assessment Report which has outlined groundwater levels. The secant pile walls have been designed such that the female piles shall terminate at shallow depths than the male piles to allow flow of water beneath the slab level.
6	Martello Tower	A ground movement assessment has been carried out adjacent to the northern elevation. The assessment is considered conservative and shows that the movements will not impact on the Martello Tower.
7	Monitoring	Vibration monitoring is to be completed through the piling works to ensure no impact on the adjacent structures and infrastructure. Movement monitoring is to be carried out throughout the bulk excavation works based on the trigger limits outlined in the report.
8	Howth Sewer	ByrneLooby have carried out an assessment on the impact on the development on the underlying Sewer which shows there will only be a minor increase in stress on the sewer. As areas to the south of the site currently apply greater stress to the sewer, the above increase in stress at the location of the development is considered appropriate.
9		
10		

Notes re providing info.	Item Nos. (from above)	Remarks
a) For client’s designer	All	
b) Hazards particular risks	-	
c) Other particular risks	-	
d) Re assumed construction methods	All	
e) For safety file	All	
f) In-house: b/f to future stages	-	

Other parties please take note: These are designer’s risk evaluations of design options carried out in-house for the purpose of our complying with designer’ duties under the Safety, Health and Welfare at Work (Construction) Regulations 2006 -2013, CDM2015 CDM2016 N.I. or other legislative EHS requirements. The evaluations relate only to those aspects / elements of the project which we are responsible for designing under the terms of our appointment by our client. Other Parties should not rely on these evaluations for their own purposes; in particular, contractors, who must deal with and control risk arising during construction, must carry out their own definitive risk assessment ab initio for that purpose

Appendix B – Minerex Hydrogeological Assessment Report

Hydrogeological Assessment Report for proposed development at Balscadden Road, Howth, Co. Dublin

Minerex Doc. Ref.: 3330-031 (Hydrogeological Assessment Report) (Rev 1)

Date: 21/02/2022

Report by:

Minerex Environmental Limited
Hydrogeological, Environmental and
Geophysical Services
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Report To:

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Prepared by:	**Reviewed by:**
Chris Fennell	Cecil Shine
Chris Fennell Ph.D	**Cecil Shine** B.Sc., M.Sc., PGeo, EurGeol
Hydrogeologist	Project Director Dewatering & Contaminated land

Minerex
Environmental

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Executive Summary

1. The site for the proposed development is underlain by a thick layer of glacial sands, gravels and clays. A wide mapped fault is located along the southern end of the site dividing Carboniferous limestones (North) from older Cambrian Bedrock (South) with fault Breccia visible on the southern end of Balscadden Bay.
2. Continuous water level monitoring, site surveys, water sampling and hydrochemical analysis have been used to develop a conceptual hydrogeological site model.
3. The conceptual site model indicates groundwater flow towards Grays Brook to the west of the site, northwards towards the Martello tower and eastwards towards Balscadden Bay as evidenced by the mapped and sampled springs.
4. The conceptual site model indicates that the proposed development, which includes 2no. secant piled walls (south and west), is unlikely to impede groundwater flow or create any significant barrier effect. The southern piled wall does not extend to the water table. While the male piles of the western piled wall do extend to the water table the likelihood of any impedance of groundwater flow is mitigated due to the groundwater flow direction and the raised levels of the female piles.

1. Introduction

Minerex Environmental Limited (MEL) was commissioned by Marlet to carry out a hydrogeological assessment for a proposed development at Balscadden Road, Howth. Co. Dublin.

The scope of this report and the specific deliverables of the assessment, as requested, are as follows:

"A Hydrological Assessment of the site is required including an assessment of the groundwater levels and natural ground water flows and/or water courses adjacent to and within the site. The Hydrological Assessment shall address the proposed development in relation to the existing hydrology both within and adjacent to the site and shall include:

1. *Groundwater monitoring of the 2 no. borehole standpipe piezometers (via diver data logger or similar) over a 3-month period.*
2. *Logs for the monitoring of groundwater including a rainfall event.*
3. *Mapping of hydrological water courses both within and adjacent to the site.*
4. *Hydrological testing of existing water courses to determine source (saline testing).*
5. *Recommendations for the management of groundwater hydrology within the proposed development.*
6. *Impact of the proposed development on local groundwater hydrology.*
7. *Interpretive report."*

2. Site Description

2.1 Geology

The site is predominantly underlain by the Ballysteen Formation. The lithology of the Ballysteen Formation is described as irregularly bedded with nodular bedded argillaceous bioclastic limestones (wackestones and packstones), interbedded with fossiliferous calcareous shales (Appendix A). A mapped fault is shown towards the southern edge of the site separating the Ballysteen formation from the Elsinore Formation. The Elsinore Formation is described as a polymict melange of quartzite, greywacke, siltstone, mudstone, and calcareous sandstone in a chaotic mudstone-sandstone matrix. Components in this formation can vary in size from pebbles to blocks hundreds of metres across.

A description of the local geology of Balscadden Bay including the fault located at the southern end of the site is included in Ref. 1 (see Figures 2.1 and 2.2). The southern side of Balscadden Bay is comprised of Cambrian aged 500-million-year-old bedrock that is more typical of the rest of the Howth peninsula. A wide fault zone spans the entire back of Balscadden Bay with fault Breccias evident on the southern end of the beach (Figures 2.3 and 2.4). Further north, The Martello Tower is underlain by glacial sediments which are in turn underlain by the aforementioned Carboniferous Limestone that is visible gently dipping along the beach (Figure 2.5).

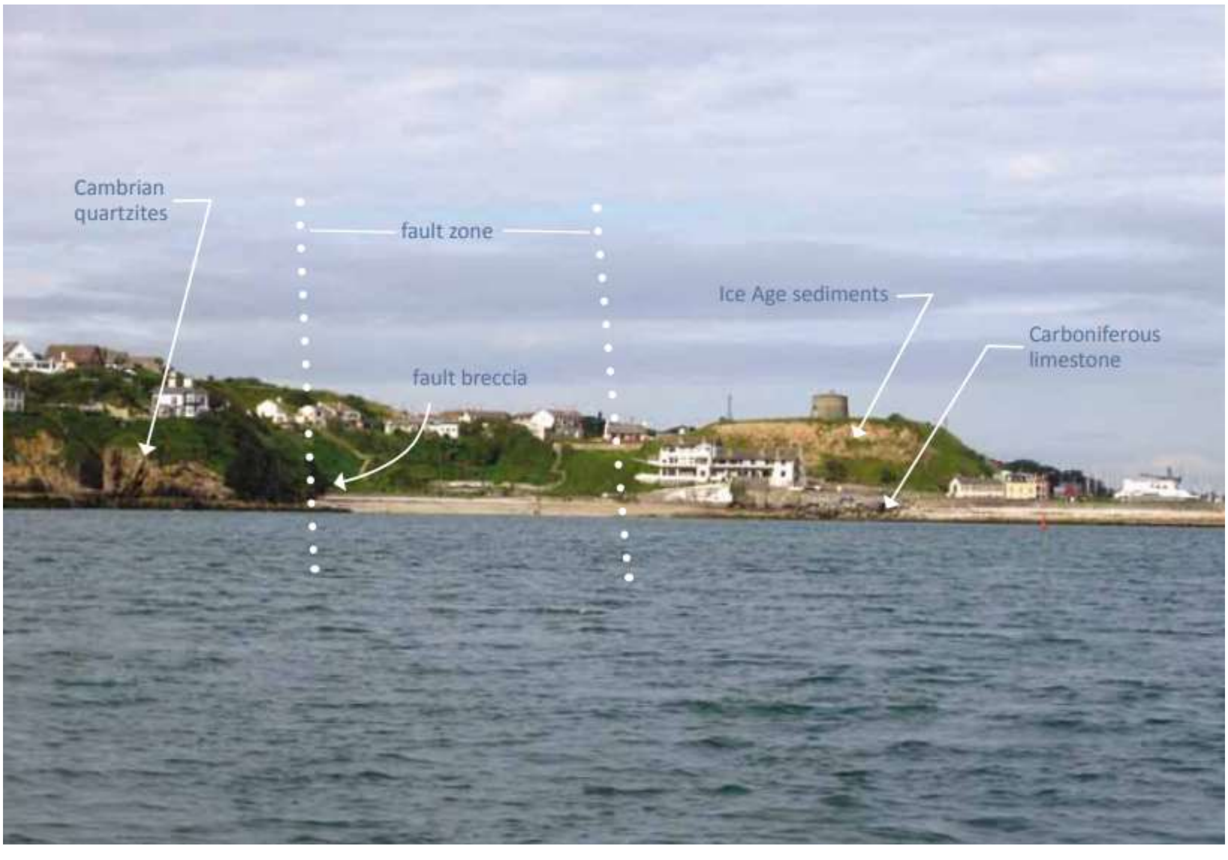


Figure 2.1 Eastward view of Balscadden Bay showing bedrock lithology and fault (Ref.1)

Figure 2.2 Southward view of Balscadden Bay showing bedrock lithology and fault (Ref.1).

Figure 2.3 Fault Breccia visible at the southern end of Balscadden Bay.

Figure 2.4 Fault Breccia visible at the southern end of Balscadden Bay.

Figure 2.5 Carboniferous limestone on Balscadden Beach.

2.2 Quaternary Sediment / Overburden

The Quaternary sediment overburden of the site is described as gravels from Lower Palaeozoic sandstones and shales. As described in Ref.1, the steep slopes surrounding the site and the Martello Tower to the north are exposures of thick sands and gravels deposited by glacial meltwaters. There is a layer of till on top of these that indicate an ice sheet advanced over the sands as a last episode of glaciation. Much of the subsoil is mapped as having low permeability (Appendix A).

2.3 Aquifer Classification

The classification of the aquifer underlying the site reflects the bedrock lithology described in Section 2.1. The portion of the site to the north of the fault underlain by the Ballysteen formation is classed as locally important aquifer with bedrock that is moderately productive only in local zones. To the south of the mapped fault the aquifer is classed as poor which is generally unproductive except for local zones (Appendix A).

2.4 Groundwater Recharge

The volume of effective rainfall likely to reach groundwater, i.e. recharge, can be estimated from recharge coefficients compiled by the Working Group on Groundwater, which are based on soil drainage, subsoil permeability, vulnerability and aquifer type (Ref. 2).

Areas classified as “made ground” are assigned a recharge coefficient of 20% (see Appendix A) due to likely restrictions in recharge as a result of paving, building etc. (Ref. 2). This recharge coefficient provides an average recharge value of 53mm/yr for the site and surrounding areas. While this likely represents the developed areas surrounding the site, as much of this site itself is undeveloped, this likely underestimates the recharge.

While groundwater recharge is indicated by the combination of soils and subsoils, a natural recharge capacity limit is applied to poorly productive aquifers to simulate ‘rejected recharge’. This reflects the limited ability of these aquifers to accept and transmit recharging waters.

The natural recharge capacity of locally important ‘Ll’ bedrock aquifers is taken as 200 mm/yr, and 100 mm/yr for poor ‘Pl’ and ‘Pu’ bedrock aquifers. Hence, the maximum recharge capacity for the proposed site is likely between 100 - 200 mm/yr.

2.5 Groundwater Vulnerability

Groundwater vulnerability at the site is mapped as ranging from High (H) at the east of the site to Extreme (E and X) towards the western edge of the site (Appendix A). High groundwater vulnerability represents an area where the depth to rock or extent of subsoil overburden ranges between 3 – 10m. The Extreme (E) and (X) vulnerability categories represent areas where the subsoil thickness ranges from 0 – 3 m and where rock is at or near the surface respectively.

While much of the western half of the site is mapped as E/X, the site investigation boreholes (BH01 and BH02) indicate at least 17m of overburden is present at these locations. While the eastern half of the site is regarded as having High vulnerability, the log from BH03 shows there to be at least 12.8 m of overburden.

The discrepancy between the vulnerability map and the site investigation is likely attributable to limitations in the vulnerability mapping data and its resolution. Given the findings of the site investigation the vulnerability of the site is likely to be moderate or low.

2.6 Protected Areas

The area to the east of the site, including Balscadden Bay and extending south around Howth Head and north along the East Pier, is designated under the Howth Head Special Area of Conservation (SAC) (Appendix A).

2.7 Surface Water Features

The EPA rivers database (Ref. 3) show two streams, one to the east and one to the west of the site (Appendix A). Gray's Brook flows northwards along Main Street onto Abbey Street where it flows along the west side of the site. It passes under Harbour Road and enters the sea to the east of the Yacht Club. Coolcur Brook, to the west of the site, flows northwards along Kilrock Road and enters the sea at the southern end of Balscadden Bay.

A more comprehensive and historical description of both rivers and their tributaries is presented in Ref. 4 (Figure 2.6). The Coolcur Brook has a catchment area of 47 hectares and is bounded by the Gray's Brook catchment on the west and the Kilrock and Canon Rock area on the east and north-east of the hill. Gray's Brook has a catchment area of 96 hectares and is bounded on the west by the Offington Stream catchment.

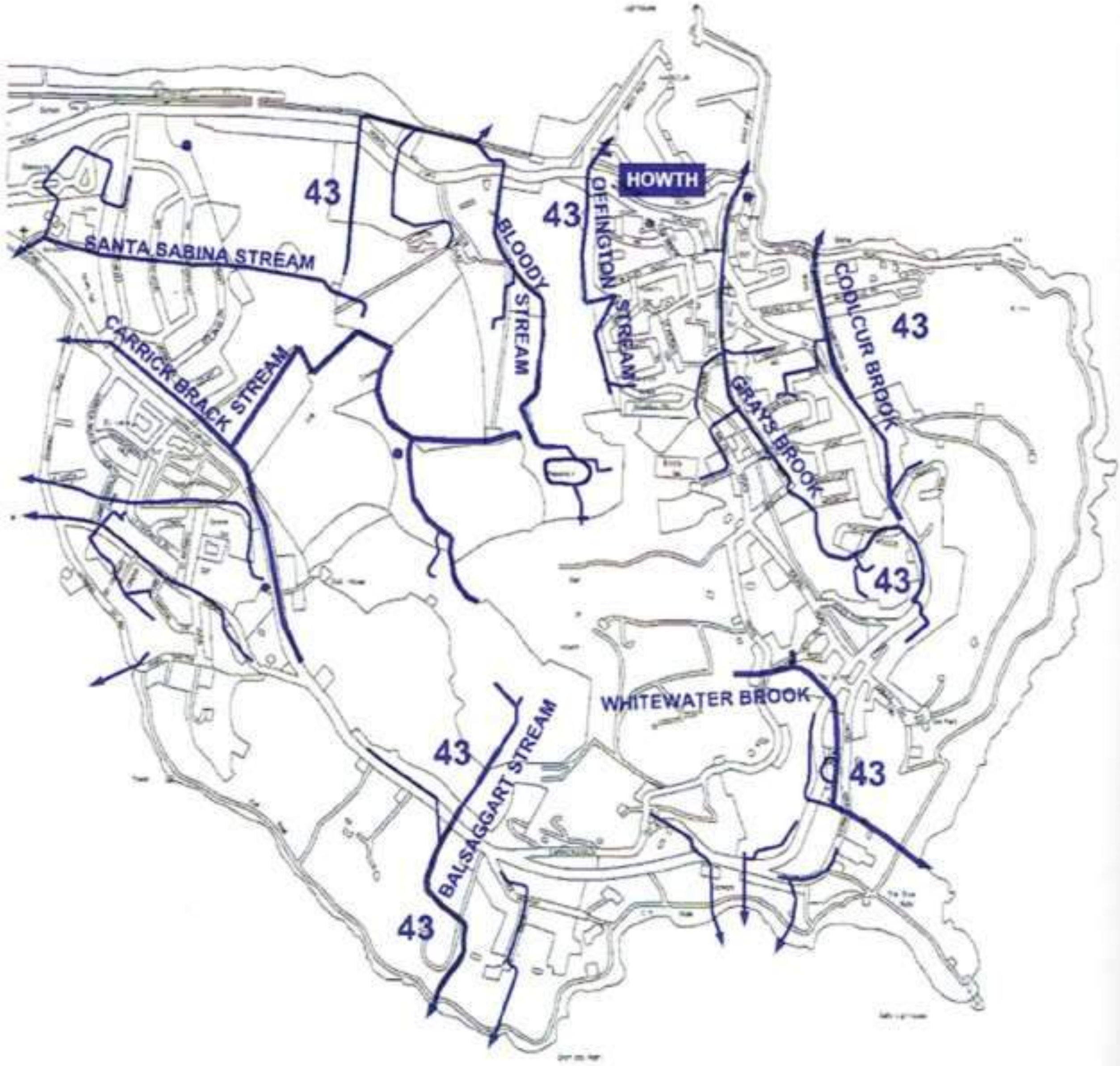


Figure 2.6 Rivers of Howth Head and Balscadden Bay (Ref. 4).

2.8 *Howth Tunnel*

The Howth Tunnel was constructed between 1955 and 1956 as the last section of a Main Trunk Sewer. It consists of a high and low level tunnel, which together are one-mile long (Ref. 5). The internal diameter of the sewer is 6.0 feet (1.83m) throughout the tunnel. The first 300m (1,000 feet) of the tunnel (from the Harbour Road Shaft), had to be supported with the primary lining RC segment rings. In that area material was not self – supporting or sound, and it predominantly consisted of boulder clay, limestone rock, dense clays of various colours, and loose brecciated quartzite rock. The tunnel passes under the site as shown in Figure 3.3.

3. Sampling & Assessment

3.1 Site Investigations

An initial site investigation was carried out in September 2017. Cable percussion boring was undertaken at 1 no. location (BH-GDG-01 – see Figure 3.1) using a Dando 150 rig to construct a 200mm diameter borehole. The borehole terminated at the scheduled depth of 20mbgl.

The groundwater standpipe installation incorporated a bentonite seal from 13.00mbgl to 14.50mbgl with a gravel response zone below this to 18.00mbgl and a second bentonite seal at the base of the response zone. The standpipe was installed to 18.00mbgl with a 3m slotted section back to 15.00mbgl to allow for any groundwater in this zone to ingress. A geosock was placed around the pipe at the slotted section. The borehole log is presented in Appendix B.

Following completion, a period of groundwater monitoring was undertaken. The well was found to be dry on four separate occasions throughout October 2017. This borehole was found to dry during all Minerex site visits in 2021.

In accordance with a Specification for Site Investigation Requirements Report issued by Waterman Moylan, two further S.I boreholes were scheduled for construction. In June 2021 cable percussion boring was undertaken at 3 no. locations (see Figure 3.1) using a Dando 150 rig to construct 200mm diameter boreholes. The boreholes terminated at depths ranging from 13.00mbgl (BH03) to 17.20mbgl (BH02) when obstructions were encountered. Groundwater monitoring standpipes were installed consisting of slotted pipe surrounded by a gravel response zone with bentonite seals (see Appendix C).

3.2 Monitoring & Sampling

3.2.1 Borehole Monitoring

Continuous groundwater level loggers or “divers” were installed in 2 no. boreholes (BH01 and BH02) for a nine-week period from August to October 2021. Groundwater levels were manually measured using a Solinst Dip meter during this period.

Boreholes BH01 and BH02 were sampled twice during the monitoring period (10/09/2021 and 06/10/2011). Prior to sampling the water level and total borehole depth of each monitoring point was recorded using a Solinst dip meter. Static water level was recorded with respect to a fixed point on the top of the well casing (noted on field sheet) with the height of this fixed above ground level also recorded. Sampling was conducted using a 12V submersible WASP five stage pump with dedicated tubing for each borehole. Prior to sampling each borehole was purged in accordance to BS ISO 5667:11. Samples were only taken once the stabilisation of field hydrochemical parameters was achieved. All field hydrochemical parameters (pH, electrical conductivity and temperature) were recorded using a HANNA INSTRUMENTS^{TM} Probe calibrated using respective standard solutions.

3.2.2 Surface Water Monitoring

Three samples were taken from surface water streams in proximity to the site on the 10/09/2021. The locations and photos of each sampling points is presented in Figure 3.2. One sample (SW3) was taken upgradient of the site from Gray's Brook after is passes through a culvert under Dungriffin Road.

Note, there are discrepancies between the published Ref. 3 and Ref. 4 maps as to where Gray's Brook enters the sea. A sample (SW2) was taken from a visible surface discharge into the sea just east of the Yacht club. This is in proximity to where it is mapped by Ref. 3 and is likely Gray's Brook. A sample (SW01) was also taken from where Ref. 4 states it enters the sea at the base of East Pier.

No samples could be obtained from Coolcur Brook to the east of the site due to restricted access.

3.2.3 Spring Monitoring

A site survey and coastal assessment was carried out during low tide on the 10/09/2021. Groundwater springs were mapped and recorded. Several springs and seepages were observed along the western edge of the site, both on Balscadden Road and Balscadden Beach. Several seepages are evident on the retaining wall running along Balscadden Road at the base and to the west of the Martello Tower. These seepages are also apparent where they run onto the road itself.

Several spring discharges are apparent along the length of the beach. These are visible through a combination of pipe drains cast into the retaining wall at the top of the beach as well as through several weakness/pathways in the concrete. At low tide, spring discharge can be seen flowing over the beach and outcropping limestone on the northern part of the bay.

Three springs were sampled where sufficient water volume could be obtained. The locations and photos of each sampling point is presented in Figure 3.3. Sample SP1 was obtained from a concrete trough on Balscadden Road. The trough is fed from a drainage pipe cast into the retaining wall below the Martello Tower. Sample SP2 was obtained from a spring seepage apparent underneath the buildings at the northern end of Balscadden Bay. Sample SP3 was obtained from a spring flow through the concrete wall and pathway at the top of Balscadden Beach. This spring was located below the pedestrian steps to the beach. Several springs are also visible in the breccia exposed on the southern end of Balscadden Bay (Figure 2.4) however, flows were not sufficient to obtain a sample.

The western and northern bounds of the site (along Abbey Street) was also examined for the presence of springs. None were observed; however, the built-up nature of this area means observations are limited.

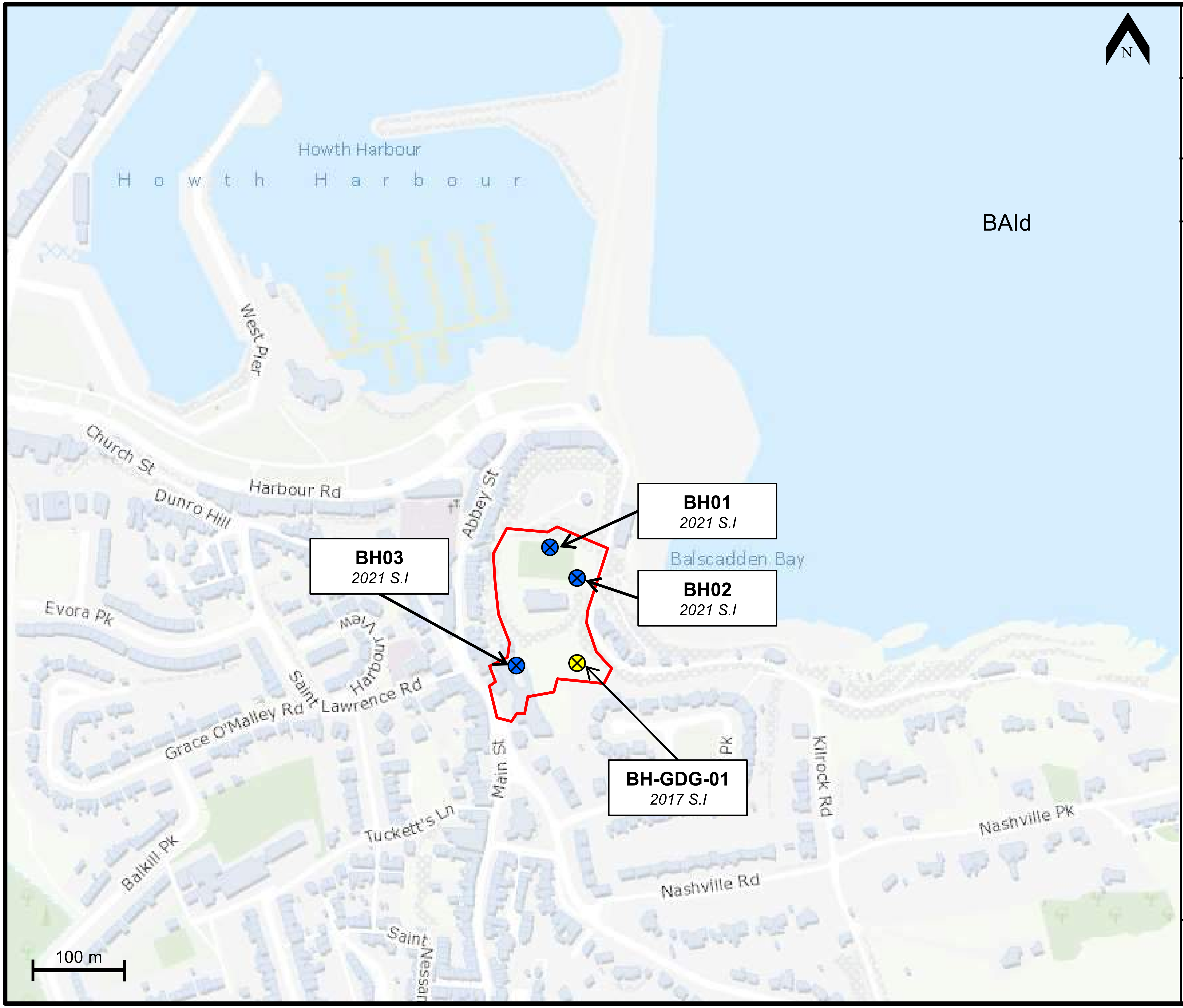


Figure 3.1
S.I Boreholes

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥	Site Outline
⊗	*2021 S.I Boreholes*
⊗	*2017 S.I Borehole*

Minerex Environmental

Figure 3.2

Surface Water
Sampling Points

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥	Site Outline
▲	Surface water sampling location

Minerex Environmental

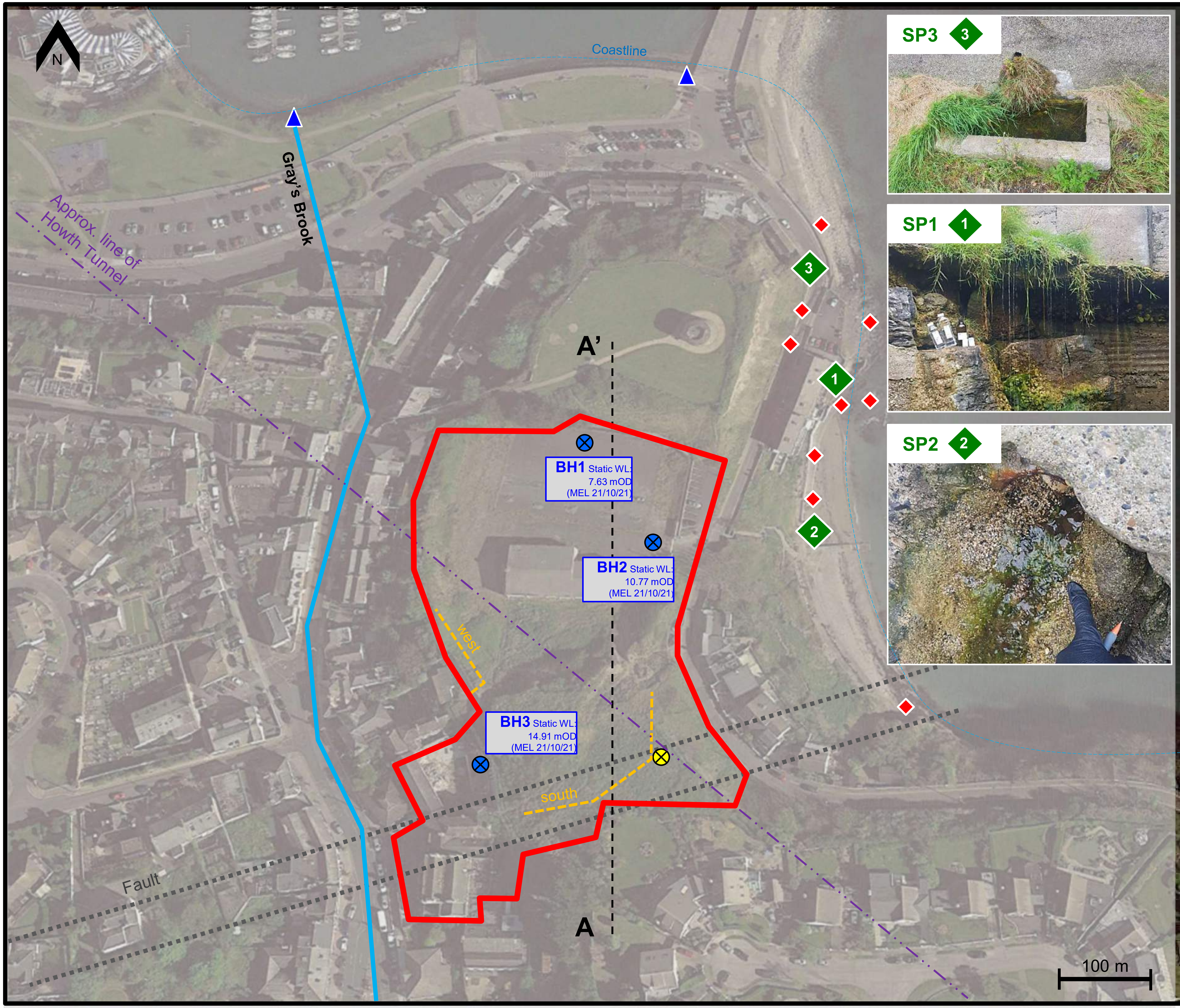


Figure 3.3
Sampling Locations

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.Rev.1
Drawn by: CF 22/10/2021

Common Legend

🟥	Site Outline
⊗	Borehole (2021 S.I)
⊗	Borehole BH-GDG-01 (2017 S.I)
◆	Spring (Sampled)
◆	Spring (Not sampled)
▲	Surface water sample
- -	Proposed secant pile wall (approximate)

Minerex Environmental

4. Results & Assessments

4.1 Hydrochemistry

Hydrochemistry results are presented in Table 4.1. Corresponding laboratory certificates of analysis are included in Appendix D.

The hydrochemical signatures associated with the surface water, groundwater and spring samples taken at the site are illustrated using a trilinear Piper diagram in Figure 4.1. The ultimate source of most dissolved ions in groundwater is the mineral assemblages in rocks near the land surface. Consequently, a general relationship between the mineral composition (or the hydrochemical signature) of natural water and that of the solid minerals with which the water has been in contact is to be expected. The term “hydrochemical facies” is used to describe the different types of groundwater hydrochemical signatures brought about by these interactions.

The hydrochemical signature associated with both BH1 and BH2 are similar and are consistent across the two separate sampling events. The hydrochemical results are consistent with a calcium/magnesium/bicarbonate signature. This is consistent with the carbonate nature of limestone bedrock.

The signatures from samples SW1 and SW2 are likely skewed towards a high sodium signature due to saline coastal influences. Both sampling points are submerged during high tide. While the samples were taken at low tide the saline signature was still evident. This is consistent with the electrical conductivity recorded at the time of sample (37,800 and 23,000 µS/cm). Comparisons between the upgradient and downgradient sample from Grays Brook are therefore challenging.

Sample SW3, taken upgradient of the site, is notably similar to the signature recorded at BH1 and BH2 (calcium/magnesium/bicarbonate). The sample was, however, significantly less mineralised, with lower concentrations of the major ions as would be expected from a surface water system.

The hydrochemical signature associated with samples SP1 and SP2 is notability consistent with BH1, BH2 and SW3. While SP1 has a similar signature, it is less mineralized compared to BH1, BH2 and SP2, with the conductivity less than half. This is consistent with mixing occurring between the natural groundwater and a less mineralized surface water. As this spring sample was taken from underneath the buildings on Balscadden Road, the mixing could be a result of a mains water leak.

The signature from SP3 has higher concentrations of sodium and potassium compared to SP1 and SP2. However, remaining hydrochemical parameters are consistent with the S.I boreholes and SP2. Note, sample SP3 was taken directly from the concrete trough on Balscadden Road due to insufficient flow from the spring. Hence, the water would have been stagnant. The elevated sodium and potassium concentrations would be consistent with increased exposure to the coastal environment.

Table 4.1 Hydrochemistry result for borehole, spring and surface water monitoring.

		BH1	BH2	BH1	BH2	SP1	SP2	SP3	SW1	SW2	SW3
Parameter	**Unit**	**13/09/2021**		**06/10/2021**		**13/09/2021**			**13/09/2021**		
Alkalinity, Total as CaCO3	mg/l	355	300	348	390	115	305	315	155	180	150
Ammoniacal Nitrogen as N	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH4	mg/l	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chloride	mg/l	74.1	77.9	80	81	33.5	110	115	16300	9290	40.1
Conductivity	uS/cm	887	856	897	847	446	980	977	37800	23000	483
pH	pH	7.39	7.27	7.3	7.16	8.13	7.57	7.69	7.81	7.71	8.04
Nitrate as NO3	mg/l	35.3	30.2	37.1	29.4	7.61	30.7	<0.35	4.27	9.27	6.88
Phosphate (Ortho as P)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0281	0.079	0.0826	0.03
Sulphate	mg/l	113	66.3	113	66.5	43	58.6	51.7	2240	1210	50.5
Calcium (Dis.Filt)	mg/l	123	116	126	122	52	122	81.4	343	228	66.8
Iron (Dis.Filt)	mg/l	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	0.0433	<0.114	<0.019	0.109
Magnesium (Dis.Filt)	mg/l	20.5	18.9	20	19	5.86	20.5	19.5	1020	624	8.85
Manganese (diss.filt)	µg/l	43.7	6.9	5.78	<3	<3	<3	9.69	<18	<3	44.4
Phosphorus (diss.filt)	µg/l	<10	<10	<10	<10	<10	<10	23.9	78.6	91.9	54.5
Potassium (Dis.Filt)	mg/l	8.36	5.71	9.71	5.5	2.94	7.27	11.9	299	175	2.44
Sodium (Dis.Filt)	mg/l	42.3	44.3	42.5	42.4	22.1	56.4	93.7	8940	5050	26

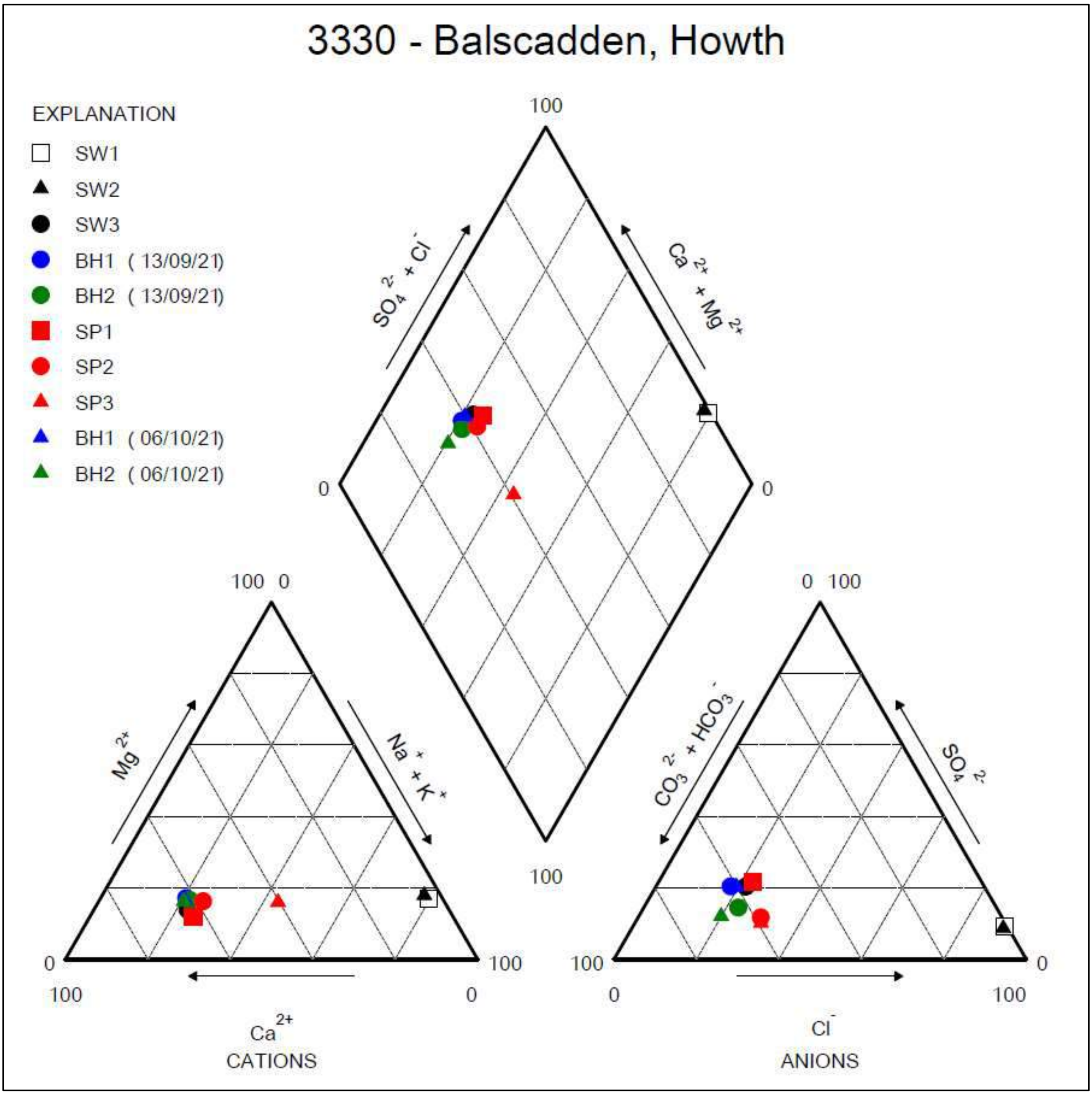


Figure 4.1 Hydrochemical signatures associated with the samples obtained (Ref. 6).

4.2 Water Level Monitoring

Continuous water level data and antecedent rainfall taken from Met Eireann (Dublin Airport) is presented in Figures 4.2 – 4.4. The water level was consistently deeper (approx. 3m) in BH01 compared to BH02. Borehole BH-GDG-01 was dry during initial monitoring in 2017. It was dry throughout the course of this investigation in 2021.

Figure 4.2 Continuous water level data from BH01 and BH02.

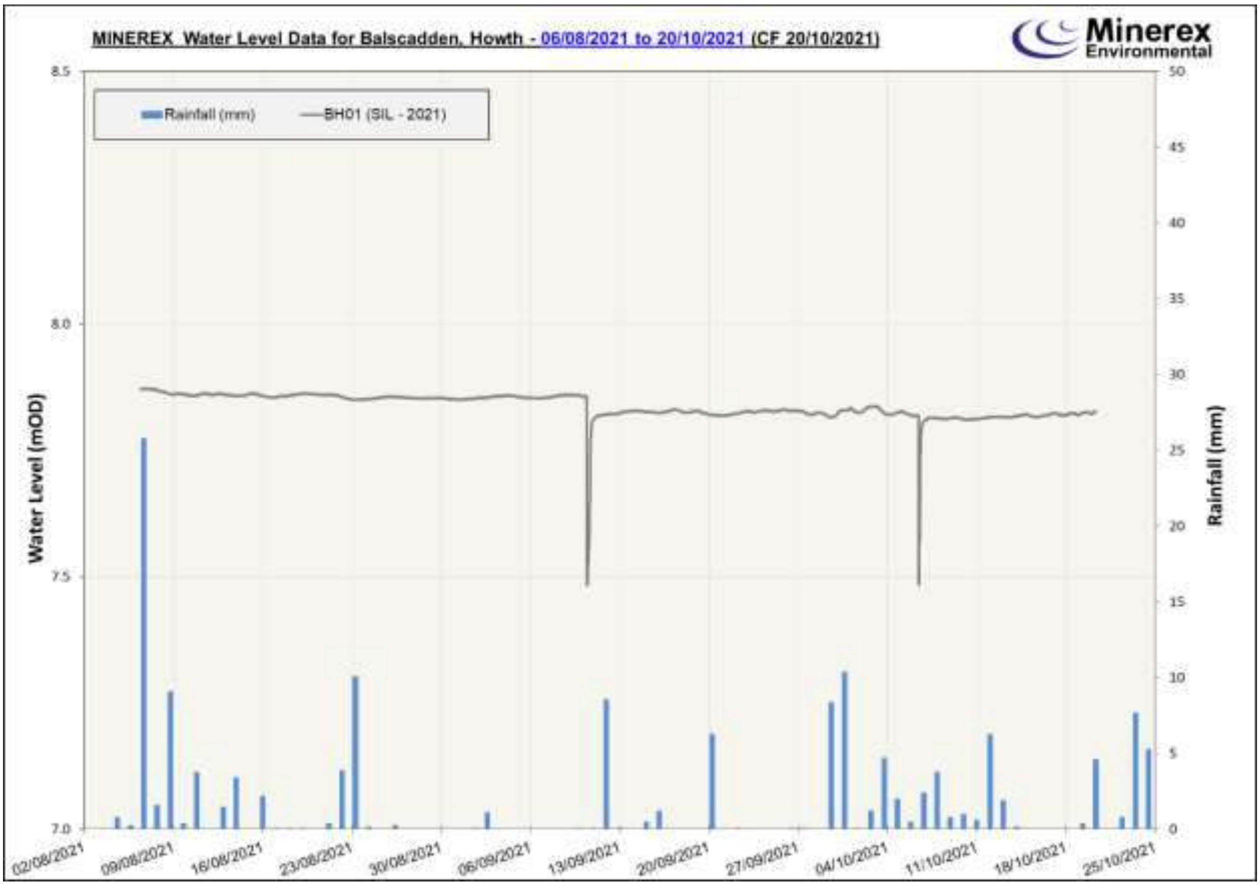


Figure 4.3 Continuous water level data from BH01 and antecedent rainfall.

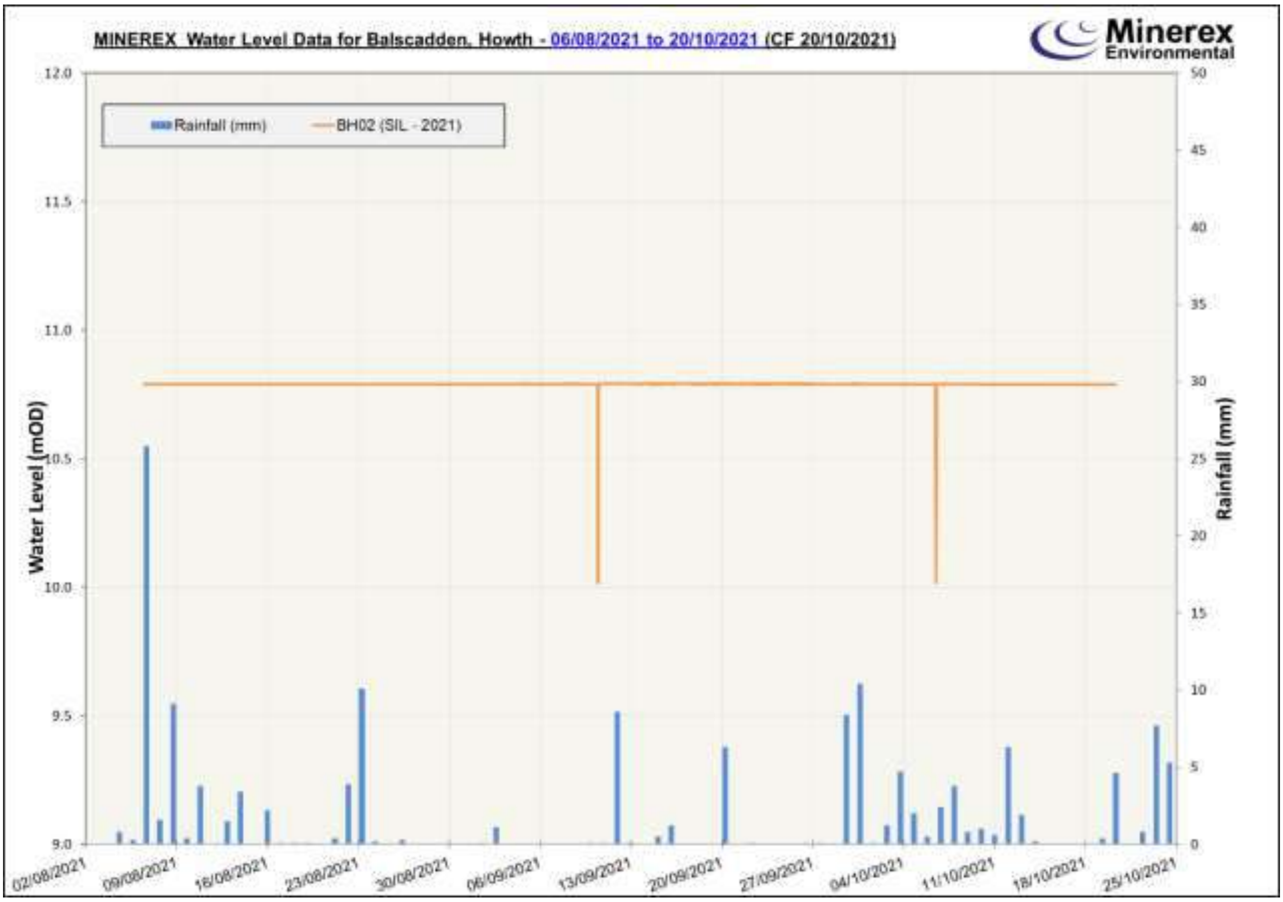


Figure 4.4 Continuous water level data from BH02 and antecedent rainfall.

5. Proposed Development & Local Hydrogeology

5.1 Conceptual Hydrogeological Site Model

A conceptual hydrogeological site model including conceptual groundwater contours and flow directions is presented in Figure 5.1.

As shown, groundwater flow is likely bound to the west of the site by Gray's Brook, with baseflow contributions likely from the western boundary of the site towards the Brook. A steep groundwater gradient from BH3 to BH1 is consistent with a northwards flow direction. Groundwater flow to the east is also apparent as evidenced by the presence of springs along Balscadden Road and Balscadden Bay. This is consistent with the hydrochemical signatures presented in Section 4.1. Bedrock groundwater flow is likely bounded to the south by the mapped fault. Seepages apparent in the Breccia located on the southern end of Balscadden Bay is consistent with groundwater flow along this fault.

The influence of the Howth Tunnel on the hydrogeological regime of the site is uncertain and would depend on the integrity of the lined section of the tunnel.

The groundwater hydrograph for BH01 and BN02 suggests little correlation with rainfall, at least on a short to medium timescale. This is consistent with depth and nature of the overburden. Further monitoring would be required to identify temporal variability of hydrographs in the long term. However, significant variation in the water level would not be expected seasonally.

5.2 Proposed Development Structures

Plans and section for the proposed development were provided to Minerex by Waterman Moylan and Byrne Looby. Two secant piled walls are planned as part of the development. One is located on the southern boundary of the site with the second located along a short section of the western boundary.

It is proposed that the male and female piles on the southern piled wall will extend to 17mOD and 23.5mOD, respectively. It is proposed that the male and female piles on the western piled wall will extend 11.5mOD and 16mOD, respectively. An 850mm RC raft slab will be constructed with an SSL of 18 mOD under a portion of the proposed development.

5.3 Proposed Development Influence on Hydrogeology

A conceptual cross section of the site, including the S.I boreholes, water level data and proposed piled walls is presented in Figure 5.2. The male piles of the southern piled wall do not extend to the water table (male pile toe level 17mOD). The likelihood of any disruption of groundwater flow and the creation of any barrier effect is low. This is further mitigated by the raised female pile toe level as the subsequent gaps (conservative estimate of 15% open area) between the male and female piles will facilitate any flow from the unsaturated zone.

The base of the male piles in the western piled wall do potentially extend to the water table. However, any disruption to groundwater flow is mitigated by the level of the female piles. Furthermore, as shown in Figure 5.1, the inferred groundwater flow direction at this location is not perpendicular to the wall and rather is closer to parallel, further reducing the likelihood of any barrier effect.

Given a formation level of approximately 17mOD for the basements of the proposed development the likelihood of any disruption to groundwater flow is low. The nature of the bedrock and overburden give rise to a low recharge coefficient for the site. The development and the construction of any paved surfaces will likely further reduce the natural recharge capacity of the site. This should be mitigated against using permeable paving and adequately designed soakaways to manage surface water where possible.

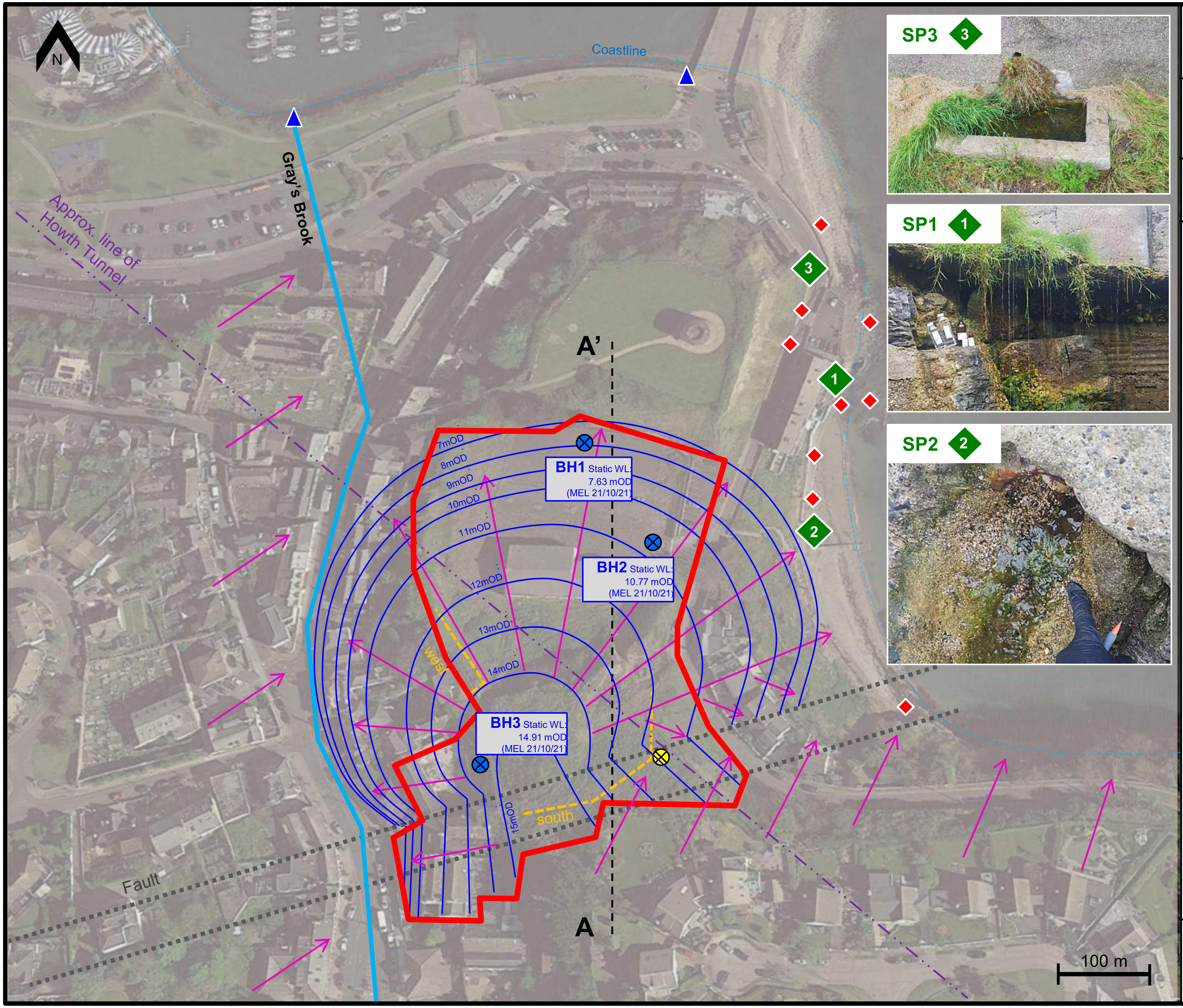


Figure 5.1
Conceptual Site Model

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.Rev.1
Drawn by: CF 22/10/2021

Common Legend

🟥	Site Outline
⊗	Borehole (2021 S.I)
⊗	Borehole BH-GDG-01 (2017 S.I)
◆	Spring (Sampled)
◆	Spring (Not sampled)
▲	Surface water sample
- -	Proposed secant pile wall (approximate)
—	Groundwater equipotentials
→	Conceptual GW flow direction

Minerex Environmental

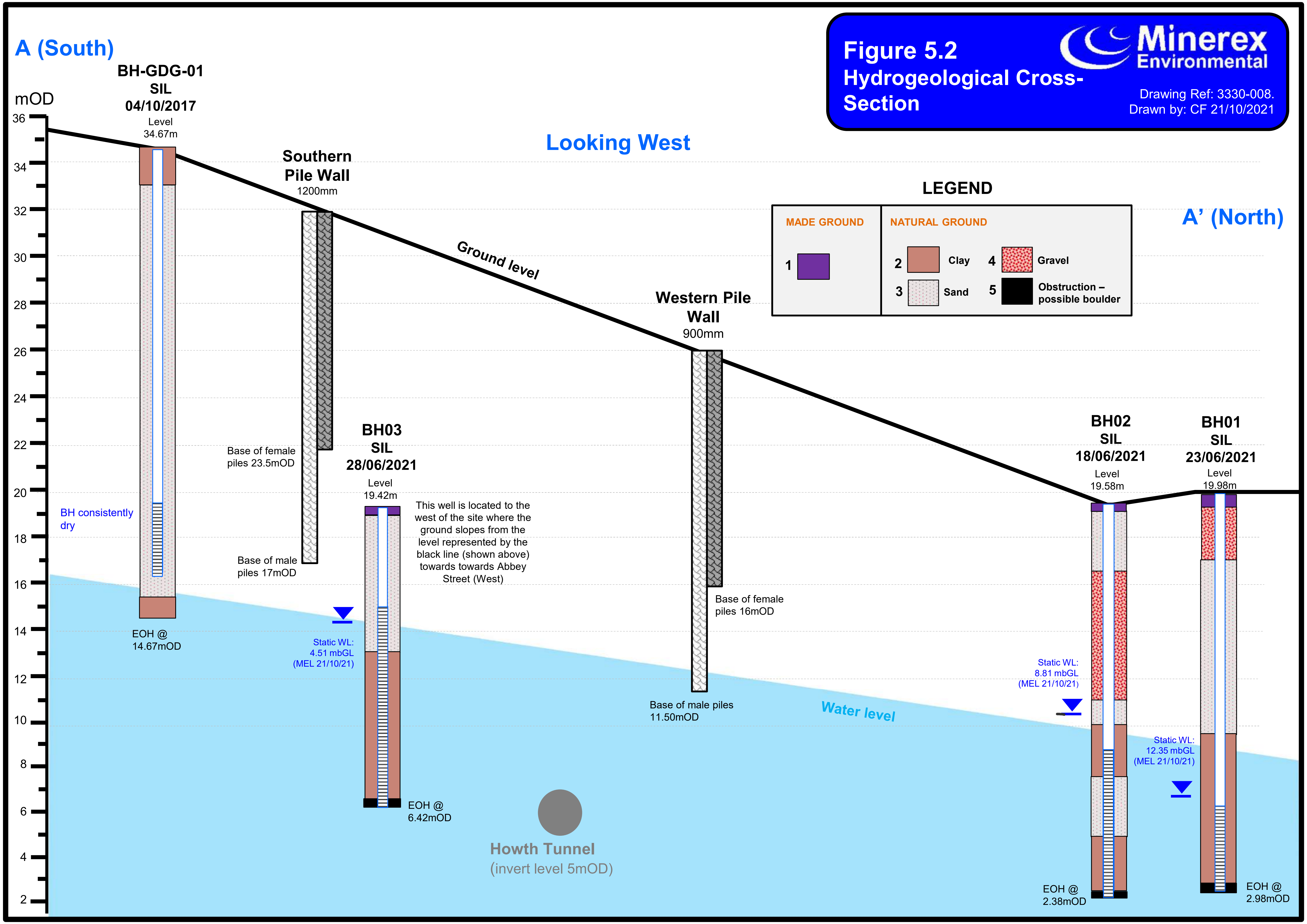


Figure 5.2 Hydrogeological Cross-Section

Minerex Environmental

Drawing Ref: 3330-008.
Drawn by: CF 21/10/2021

6. Summary & Conclusions

1. The site for the proposed development is underlain by a thick layer of glacial sands, gravels and clays. A wide mapped fault is located along the southern end of the site dividing Carboniferous limestones (North) from older Cambrian Bedrock (South) with fault Breccia visible on the southern end of Balscadden Bay.

2. Continuous water level monitoring, site surveys, water sampling and hydrochemical analysis have been used to develop a conceptual hydrogeological site model.

3. The conceptual site model indicates groundwater flow towards Grays Brook to the west of the site, northwards towards the Martello tower and eastwards towards Balscadden Bay as evidenced by the mapped and sampled springs.

4. The conceptual site model indicates that the proposed development, which includes 2no. secant piled walls (south and west), is unlikely to impede groundwater flow or create any significant barrier effect. The southern piled wall does not extend to the water table. While the male piles of the western piled wall do extend to the water table the likelihood of any impedance of groundwater flow is mitigated due to the groundwater flow direction and the raised levels of the female piles.

7. References

No.	Description
1	Parkes, M (2012) Islands, Coasts and Quarries. The Geological Heritage of Fingal. Fingal County Council
2.	Hunter Williams, N.H., Misstear, B.D., Daly, D and Lee, M (2013) Development of a national groundwater recharge map for the Republic of Ireland. *Journal of Engineering Geology and Hydrogeology*, **46**, 493-506.
3	EPA Geoportal Map Viewer (2021) Environmental Protection Agency
4	Sweeney, C.L., O'Connell, G and Curtis, M (2017) The Rivers of Dublin. Irish Academic Press: Kildare.
5	O'Connor Sutton Cronin (2019) Rennie Place Strategic Housing Development, Balscadden Road, Howth, Co. Dublin. Structural and Geotechnical Engineering Report for CREKAV TRADING GP LTD.
6	Winston, R.B., 2020, GW Chart version 1.30: U.S. Geological Survey Software Release.
7	Public Data Viewer Series (2021) Geological Survey of Ireland

8. Appendices

Appendix A

Drawing Title
Bedrock Geology

Client: Marlet - Balscadden
Project: 3330

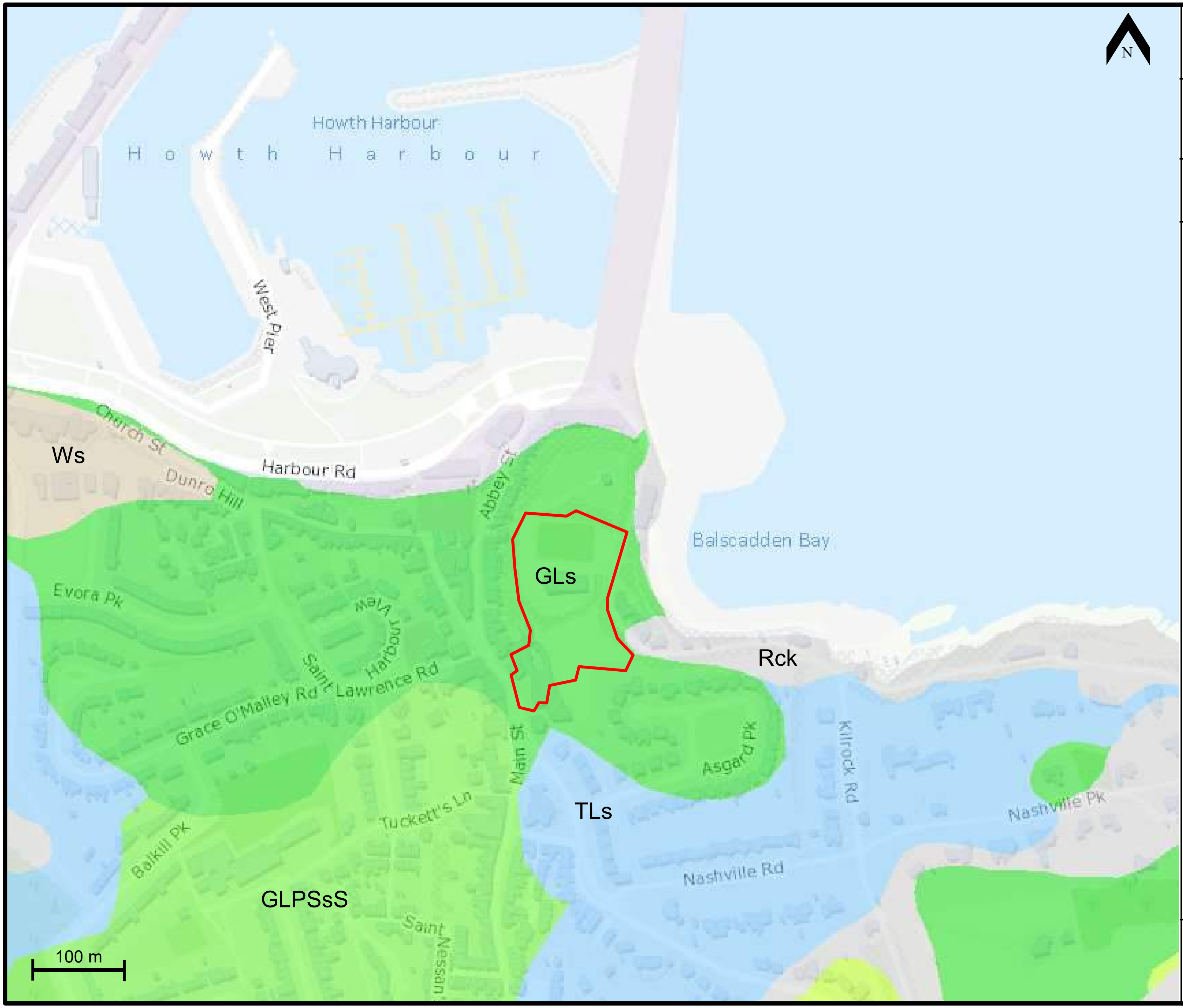
Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥	Site Outline
WA	Waulsortian Limestone - *Massive unbedded lime-mudstone*
BA	Ballysteen Formation - *Dark muddy limestone, shale*
EL	Elsinore Formation - *Polymict melange*
DK	Drumleck Formation - *Quartzite & mudstone melange*

Ref.7

Minerex Environmental



Drawing Title
Quaternary Sediments

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥	Site Outline
GLs	Gravels derived from Limestones
TLs	Till derived from Limestones
GLP SsS	Gravels derived from Lower Palaeozoic sandstones and shales
Ws	Windblown sands
Rck	Bedrock outcrop of subcrop

Ref.7

Minerex Environmental

Drawing Title
Subsoil Permeability

Client: Marlet - Balscadden
Project: 3330

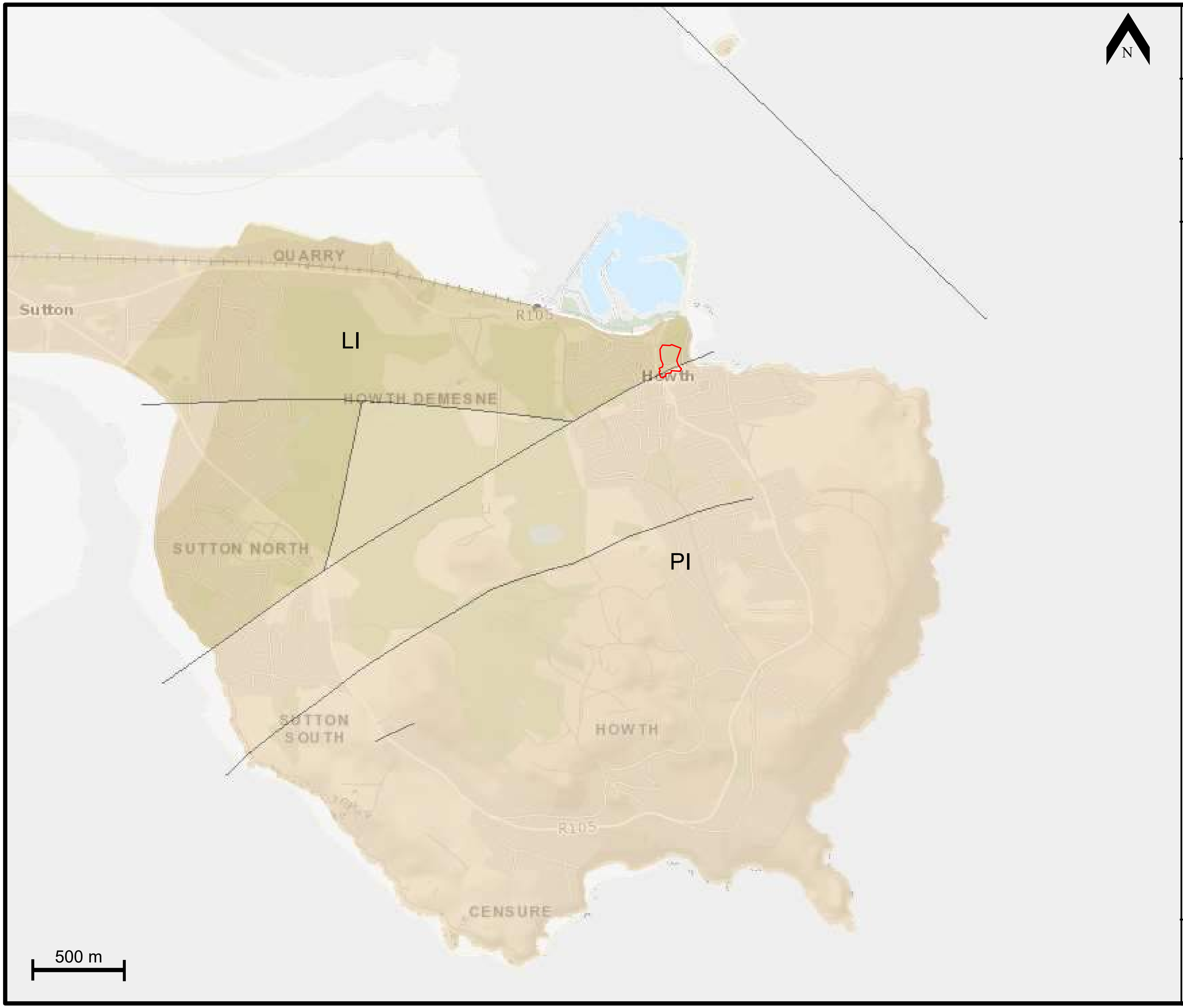
Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

▢	Site Outline
L	Low permeability

Ref.7

Minerex Environmental



Drawing Title
Aquifer Classification

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥	Site outline
LI	Locally Important Aquifer - *Bedrock which is moderately productive only in local zones*
PI	Poor Aquifer - *Bedrock which is generally unproductive except for local zones*

Ref.7

Minerex Environmental

Drawing Title
Groundwater Recharge

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

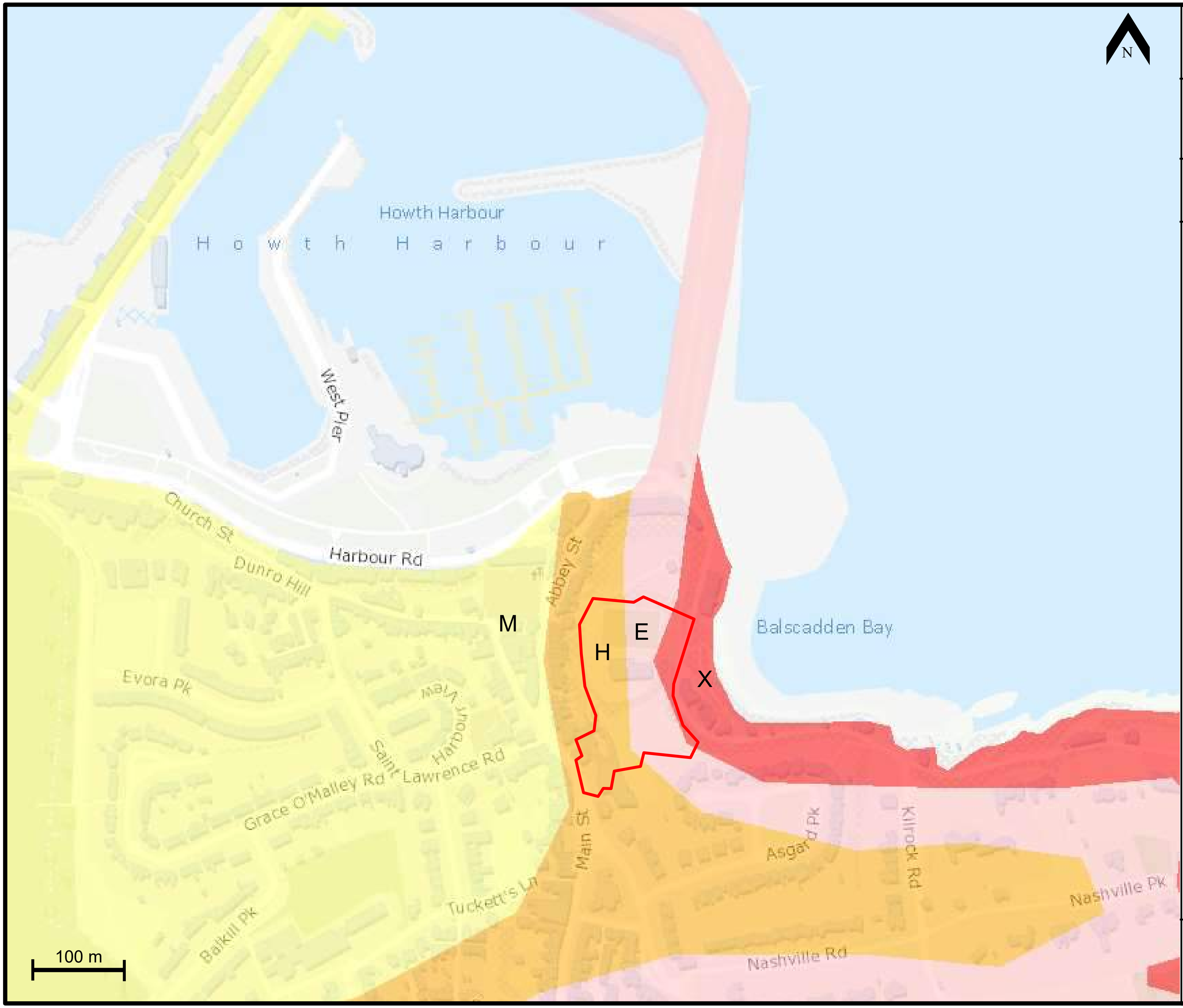
🟥 Site Outline

1 Recharge Coefficient = 20%
Average Recharge = 53 mm/yr

2 Recharge Coefficient = 40%
Average Recharge = 40 mm/yr

Ref.7

Minerex Environmental



Drawing Title
Groundwater Vulnerability

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥	Site Outline
M	Moderate
H	High
E	Extreme
X	Rock near surface or karst

Ref.7

Minerex Environmental

Drawing Title
Protected Areas

Client: Marlet - Balscadden
Project: 3330

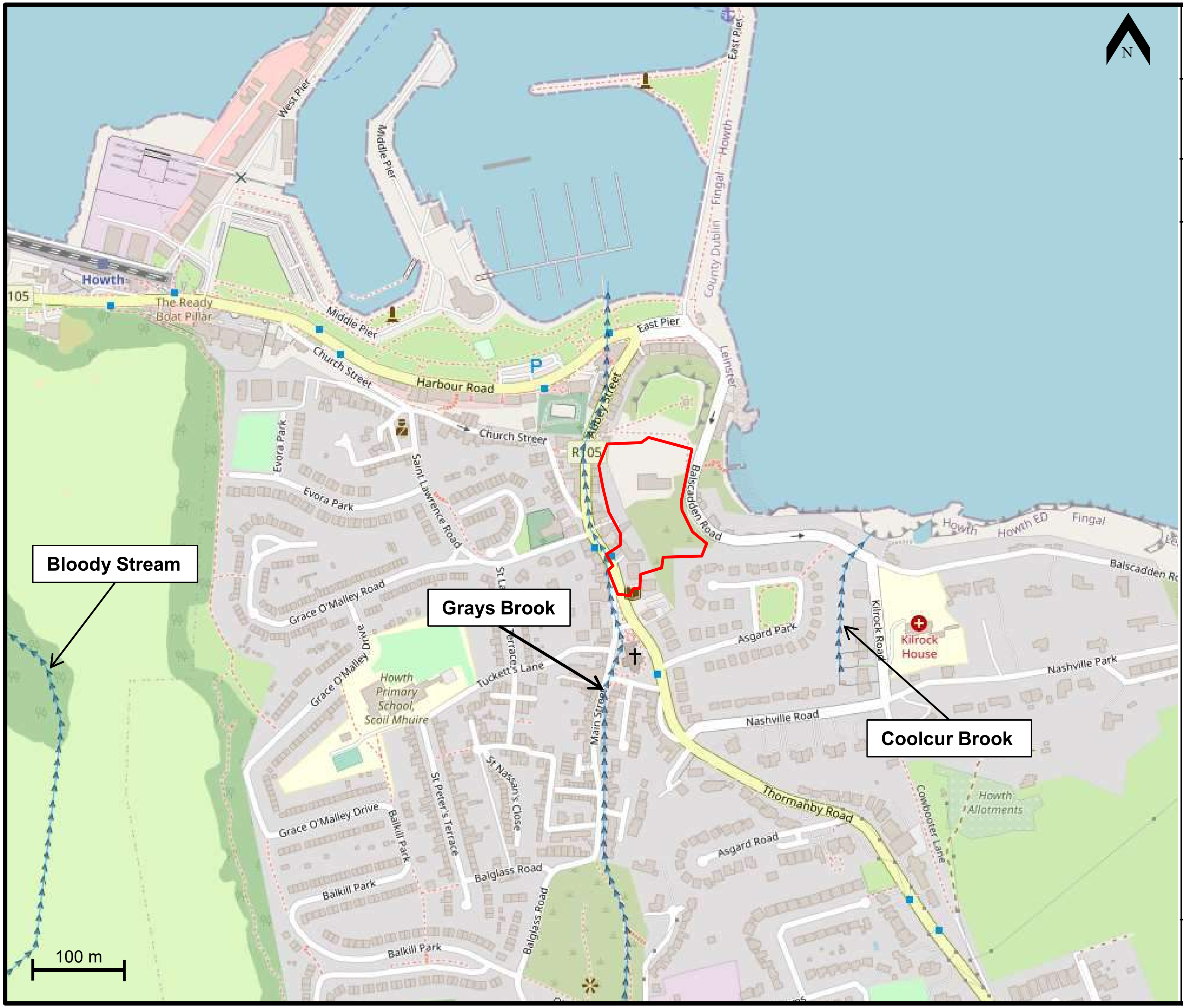
Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥	Site Outline

Ref.3

Minerex Environmental



Drawing Title
Stream Network

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥 Site Outline

Ref.3

Minerex Environmental

Appendix B

Contract No: 5417	# Cable Percussion Borehole Log				Borehole No: **BH-GDG-01**

Contract:	Balscadden	Easting:	728800.001	Date Started:	29/09/2017
Location:	Howth, Dublin 13	Northing:	739083.441	Date Completed:	04/10/2017
Client:	Crekav Ltd Partnership	Elevation:	34.67	Logged By:	S. Letch
Engineer:	Gavin & Doherty Geosolutions	Rig Type:	Dando 150	Drilled By:	T. Tindall

Depth (m) Depth	Stratum Description	Legend	Level (mOD) Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike	Backfill
0.20	TOPSOIL.	▨	34.47					
	Stiff brown sandy slightly gravelly silty CLAY.	▨		0.50	B	TT01		
				1.00	C	N=17 (4,3/4,4,4,5)		
1.40	Medium dense light brown silty gravelly fine to coarse SAND with lenses of silty very sandy GRAVEL.	▨	33.27	1.50	B	TT02		
				2.00	C	N=30 (4,4/7,9,7,7)		
				2.50	B	TT03		
				3.00	C	N=42 (5,10/10,11,10,11)		
				3.50	B	TT04		
				4.00	C	N=34 (2,3/4,6,8,16)		
				4.50	B	TT05		
				5.00	C	N=25 (3,3/5,6,6,8)		
				5.50	B	TT06		
				6.00	C	N=28 (4,5/7,6,6,9)		
				6.50	B	TT07		
				7.00	C	N=27 (3,4/4,7,8,8)		
				7.50	B	TT08		
				8.00	C	N=34 (3,5/6,8,11,9)		
				8.50	B	TT09		
				9.00	C	N=23 (4,5/4,4,7,8)		
				9.50	B	TT10		
				10.00	C	N=22 (5,4/4,6,6,6)		

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed:	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:		
						29/09 02/10 02/10 03/10	2.00 2.00 8.50 8.50	Dry Dry Dry Dry	0.00 15.00	15.00 18.00	Solid Slotted	0.00 13.00 14.50 18.00 19.00	13.00 14.50 18.00 19.00 20.00	Gravel Bentonite Gravel Bentonite Gravel	Water added to assist drilling - approx 165l/m.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental C: Cone SPT S: Split spoon SPT

Contract No: 5417	Cable Percussion Borehole Log				Borehole No: **BH-GDG-01**
Contract:	Balscadden	Easting:	728800.001	Date Started:	29/09/2017
Location:	Howth, Dublin 13	Northing:	739083.441	Date Completed:	04/10/2017
Client:	Crekav Ltd Partnership	Elevation:	34.67	Logged By:	S. Letch
Engineer:	Gavin & Doherty Geosolutions	Rig Type:	Dando 150	Drilled By:	T. Tindall

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
10.5		Medium dense light brown silty gravelly fine to coarse SAND with lenses of silty very sandy GRAVEL.		24.0		10.50	B	TT11		
11.0				23.5		11.00	C	N=22 (8,5/5,4,6,7)		
11.5				23.0		11.50	B	TT12		
12.0				22.5		12.00	C	N=21 (4,5/4,6,5,6)		
12.5				22.0		12.50	B	TT13		
13.0				21.5		13.00	C	N=26 (4,4/4,7,8,7)		
13.5				21.0		13.50	B	TT14		
14.0				20.5		14.00	C	N=24 (4,5/5,8,5,6)		
14.5				20.0		14.50	B	TT15		
15.0				19.5		15.00	C	N=29 (6,8/5,5,8,11)		
15.5				19.0		15.50	B	TT16		
16.0				18.5		16.00	C	N=23 (5,5/4,6,7,6)		
16.5				18.0		16.50	B	TT17		
17.0				17.5		17.00	C	N=32 (6,7/9,6,6,11)		
17.5				17.0		17.50	B	TT18		
18.0				16.5		18.00	C	N=15 (3,3/4,3,4,4)		
18.5				16.0		18.50	B	TT19		
19.0				15.5		19.00	C	N=40 (5,8/7,11,12,10)		
	19.20	Very stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.			15.47					
19.5				15.0		19.50	B	TT20		
20.0	20.00	End of Borehole at 20.00m		14.5	14.67					

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed:	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	Water added to assist drilling - approx 165l/m.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental C: Cone SPT S: Split spoon SPT
						29/09	2.00	Dry	0.00	15.00	Solid	0.00	13.00	Gravel		
						02/10	2.00	Dry	15.00	18.00	Slotted	13.00	14.50	Bentonite		
						02/10	8.50	Dry				14.50	18.00	Gravel		
						03/10	8.50	Dry				18.00	19.00	Bentonite		
												19.00	20.00	Gravel		

Appendix C

Contract No: 5836	# Cable Percussion Borehole Log			Borehole No: **BH01**
Contract:	Balscadden	Easting: 728766.929	Date Started:	16/06/2021
Location:	Howth, Co. Dublin	Northing: 739199.986	Date Completed:	18/06/2021
Client:	Marlet	Elevation: 19.98	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter: 200mm	Status:	FINAL

Depth (m)	Stratum Description	Level (mOD) Depth
0.20	MADE GROUND: tarmacadam.	19.78
0.50	MADE GROUND: grey silty sandy gravel.	19.48
2.80	Medium dense brown silty sandy GRAVEL with low cobble content.	17.18
5.50	Loose becoming medium dense light brown silty gravelly SAND.	14.48
6.00	Light brown slightly silty gravelly SAND.	13.98
	Medium dense becoming dense light brown slightly silty gravelly SAND.	

Depth	Type	Result
1.00	B	JOT01
1.00	C	N=17 (2,4/4,5,4,4)
2.00	B	JOT02
2.00	C	N=12 (1,2/2,3,3,4)
3.00	B	JOT03
3.00	C	N=7 (1,1/1,2,2,2)
4.00	B	JOT04
4.00	C	N=15 (1,2/3,3,4,5)
5.00	B	JOT05
5.00	C	N=20 (2,2/3,4,6,7)
6.00	B	JOT06
6.00	C	N=21 (2,2/4,5,6,6)
7.00	B	JOT07
7.00	C	N=28 (2,4/5,7,7,9)
8.00	B	JOT08
8.00	C	N=30 (1,3/6,7,7,10)
9.00	B	JOT09
9.00	C	N=36 (2,4/7,9,9,11)
~~10.00~~	~~B~~	~~JOT10~~

Chiselling:

From:	To:	Time:
15.00	15.20	00:45
16.40	16.50	00:45
16.80	17.00	01:00

Water Strikes:

Strike:	Rose:	Depth Sealed

Water Details:

Date:	Hole Depth:	Water Depth:
16/06	9.30	Dry
17/06	12.30	Dry
18/06	17.00	Dry

Installation:

From:	To:	Pipe:
0.00	14.00	Solid
14.00	17.00	Slotted

Backfill:

From:	To:	Type:
0.00	0.70	Bentonite
0.70	12.00	Gravel
12.00	13.00	Bentonite
13.00	17.00	Gravel

Remarks:
Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No:		Borehole No:
5836	**Cable Percussion Borehole Log**	**BH01**

Contract:	Balscadden	Easting:	728766.929	Date Started:	16/06/2021
Location:	Howth, Co. Dublin	Northing:	739199.986	Date Completed:	18/06/2021
Client:	Marlet	Elevation:	19.98	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
		Medium dense becoming dense light brown slightly silty gravelly SAND.				10.00	C	N=18 (2,3/4,4,5,5)		
10.5	10.50	Very stiff brown slightly sandy gravelly silty CLAY with low cobble content and bands of gravelly sand.		9.5	9.48					
11.0				9.0		11.00 11.00	B C	JOT11 N=24 (3,4/5,6,6,7)		
11.5				8.5						
12.0				8.0		12.00 12.00	B C	JOT12 N=35 (4,5/7,9,9,10)		
12.5				7.5						
13.0				7.0		13.00 13.00	B C	JOT13 50 (25 for 125mm/50 for 90mm)		
13.5				6.5						
14.0				6.0		14.00 14.00	B C	JOT14 N=50 (4,9/50 for 235mm)		
14.5				5.5						
15.0				5.0		15.00 15.00	B C	JOT15 50 (10,15/50 for 125mm)		
15.5				4.5						
16.0				4.0		16.00 16.00	B C	JOT16 50 (11,14/50 for 100mm)		
16.5				3.5						
	16.80	Obstruction - possible boulders.			3.18					
17.0	17.00	End of Borehole at 17.00m		3.0	2.98	17.00	C	50 (25 for 5mm/50 for 5mm)		
17.5				2.5						
18.0				2.0						
18.5				1.5						
19.0				1.0						
19.5				0.5						

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:		
15.00 16.40 16.80	15.20 16.50 17.00	00:45 00:45 01:00							0.00 14.00	14.00 17.00	Solid Slotted	0.00 0.70 12.00 13.00	0.70 12.00 13.00 17.00	Bentonite Gravel Bentonite Gravel	Borehole terminated due to obstruction.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water C: Cone SPT S: Split spoon SPT

Cable Percussion Borehole Log

Contract No:	Borehole No:
5836	BH02

Contract:	Balscadden	Easting:	728791.582	Date Started:	21/06/2021
Location:	Howth, Co. Dublin	Northing:	739163.531	Date Completed:	23/06/2021
Client:	Marlet	Elevation:	19.58	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
		MADE GROUND: tarmacadam.								
	0.20	Grey slightly silty very sandy GRAVEL.			19.38					
						1.00	B	JOT17		
						1.00	C	N=12 (1,2/2,3,3,4)		
						2.00	B	JOT18		
						2.00	C	N=15 (2,3/3,4,4,4)		
	3.00	Loose becoming medium dense brown silty very gravelly SAND.			16.58	3.00	B	JOT19		
						3.00	C	N=10 (1,1/2,2,3,3)		
						4.00	B	JOT20		
						4.00	C	N=8 (2,2/2,2,2,2)		
						5.00	B	JOT21		
						5.00	C	N=11 (2,2/3,3,2,3)		
						6.00	B	JOT22		
						6.00	C	N=8 (2,1/2,2,2,2)		
						7.00	B	JOT23		
						7.00	C	N=11 (3,3/2,3,3,3)		
						8.00	B	JOT24		
						8.00	C	N=15 (3,3/4,4,3,4)		
	8.50	Medium dense becoming dense light brown silty gravelly SAND.			11.08					
						9.00	B	JOT25		
						9.00	C	N=13 (2,2/3,3,3,4)		
	9.70	Very stiff brown slightly sandy gravelly silty CLAY with			9.88					
						~~10.00~~	~~B~~	~~JOT26~~		

Chiselling:			Water Strikes:			Water Details:		
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:
17.10	17.20	01:00				21/06	3.00	Dry
						22/06	12.00	Dry
						23/06	17.20	Dry

Installation:			Backfill:		
From:	To:	Pipe:	From:	To:	Type:
0.00	9.00	Solid	0.00	1.00	Bentonite
9.00	17.20	Slotted	1.00	7.00	Gravel
			7.00	8.00	Bentonite
			8.00	17.20	Gravel

Remarks:

Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No:		Borehole No:
5836	**Cable Percussion Borehole Log**	**BH02**

Contract:	Balscadden	Easting:	728791.582	Date Started:	21/06/2021
Location:	Howth, Co. Dublin	Northing:	739163.531	Date Completed:	23/06/2021
Client:	Marlet	Elevation:	19.58	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Depth	Stratum Description	Level (mOD) Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike
	low cobble content.		10.00	C	N=38 (6,7/7,9,11,11)	
10.50	Very stiff brown slightly sandy slightly gravelly silty CLAY.	9.08				
			11.00 11.00	B C	JOT27 N=40 (7,8/9,9,10,12)	
			12.00 12.00	B C	JOT28 N=37 (5,7/9,9,9,10)	
			13.00 13.00	B C	JOT29 N=44 (4,6/10,11,11,12)	
			14.00 14.00	B C	JOT30 N=39 (3,5/7,11,10,11)	
14.60	Very stiff brown slightly sandy gravelly silty CLAY with low cobble content and bands of gravelly sand.	4.98				
			15.00 15.00	B C	JOT31 50 (5,11/50 for 60mm)	
			16.00 16.00	B C	JOT32 50 (6,12/50 for 115mm)	
			17.00	C	50 (23 for 95mm/50 for 5mm)	
17.10	Obstruction - possible boulders.	2.48	17.10	B	JOT33	
17.20	End of Borehole at 17.20m	2.38				

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	
17.10	17.20	01:00							0.00	9.00	Solid	0.00	1.00	Bentonite	Borehole terminated due to obstruction.
									9.00	17.20	Slotted	1.00	7.00	Gravel	
												7.00	8.00	Bentonite	
												8.00	17.20	Gravel	

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Cable Percussion Borehole Log

Contract No: 5836				Borehole No:	**BH03**
Contract:	Balscadden	Easting:	728739.243	Date Started:	24/06/2021
Location:	Howth, Co. Dublin	Northing:	739069.592	Date Completed:	28/06/2021
Client:	Marlet	Elevation:	19.42	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)	Stratum Description	Level (mOD)
0.10	MADE GROUND: tarmacadam.	19.32
0.60	MADE GROUND: grey sandy gravel with medium cobble content and some red brick and concrete fragments.	18.82
2.80	Medium dense light brown silty gravelly SAND.	16.62
4.90	Medium dense yellow slightly silty SAND.	14.52
6.40	Medium dense light brown silty gravelly SAND.	13.02
7.50	Stiff brown slightly sandy gravelly silty CLAY with low cobble content.	11.92
	Very stiff black slightly sandy gravelly silty CLAY with low cobble content.	

Samples and Insitu Tests

Depth	Type	Result
1.00	B	JOT34
1.00	C	N=18 (2,3/4,4,5,5)
2.00	B	JOT35
2.00	C	N=21 (2,4/5,5,5,6)
3.00	B	JOT36
3.00	C	N=23 (4,5/5,6,6,6)
4.00	B	JOT37
4.00	C	N=19 (2,4/4,5,5,5)
5.00	B	JOT38
5.00	C	N=15 (2,2/3,4,4,4)
6.00	B	JOT39
6.00	C	N=24 (2,4/5,6,6,7)
7.00	B	JOT40
7.00	C	N=30 (2,5/7,7,7,9)
8.00	B	JOT41
8.00	C	50 (25 for 135mm/50 for 10mm)
9.00	B	JOT42
9.00	C	50 (5,7/50 for 100mm)
10.00	B	JOT43

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	
12.80	13.00	01:00	4.80	4.50	6.80	24/06 25/06 28/06	3.50 10.50 13.00	Dry 10.20 3.80	0.00 4.00	4.00 13.00	Solid Slotted	0.00 3.00	3.00 13.00	Bentonite Gravel	Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No:	# Cable Percussion Borehole Log	Borehole No:
5836		**BH03**

Contract:	Balscadden	Easting:	728739.243	Date Started:	24/06/2021
Location:	Howth, Co. Dublin	Northing:	739069.592	Date Completed:	28/06/2021
Client:	Marlet	Elevation:	19.42	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Scale	Depth (m) Depth	Stratum Description	Legend	Level (mOD) Scale	Level (mOD) Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike	Backfill
		Very stiff black slightly sandy gravelly silty CLAY with low cobble content.				10.00	C	50 (25 for 125mm/50 for 110mm)		
						11.00	B	JOT44		
						11.00	C	50 (25 for 125mm/50 for 100mm)		
						12.00	B	JOT45		
						12.00	C	50 (25 for 115mm/50 for 25mm)		
	12.80	Obstruction - possible boulders.			6.62	12.80	B	JOT46		
	13.00	End of Borehole at 13.00m			6.42	13.00	C	50 (25 for 5mm/50 for 5mm)		

Depth scale: 10.5, 11.0, 11.5, 12.0, 12.5, 13.0, 13.5, 14.0, 14.5, 15.0, 15.5, 16.0, 16.5, 17.0, 17.5, 18.0, 18.5, 19.0, 19.5

Level scale: 9.0, 8.5, 8.0, 7.5, 7.0, 6.5, 6.0, 5.5, 5.0, 4.5, 4.0, 3.5, 3.0, 2.5, 2.0, 1.5, 1.0, 0.5, 0.0, -0.5

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Depth Sealed	Water Details: Date:	Hole Depth:	Water Depth:	Installation: From:	To:	Pipe:	Backfill: From:	To:	Type:	Remarks:
12.80	13.00	01:00	4.80	4.50	6.80				0.00 4.00	4.00 13.00	Solid Slotted	0.00 3.00	3.00 13.00	Bentonite Gravel	Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Appendix D

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Minerex Environmental
Taney hall
Eglinton Terrace
Dundrum
Dublin
Dublin 14

Attention: Chris Fennell

CERTIFICATE OF ANALYSIS

Date of report Generation:	23 September 2021
Customer:	Minerex Environmental
Sample Delivery Group (SDG):	210914-80
Your Reference:	3330-COC1
Location:	Marlet - Balscadden
Report No:	614351
Order Number:	

This report has been revised and directly supersedes 613762 in its entirety.

We received 8 samples on Tuesday September 14, 2021 and 8 of these samples were scheduled for analysis which was completed on Thursday September 23, 2021. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan
Operations Manager

UKAS
TESTING
1291

Version: 3.1 Version Issued: 23/09/2021

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
24972424	BH1		0.00 - 0.00	13/09/2021
24972431	BH2		0.00 - 0.00	13/09/2021
24972467	SP1		0.00 - 0.00	13/09/2021
24972476	SP2		0.00 - 0.00	13/09/2021
24972482	SP3		0.00 - 0.00	13/09/2021
24972439	SW1		0.00 - 0.00	13/09/2021
24972453	SW2		0.00 - 0.00	13/09/2021
24972460	SW3		0.00 - 0.00	13/09/2021

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG: 210914-80
Client Ref.: 3330-COC1
Report Number: 614351
Location: Marlet - Balscadden
Superseded Report: 613762

Results Legend

- X **Test**
- N **No Determination Possible**

Sample Types -

- S - Soil/Solid
- UNS - Unspecified Solid
- GW - Ground Water
- SW - Surface Water
- LE - Land Leachate
- PL - Prepared Leachate
- PR - Process Water
- SA - Saline Water
- TE - Trade Effluent
- TS - Treated Sewage
- US - Untreated Sewage
- RE - Recreational Water
- DW - Drinking Water Non-regulatory
- UNL - Unspecified Liquid
- SL - Sludge
- G - Gas
- OTH - Other

Lab Sample No(s)			24972424			24972431			24972467			24972476			24972482			24972439			24972453
Customer Sample Reference			BH1			BH2			SP1			SP2			SP3			SW1			SW2
AGS Reference																					
Depth (m)			0.00 - 0.00			0.00 - 0.00			0.00 - 0.00			0.00 - 0.00			0.00 - 0.00			0.00 - 0.00			0.00 - 0.00
Container			1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)
Sample Type			GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	SW	SW	SW	SW
Alkalinity as CaCO3	All	NDPs: 0 Tests: 8	X			X			X			X			X			X			X
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 8		X			X			X			X			X			X		
Anions by ion Chromatography	All	NDPs: 0 Tests: 8	X			X			X			X			X			X			X
Anions by Kone (w)	All	NDPs: 0 Tests: 8	X			X			X			X			X			X			X
Conductivity (at 20 deg.C)	All	NDPs: 0 Tests: 8	X			X			X			X			X			X			X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 8			X			X			X			X			X			X	
Phosphate by Kone (w)	All	NDPs: 0 Tests: 8	X			X			X			X			X			X			X

24972460	SW3		0.00 - 0.00	HNO3 Filtered (ALE204)	SW												X		
				H2SO4 (ALE244)	SW				X										
				1lplastic (ALE221)	SW		X				X		X		X				X
24972453	SW2		0.00 - 0.00	HNO3 Filtered (ALE204)	SW												X		
				H2SO4 (ALE244)	SW				X										

Validated

CERTIFICATE OF ANALYSIS

SDG: 210914-80
Client Ref.: 3330-COC1
Report Number: 614351
Location: Marlet - Balscadden
Superseded Report: 613762

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4♦§@	Sample deviation (see appendix)

		Customer Sample Ref.	BH1	BH2	SP1	SP2	SP3	SW1
		Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
		Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Surface Water (SW)
		Date Sampled	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
		Sample Time	00:00	00:00	00:00	00:00	00:00	00:00
		Date Received	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
		SDG Ref	210914-80	210914-80	210914-80	210914-80	210914-80	210914-80
		Lab Sample No.(s)	24972424	24972431	24972467	24972476	24972482	24972439
		AGS Reference						
Component	**LOD/Units**	**Method**						
Alkalinity, Total as CaCO3	<2 mg/l	TM043	355 #	300 #	115 #	305 #	315 #	155 #
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	<0.2 #	<0.2 #	<0.2 #	<0.2 #	<0.2 #	<0.2 #
Ammoniacal Nitrogen as NH4	<0.3 mg/l	TM099	<0.3 #	<0.3 #	<0.3 #	<0.3 #	<0.3 #	<0.3 #
Conductivity @ 20 deg.C	<0.02 mS/cm	TM120	0.86 #	0.803 #	0.39 #	0.936 #	0.89 #	37.8 #
Manganese (diss.filt)	<3 µg/l	TM152	43.7 #	6.9 #	<3 #	<3 #	9.69 #	<18 #
Phosphorus (diss.filt)	<10 µg/l	TM152	<10 #	<10 #	<10 #	<10 #	23.9 #	78.6 #
Sodium (Dis.Filt)	<0.076 mg/l	TM152	42.3 #	44.3 #	22.1 #	56.4 #	93.7 #	8940 #
Magnesium (Dis.Filt)	<0.036 mg/l	TM152	20.5 #	18.9 #	5.86 #	20.5 #	19.5 #	1020 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152	8.36 #	5.71 #	2.94 #	7.27 #	11.9 #	299 #
Calcium (Dis.Filt)	<0.2 mg/l	TM152	123 #	116 #	52 #	122 #	81.4 #	343 #
Iron (Dis.Filt)	<0.019 mg/l	TM152	<0.019 #	<0.019 #	<0.019 #	<0.019 #	0.0433 #	<0.114 #
Sulphate	<2 mg/l	TM184	113 #	66.3 #	43 #	58.6 #	51.7 #	2240 #
Chloride	<2 mg/l	TM184	74.1 #	77.9 #	33.5 #	110 #	115 #	16300 #
Phosphate (Ortho as P)	<0.02 mg/l	TM184	<0.02 #	<0.02 #	<0.02 #	<0.02 #	0.0281 #	0.079 #
Nitrate as NO3	<0.07 mg/l	TM226	35.3 #	30.2 #	7.61 #	30.7 #	<0.35 #	4.27 #

Validated

CERTIFICATE OF ANALYSIS

SDG: 210914-80
Client Ref.: 3330-COC1
Report Number: 614351
Location: Marlet - Balscadden
Superseded Report: 613762

Results Legend	
#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4♦§@	Sample deviation (see appendix)

		Customer Sample Ref.	SW2	SW3
		Depth (m)	0.00 - 0.00	0.00 - 0.00
		Sample Type	Surface Water (SW)	Surface Water (SW)
		Date Sampled	13/09/2021	13/09/2021
		Sample Time	00:00	00:00
		Date Received	14/09/2021	14/09/2021
		SDG Ref	210914-80	210914-80
		Lab Sample No.(s)	24972453	24972460
		AGS Reference		
Component	**LOD/Units**	**Method**		
Alkalinity, Total as CaCO3	<2 mg/l	TM043	180 #	150 #
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	<0.2 #	<0.2 #
Ammoniacal Nitrogen as NH4	<0.3 mg/l	TM099	<0.3 #	<0.3 #
Conductivity @ 20 deg.C	<0.02 mS/cm	TM120	23 #	0.457 #
Manganese (diss.filt)	<3 µg/l	TM152	<3 #	44.4 #
Phosphorus (diss.filt)	<10 µg/l	TM152	91.9 #	54.5 #
Sodium (Dis.Filt)	<0.076 mg/l	TM152	5050 #	26 #
Magnesium (Dis.Filt)	<0.036 mg/l	TM152	624 #	8.85 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152	175 #	2.44 #
Calcium (Dis.Filt)	<0.2 mg/l	TM152	228 #	66.8 #
Iron (Dis.Filt)	<0.019 mg/l	TM152	<0.019 #	0.109 #
Sulphate	<2 mg/l	TM184	1210 #	50.5 #
Chloride	<2 mg/l	TM184	9290 #	40.1 #
Phosphate (Ortho as P)	<0.02 mg/l	TM184	0.0826 #	0.03 #
Nitrate as NO3	<0.07 mg/l	TM226	9.27 #	6.88 #

Table of Results - Appendix

Method No	Reference	Description
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM120	Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970	Determination of Electrical Conductivity using a Conductivity Meter
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM226	In-House Method	Determination of Anions in Waters using Ion Chromatography

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

Test Completion Dates

Lab Sample No(s)	24972424	24972431	24972467	24972476	24972482	24972439	24972453	24972460
Customer Sample Ref.	BH1	BH2	SP1	SP2	SP3	SW1	SW2	SW3
AGS Ref.								
Depth	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water	Surface Water
Alkalinity as CaCO3	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021
Ammoniacal Nitrogen	17-Sep-2021	20-Sep-2021	17-Sep-2021	17-Sep-2021	17-Sep-2021	20-Sep-2021	20-Sep-2021	20-Sep-2021
Anions by ion Chromatography	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021
Anions by Kone (w)	18-Sep-2021	18-Sep-2021	18-Sep-2021	18-Sep-2021	18-Sep-2021	18-Sep-2021	18-Sep-2021	18-Sep-2021
Conductivity (at 20 deg.C)	23-Sep-2021	23-Sep-2021	23-Sep-2021	23-Sep-2021	23-Sep-2021	23-Sep-2021	23-Sep-2021	23-Sep-2021
Dissolved Metals by ICP-MS	17-Sep-2021	17-Sep-2021	17-Sep-2021	17-Sep-2021	17-Sep-2021	18-Sep-2021	18-Sep-2021	17-Sep-2021
Phosphate by Kone (w)	15-Sep-2021	15-Sep-2021	15-Sep-2021	15-Sep-2021	15-Sep-2021	15-Sep-2021	15-Sep-2021	15-Sep-2021

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as “mixed hydrocarbons”. Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
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Deeside
CH5 3US
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Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Minerex Environmental
Taney hall
Eglinton Terrace
Dundrum
Dublin
Dublin 14

Attention: Chris Fennell

CERTIFICATE OF ANALYSIS

Date of report Generation:	14 October 2021
Customer:	Minerex Environmental
Sample Delivery Group (SDG):	211007-123
Your Reference:	3330-COC2
Location:	Marlet - Balscadden
Report No:	617204
Order Number:	

We received 2 samples on Thursday October 07, 2021 and 2 of these samples were scheduled for analysis which was completed on Thursday October 14, 2021. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan
Operations Manager

UKAS TESTING 1291

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
25113801	BH1		0.00 - 0.00	06/10/2021
25113808	BH2		0.00 - 0.00	06/10/2021

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG: 211007-123
Client Ref.: 3330-COC2
Report Number: 617204
Location: Marlet - Balscadden
Superseded Report:

Results Legend

X **Test**

N **No Determination Possible**

Sample Types -
- S - Soil/Solid
- UNS - Unspecified Solid
- GW - Ground Water
- SW - Surface Water
- LE - Land Leachate
- PL - Prepared Leachate
- PR - Process Water
- SA - Saline Water
- TE - Trade Effluent
- TS - Treated Sewage
- US - Untreated Sewage
- RE - Recreational Water
- DW - Drinking Water Non-regulatory
- UNL - Unspecified Liquid
- SL - Sludge
- G - Gas
- OTH - Other

Lab Sample No(s)			25113801			25113808		
Customer Sample Reference			BH1			BH2		
AGS Reference								
Depth (m)			0.00 - 0.00			0.00 - 0.00		
Container			1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)
Sample Type			GW	GW	GW	GW	GW	GW
Alkalinity as CaCO3	All	NDPs: 0 Tests: 2	X			X		
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 2		X			X	
Anions by ion Chromatography	All	NDPs: 0 Tests: 2	X			X		
Anions by Kone (w)	All	NDPs: 0 Tests: 2	X			X		
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2			X			X
Phosphate by Kone (w)	All	NDPs: 0 Tests: 2	X			X		

CERTIFICATE OF ANALYSIS

SDG: 211007-123
Client Ref.: 3330-COC2
Report Number: 617204
Location: Marlet - Balscadden
Superseded Report:

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4♦§@	Sample deviation (see appendix)

Customer Sample Ref.	BH1	BH2
Depth (m)	0.00 - 0.00	0.00 - 0.00
Sample Type	Ground Water (GW)	Ground Water (GW)
Date Sampled	06/10/2021	06/10/2021
Sample Time	00:00	00:00
Date Received	07/10/2021	07/10/2021
SDG Ref	211007-123	211007-123
Lab Sample No.(s)	25113801	25113808
AGS Reference		

Component	LOD/Units	Method	BH1	BH2
Alkalinity, Total as CaCO3	<2 mg/l	TM043	348 #	390 #
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	<0.2 #	<0.2 #
Ammoniacal Nitrogen as NH4	<0.3 mg/l	TM099	<0.3 #	<0.3 #
Manganese (diss.filt)	<3 µg/l	TM152	5.78 #	<3 #
Phosphorus (diss.filt)	<10 µg/l	TM152	<10 #	<10 #
Sodium (Dis.Filt)	<0.076 mg/l	TM152	42.5 #	42.4 #
Magnesium (Dis.Filt)	<0.036 mg/l	TM152	20 #	19 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152	9.71 #	5.5 #
Calcium (Dis.Filt)	<0.2 mg/l	TM152	126 #	122 #
Iron (Dis.Filt)	<0.019 mg/l	TM152	<0.019 #	<0.019 #
Sulphate	<2 mg/l	TM184	113 #	66.5 #
Chloride	<2 mg/l	TM184	80 #	81 #
Phosphate (Ortho as P)	<0.02 mg/l	TM184	<0.02 #	<0.02 #
Nitrate as NO3	<0.07 mg/l	TM226	37.1 #	29.4 #

Table of Results - Appendix

Method No	Reference	Description
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM226	In-House Method	Determination of Anions in Waters using Ion Chromatography

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

Test Completion Dates

Lab Sample No(s)	25113801	25113808
Customer Sample Ref.	BH1	BH2
AGS Ref.		
Depth	0.00 - 0.00	0.00 - 0.00
Type	Ground Water	Ground Water
Alkalinity as CaCO3	11-Oct-2021	11-Oct-2021
Ammoniacal Nitrogen	12-Oct-2021	12-Oct-2021
Anions by ion Chromatography	12-Oct-2021	12-Oct-2021
Anions by Kone (w)	11-Oct-2021	11-Oct-2021
Dissolved Metals by ICP-MS	14-Oct-2021	14-Oct-2021
Phosphate by Kone (w)	11-Oct-2021	11-Oct-2021

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix C – 2021 Ground Investigation

S.I. Ltd Contract No: 5836

Client:	Marlet
Engineer:	Waterman Moylan
Contractor:	Site Investigations Ltd

Balscadden,
Howth, Co. Dublin
Site Investigation Report

Prepared by:

....

Stephen Letch

Issue Date:	13/07/2021
Status	Final
Revision	2

Contents:

Appendices:

1. Introduction

On the instructions of Waterman Moylan, Site Investigations Ltd (SIL) was appointed to complete a ground investigation at Balscadden, Howth, Co. Dublin. The investigation was completed for a residential development on the site and was completed on behalf of the Client, Marlet. The investigation was completed in June 2021.

2. Site Location

The site is located on the Balscadden Road, Howth, Co. Dublin, on the Howth peninsula to the east of Dublin city. The map of the Dublin (below left) shows the location of Howth and the second map shows the boundary of the site in Howth.

3. Fieldwork

The fieldworks comprised a programme of cable percussive boreholes and trial pits. All fieldwork was carried out in accordance with BS 5930:2015, Engineers Ireland GI Specification and Related Document 2nd Edition 2016 and Eurocode 7: Geotechnical Design.

The fieldworks comprised the following:

- 3 No. cable percussive boreholes
- 3 No. trial pits

3.1. Cable Percussion Boreholes with Rotary Coreholes

Cable percussion boring was undertaken at 3 No. locations using a Dando 150 rig and constructed 200mm diameter boreholes. The boreholes terminated at depths ranging from 13.00mbgl (BH03) to 17.20mbgl (BH02) when obstructions were encountered. It was not possible to collect undisturbed samples due to the granular soils encountered so bulk disturbed samples were recovered at regular intervals.

To test the strength of the stratum, Standard Penetration Tests (SPT's) were performed at 1.00m intervals in accordance with BS 1377 (1990). In soils with high gravel and cobble content it is appropriate to use a solid cone (60°) (CPT) instead of the split spoon and this was used throughout the testing. The test is completed over 450mm and the cone is driven 150mm into the stratum to ensure that the test is conducted over an undisturbed zone. The cone is then driven the remaining 300mm and the blows recorded to report the N-Value. The report shows the N-Value with the 75mm incremental blows listed in brackets (e.g., BH01 at 1.00mbgl where N=17(2,4/4,5,4,4). Where refusal of 50 blows across the test zone was encountered was achieved during testing, the penetration depth is also reported (e.g., BH01 at 13.00mbgl where N=50-(25 for 125mm/50 for 90mm)).

Groundwater monitoring standpipes were installed, upon instruction from Minerex Ltd, and consisted of slotted pipe surrounded by a gravel response zone with bentonite seals.

The cable percussive borehole logs are presented in Appendix 1.

3.2. Trial Pits

3 No. trial pits were excavated using a wheeled excavator. The strata were logged and photographed by SIL geotechnical engineer and groundwater ingresses and pit wall stability was also recorded. Representative disturbed bulk samples were recovered as the pits were excavated, which were returned to the laboratory for geotechnical testing.

The trial pit logs and photographs are presented in Appendix 2.

3.3. Surveying

Following completion of all the fieldworks, a survey of the exploratory hole locations was completed using a GeoMax GPS Rover. The data is supplied on each individual log and along with a site plan in Appendix 4.

4. Laboratory Testing

Laboratory testing has been performed on representative soil samples, as scheduled by ByrneLooby,and these were completed in accordance of BS1377: 1990 or the relevant specification. Testing included:

- 2 No. Moisture contents
- 2 No. Atterberg limits
- 8 No. Particle size gradings
- 5 No. pH
- 5 No. Water soluble sulphate

Specialist geotechnical testing was completed on the samples by NMTL Ltd and consisted of the following:

- 1 No. Shear box

The soil laboratory test results are presented in Appendix 3.

Appendix 1

Cable Percussive Borehole Logs

Contract No:	# Cable Percussion Borehole Log	Borehole No:
5836		**BH01**

Contract:	Balscadden	Easting:	728766.929	Date Started:	16/06/2021
Location:	Howth, Co. Dublin	Northing:	739199.986	Date Completed:	18/06/2021
Client:	Marlet	Elevation:	19.98	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
		MADE GROUND: tarmacadam.								
	0.20	MADE GROUND: grey silty sandy gravel.			19.78					
0.5	0.50	Medium dense brown silty sandy GRAVEL with low cobble content.		19.5	19.48					
1.0				19.0		1.00 1.00	B C	JOT01 N=17 (2,4/4,5,4,4)		
1.5				18.5						
2.0				18.0		2.00 2.00	B C	JOT02 N=12 (1,2/2,3,3,4)		
2.5				17.5						
	2.80	Loose becoming medium dense light brown silty gravelly SAND.			17.18					
3.0				17.0		3.00 3.00	B C	JOT03 N=7 (1,1/1,2,2,2)		
3.5				16.5						
4.0				16.0		4.00 4.00	B C	JOT04 N=15 (1,2/3,3,4,5)		
4.5				15.5						
5.0				15.0		5.00 5.00	B C	JOT05 N=20 (2,2/3,4,6,7)		
5.5	5.50	Light brown slightly silty gravelly SAND.		14.5	14.48					
6.0	6.00	Medium dense becoming dense light brown slightly silty gravelly SAND.		14.0	13.98	6.00 6.00	B C	JOT06 N=21 (2,2/4,5,6,6)		
6.5				13.5						
7.0				13.0		7.00 7.00	B C	JOT07 N=28 (2,4/5,7,7,9)		
7.5				12.5						
8.0				12.0		8.00 8.00	B C	JOT08 N=30 (1,3/6,7,7,10)		
8.5				11.5						
9.0				11.0		9.00 9.00	B C	JOT09 N=36 (2,4/7,9,9,11)		
9.5				10.5						
						10.00	B	JOT10		

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:		
15.00 16.40 16.80	15.20 16.50 17.00	00:45 00:45 01:00				16/06 17/06 18/06	9.30 12.30 17.00	Dry Dry Dry	0.00 14.00	14.00 17.00	Solid Slotted	0.00 0.70 12.00 13.00	0.70 12.00 13.00 17.00	Bentonite Gravel Bentonite Gravel	Borehole terminated due to obstruction.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water C: Cone SPT S: Split spoon SPT

Contract No: 5836	Cable Percussion Borehole Log	Borehole No: **BH01**

Contract:	Balscadden	Easting:	728766.929	Date Started:	16/06/2021
Location:	Howth, Co. Dublin	Northing:	739199.986	Date Completed:	18/06/2021
Client:	Marlet	Elevation:	19.98	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
		Medium dense becoming dense light brown slightly silty gravelly SAND.				10.00	C	N=18 (2,3/4,4,5,5)		
10.5	10.50	Very stiff brown slightly sandy gravelly silty CLAY with low cobble content and bands of gravelly sand.		9.5	9.48					
11.0				9.0		11.00 11.00	B C	JOT11 N=24 (3,4/5,6,6,7)		
11.5				8.5						
12.0				8.0		12.00 12.00	B C	JOT12 N=35 (4,5/7,9,9,10)		
12.5				7.5						
13.0				7.0		13.00 13.00	B C	JOT13 50 (25 for 125mm/50 for 90mm)		
13.5				6.5						
14.0				6.0		14.00 14.00	B C	JOT14 N=50 (4,9/50 for 235mm)		
14.5				5.5						
15.0				5.0		15.00 15.00	B C	JOT15 50 (10,15/50 for 125mm)		
15.5				4.5						
16.0				4.0		16.00 16.00	B C	JOT16 50 (11,14/50 for 100mm)		
16.5				3.5						
	16.80	Obstruction - possible boulders.			3.18					
17.0	17.00	End of Borehole at 17.00m		3.0	2.98	17.00	C	50 (25 for 5mm/50 for 5mm)		
17.5				2.5						
18.0				2.0						
18.5				1.5						
19.0				1.0						
19.5				0.5						

Chiselling:			Water Strikes:			Water Details:		
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:
15.00	15.20	00:45						
16.40	16.50	00:45						
16.80	17.00	01:00						

Installation:			Backfill:		
From:	To:	Pipe:	From:	To:	Type:
0.00	14.00	Solid	0.00	0.70	Bentonite
14.00	17.00	Slotted	0.70	12.00	Gravel
			12.00	13.00	Bentonite
			13.00	17.00	Gravel

Remarks:

Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No:	# Cable Percussion Borehole Log	Borehole No:
5836		**BH02**

Contract:	Balscadden	Easting:	728791.582	Date Started:	21/06/2021
Location:	Howth, Co. Dublin	Northing:	739163.531	Date Completed:	23/06/2021
Client:	Marlet	Elevation:	19.58	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Depth	Stratum Description	Level (mOD) Depth	Samples Depth	Type	Result	Water Strike
0.20	MADE GROUND: tarmacadam.	19.38				
	Grey slightly silty very sandy GRAVEL.					
			1.00 1.00	B C	JOT17 N=12 (1,2/2,3,3,4)	
			2.00 2.00	B C	JOT18 N=15 (2,3/3,4,4,4)	
3.00		16.58	3.00 3.00	B C	JOT19 N=10 (1,1/2,2,3,3)	
	Loose becoming medium dense brown silty very gravelly SAND.					
			4.00 4.00	B C	JOT20 N=8 (2,2/2,2,2,2)	
			5.00 5.00	B C	JOT21 N=11 (2,2/3,3,2,3)	
			6.00 6.00	B C	JOT22 N=8 (2,1/2,2,2,2)	
			7.00 7.00	B C	JOT23 N=11 (3,3/2,3,3,3)	
			8.00 8.00	B C	JOT24 N=15 (3,3/4,4,3,4)	
8.50		11.08				
	Medium dense becoming dense light brown silty gravelly SAND.					
			9.00 9.00	B C	JOT25 N=13 (2,2/3,3,3,4)	
9.70		9.88				
	Very stiff brown slightly sandy gravelly silty CLAY with					
			10.00	B	JOT26	

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Depth Sealed	Water Details: Date:	Hole Depth:	Water Depth:
17.10	17.20	01:00				21/06	3.00	Dry
						22/06	12.00	Dry
						23/06	17.20	Dry

Installation: From:	To:	Pipe:	Backfill: From:	To:	Type:
0.00	9.00	Solid	0.00	1.00	Bentonite
9.00	17.20	Slotted	1.00	7.00	Gravel
			7.00	8.00	Bentonite
			8.00	17.20	Gravel

Remarks:
Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No: 5836	# Cable Percussion Borehole Log				Borehole No: **BH02**
Contract:	Balscadden	Easting:	728791.582	Date Started:	21/06/2021
Location:	Howth, Co. Dublin	Northing:	739163.531	Date Completed:	23/06/2021
Client:	Marlet	Elevation:	19.58	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
		low cobble content.		9.5		10.00	C	N=38 (6,7/7,9,11,11)		
10.5	10.50	Very stiff brown slightly sandy slightly gravelly silty CLAY.		9.0	9.08					
11.0				8.5		11.00 11.00	B C	JOT27 N=40 (7,8/9,9,10,12)		
11.5				8.0						
12.0				7.5		12.00 12.00	B C	JOT28 N=37 (5,7/9,9,9,10)		
12.5				7.0						
13.0				6.5		13.00 13.00	B C	JOT29 N=44 (4,6/10,11,11,12)		
13.5				6.0						
14.0				5.5		14.00 14.00	B C	JOT30 N=39 (3,5/7,11,10,11)		
14.5	14.60	Very stiff brown slightly sandy gravelly silty CLAY with low cobble content and bands of gravelly sand.		5.0	4.98					
15.0				4.5		15.00 15.00	B C	JOT31 50 (5,11/50 for 60mm)		
15.5				4.0						
16.0				3.5		16.00 16.00	B C	JOT32 50 (6,12/50 for 115mm)		
16.5				3.0						
17.0	17.10 17.20	Obstruction - possible boulders. End of Borehole at 17.20m		2.5	2.48 2.38	17.00 17.10	C B	50 (23 for 95mm/50 for 5mm) JOT33		
17.5				2.0						
18.0				1.5						
18.5				1.0						
19.0				0.5						
19.5				0.0						

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	
17.10	17.20	01:00							0.00	9.00	Solid	0.00	1.00	Bentonite	Borehole terminated due to obstruction.
									9.00	17.20	Slotted	1.00	7.00	Gravel	
												7.00	8.00	Bentonite	
												8.00	17.20	Gravel	

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No:	Cable Percussion Borehole Log	Borehole No:
5836		**BH03**

Contract:	Balscadden	Easting:	728739.243	Date Started:	24/06/2021
Location:	Howth, Co. Dublin	Northing:	739069.592	Date Completed:	28/06/2021
Client:	Marlet	Elevation:	19.42	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)	Stratum Description	Level (mOD)
0.10	MADE GROUND: tarmacadam.	19.32
0.60	MADE GROUND: grey sandy gravel with medium cobble content and some red brick and concrete fragments.	18.82
2.80	Medium dense light brown silty gravelly SAND.	16.62
4.90	Medium dense yellow slightly silty SAND.	14.52
6.40	Medium dense light brown silty gravelly SAND.	13.02
7.50	Stiff brown slightly sandy gravelly silty CLAY with low cobble content.	11.92
	Very stiff black slightly sandy gravelly silty CLAY with low cobble content.	

Samples and Insitu Tests Depth	Type	Result
1.00	B	JOT34
1.00	C	N=18 (2,3/4,4,5,5)
2.00	B	JOT35
2.00	C	N=21 (2,4/5,5,5,6)
3.00	B	JOT36
3.00	C	N=23 (4,5/5,6,6,6)
4.00	B	JOT37
4.00	C	N=19 (2,4/4,5,5,5)
5.00	B	JOT38
5.00	C	N=15 (2,2/3,4,4,4)
6.00	B	JOT39
6.00	C	N=24 (2,4/5,6,6,7)
7.00	B	JOT40
7.00	C	N=30 (2,5/7,7,7,9)
8.00	B	JOT41
8.00	C	50 (25 for 135mm/50 for 10mm)
9.00	B	JOT42
9.00	C	50 (5,7/50 for 100mm)
10.00	B	JOT43

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	
12.80	13.00	01:00	4.80	4.50	6.80	24/06	3.50	Dry	0.00	4.00	Solid	0.00	3.00	Bentonite	Borehole terminated due to obstruction.
						25/06	10.50	10.20	4.00	13.00	Slotted	3.00	13.00	Gravel	
						28/06	13.00	3.80							

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No: 5836	# Cable Percussion Borehole Log				Borehole No: **BH03**
Contract:	Balscadden	Easting:	728739.243	Date Started:	24/06/2021
Location:	Howth, Co. Dublin	Northing:	739069.592	Date Completed:	28/06/2021
Client:	Marlet	Elevation:	19.42	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
		Very stiff black slightly sandy gravelly silty CLAY with low cobble content.				10.00	C	50 (25 for 125mm/50 for 110mm)		
				9.0						
10.5										
				8.5						
11.0						11.00	B	JOT44		
						11.00	C	50 (25 for 125mm/50 for 100mm)		
				8.0						
11.5										
				7.5						
12.0						12.00	B	JOT45		
						12.00	C	50 (25 for 115mm/50 for 25mm)		
				7.0						
12.5										
	12.80				6.62	12.80	B	JOT46		
		Obstruction - possible boulders.		6.5						
13.0	13.00				6.42	13.00	C	50 (25 for 5mm/50 for 5mm)		
		End of Borehole at 13.00m								
				6.0						
13.5										
				5.5						
14.0										
				5.0						
14.5										
				4.5						
15.0										
				4.0						
15.5										
				3.5						
16.0										
				3.0						
16.5										
				2.5						
17.0										
				2.0						
17.5										
				1.5						
18.0										
				1.0						
18.5										
				0.5						
19.0										
				0.0						
19.5										
				-0.5						

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	Borehole terminated due to obstruction.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water C: Cone SPT S: Split spoon SPT
12.80	13.00	01:00	4.80	4.50	6.80				0.00	4.00	Solid	0.00	3.00	Bentonite		
									4.00	13.00	Slotted	3.00	13.00	Gravel		

Appendix 2

Trial Pit Logs and Photographs

Contract No: 5836	# Trial Pit Log				Trial Pit No: **TP01**
Contract:	Balscadden	Easting:	728786.136	Date:	15/06/2021
Location:	Howth, Co. Dublin	Northing:	739106.863	Excavator:	JCB 3CX
Client:	Marlet	Elevation:	29.92	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	2.50 x 1.10 x 2.50	Status:	FINAL

Level (mbgl)		Stratum Description	Legend	Level (mOD)		Samples / Field Tests			Water Strike
Scale:	Depth			Scale:	Depth:	Depth	Type	Result	
	0.05	TOPSOIL.	▨		29.87				
		Brown silty slightly gravelly fine to coarse SAND with low cobble content and some gravel laminas. Gravel is fine to coarse, subrounded to rounded of various lithologies. Cobbles are subrounded to rounded of various lithologies.							
				29.5					
0.5									
				29.0					
1.0						1.00	B	MK01	
				28.5					
1.5									
				28.0					
2.0									
				27.5					
2.5	2.50	**Pit terminated at 2.50m**			27.42	2.50	B	MK02	
				27.0					
3.0									

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5836	Trial Pit Log	Trial Pit No: **TP02**

Contract:	Balscadden	Easting:	728754.368	Date:	15/06/2021
Location:	Howth, Co. Dublin	Northing:	739110.303	Excavator:	JCB 3CX
Client:	Marlet	Elevation:	23.98	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	2.90 x 1.10 x 2.70	Status:	FINAL

Level (mbgl)		Stratum Description	Legend	Level (mOD)		Samples / Field Tests			Water Strike
Scale:	Depth			Scale:	Depth:	Depth	Type	Result	
		TOPSOIL.	▨						
	0.20	Brown silty very gravelly fine to coarse SAND with low cobble content and some gravel laminas. Gravel is fine to coarse, subrounded to rounded of various lithologies. Cobbles are subrounded to rounded of various lithologies. (Possible MADE GROUND: traces of plastic identified in pit).	░		23.78				
0.5			░	23.5					
1.0			░	23.0		1.00	B	MK05	
1.5			░	22.5					
2.0			░	22.0		2.00	B	MK06	
2.5			░	21.5					
	2.70	**Pit terminated at 2.70m**			21.28				
3.0				21.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No:	Trial Pit Log				Trial Pit No:
5836					**TP03**

Contract:	Balscadden	Easting:	728736.781	Date:	15/06/2021
Location:	Howth, Co. Dublin	Northing:	739134.128	Excavator:	JCB 3CX
Client:	Marlet	Elevation:	20.47	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	2.50 x 1.10 x 3.00	Status:	FINAL

Level (mbgl) Depth	Stratum Description	Legend	Level (mOD) Depth:	Samples / Field Tests Depth	Type	Result	Water Strike
0.05	TOPSOIL.	▨	20.42				
0.20	MADE GROUND: grey brown silty very gravelly sand with low cobble content and some plastic fragments.	▩	20.27				
0.90	Brown silty gravelly fine to coarse SAND with some gravel laminas. Gravel is fine to coarse, subrounded to rounded of various lithologies.	⁘	19.57				
3.00	Grey brown silty very gravelly fine to coarse SAND with medium cobble content. Gravel is fine to coarse, subrounded to rounded of various lithologies. Cobbles are subrounded to rounded of various lithologies.	⁘	17.47	1.00 2.00	B B	MK03 MK04	
	Pit terminated at 3.00m						

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

TP01 Sidewall

TP01 Spoil

TP02 Sidewall

TP02 Spoil

TP03 Sidewall

TP03 Spoil

Appendix 3

Geotechnical Laboratory Test Results

Classification Tests in accordance with BS1377: Part 4

Client	Marlet
Site	Balscadden, Howth
S.I. File No	5836 / 21
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email info@siteinvestigations.ie
Report Date	6th July 2021

Hole ID	Depth	Sample No	Lab Ref No.	Sample Type	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plastic Index %	Min. Dry Density Mg/m^3	Particle Density Mg/m^3	% passing 425um	Comments	**Remarks** **C**=Clay; **M**=Silt **Plasticity**: **L**=Low; **I**=Intermediate; **H**=High; **V**=Very High; **E**=Extremely High
BH01	12.00	JOT12	21/838	B	12.1	34	20	14			63.2		CL
BH02	16.00	JOT32	21/842	B	18.5	38	24	14			50.9		CI

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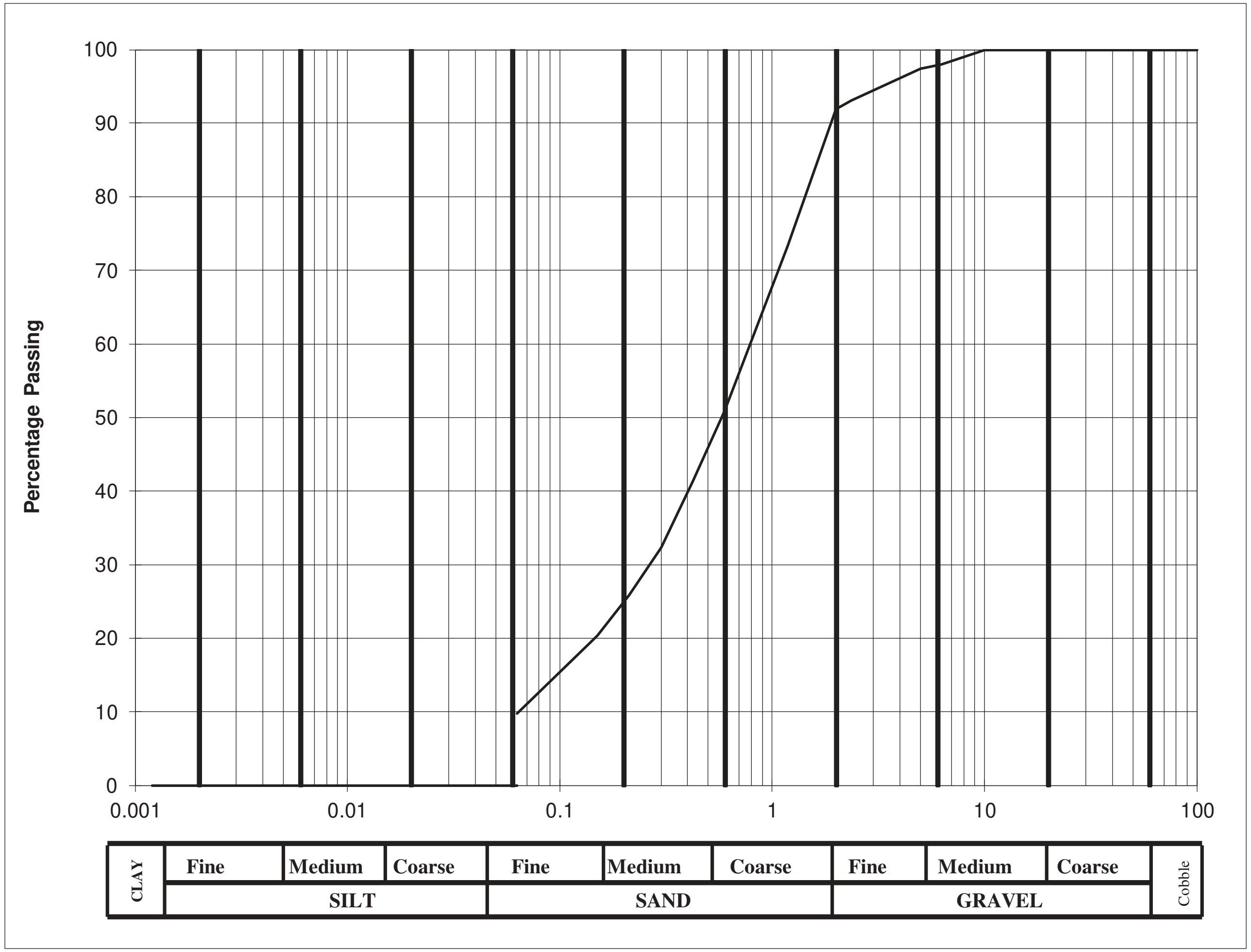
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	98		
5.0	97.4		
2.36	93.1		
2.00	91.9		
1.18	73.2		
0.600	50.9		
0.425	41.4		
0.300	32.3		
0.212	25.8		
0.150	20.3		
0.063	10		

Cobbles, %	0
Gravel, %	8
Sand, %	82
Clay / Silt, %	10



Client :	Marlet		Lab. No :	21/836		Hole ID :	BH 01
Project :	Balscadden, Howth		Sample No :	JOT04		Depth, m :	4.00

Material description :	silty gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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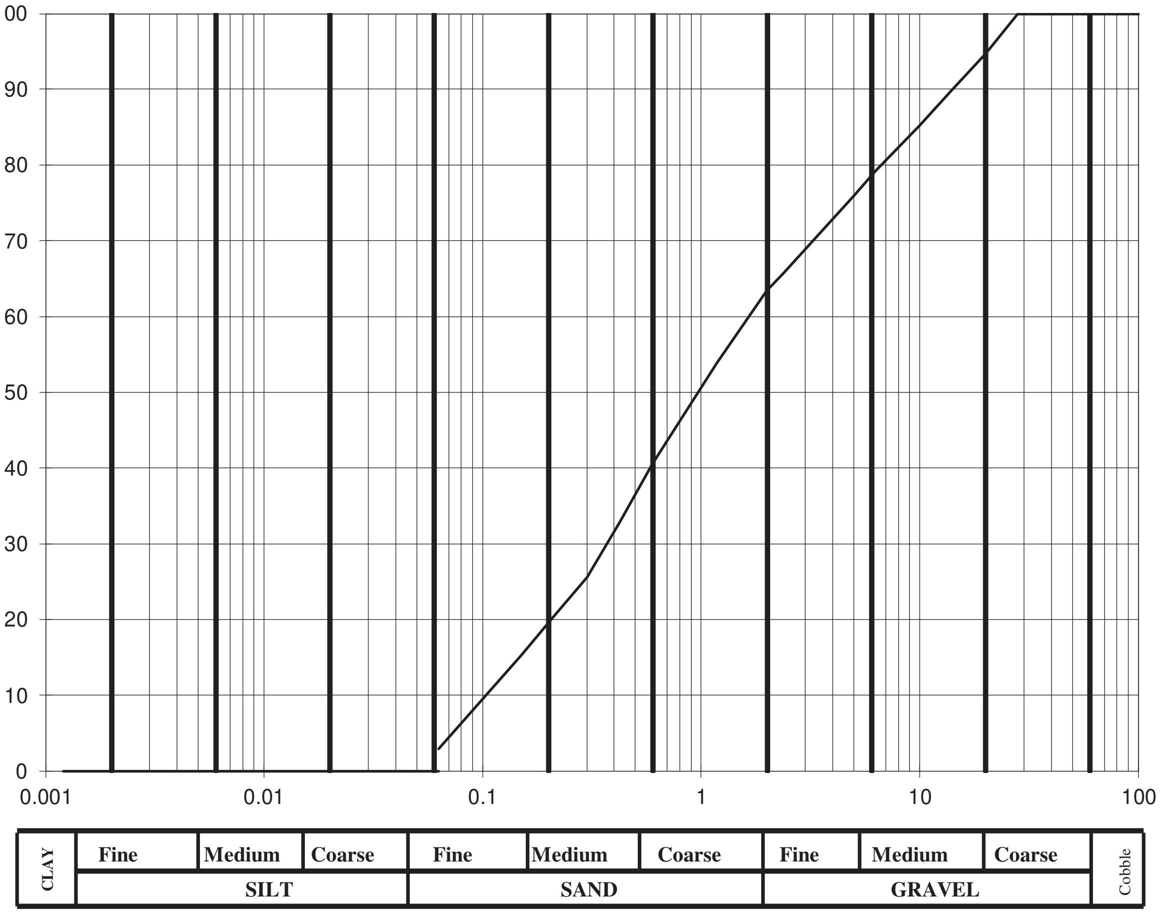
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	94.7		
14	89.9		
10	85.2		
6.3	79.2		
5.0	75.9		
2.36	65.6		
2.00	63.4		
1.18	53.9		
0.600	40.5		
0.425	32.8		
0.300	25.6		
0.212	20.4		
0.150	15.3		
0.063	3		

Cobbles, %	0
Gravel, %	37
Sand, %	60
Clay / Silt, %	3



Client :	Marlet	Lab. No :	21/837	Hole ID :	BH 01
Project :	Balscadden, Howth	Sample No :	JOT08	Depth, m :	8.00

Material description :	slightly silty gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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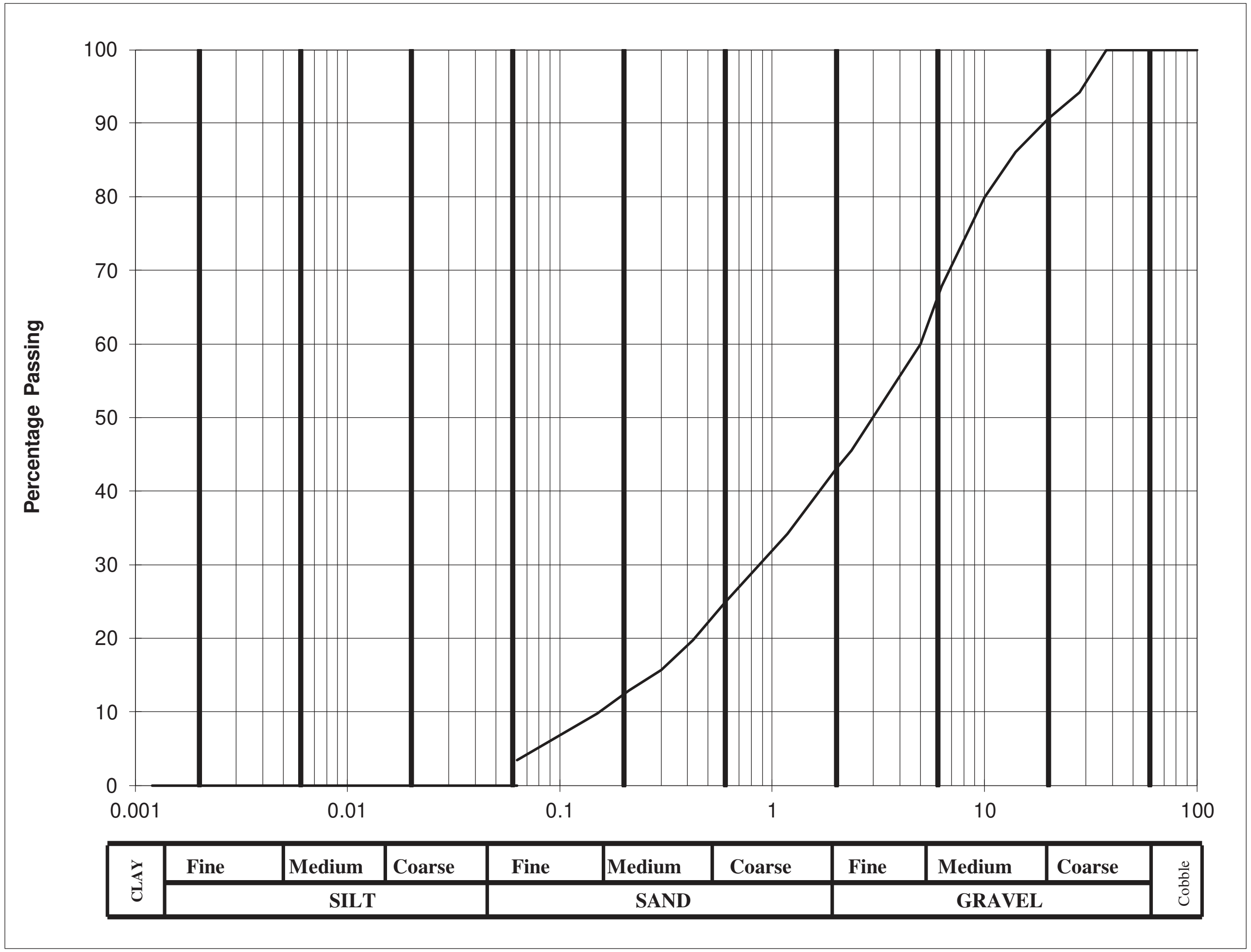
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	94.2		
20	90.6		
14	86.1		
10	79.9		
6.3	67.8		
5.0	60		
2.36	45.5		
2.00	43		
1.18	34.2		
0.600	24.8		
0.425	19.7		
0.300	15.7		
0.212	12.9		
0.150	9.8		
0.063	4		

Cobbles, %	0
Gravel, %	57
Sand, %	39
Clay / Silt, %	4



Client :	Marlet		Lab. No :	21/839		Hole ID :	BH 02
Project :	Balscadden, Howth		Sample No :	JOT18		Depth, m :	2.00

Material description :	slightly silty very sandy GRAVEL
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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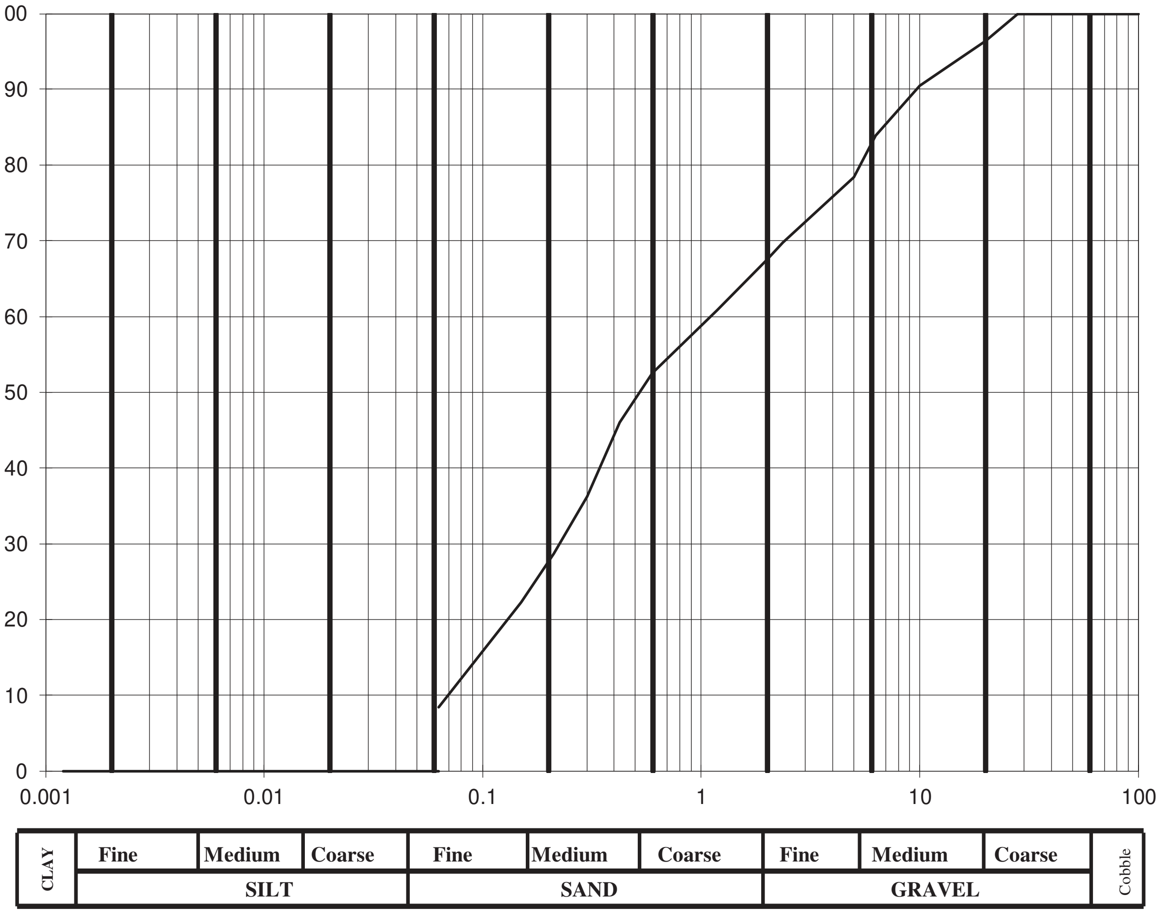
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	96.4		
14	93.3		
10	90.5		
6.3	83.9		
5.0	78.4		
2.36	69.8		
2.00	67.5		
1.18	60.8		
0.600	52.5		
0.425	46		
0.300	36.2		
0.212	28.7		
0.150	22.3		
0.063	9		

Cobbles, %	0
Gravel, %	33
Sand, %	59
Clay / Silt, %	9



Client :	Marlet		Lab. No :	21/840		Hole ID :	BH 02
Project :	Balscadden, Howth		Sample No :	JOT21		Depth, m :	5.00

Material description :	silty very gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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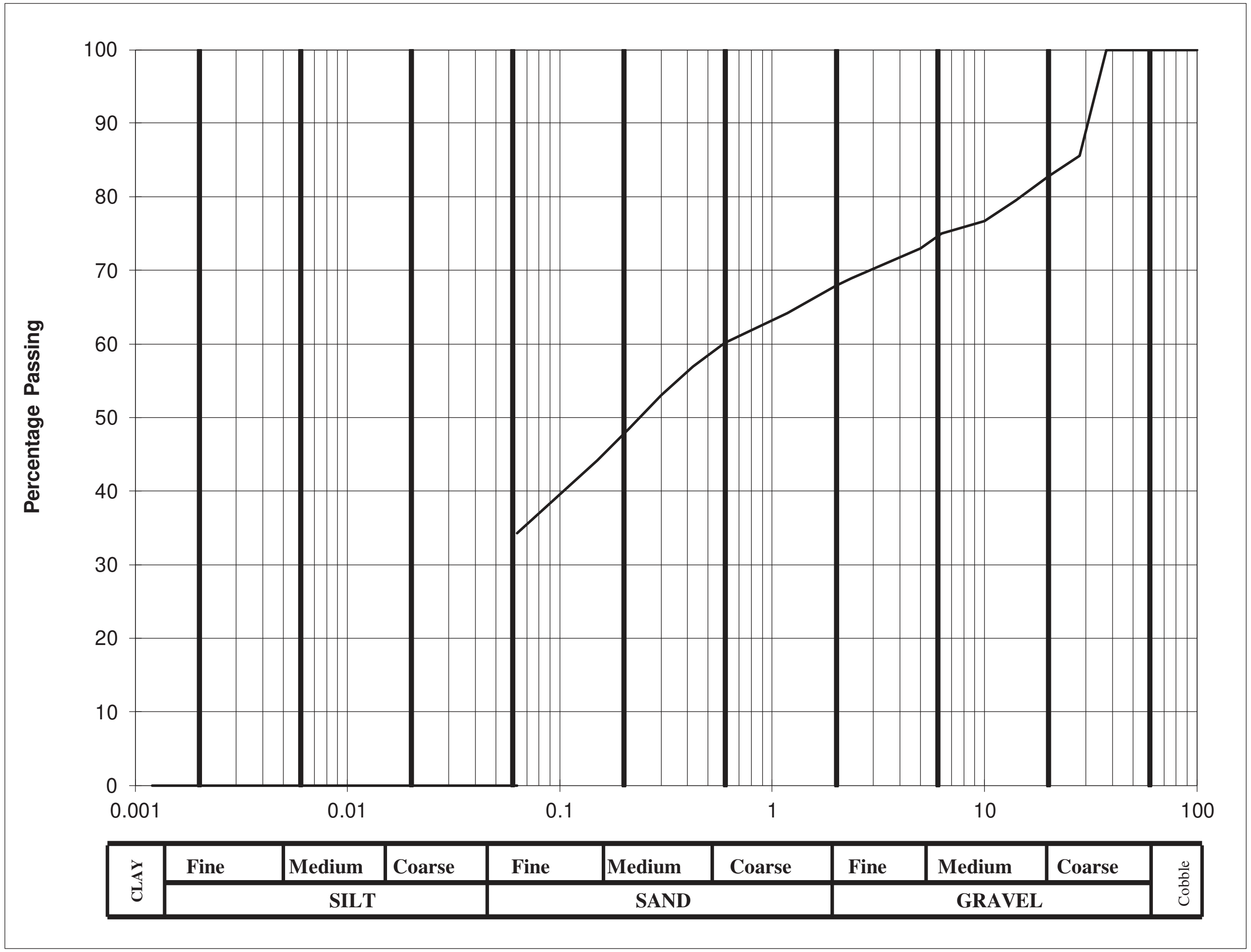
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis Diameter, mm	 % passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	85.6		
20	82.8		
14	79.5		
10	76.7		
6.3	75		
5.0	73		
2.36	68.9		
2.00	67.9		
1.18	64.2		
0.600	60.1		
0.425	56.9		
0.300	53		
0.212	48.5		
0.150	44.2		
0.063	34		

Cobbles, %	0
Gravel, %	32
Sand, %	34
Clay / Silt, %	34



Client :	Marlet	Lab. No :	21/841	Hole ID :	BH 02
Project :	Balscadden, Howth	Sample No :	JOT29	Depth, m :	13.00

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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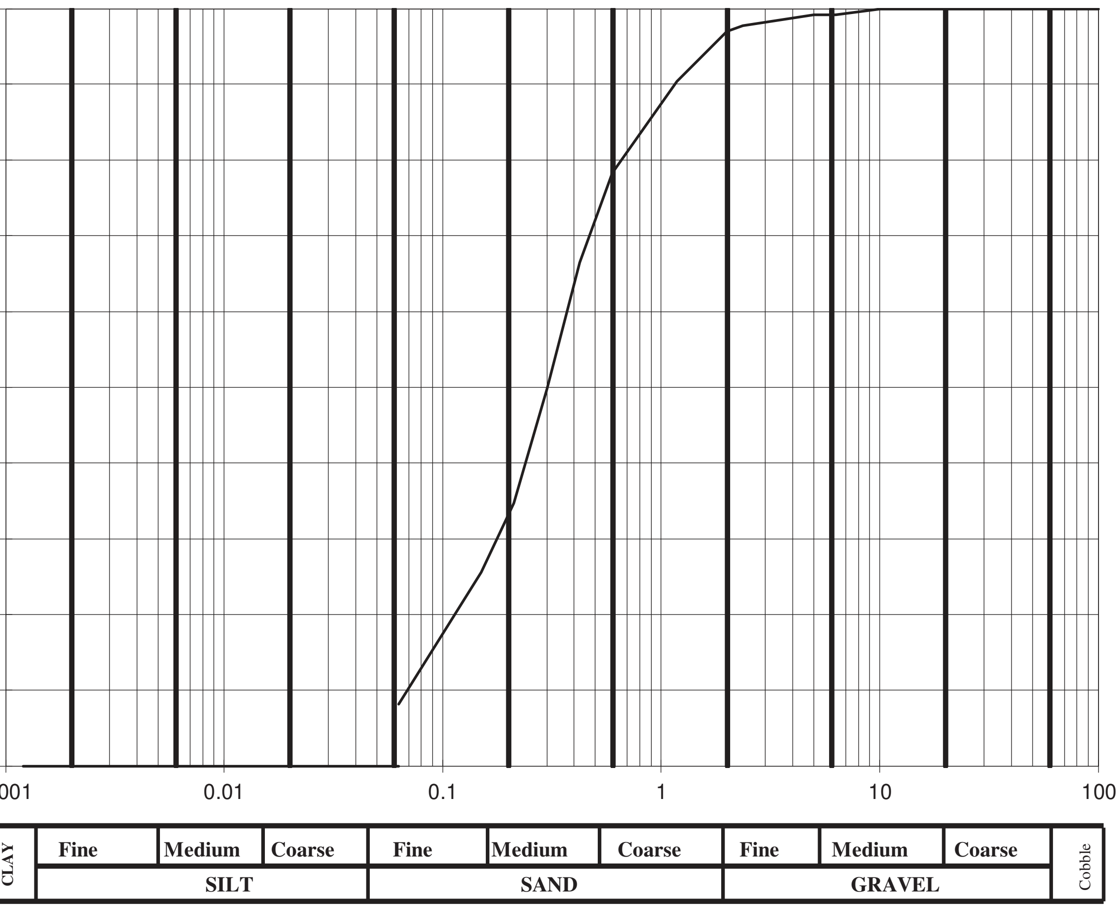
BS 1377 Particle Size Analysis

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99.2		
5.0	99.2		
2.36	97.7		
2.00	97		
1.18	90.4		
0.600	78.3		
0.425	66.5		
0.300	49.8		
0.212	34.7		
0.150	25.6		
0.063	8		

Cobbles, %	0
Gravel, %	3
Sand, %	89
Clay / Silt, %	8



Client :	Marlet		Lab. No :	21/833		Hole ID :	TP 01
Project :	Balscadden, Howth		Sample No :	MK01		Depth, m :	1.00

Material description :	silty slightly gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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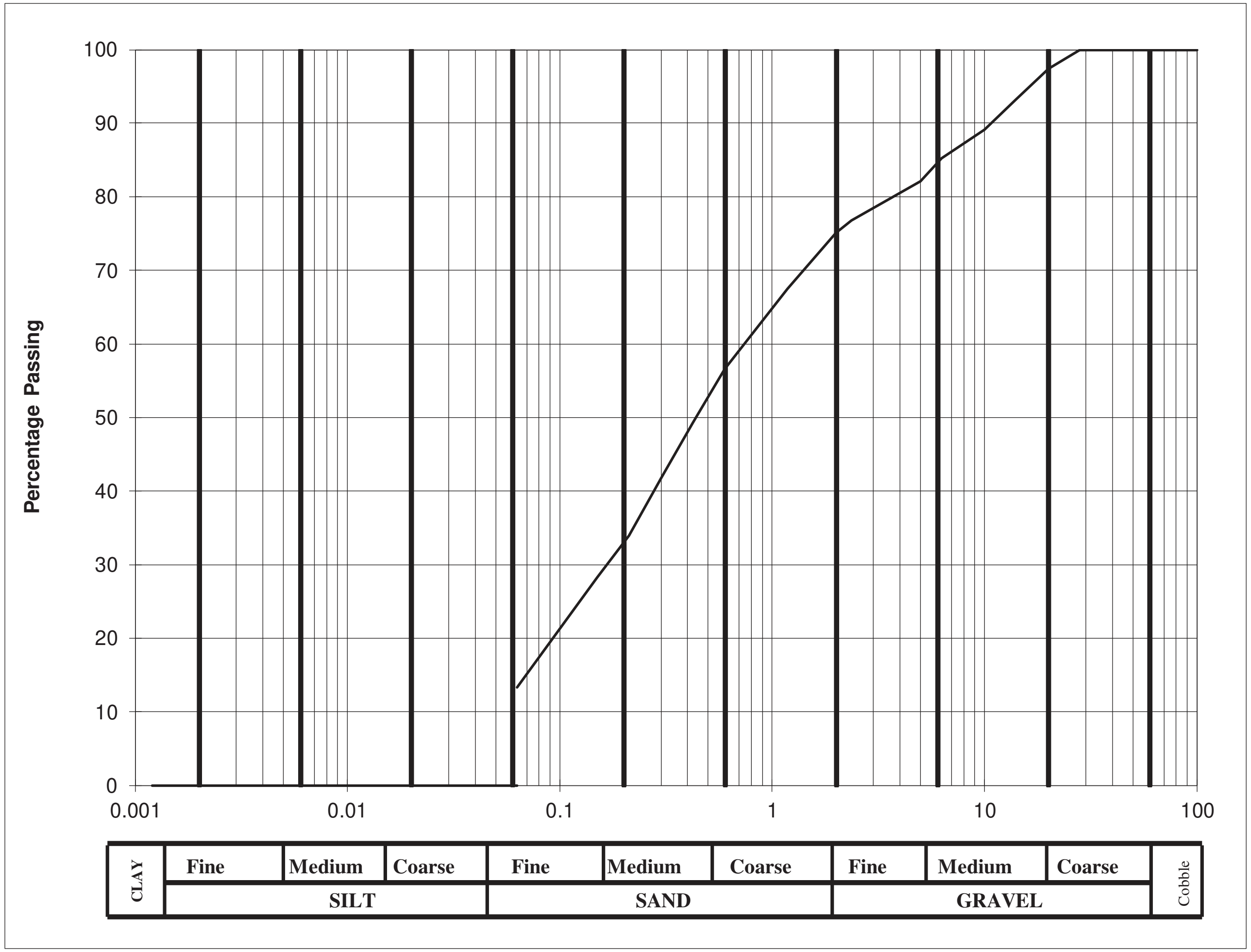
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	97.4		
14	93.2		
10	89.1		
6.3	85.2		
5.0	82.1		
2.36	76.8		
2.00	75.1		
1.18	67.5		
0.600	56.6		
0.425	49.3		
0.300	41.8		
0.212	33.9		
0.150	28.3		
0.063	13		

Cobbles, %	0
Gravel, %	25
Sand, %	62
Clay / Silt, %	13



Client :	Marlet
Project :	Balscadden, Howth

Lab. No :	21/834
Sample No :	MK06

Hole ID :	TP 02
Depth, m :	2.00

Material description :	silty very gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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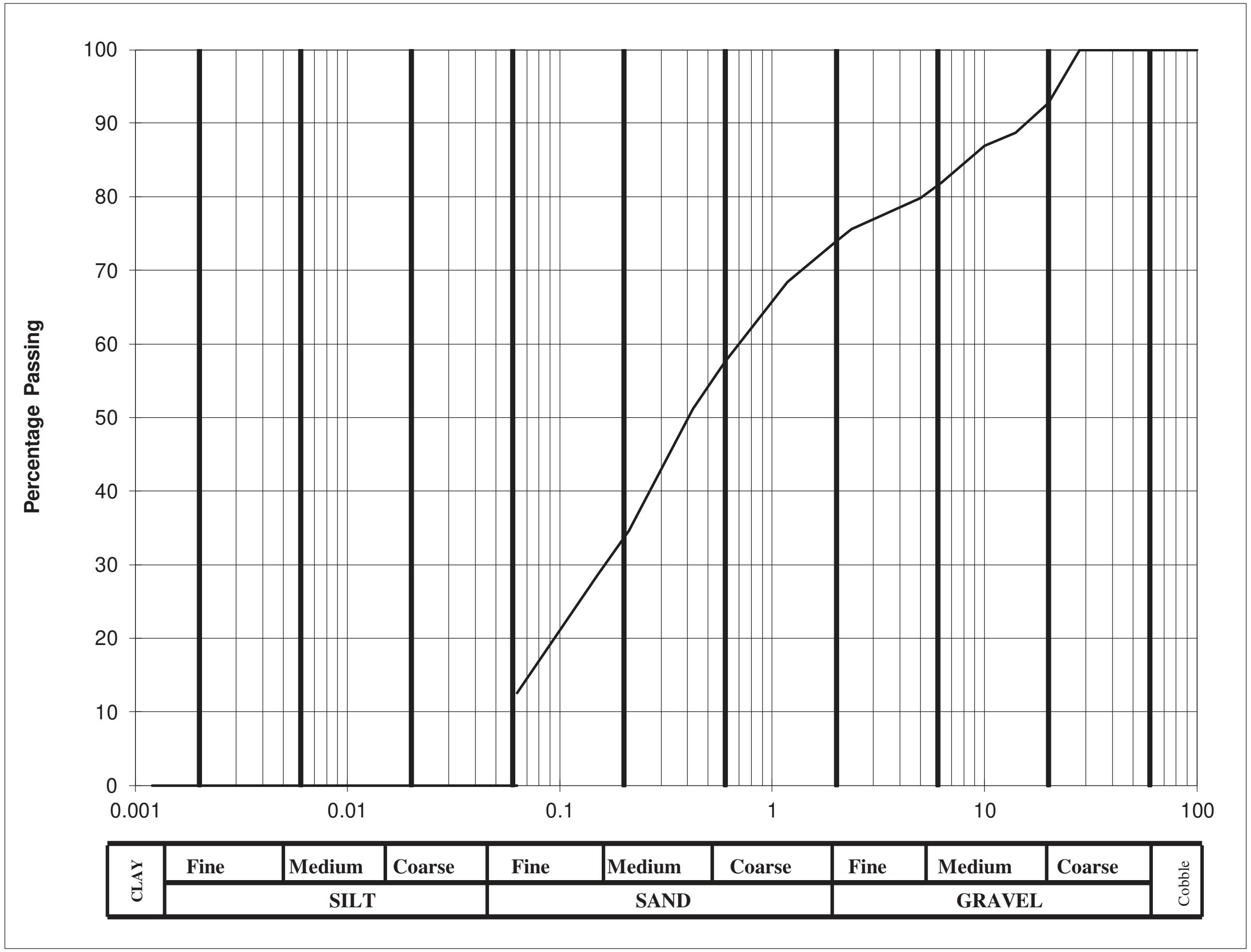
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	92.7		
14	88.7		
10	86.9		
6.3	81.9		
5.0	79.8		
2.36	75.6		
2.00	73.9		
1.18	68.4		
0.600	57.5		
0.425	51.2		
0.300	43		
0.212	34.6		
0.150	28.5		
0.063	13		

Cobbles, %	0
Gravel, %	26
Sand, %	61
Clay / Silt, %	13



Client :	Marlet	Lab. No :	21/835	Hole ID :	TP 03
Project :	Balscadden, Howth	Sample No :	MK04	Depth, m :	2.00

Material description :	silty very gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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Chemical Testing
In accordance with BS 1377: Part 3

Client	Marlet
Site	Balscadden, Howth
S.I. File No	5836 / 21
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email:info@siteinvestigations.ie
Report Date	6th July 2021

Hole Id	Depth (mBGL)	Sample No	Lab Ref	pH Value	Water Soluble Sulphate Content (2:1 Water-soil extract) (SO_3) g/L	Water Soluble Sulphate Content (2:1 Water-soil extract) (SO_3) %	Loss on Ignition (Organic Content) %	Chloride ion Content (water:soil ratio 2:1) %	% passing 2mm	Remarks
BH01	4.00	JOT04	21/836	8.57	0.119	0.109			91.9	
BH02	5.00	JOT21	21/840	8.57	0.120	0.081			67.5	
TP01	1.00	MK01	21/833	8.56	0.122	0.118			97.0	
TP02	2.00	MK06	21/834	8.49	0.117	0.088			75.1	
TP03	2.00	MK04	21/835	8.50	0.117	0.087			73.9	

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SHEAR BOX TEST

Test Method **BS 1377 : Part 7 : 1990 : Method 4**

Preparation procedure **Remoulded with 2.5 kg rammer at natural moisture content.**
Material screened on 2mm sieve

Description **Reb/brown slightly silty slightly gravelly fine to coarse SAND.**

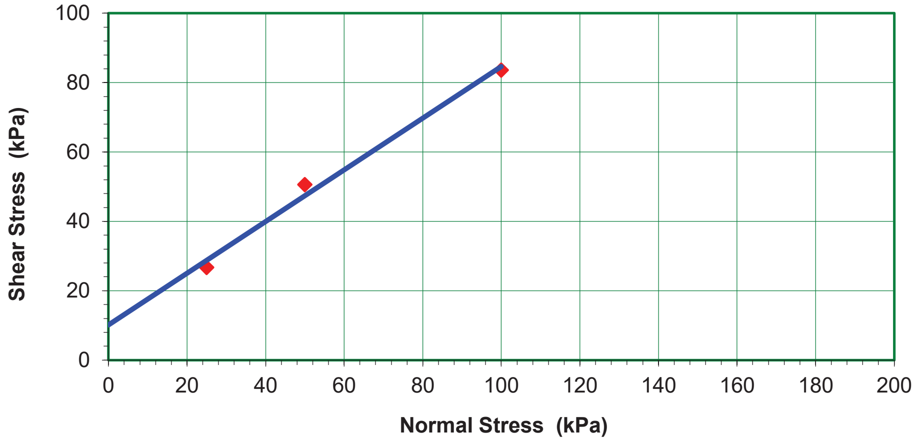
Weighings		**Stage 1**	**Stage 2**	**Stage 3**	**Nominal Dimensions**		
Wet soil	gms	345.2	344.5	344.9	Length	L1 mm	60
Dry soil	gms	160.9	160.5	160.7		L2 mm	60
					Area	A mm2	3600
Wet soil	gms	190.5	189.9	190.4	Height	H mm	25
Dry soil	gms	160.9	160.5	160.7	Volume	V cm3	90
Water	gms	29.7	29.4	29.7	Particle density	Mg/m3	2.70
Moisture Content (%)		18.4	18.3	18.5			
Bulk Density (Mg/m3)		2.12	2.11	2.12			
Dry density (Mg/m3)		1.79	1.78	1.79			
Voids ratio e		0.5104	0.5140	0.5121			
Degree of saturation (%)		97.5	96.2	97.3			

Final Details

	Stage 1	**Stage 2**	**Stage 3**
Normal Loads(kPa)	25	50	100
Shear stress (kPa)	26.7	50.6	83.6
Horizontal Displacement (mm)	1.743	2.227	2.039
Vertical displacement (mm)	-0.169	0.015	-0.040
Rate of displacement (mm/min)		0.5000	

Date sampled	n/a		Peak
Date received	25/06/2021	Cohesion c' (kPa)	10.2
Date tested	08/07/2021	Friction angle phi'	36.1°

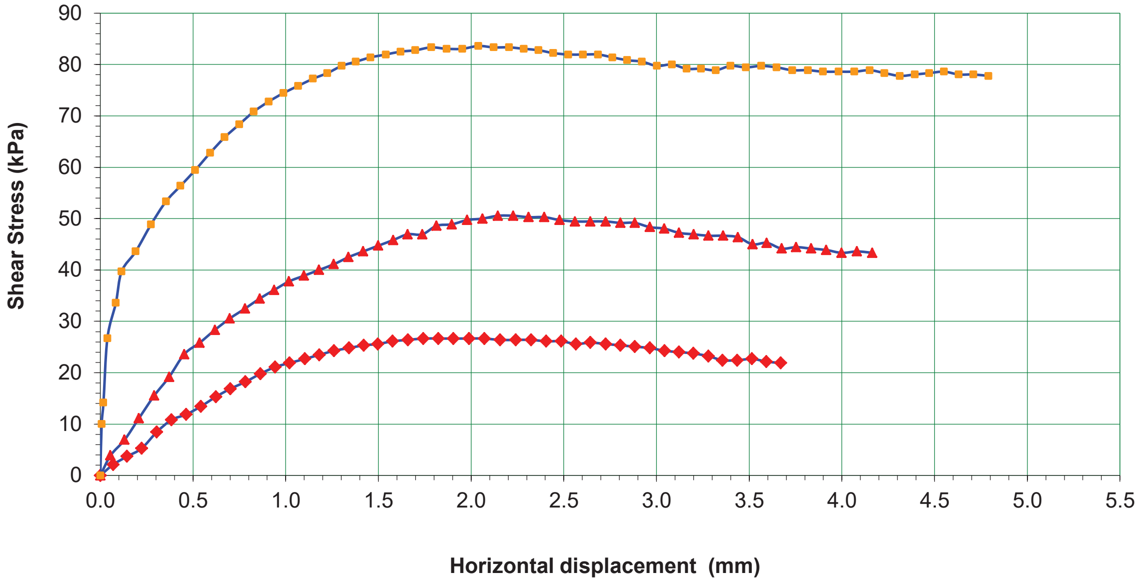
Mohr Envelope

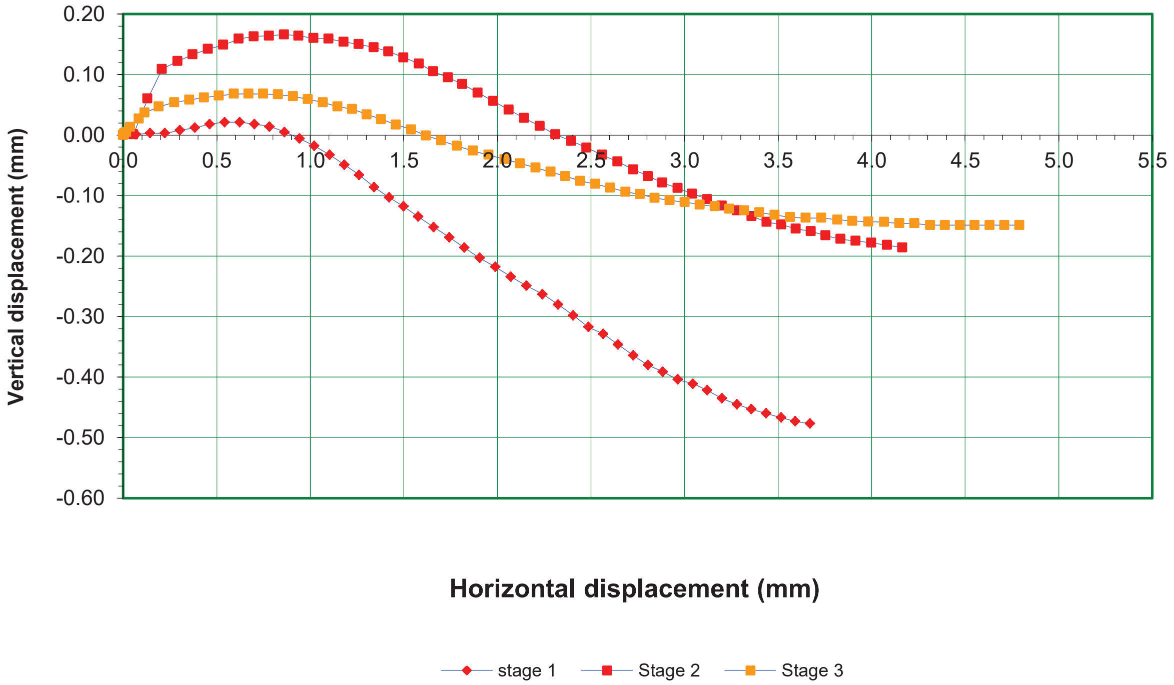


SIL PROJECT ID: 5836-21

NM **T L** **Ltd**	**Quick drained shear box in 60mm square shear box**		Job No. NMTL_3403 Borehole No. TP01
	Project Balscadden, Howth		Sample No. MK02
Operator Sb	Checked Nc	Approved Bc	Depth. 2.50m

SHEAR STAGE





SIL PROJECT ID: 5836-21

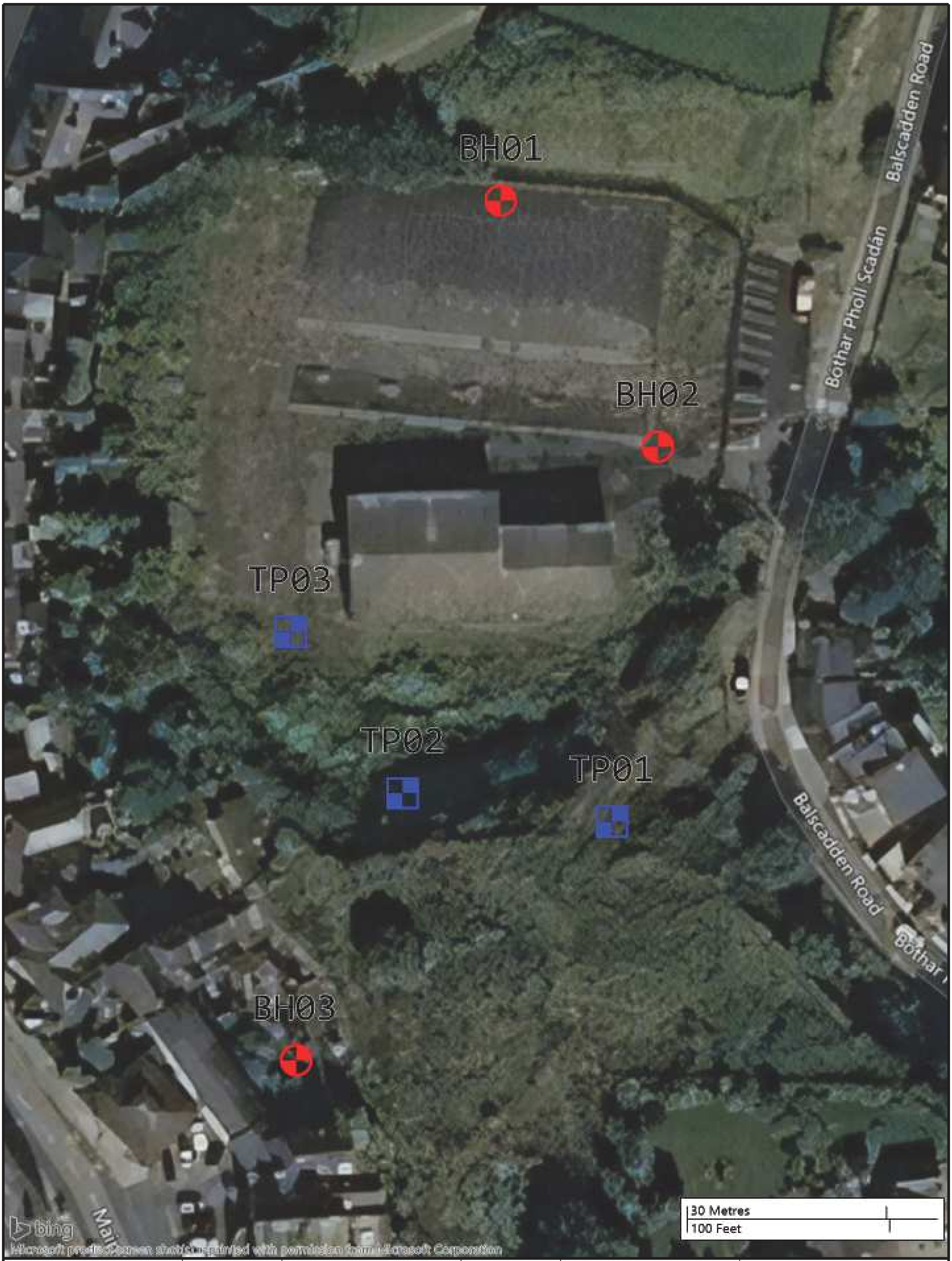
NM T L Ltd	**Quick drained shear box in 60mm square shear box**		Job No. NMTL_3403
			Borehole No. TP01
	Project Balscadden, Howth		Sample No. MK02
Operator Sb	Checked Nc	Approved Bc	Depth. 2.50m

Appendix 4

Survey Data

Survey Data

Location	Irish Transverse Mercator		Elevation	Irish National Grid	
	Easting	Northing		Easting	Northing
Boreholes					
BH01	728766.929	739199.986	19.98	328844.016	239174.894
BH02	728791.582	739163.531	19.58	328868.675	239138.431
BH03	728739.243	739069.592	19.42	328816.326	239044.471
Trial Pits					
TP01	728786.136	739106.863	29.92	328863.228	239081.751
TP02	728754.368	739110.303	23.98	328831.454	239085.191
TP03	728736.781	739134.128	20.47	328813.863	239109.021



Contract No:	5836	Client:	Marlet
Contract:	Balscadden	Engineer:	Waterman Moylan
Location:	Howth, Co. Dublin	Scale:	1:750
Title:	Site Plan	Drawn By:	SL

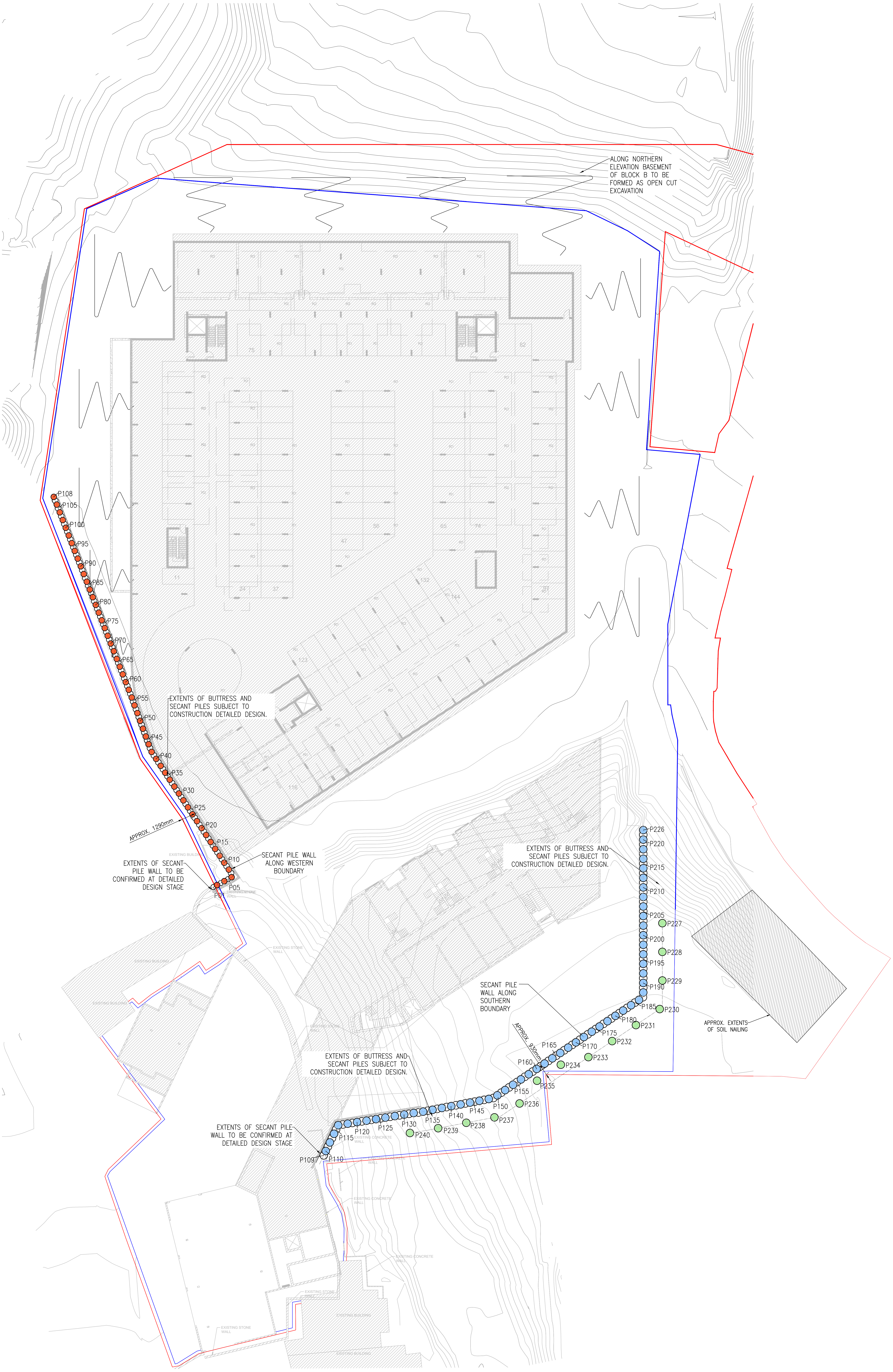
Legend Key

● Locations By Type - CP

▨ Locations By Type - TP

Appendix D – Drawings

A1



PLAN 1:300 PILE LAYOUT
SCALE 1:300

GENERAL NOTES

1. DO NOT SCALE OFF DRAWING.
2. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. ALL LEVELS IN METERS (MALIN HEAD) UNLESS NOTED OTHERWISE.
4. DESIGN IS SUBJECT TO DETAILED CONSTRUCTION DESIGN.
5. DRAWINGS TO BE READ IN CONJUCTION WITH BYRNELOOBY REPORT B1800–GEO–R001.
6. PILES TO BE DESIGNED IN ACCORDANCE WITH I.S. EN 1997–1:2004 EUROCODE 7 GEOTECHNICAL DESIGN – PART 1 AND THE IRISH NATIONAL ANNEX TO I.S. EN 1997–1:2004.
7. DESIGN IS BASED ON 1200mm DIAMETER HARD AND FIRM PILES FOR SECANT PILE WALL TYPE 01 AND BUTTRESS PILES – PILE TYPE 03. DESIGN IS BASED ON 900mm DIAMETER HARD AND FIRM PILES FOR SECANT PILE WALL FOR SECANT PILE WALL TYPE 02.
8. FIRM PILES FOR SECANT PILE WALLS TO EXTEND TO A MINIMUM OF 1m BELOW FORMATION LEVEL.
9. BYRNELOOBY LAYOUT DRAWINGS ARE INDICATIVE ONLY. PILE SETTING OUT DETAILS SUBJECT TO ENGINEERS DETAILING.

01	18/02	GENERAL REVISION	AI	NP	MR
00	26/11	WORK IN PROGRESS	AI	NP	MR
Rev	Date	Description	By	Chk	App

BYRNELOOBY
WWW.BYRNELOOBY.COM
IRELAND | UK | UAE | BAHRAIN | KSA

CLIENT
BALSCADDEN GP3 Ltd.

PROJECT
BALSCADDEN ROAD

DRAWING TITLE
OVERALL SITE PLAN

STATUS
DRAFT

Date: 26/11/21	Scale: 1:300	Drawn: MON	Chk: NP	App: MR
Project No: B1800	Drg. No: B1800–1000			Rev: 01

A1

EXTENTS OF SECANT PILE WALL TO BE CONFIRMED AT DETAILED DESIGN STAGE

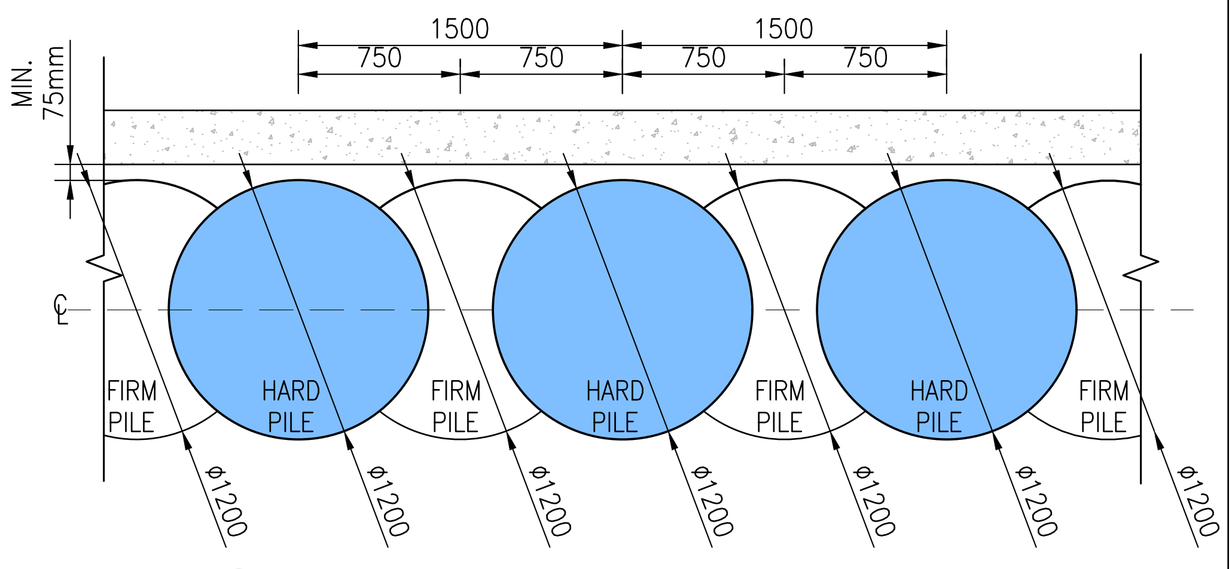
EXTENTS OF BUTTRESS AND SECANT PILES SUBJECT TO CONSTRUCTION DETAILED DESIGN.

EXTENTS OF BUTTRESS PILES SUBJECT TO CONSTRUCTION DETAILED DESIGN.

EXTENTS OF SECANT PILE WALL TO BE CONFIRMED AT DETAILED DESIGN STAGE

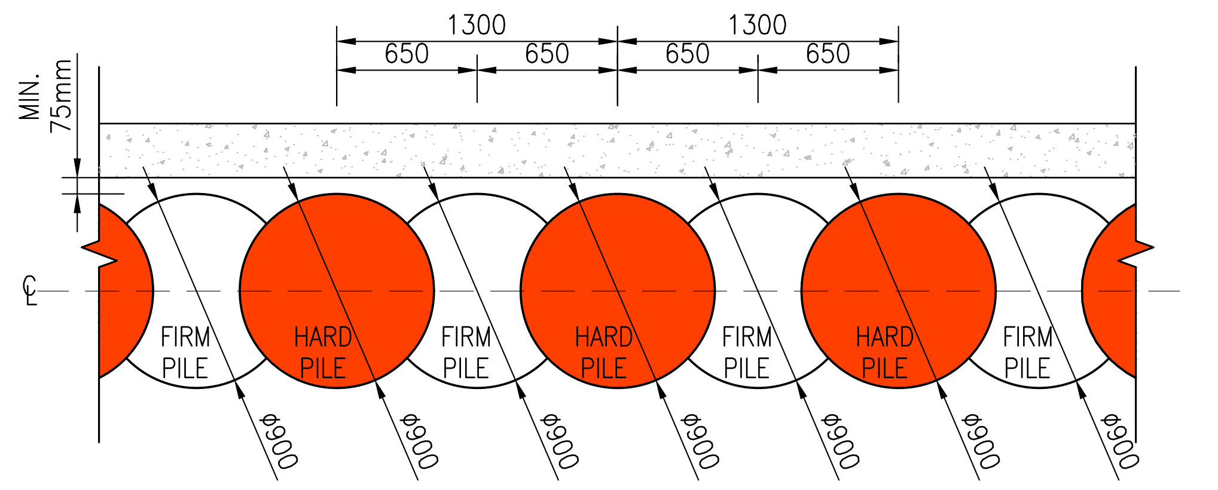
PLAN 1:200 **PILE LAYOUT**

SCALE 1:200



TYP 1:25 **SECANT PILE WALL TYPICAL SETOUT**

SCALE 1:25

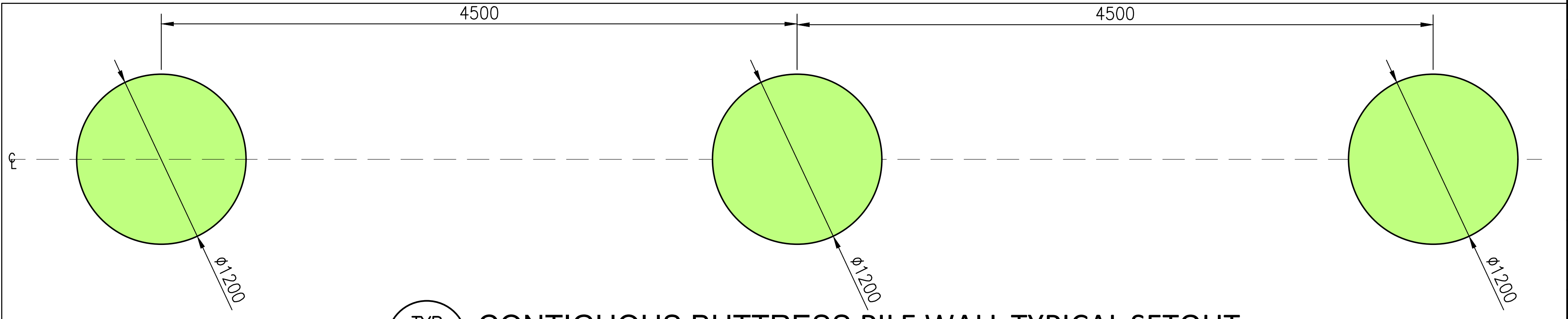


TYP 1:25 **SECANT PILE WALL TYPICAL SETOUT**

SCALE 1:25

LEGEND:

- 🟥 WALL TYPE 01 (WT01)
- 🟦 WALL TYPE 02 (WT02)
- 🟩 WALL TYPE 03 (WT03)
- — DEVELOPMENT BOUNDARY (TBC BY WM)
- — SITE BOUNDARY (TBC BY WM)



TYP 1:25 **CONTIGUOUS BUTTRESS PILE WALL TYPICAL SETOUT**

SCALE 1:25

GENERAL NOTES

1. DO NOT SCALE OFF DRAWING.
2. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. ALL LEVELS IN METERS (MALIN HEAD) UNLESS NOTED OTHERWISE.
4. DESIGN IS SUBJECT TO DETAILED CONSTRUCTION DESIGN.
5. DRAWINGS TO BE READ IN CONJUCTION WITH BYRNELOOBY REPORT B1800–GEO–R001.
6. PILES TO BE DESIGNED IN ACCORDANCE WITH I.S. EN 1997–1:2004 EUROCODE 7 GEOTECHNICAL DESIGN – PART 1 AND THE IRISH NATIONAL ANNEX TO I.S. EN 1997–1:2004.
7. DESIGN IS BASED ON 1200mm DIAMETER HARD AND FIRM PILES FOR SECANT PILE WALL TYPE 01 AND BUTTRESS PILES – PILE TYPE 03. DESIGN IS BASED ON 900mm DIAMETER HARD AND FIRM PILES FOR SECANT PILE WALL FOR SECANT PILE WALL TYPE 02.
8. FIRM PILES FOR SECANT PILE WALLS TO EXTEND TO A MINIMUM OF 1m BELOW FORMATION LEVEL.
9. BYRNELOOBY LAYOUT DRAWINGS ARE INDICATIVE ONLY. PILE SETTING OUT DETAILS SUBJECT TO ENGINEERS DETAILING.

Rev	Date	Description	By	Chk	App
01	18/02	GENERAL REVISION	AI	NP	MR
00	26/10	WORK IN PROGRESS	AI	NP	MR

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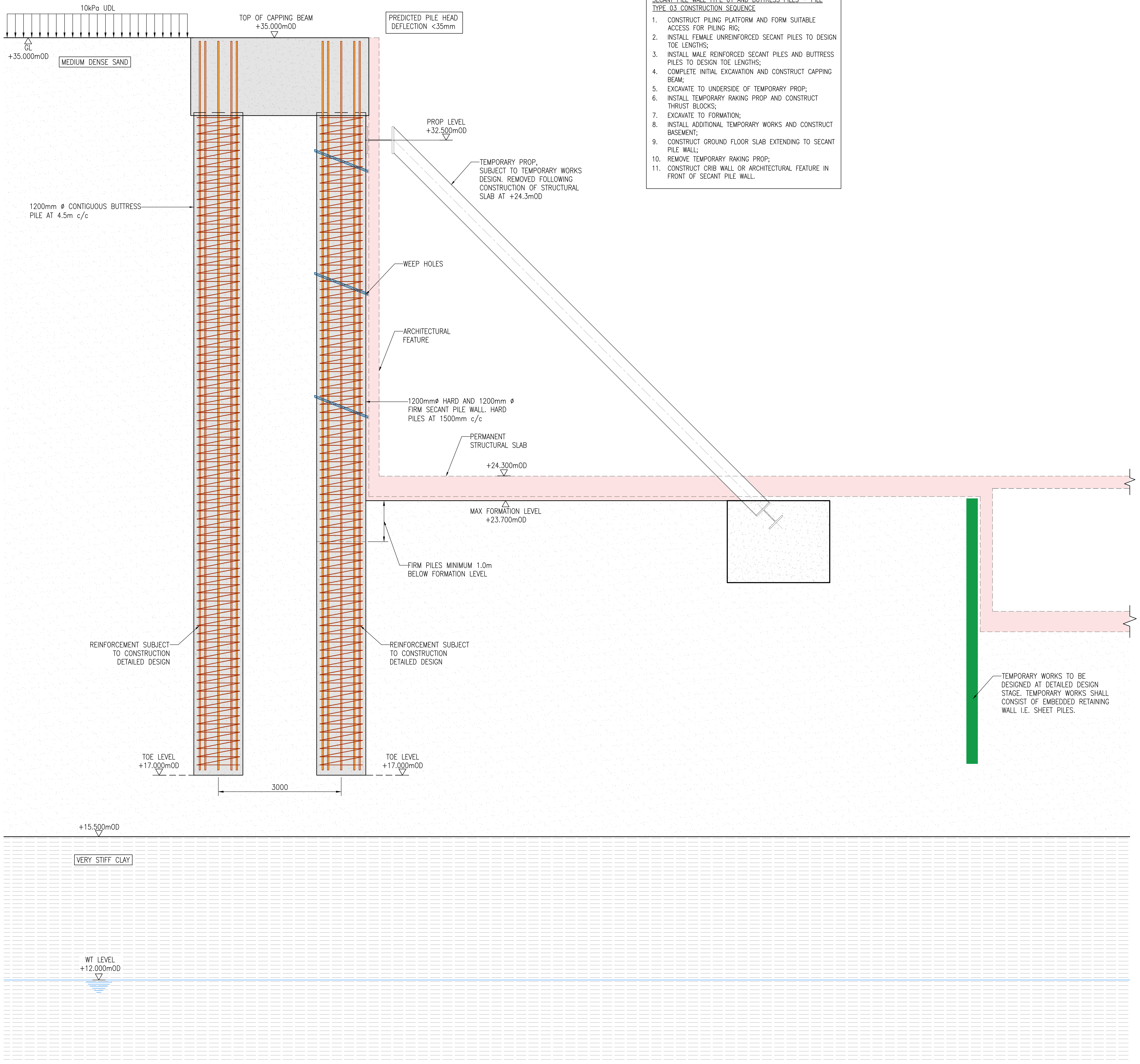
PROJECT
BALSCADDEN ROAD

DRAWING TITLE
RETAINING WALL PILE LAYOUT

STATUS
DRAFT

Date: 26/10/21 | Scale: AS NOTED | Drawn: AI | Chk: NP | App: MR
Project No: B1800 | Drg. No: B1800–1001 | Rev: 01

A1



PT03 1:50 **BUTTRESS PILES - PILE TYPE 03**
SCALE

WT01 1:50 **SECANT PILE WALL TYPE 01**
SCALE

SECANT PILE WALL TYPE 01 AND BUTTRESS PILES – PILE TYPE 03 CONSTRUCTION SEQUENCE

1. CONSTRUCT PILING PLATFORM AND FORM SUITABLE ACCESS FOR PILING RIG;
2. INSTALL FEMALE UNREINFORCED SECANT PILES TO DESIGN TOE LENGTHS;
3. INSTALL MALE REINFORCED SECANT PILES AND BUTTRESS PILES TO DESIGN TOE LENGTHS;
4. COMPLETE INITIAL EXCAVATION AND CONSTRUCT CAPPING BEAM;
5. EXCAVATE TO UNDERSIDE OF TEMPORARY PROP;
6. INSTALL TEMPORARY RAKING PROP AND CONSTRUCT THRUST BLOCKS;
7. EXCAVATE TO FORMATION;
8. INSTALL ADDITIONAL TEMPORARY WORKS AND CONSTRUCT BASEMENT;
9. CONSTRUCT GROUND FLOOR SLAB EXTENDING TO SECANT PILE WALL;
10. REMOVE TEMPORARY RAKING PROP;
11. CONSTRUCT CRIB WALL OR ARCHITECTURAL FEATURE IN FRONT OF SECANT PILE WALL.

GENERAL NOTES

1. DO NOT SCALE OFF DRAWING.
2. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. ALL LEVELS IN METERS (MALIN HEAD) UNLESS NOTED OTHERWISE.
4. DESIGN IS SUBJECT TO DETAILED CONSTRUCTION DESIGN.
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8. FIRM PILES FOR SECANT PILE WALLS TO EXTEND TO A MINIMUM OF 1m BELOW FORMATION LEVEL.
9. BYRNELOOBY LAYOUT DRAWINGS ARE INDICATIVE ONLY. PILE SETTING OUT DETAILS SUBJECT TO ENGINEERS DETAILING.

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DRAWING TITLE
RETAINING WALL PILES
SECTIONS AND DETAILS
SHEET 01 OF 02

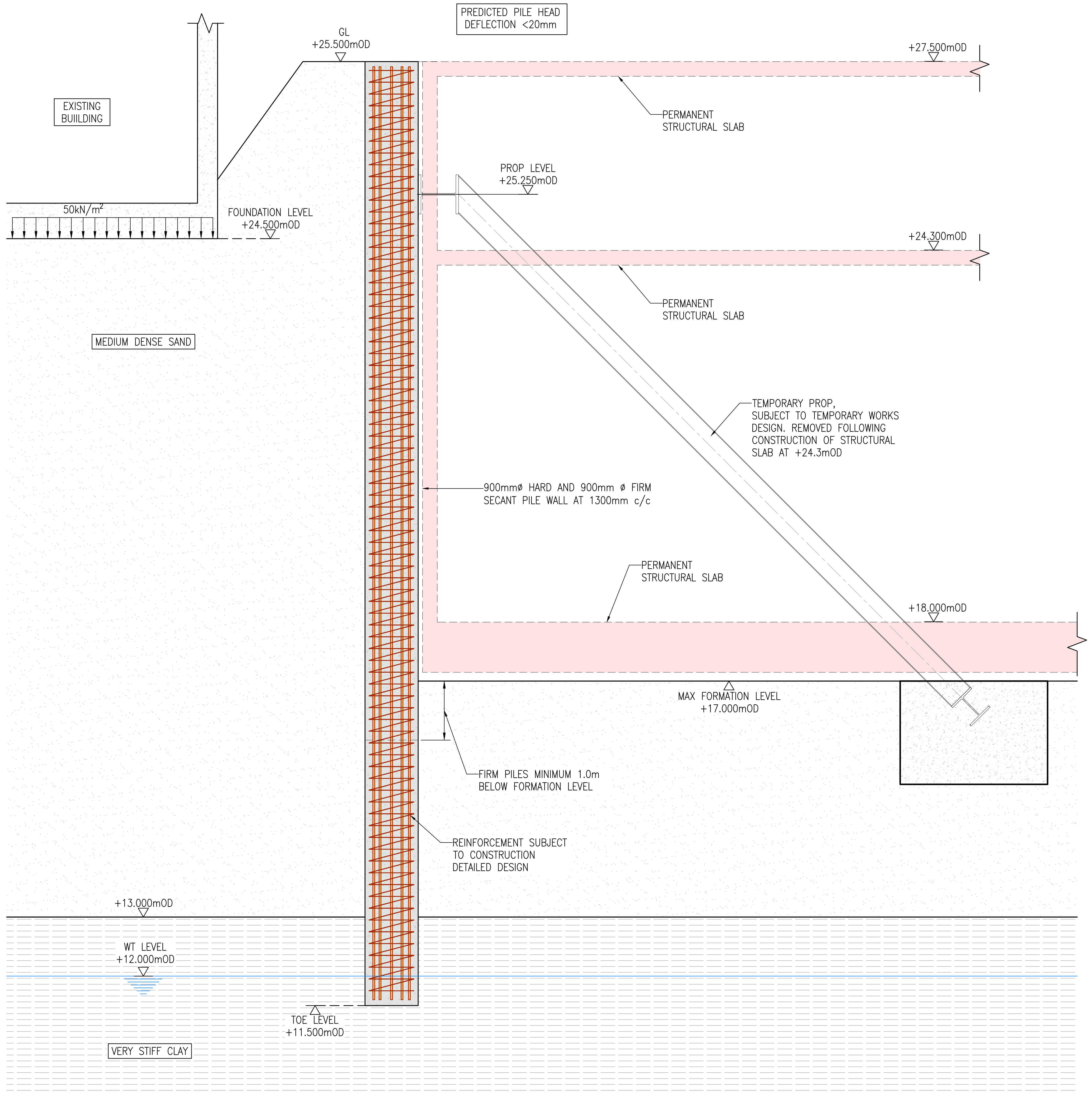
STATUS
DRAFT

Date: 26/10/21 | Scale: AS NOTED | Drawn: AI | Chk: NP | App: MR
Project No: B1800 | Drg. No: B1800–1002 | Rev: 01

A1

SECANT PILE WALL TYPE 02

1. CONSTRUCT PILING PLATFORM AND FORM SUITABLE ACCESS FOR PILING RIG;
2. INSTALL FEMALE UNREINFORCED SECANT PILES TO DESIGN TOE LENGTHS;
3. INSTALL MALE REINFORCED SECANT PILES TO DESIGN TOE LENGTHS;
4. COMPLETE INITIAL EXCAVATION;
5. EXCAVATE TO UNDERSIDE OF TEMPORARY PROP;
6. INSTALL TEMPORARY RAKING PROP AND CONSTRUCT THRUST BLOCKS;
7. EXCAVATE TO FORMATION;
8. CONSTRUCT BASEMENT FLOOR SLAB, GROUND FLOOR SLAB AND FIRST FLOOR SLAB;
9. REMOVE TEMPORARY RAKING PROP;
10. CONSTRUCT CRIB WALL OR ARCHITECTURAL FEATURE IN FRONT OF SECANT PILE WALL.



WT02
1:50
SECANT PILE WALL TYPE 02
SCALE

GENERAL NOTES

1. DO NOT SCALE OFF DRAWING.
2. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. ALL LEVELS IN METERS (MALIN HEAD) UNLESS NOTED OTHERWISE.
4. DESIGN IS SUBJECT TO DETAILED CONSTRUCTION DESIGN.
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Rev	Date	Description	By	Chk	App
01	18/02	GENERAL REVISION	AI	NP	MR
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PROJECT
BALSCADDEN ROAD

DRAWING TITLE
RETAINING WALL PILES
SECTIONS AND DETAILS
SHEET 02 OF 02

STATUS
DRAFT

Date: 26/10/21
Scale: AS NOTED
Drawn: AI
Chk: NP
App: MR

Project No: B1800
Drg. No: B1800-1003
Rev: 01

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Appendix E

Hydrogeological Assessment Report for proposed development at Balscadden Road, Howth, Co. Dublin

Minerex Doc. Ref.: 3330-031 (Hydrogeological Assessment Report) (Rev 1)

Date: 21/02/2022

Report by:

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Hydrogeological, Environmental and
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Prepared by:	**Reviewed by:**
Chris Fennell	Cecil Shine
Chris Fennell Ph.D	**Cecil Shine** B.Sc., M.Sc., PGeo, EurGeol
Hydrogeologist	Project Director Dewatering & Contaminated land

Contents

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5. Interpretations contained in this report are derived from available information of the site conditions, the likely environmental responses and the experience of the company.
6. MEL has prepared this report in line with best current practice and with all reasonable professional judgement, skill, care and diligence in consideration of the limits imposed by materials, equipment and methodologies used, and the time constraints and resources devoted to it as agreed with the client.
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Executive Summary

1. The site for the proposed development is underlain by a thick layer of glacial sands, gravels and clays. A wide mapped fault is located along the southern end of the site dividing Carboniferous limestones (North) from older Cambrian Bedrock (South) with fault Breccia visible on the southern end of Balscadden Bay.
2. Continuous water level monitoring, site surveys, water sampling and hydrochemical analysis have been used to develop a conceptual hydrogeological site model.
3. The conceptual site model indicates groundwater flow towards Grays Brook to the west of the site, northwards towards the Martello tower and eastwards towards Balscadden Bay as evidenced by the mapped and sampled springs.
4. The conceptual site model indicates that the proposed development, which includes 2no. secant piled walls (south and west), is unlikely to impede groundwater flow or create any significant barrier effect. The southern piled wall does not extend to the water table. While the male piles of the western piled wall do extend to the water table the likelihood of any impedance of groundwater flow is mitigated due to the groundwater flow direction and the raised levels of the female piles.

1. Introduction

Minerex Environmental Limited (MEL) was commissioned by Marlet to carry out a hydrogeological assessment for a proposed development at Balscadden Road, Howth. Co. Dublin.

The scope of this report and the specific deliverables of the assessment, as requested, are as follows:

"A Hydrological Assessment of the site is required including an assessment of the groundwater levels and natural ground water flows and/or water courses adjacent to and within the site. The Hydrological Assessment shall address the proposed development in relation to the existing hydrology both within and adjacent to the site and shall include:

1. *Groundwater monitoring of the 2 no. borehole standpipe piezometers (via diver data logger or similar) over a 3-month period.*
2. *Logs for the monitoring of groundwater including a rainfall event.*
3. *Mapping of hydrological water courses both within and adjacent to the site.*
4. *Hydrological testing of existing water courses to determine source (saline testing).*
5. *Recommendations for the management of groundwater hydrology within the proposed development.*
6. *Impact of the proposed development on local groundwater hydrology.*
7. *Interpretive report."*

2. Site Description

2.1 Geology

The site is predominantly underlain by the Ballysteen Formation. The lithology of the Ballysteen Formation is described as irregularly bedded with nodular bedded argillaceous bioclastic limestones (wackestones and packstones), interbedded with fossiliferous calcareous shales (Appendix A). A mapped fault is shown towards the southern edge of the site separating the Ballysteen formation from the Elsinore Formation. The Elsinore Formation is described as a polymict melange of quartzite, greywacke, siltstone, mudstone, and calcareous sandstone in a chaotic mudstone-sandstone matrix. Components in this formation can vary in size from pebbles to blocks hundreds of metres across.

A description of the local geology of Balscadden Bay including the fault located at the southern end of the site is included in Ref. 1 (see Figures 2.1 and 2.2). The southern side of Balscadden Bay is comprised of Cambrian aged 500-million-year-old bedrock that is more typical of the rest of the Howth peninsula. A wide fault zone spans the entire back of Balscadden Bay with fault Breccias evident on the southern end of the beach (Figures 2.3 and 2.4). Further north, The Martello Tower is underlain by glacial sediments which are in turn underlain by the aforementioned Carboniferous Limestone that is visible gently dipping along the beach (Figure 2.5).

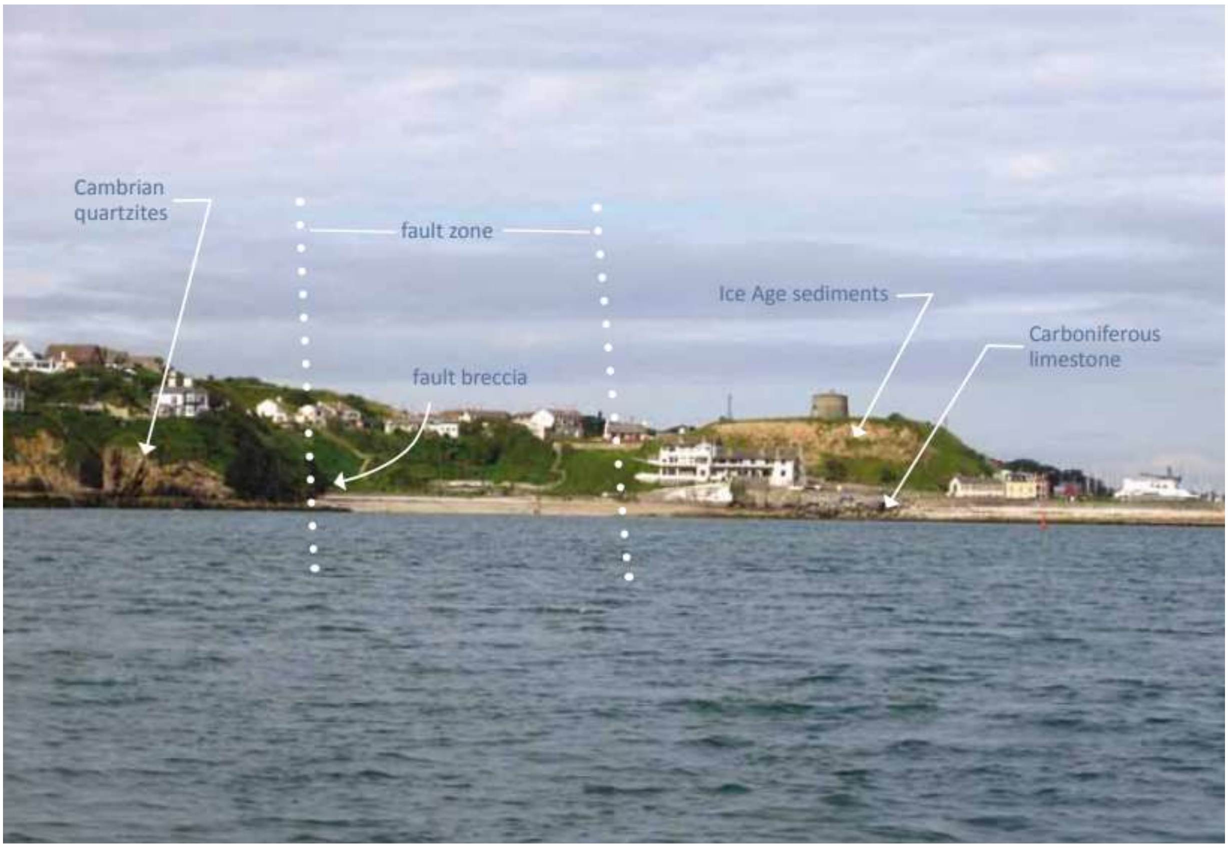

Figure 2.1 Eastward view of Balscadden Bay showing bedrock lithology and fault (Ref.1)

Figure 2.2 Southward view of Balscadden Bay showing bedrock lithology and fault (Ref.1).

Figure 2.3 Fault Breccia visible at the southern end of Balscadden Bay.

Figure 2.4 Fault Breccia visible at the southern end of Balscadden Bay.

Figure 2.5 Carboniferous limestone on Balscadden Beach.

2.2 Quaternary Sediment / Overburden

The Quaternary sediment overburden of the site is described as gravels from Lower Palaeozoic sandstones and shales. As described in Ref.1, the steep slopes surrounding the site and the Martello Tower to the north are exposures of thick sands and gravels deposited by glacial meltwaters. There is a layer of till on top of these that indicate an ice sheet advanced over the sands as a last episode of glaciation. Much of the subsoil is mapped as having low permeability (Appendix A).

2.3 Aquifer Classification

The classification of the aquifer underlying the site reflects the bedrock lithology described in Section 2.1. The portion of the site to the north of the fault underlain by the Ballysteen formation is classed as locally important aquifer with bedrock that is moderately productive only in local zones. To the south of the mapped fault the aquifer is classed as poor which is generally unproductive except for local zones (Appendix A).

2.4 Groundwater Recharge

The volume of effective rainfall likely to reach groundwater, i.e. recharge, can be estimated from recharge coefficients compiled by the Working Group on Groundwater, which are based on soil drainage, subsoil permeability, vulnerability and aquifer type (Ref. 2).

Areas classified as “made ground” are assigned a recharge coefficient of 20% (see Appendix A) due to likely restrictions in recharge as a result of paving, building etc. (Ref. 2). This recharge coefficient provides an average recharge value of 53mm/yr for the site and surrounding areas. While this likely represents the developed areas surrounding the site, as much of this site itself is undeveloped, this likely underestimates the recharge.

While groundwater recharge is indicated by the combination of soils and subsoils, a natural recharge capacity limit is applied to poorly productive aquifers to simulate ‘rejected recharge’. This reflects the limited ability of these aquifers to accept and transmit recharging waters.

The natural recharge capacity of locally important ‘Ll’ bedrock aquifers is taken as 200 mm/yr, and 100 mm/yr for poor ‘Pl’ and ‘Pu’ bedrock aquifers. Hence, the maximum recharge capacity for the proposed site is likely between 100 - 200 mm/yr.

2.5 Groundwater Vulnerability

Groundwater vulnerability at the site is mapped as ranging from High (H) at the east of the site to Extreme (E and X) towards the western edge of the site (Appendix A). High groundwater vulnerability represents an area where the depth to rock or extent of subsoil overburden ranges between 3 – 10m. The Extreme (E) and (X) vulnerability categories represent areas where the subsoil thickness ranges from 0 – 3 m and where rock is at or near the surface respectively.

While much of the western half of the site is mapped as E/X, the site investigation boreholes (BH01 and BH02) indicate at least 17m of overburden is present at these locations. While the eastern half of the site is regarded as having High vulnerability, the log from BH03 shows there to be at least 12.8 m of overburden.

The discrepancy between the vulnerability map and the site investigation is likely attributable to limitations in the vulnerability mapping data and its resolution. Given the findings of the site investigation the vulnerability of the site is likely to be moderate or low.

2.6 Protected Areas

The area to the east of the site, including Balscadden Bay and extending south around Howth Head and north along the East Pier, is designated under the Howth Head Special Area of Conservation (SAC) (Appendix A).

2.7 Surface Water Features

The EPA rivers database (Ref. 3) show two streams, one to the east and one to the west of the site (Appendix A). Gray’s Brook flows northwards along Main Street onto Abbey Street where it flows along the west side of the site. It passes under Harbour Road and enters the sea to the east of the Yacht Club. Coolcur Brook, to the west of the site, flows northwards along Kilrock Road and enters the sea at the southern end of Balscadden Bay.

A more comprehensive and historical description of both rivers and their tributaries is presented in Ref. 4 (Figure 2.6). The Coolcur Brook has a catchment area of 47 hectares and is bounded by the Gray’s Brook catchment on the west and the Kilrock and Canon Rock area on the east and north-east of the hill. Gray’s Brook has a catchment area of 96 hectares and is bounded on the west by the Offington Stream catchment.

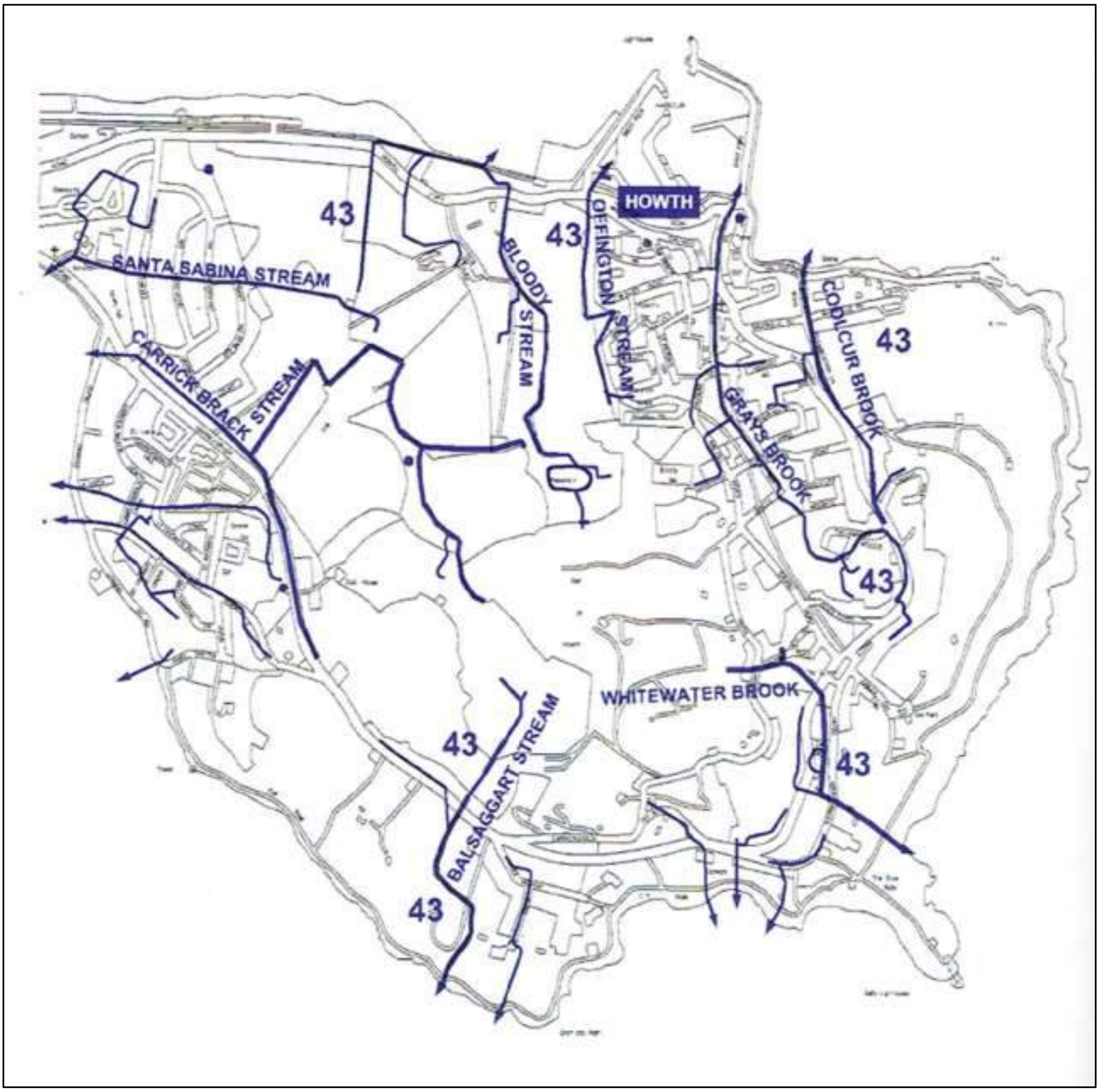

Figure 2.6 Rivers of Howth Head and Balscadden Bay (Ref. 4).

2.8 Howth Tunnel

The Howth Tunnel was constructed between 1955 and 1956 as the last section of a Main Trunk Sewer. It consists of a high and low level tunnel, which together are one-mile long (Ref. 5). The internal diameter of the sewer is 6.0 feet (1.83m) throughout the tunnel. The first 300m (1,000 feet) of the tunnel (from the Harbour Road Shaft), had to be supported with the primary lining RC segment rings. In that area material was not self – supporting or sound, and it predominantly consisted of boulder clay, limestone rock, dense clays of various colours, and loose brecciated quartzite rock. The tunnel passes under the site as shown in Figure 3.3.

3. Sampling & Assessment

3.1 Site Investigations

An initial site investigation was carried out in September 2017. Cable percussion boring was undertaken at 1 no. location (BH-GDG-01 – see Figure 3.1) using a Dando 150 rig to construct a 200mm diameter borehole. The borehole terminated at the scheduled depth of 20mbgl.

The groundwater standpipe installation incorporated a bentonite seal from 13.00mbgl to 14.50mbgl with a gravel response zone below this to 18.00mbgl and a second bentonite seal at the base of the response zone. The standpipe was installed to 18.00mbgl with a 3m slotted section back to 15.00mbgl to allow for any groundwater in this zone to ingress. A geosock was placed around the pipe at the slotted section. The borehole log is presented in Appendix B.

Following completion, a period of groundwater monitoring was undertaken. The well was found to be dry on four separate occasions throughout October 2017. This borehole was found to dry during all Minerex site visits in 2021.

In accordance with a Specification for Site Investigation Requirements Report issued by Waterman Moylan, two further S.I boreholes were scheduled for construction. In June 2021 cable percussion boring was undertaken at 3 no. locations (see Figure 3.1) using a Dando 150 rig to construct 200mm diameter boreholes. The boreholes terminated at depths ranging from 13.00mbgl (BH03) to 17.20mbgl (BH02) when obstructions were encountered. Groundwater monitoring standpipes were installed consisting of slotted pipe surrounded by a gravel response zone with bentonite seals (see Appendix C).

3.2 Monitoring & Sampling

3.2.1 Borehole Monitoring

Continuous groundwater level loggers or “divers” were installed in 2 no. boreholes (BH01 and BH02) for a nine-week period from August to October 2021. Groundwater levels were manually measured using a Solinst Dip meter during this period.

Boreholes BH01 and BH02 were sampled twice during the monitoring period (10/09/2021 and 06/10/2011). Prior to sampling the water level and total borehole depth of each monitoring point was recorded using a Solinst dip meter. Static water level was recorded with respect to a fixed point on the top of the well casing (noted on field sheet) with the height of this fixed above ground level also recorded. Sampling was conducted using a 12V submersible WASP five stage pump with dedicated tubing for each borehole. Prior to sampling each borehole was purged in accordance to BS ISO 5667:11. Samples were only taken once the stabilisation of field hydrochemical parameters was achieved. All field hydrochemical parameters (pH, electrical conductivity and temperature) were recorded using a HANNA INSTRUMENTS^{TM} Probe calibrated using respective standard solutions.

3.2.2 Surface Water Monitoring

Three samples were taken from surface water streams in proximity to the site on the 10/09/2021. The locations and photos of each sampling points is presented in Figure 3.2. One sample (SW3) was taken upgradient of the site from Gray’s Brook after is passes through a culvert under Dungriffin Road.

Note, there are discrepancies between the published Ref. 3 and Ref. 4 maps as to where Gray’s Brook enters the sea. A sample (SW2) was taken from a visible surface discharge into the sea just east of the Yacht club. This is in proximity to where it is mapped by Ref. 3 and is likely Gray’s Brook. A sample (SW01) was also taken from where Ref. 4 states it enters the sea at the base of East Pier.

No samples could be obtained from Coolcur Brook to the east of the site due to restricted access.

3.2.3 Spring Monitoring

A site survey and coastal assessment was carried out during low tide on the 10/09/2021. Groundwater springs were mapped and recorded. Several springs and seepages were observed along the western edge of the site, both on Balscadden Road and Balscadden Beach. Several seepages are evident on the retaining wall running along Balscadden Road at the base and to the west of the Martello Tower. These seepages are also apparent where they run onto the road itself.

Several spring discharges are apparent along the length of the beach. These are visible through a combination of pipe drains cast into the retaining wall at the top of the beach as well as through several weakness/pathways in the concrete. At low tide, spring discharge can be seen flowing over the beach and outcropping limestone on the northern part of the bay.

Three springs were sampled where sufficient water volume could be obtained. The locations and photos of each sampling point is presented in Figure 3.3. Sample SP1 was obtained from a concrete trough on Balscadden Road. The trough is fed from a drainage pipe cast into the retaining wall below the Martello Tower. Sample SP2 was obtained from a spring seepage apparent underneath the buildings at the northern end of Balscadden Bay. Sample SP3 was obtained from a spring flow through the concrete wall and pathway at the top of Balscadden Beach. This spring was located below the pedestrian steps to the beach. Several springs are also visible in the breccia exposed on the southern end of Balscadden Bay (Figure 2.4) however, flows were not sufficient to obtain a sample.

The western and northern bounds of the site (along Abbey Street) was also examined for the presence of springs. None were observed; however, the built-up nature of this area means observations are limited.

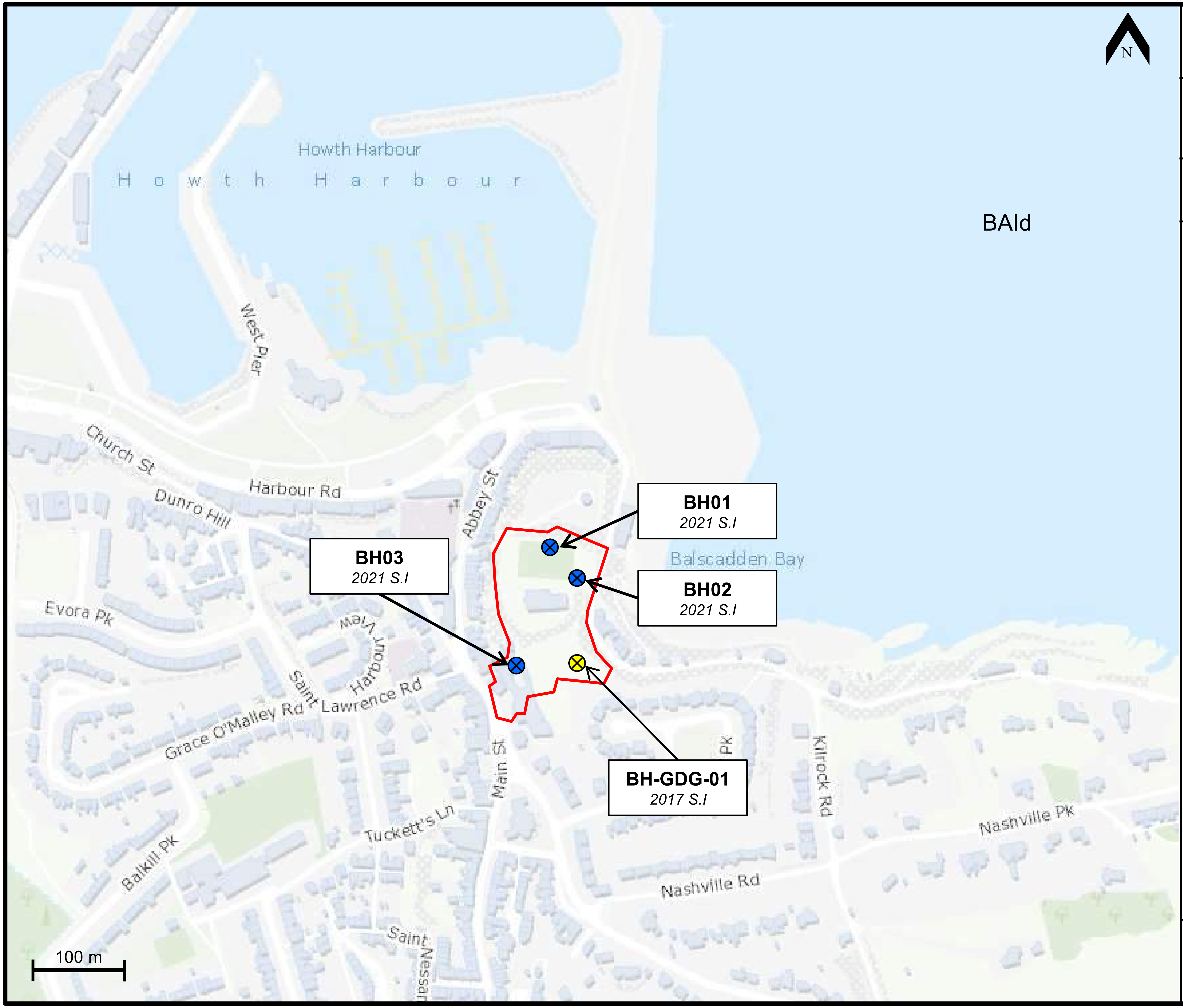

Figure 3.1
S.I Boreholes

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥	Site Outline
⊗	*2021 S.I Boreholes*
⊗	*2017 S.I Borehole*

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Figure 3.2
Surface Water
Sampling Points

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

▭	Site Outline
▲	Surface water sampling location

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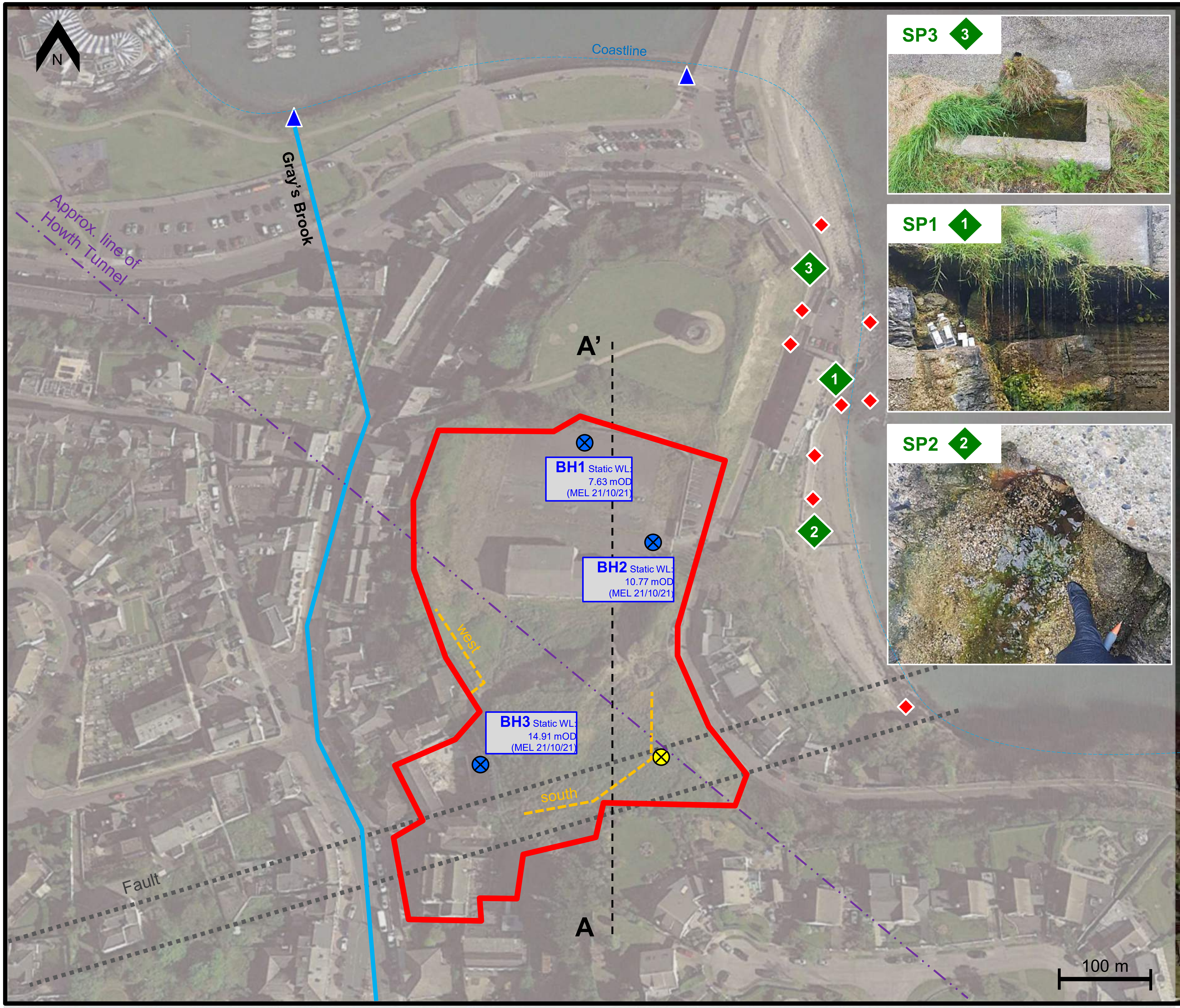
Figure 3.3
Sampling Locations

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.Rev.1
Drawn by: CF 22/10/2021



Common Legend

▢	Site Outline
⊗	Borehole (2021 S.I)
⊗	Borehole BH-GDG-01 (2017 S.I)
◆	Spring (Sampled)
◆	Spring (Not sampled)
▲	Surface water sample
- -	Proposed secant pile wall (approximate)

Minerex Environmental

4. Results & Assessments

4.1 Hydrochemistry

Hydrochemistry results are presented in Table 4.1. Corresponding laboratory certificates of analysis are included in Appendix D.

The hydrochemical signatures associated with the surface water, groundwater and spring samples taken at the site are illustrated using a trilinear Piper diagram in Figure 4.1. The ultimate source of most dissolved ions in groundwater is the mineral assemblages in rocks near the land surface. Consequently, a general relationship between the mineral composition (or the hydrochemical signature) of natural water and that of the solid minerals with which the water has been in contact is to be expected. The term “hydrochemical facies” is used to describe the different types of groundwater hydrochemical signatures brought about by these interactions.

The hydrochemical signature associated with both BH1 and BH2 are similar and are consistent across the two separate sampling events. The hydrochemical results are consistent with a calcium/magnesium/bicarbonate signature. This is consistent with the carbonate nature of limestone bedrock.

The signatures from samples SW1 and SW2 are likely skewed towards a high sodium signature due to saline coastal influences. Both sampling points are submerged during high tide. While the samples were taken at low tide the saline signature was still evident. This is consistent with the electrical conductivity recorded at the time of sample (37,800 and 23,000 µS/cm). Comparisons between the upgradient and downgradient sample from Grays Brook are therefore challenging.

Sample SW3, taken upgradient of the site, is notably similar to the signature recorded at BH1 and BH2 (calcium/magnesium/bicarbonate). The sample was, however, significantly less mineralised, with lower concentrations of the major ions as would be expected from a surface water system.

The hydrochemical signature associated with samples SP1 and SP2 is notability consistent with BH1, BH2 and SW3. While SP1 has a similar signature, it is less mineralized compared to BH1, BH2 and SP2, with the conductivity less than half. This is consistent with mixing occurring between the natural groundwater and a less mineralized surface water. As this spring sample was taken from underneath the buildings on Balscadden Road, the mixing could be a result of a mains water leak.

The signature from SP3 has higher concentrations of sodium and potassium compared to SP1 and SP2. However, remaining hydrochemical parameters are consistent with the S.I boreholes and SP2. Note, sample SP3 was taken directly from the concrete trough on Balscadden Road due to insufficient flow from the spring. Hence, the water would have been stagnant. The elevated sodium and potassium concentrations would be consistent with increased exposure to the coastal environment.

Table 4.1 Hydrochemistry result for borehole, spring and surface water monitoring.

Minerex Environmental		BH1	BH2	BH1	BH2	SP1	SP2	SP3	SW1	SW2	SW3
Parameter	**Unit**	**13/09/2021**		**06/10/2021**		**13/09/2021**			**13/09/2021**		
Alkalinity, Total as CaCO3	mg/l	355	300	348	390	115	305	315	155	180	150
Ammoniacal Nitrogen as N	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH4	mg/l	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chloride	mg/l	74.1	77.9	80	81	33.5	110	115	16300	9290	40.1
Conductivity	uS/cm	887	856	897	847	446	980	977	37800	23000	483
pH	pH	7.39	7.27	7.3	7.16	8.13	7.57	7.69	7.81	7.71	8.04
Nitrate as NO3	mg/l	35.3	30.2	37.1	29.4	7.61	30.7	<0.35	4.27	9.27	6.88
Phosphate (Ortho as P)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0281	0.079	0.0826	0.03
Sulphate	mg/l	113	66.3	113	66.5	43	58.6	51.7	2240	1210	50.5
Calcium (Dis.Filt)	mg/l	123	116	126	122	52	122	81.4	343	228	66.8
Iron (Dis.Filt)	mg/l	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	0.0433	<0.114	<0.019	0.109
Magnesium (Dis.Filt)	mg/l	20.5	18.9	20	19	5.86	20.5	19.5	1020	624	8.85
Manganese (diss.filt)	µg/l	43.7	6.9	5.78	<3	<3	<3	9.69	<18	<3	44.4
Phosphorus (diss.filt)	µg/l	<10	<10	<10	<10	<10	<10	23.9	78.6	91.9	54.5
Potassium (Dis.Filt)	mg/l	8.36	5.71	9.71	5.5	2.94	7.27	11.9	299	175	2.44
Sodium (Dis.Filt)	mg/l	42.3	44.3	42.5	42.4	22.1	56.4	93.7	8940	5050	26

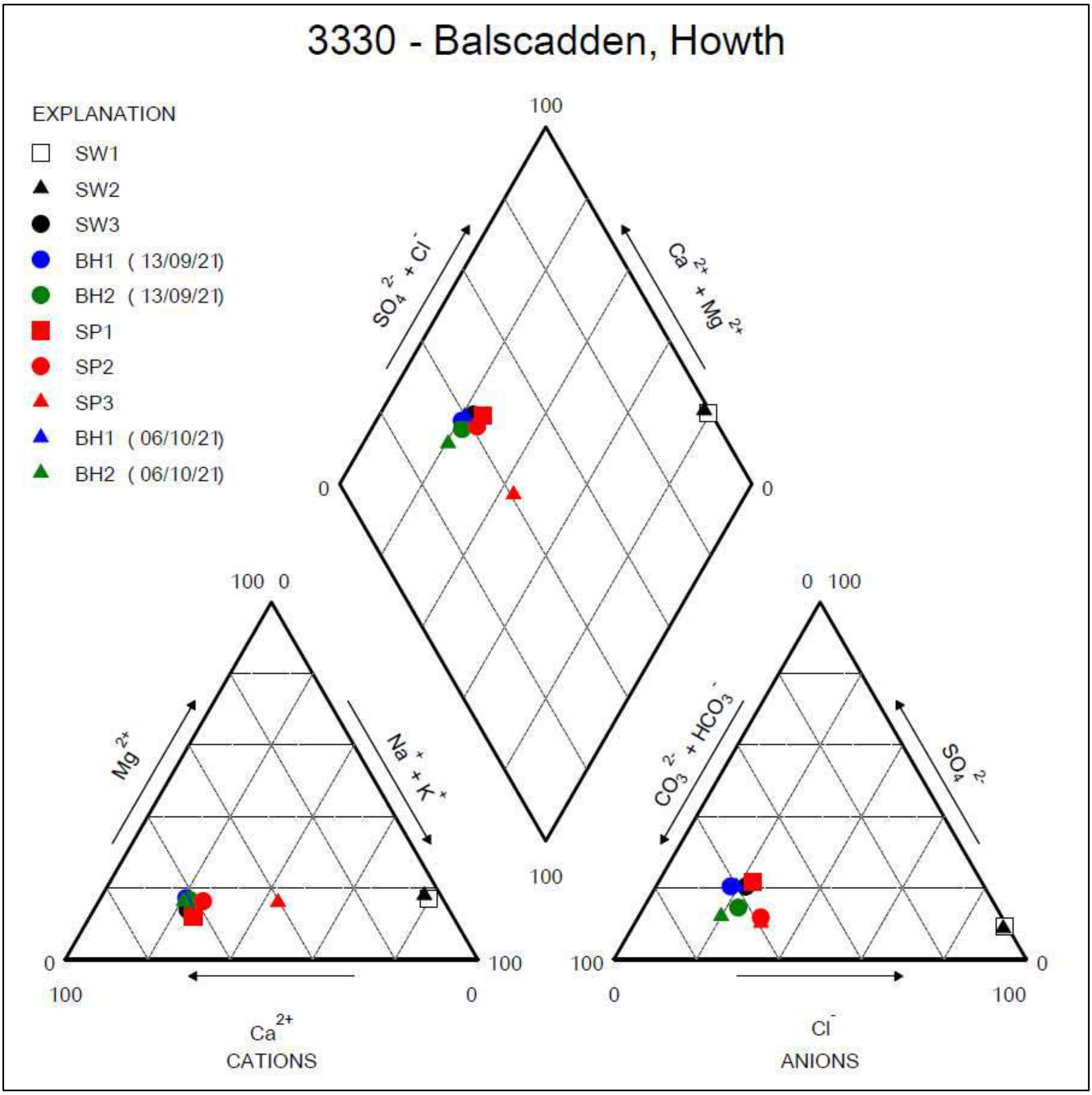


Figure 4.1 Hydrochemical signatures associated with the samples obtained (Ref. 6).

4.2 Water Level Monitoring

Continuous water level data and antecedent rainfall taken from Met Eireann (Dublin Airport) is presented in Figures 4.2 – 4.4. The water level was consistently deeper (approx. 3m) in BH01 compared to BH02. Borehole BH-GDG-01 was dry during initial monitoring in 2017. It was dry throughout the course of this investigation in 2021.

Figure 4.2 Continuous water level data from BH01 and BH02.

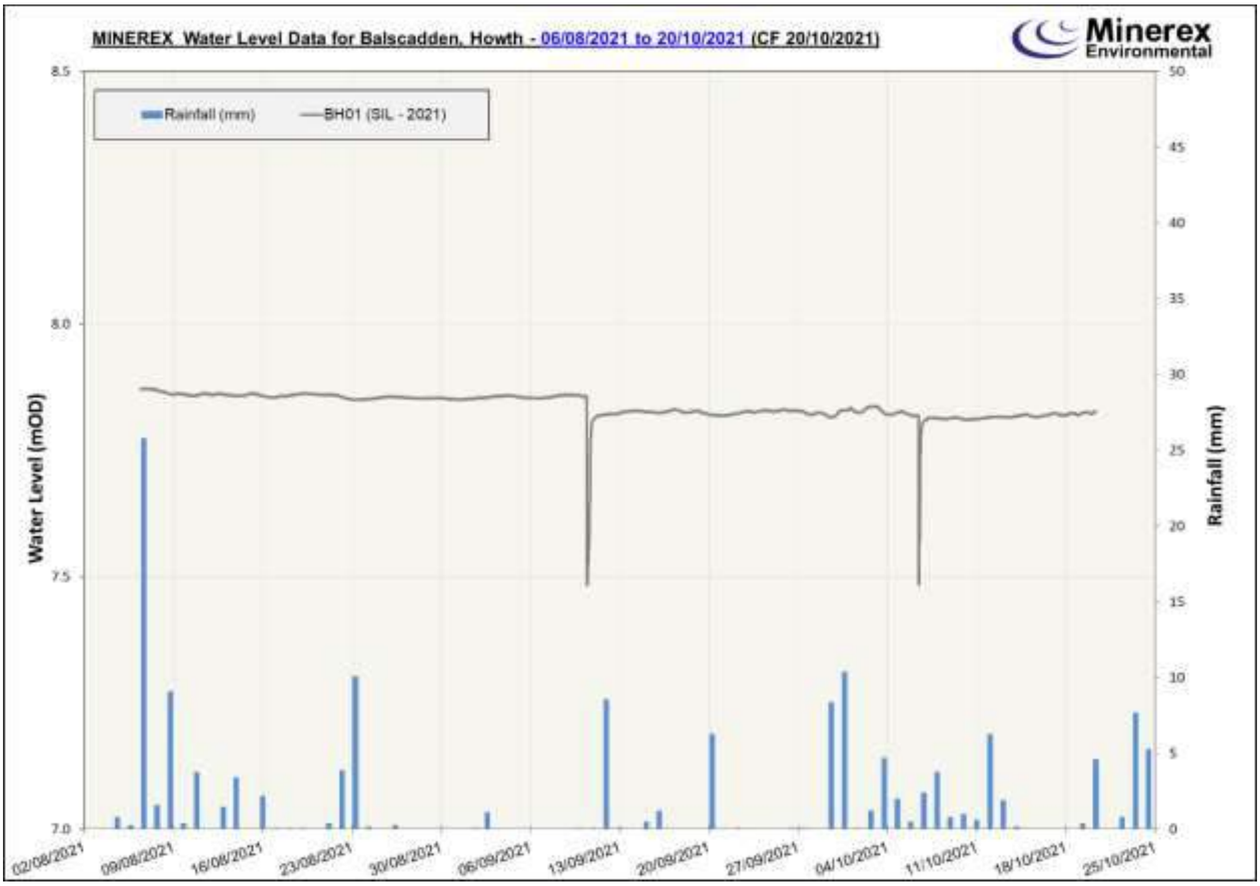


Figure 4.3 Continuous water level data from BH01 and antecedent rainfall.

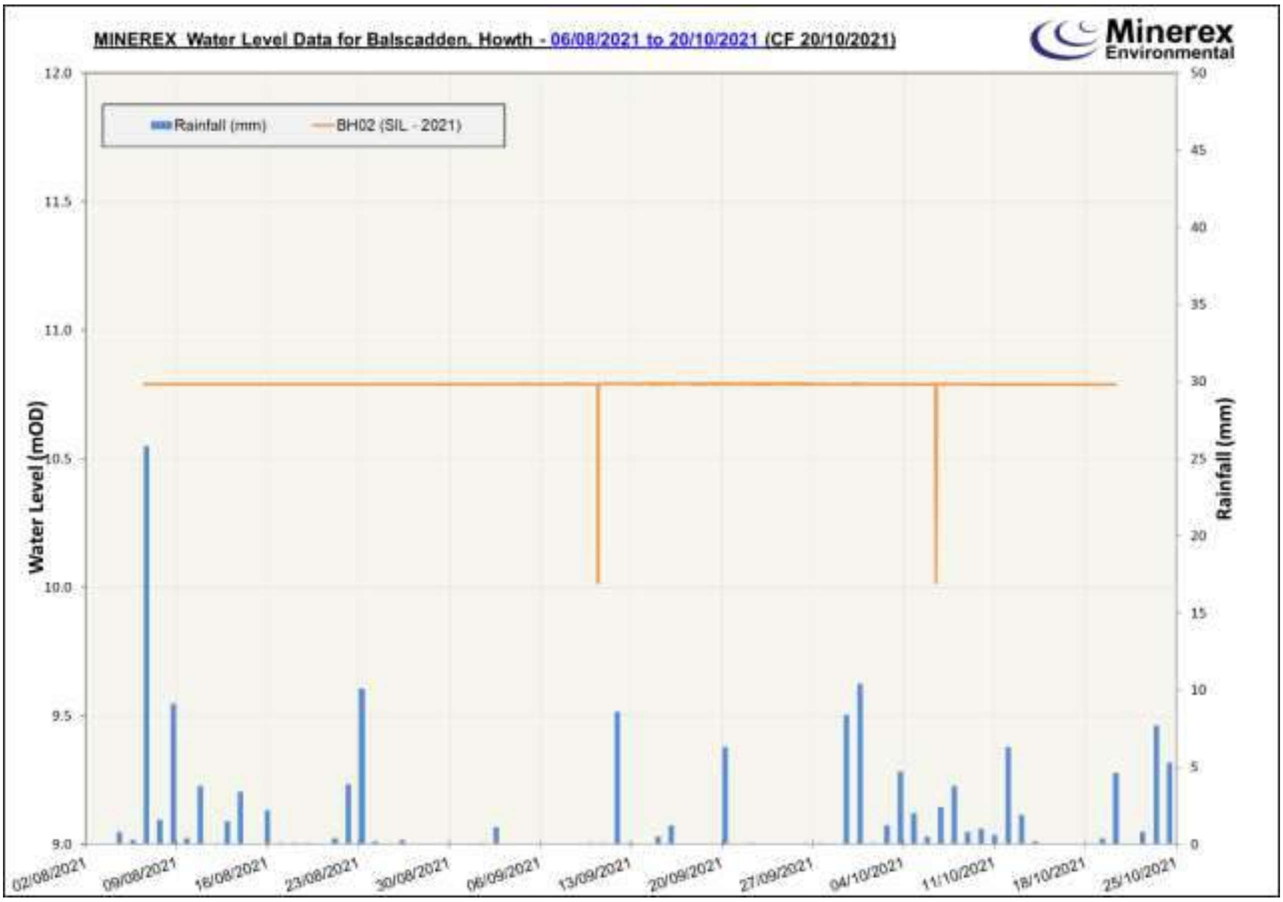


Figure 4.4 Continuous water level data from BH02 and antecedent rainfall.

5. Proposed Development & Local Hydrogeology

5.1 Conceptual Hydrogeological Site Model

A conceptual hydrogeological site model including conceptual groundwater contours and flow directions is presented in Figure 5.1.

As shown, groundwater flow is likely bound to the west of the site by Gray's Brook, with baseflow contributions likely from the western boundary of the site towards the Brook. A steep groundwater gradient from BH3 to BH1 is consistent with a northwards flow direction. Groundwater flow to the east is also apparent as evidenced by the presence of springs along Balscadden Road and Balscadden Bay. This is consistent with the hydrochemical signatures presented in Section 4.1. Bedrock groundwater flow is likely bounded to the south by the mapped fault. Seepages apparent in the Breccia located on the southern end of Balscadden Bay is consistent with groundwater flow along this fault.

The influence of the Howth Tunnel on the hydrogeological regime of the site is uncertain and would depend on the integrity of the lined section of the tunnel.

The groundwater hydrograph for BH01 and BN02 suggests little correlation with rainfall, at least on a short to medium timescale. This is consistent with depth and nature of the overburden. Further monitoring would be required to identify temporal variability of hydrographs in the long term. However, significant variation in the water level would not be expected seasonally.

5.2 Proposed Development Structures

Plans and section for the proposed development were provided to Minerex by Waterman Moylan and Byrne Looby. Two secant piled walls are planned as part of the development. One is located on the southern boundary of the site with the second located along a short section of the western boundary.

It is proposed that the male and female piles on the southern piled wall will extend to 17mOD and 23.5mOD, respectively. It is proposed that the male and female piles on the western piled wall will extend 11.5mOD and 16mOD, respectively. An 850mm RC raft slab will be constructed with an SSL of 18 mOD under a portion of the proposed development.

5.3 Proposed Development Influence on Hydrogeology

A conceptual cross section of the site, including the S.I boreholes, water level data and proposed piled walls is presented in Figure 5.2. The male piles of the southern piled wall do not extend to the water table (male pile toe level 17mOD). The likelihood of any disruption of groundwater flow and the creation of any barrier effect is low. This is further mitigated by the raised female pile toe level as the subsequent gaps (conservative estimate of 15% open area) between the male and female piles will facilitate any flow from the unsaturated zone.

The base of the male piles in the western piled wall do potentially extend to the water table. However, any disruption to groundwater flow is mitigated by the level of the female piles. Furthermore, as shown in Figure 5.1, the inferred groundwater flow direction at this location is not perpendicular to the wall and rather is closer to parallel, further reducing the likelihood of any barrier effect.

Given a formation level of approximately 17mOD for the basements of the proposed development the likelihood of any disruption to groundwater flow is low. The nature of the bedrock and overburden give rise to a low recharge coefficient for the site. The development and the construction of any paved surfaces will likely further reduce the natural recharge capacity of the site. This should be mitigated against using permeable paving and adequately designed soakaways to manage surface water where possible.

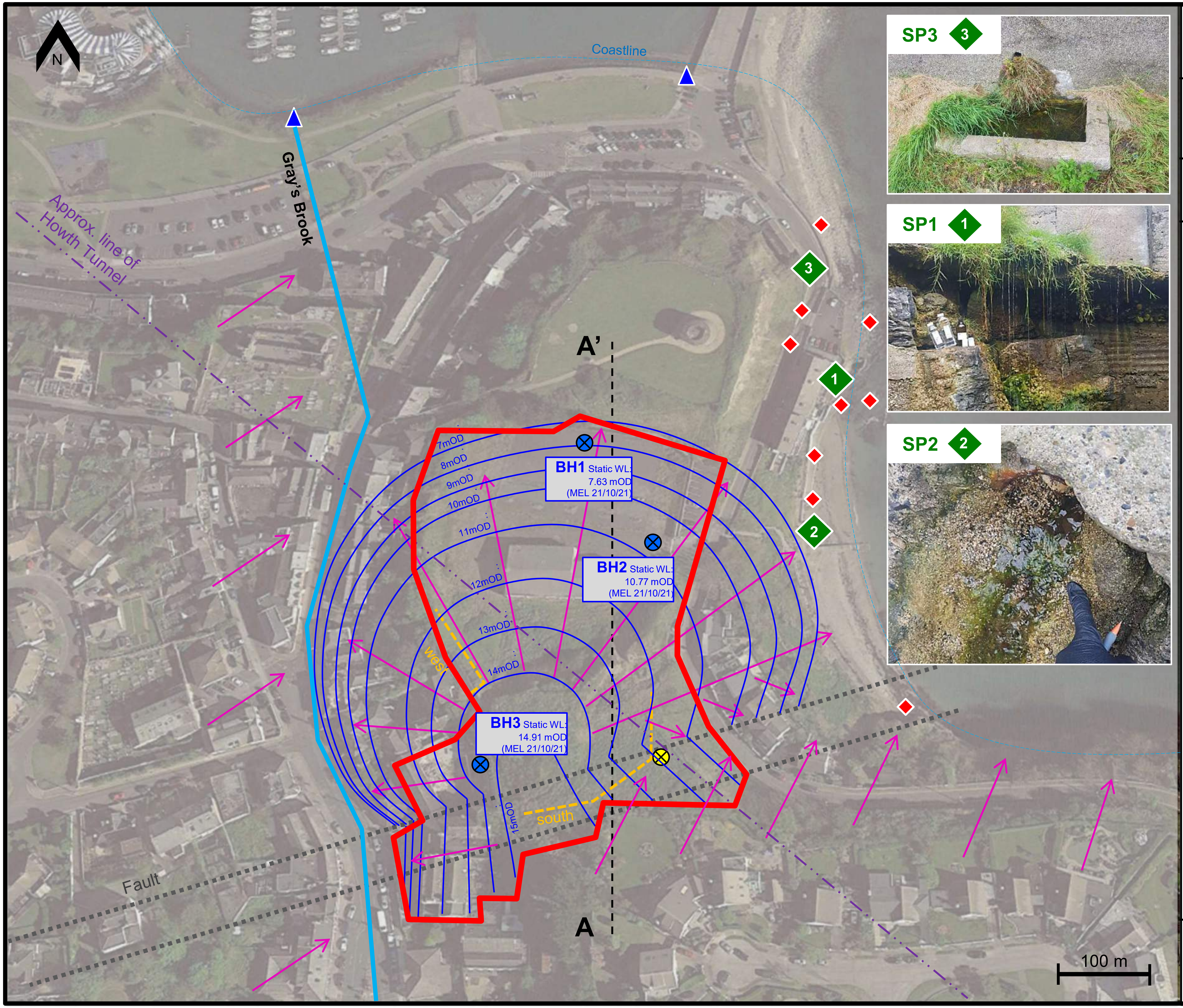


Figure 5.1
Conceptual Site Model

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.Rev.1
Drawn by: CF 22/10/2021

Common Legend

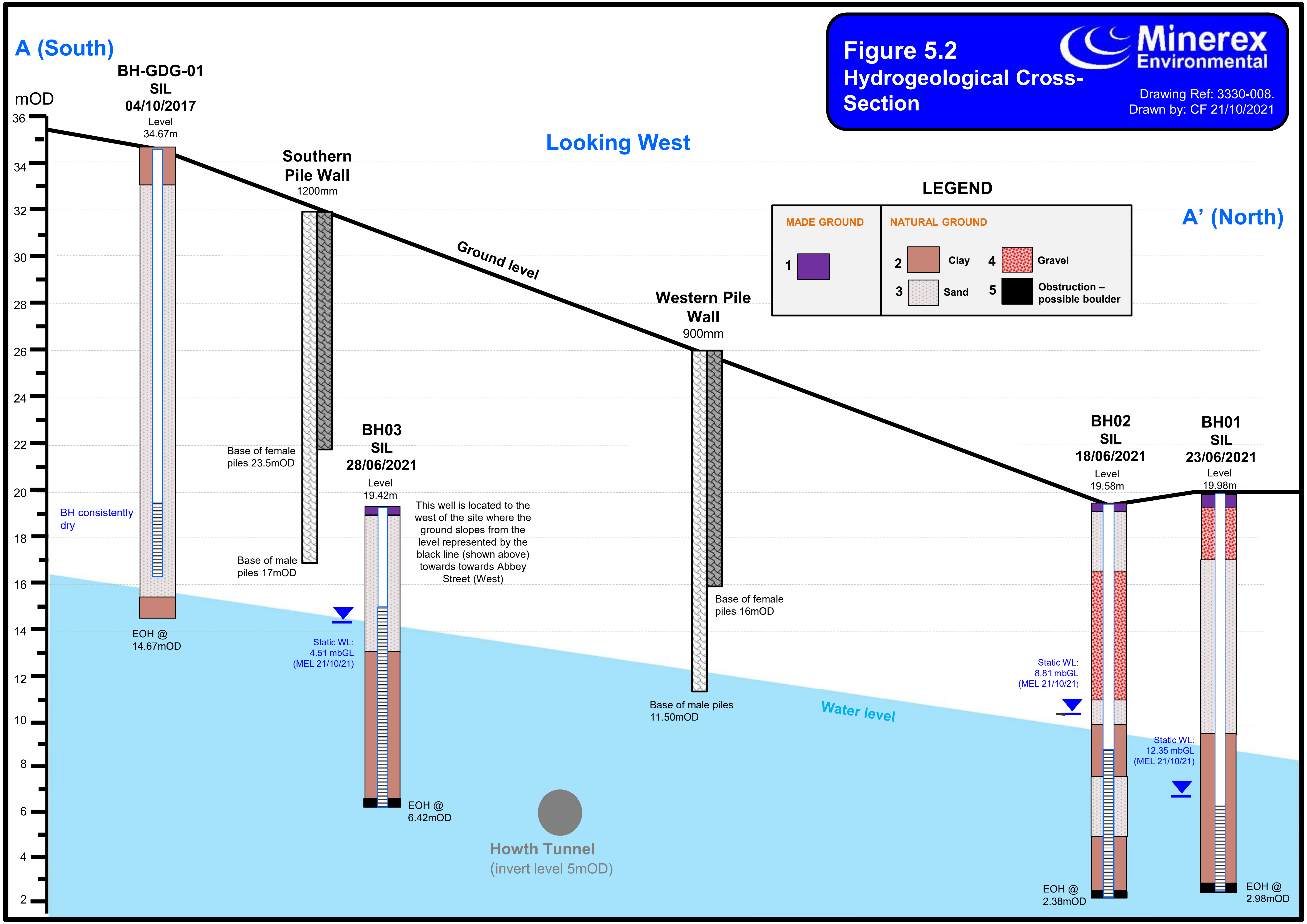
▢	Site Outline
⊗	Borehole (2021 S.I)
⊗	Borehole BH-GDG-01 (2017 S.I)
◆	Spring (Sampled)
◆	Spring (Not sampled)
▲	Surface water sample
- -	Proposed secant pile wall (approximate)
—	Groundwater equipotentials
→	Conceptual GW flow direction

Minerex Environmental

Figure 5.2
Hydrogeological Cross-Section

Minerex Environmental

Drawing Ref: 3330-008.
Drawn by: CF 21/10/2021



6. Summary & Conclusions

1. The site for the proposed development is underlain by a thick layer of glacial sands, gravels and clays. A wide mapped fault is located along the southern end of the site dividing Carboniferous limestones (North) from older Cambrian Bedrock (South) with fault Breccia visible on the southern end of Balscadden Bay.

2. Continuous water level monitoring, site surveys, water sampling and hydrochemical analysis have been used to develop a conceptual hydrogeological site model.

3. The conceptual site model indicates groundwater flow towards Grays Brook to the west of the site, northwards towards the Martello tower and eastwards towards Balscadden Bay as evidenced by the mapped and sampled springs.

4. The conceptual site model indicates that the proposed development, which includes 2no. secant piled walls (south and west), is unlikely to impede groundwater flow or create any significant barrier effect. The southern piled wall does not extend to the water table. While the male piles of the western piled wall do extend to the water table the likelihood of any impedance of groundwater flow is mitigated due to the groundwater flow direction and the raised levels of the female piles.

7. References

No.	Description
1	Parkes, M (2012) Islands, Coasts and Quarries. The Geological Heritage of Fingal. Fingal County Council
2.	Hunter Williams, N.H., Misstear, B.D., Daly, D and Lee, M (2013) Development of a national groundwater recharge map for the Republic of Ireland. *Journal of Engineering Geology and Hydrogeology*, **46**, 493-506.
3	EPA Geoportal Map Viewer (2021) Environmental Protection Agency
4	Sweeney, C.L., O'Connell, G and Curtis, M (2017) The Rivers of Dublin. Irish Academic Press: Kildare.
5	O'Connor Sutton Cronin (2019) Rennie Place Strategic Housing Development, Balscadden Road, Howth, Co. Dublin. Structural and Geotechnical Engineering Report for CREKAV TRADING GP LTD.
6	Winston, R.B., 2020, GW Chart version 1.30: U.S. Geological Survey Software Release.
7	Public Data Viewer Series (2021) Geological Survey of Ireland

8. Appendices

Appendix A

Drawing Title
Bedrock Geology

Client: Marlet - Balscadden
Project: 3330

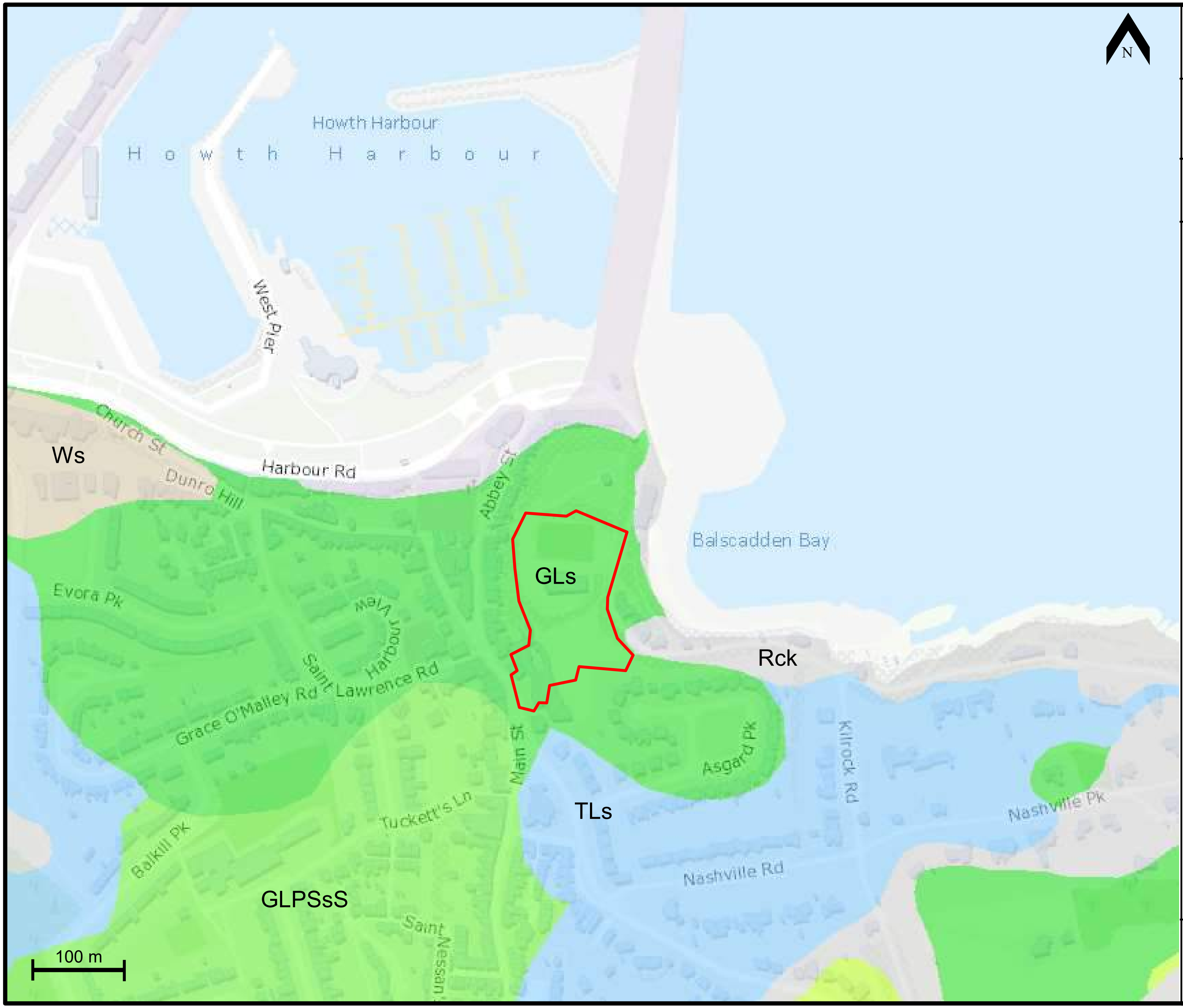
Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

	Site Outline
WA	Waulsortian Limestone - *Massive unbedded lime-mudstone*
BA	Ballysteen Formation - *Dark muddy limestone, shale*
EL	Elsinore Formation - *Polymict melange*
DK	Drumleck Formation - *Quartzite & mudstone melange*

Ref.7

Minerex Environmental



Drawing Title
Quaternary Sediments

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

□	Site Outline
GLs	Gravels derived from Limestones
TLs	Till derived from Limestones
GLP SsS	Gravels derived from Lower Palaeozoic sandstones and shales
Ws	Windblown sands
Rck	Bedrock outcrop of subcrop

Ref.7

Minerex Environmental

Drawing Title
Subsoil Permeability

Client: Marlet - Balscadden
Project: 3330

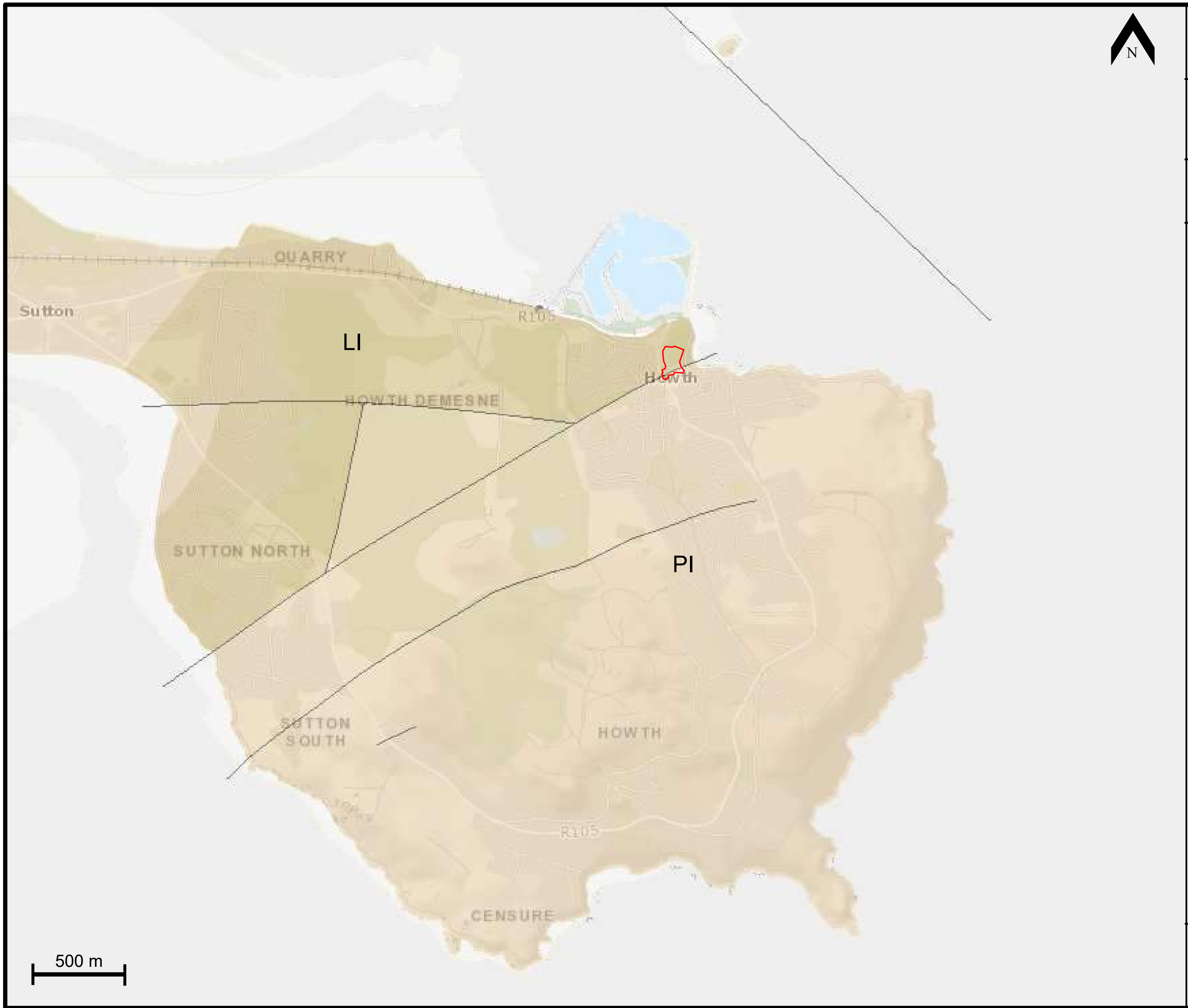
Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥	Site Outline
L	Low permeability

Ref.7

Minerex Environmental



Drawing Title
Aquifer Classification

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

□	Site outline
LI	Locally Important Aquifer *- Bedrock which is moderately productive only in local zones*
PI	Poor Aquifer *- Bedrock which is generally unproductive except for local zones*

Ref.7

Minerex Environmental

Drawing Title
Groundwater Recharge

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

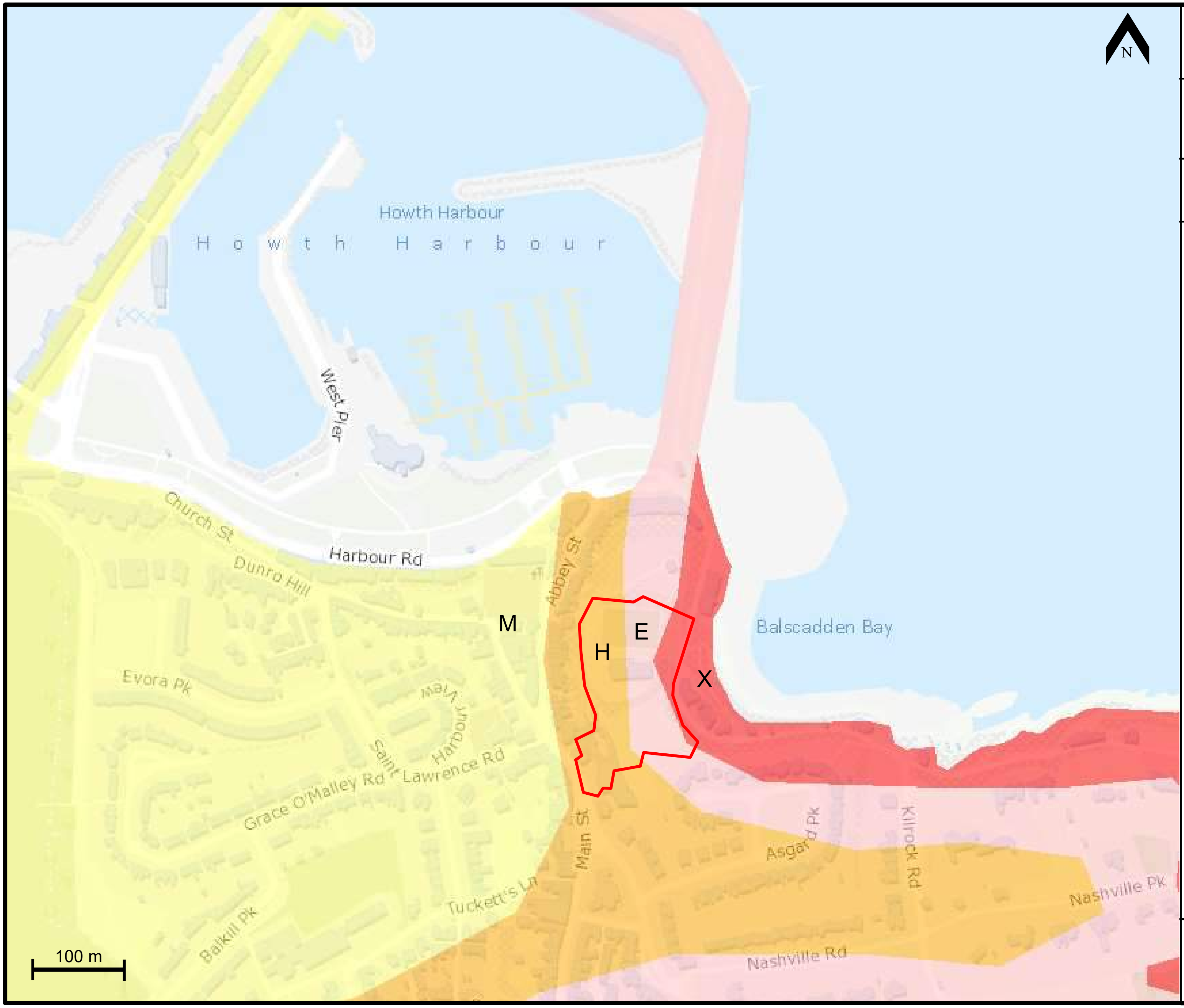
Common Legend

Site Outline

1	Recharge Coefficient = 20% Average Recharge = 53 mm/yr
2	Recharge Coefficient = 40% Average Recharge = 40 mm/yr

Ref.7

Minerex Environmental



Drawing Title
Groundwater Vulnerability

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥	Site Outline
M	Moderate
H	High
E	Extreme
X	Rock near surface or karst

Ref.7

Minerex Environmental

Drawing Title
Protected Areas

Client: Marlet - Balscadden
Project: 3330

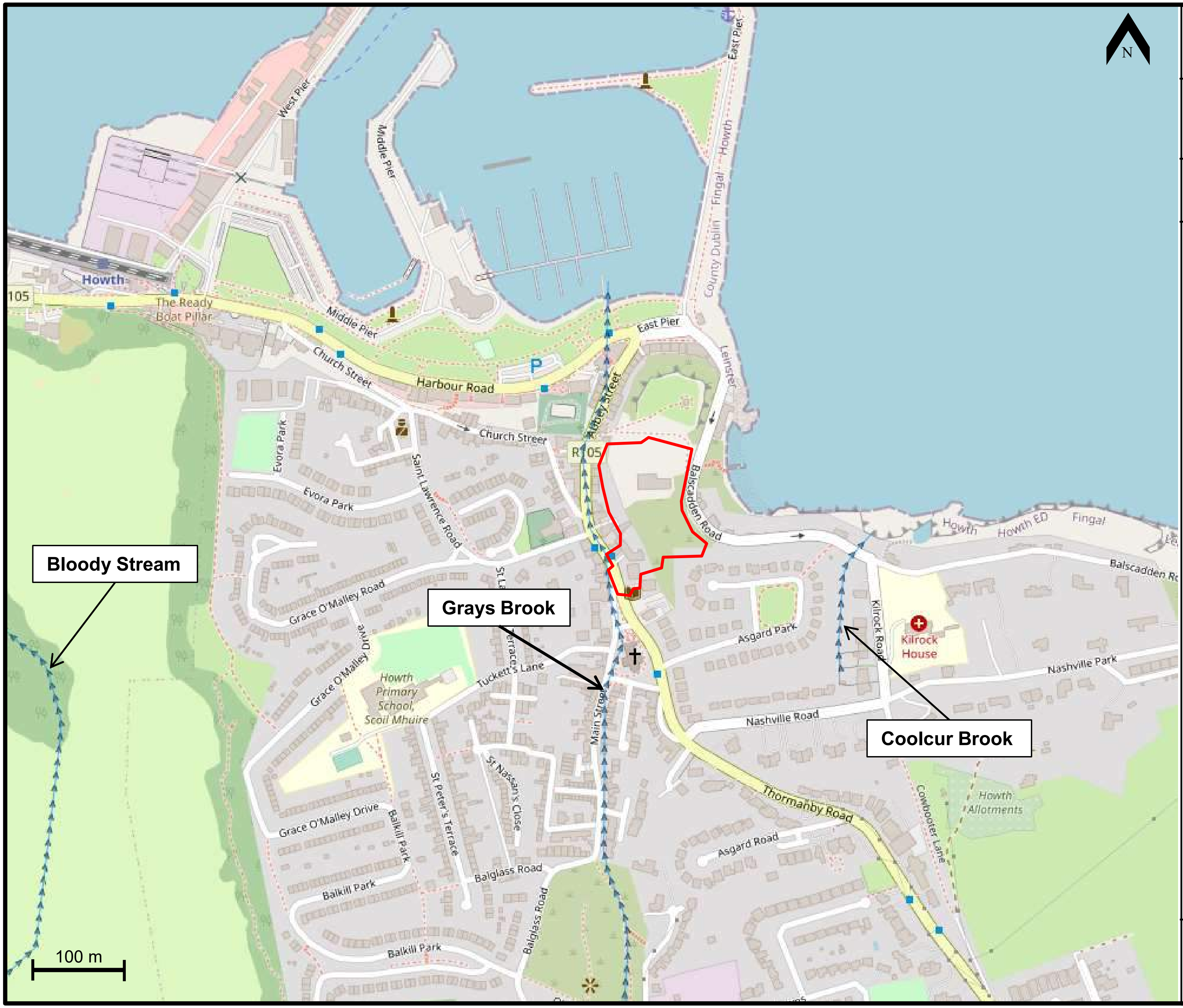
Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥 Site Outline

Ref.3

Minerex Environmental



Drawing Title
Stream Network

Client: Marlet - Balscadden
Project: 3330

Drawing Ref: 3330-008.ppt
Drawn by: CF 12/10/2021

Common Legend

🟥 Site Outline

Ref.3

Minerex Environmental

Appendix B

Contract No: 5417	# Cable Percussion Borehole Log				Borehole No: **BH-GDG-01**
Contract:	Balscadden	Easting:	728800.001	Date Started:	29/09/2017
Location:	Howth, Dublin 13	Northing:	739083.441	Date Completed:	04/10/2017
Client:	Crekav Ltd Partnership	Elevation:	34.67	Logged By:	S. Letch
Engineer:	Gavin & Doherty Geosolutions	Rig Type:	Dando 150	Drilled By:	T. Tindall

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
	0.20	TOPSOIL.		34.5	34.47					
		Stiff brown sandy slightly gravelly silty CLAY.								
0.5				34.0		0.50	B	TT01		
1.0				33.5		1.00	C	N=17 (4,3/4,4,4,5)		
1.5	1.40	Medium dense light brown silty gravelly fine to coarse SAND with lenses of silty very sandy GRAVEL.		33.0	33.27	1.50	B	TT02		
2.0				32.5		2.00	C	N=30 (4,4/7,9,7,7)		
2.5				32.0		2.50	B	TT03		
3.0				31.5		3.00	C	N=42 (5,10/10,11,10,11)		
3.5				31.0		3.50	B	TT04		
4.0				30.5		4.00	C	N=34 (2,3/4,6,8,16)		
4.5				30.0		4.50	B	TT05		
5.0				29.5		5.00	C	N=25 (3,3/5,6,6,8)		
5.5				29.0		5.50	B	TT06		
6.0				28.5		6.00	C	N=28 (4,5/7,6,6,9)		
6.5				28.0		6.50	B	TT07		
7.0				27.5		7.00	C	N=27 (3,4/4,7,8,8)		
7.5				27.0		7.50	B	TT08		
8.0				26.5		8.00	C	N=34 (3,5/6,8,11,9)		
8.5				26.0		8.50	B	TT09		
9.0				25.5		9.00	C	N=23 (4,5/4,4,7,8)		
9.5				25.0		9.50	B	TT10		
10.0						10.00	C	N=22 (5,4/4,6,6,6)		

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed:	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	Water added to assist drilling - approx 165l/m.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental C: Cone SPT S: Split spoon SPT
						29/09	2.00	Dry	0.00	15.00	Solid	0.00	13.00	Gravel		
						02/10	2.00	Dry	15.00	18.00	Slotted	13.00	14.50	Bentonite		
						02/10	8.50	Dry				14.50	18.00	Gravel		
						03/10	8.50	Dry				18.00	19.00	Bentonite		
												19.00	20.00	Gravel		

Contract No: 5417	Cable Percussion Borehole Log				Borehole No: **BH-GDG-01**
Contract:	Balscadden	Easting:	728800.001	Date Started:	29/09/2017
Location:	Howth, Dublin 13	Northing:	739083.441	Date Completed:	04/10/2017
Client:	Crekav Ltd Partnership	Elevation:	34.67	Logged By:	S. Letch
Engineer:	Gavin & Doherty Geosolutions	Rig Type:	Dando 150	Drilled By:	T. Tindall

Depth (m) Scale	Depth (m) Depth	Stratum Description	Level (mOD) Scale	Level (mOD) Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike
10.5		Medium dense light brown silty gravelly fine to coarse SAND with lenses of silty very sandy GRAVEL.	24.0		10.50	B	TT11	
11.0			23.5		11.00	C	N=22 (8,5/5,4,6,7)	
11.5			23.0		11.50	B	TT12	
12.0			22.5		12.00	C	N=21 (4,5/4,6,5,6)	
12.5			22.0		12.50	B	TT13	
13.0			21.5		13.00	C	N=26 (4,4/4,7,8,7)	
13.5			21.0		13.50	B	TT14	
14.0			20.5		14.00	C	N=24 (4,5/5,8,5,6)	
14.5			20.0		14.50	B	TT15	
15.0			19.5		15.00	C	N=29 (6,8/5,5,8,11)	
15.5			19.0		15.50	B	TT16	
16.0			18.5		16.00	C	N=23 (5,5/4,6,7,6)	
16.5			18.0		16.50	B	TT17	
17.0			17.5		17.00	C	N=32 (6,7/9,6,6,11)	
17.5			17.0		17.50	B	TT18	
18.0			16.5		18.00	C	N=15 (3,3/4,3,4,4)	
18.5			16.0		18.50	B	TT19	
19.0					19.00	C	N=40 (5,8/7,11,12,10)	
	19.20	Very stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.	15.5	15.47				
19.5			15.0		19.50	B	TT20	
20.0	20.00	End of Borehole at 20.00m	14.5	14.67				

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed:	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	Water added to assist drilling - approx 165l/m.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental C: Cone SPT S: Split spoon SPT
						29/09	2.00	Dry	0.00	15.00	Solid	0.00	13.00	Gravel		
						02/10	2.00	Dry	15.00	18.00	Slotted	13.00	14.50	Bentonite		
						02/10	8.50	Dry				14.50	18.00	Gravel		
						03/10	8.50	Dry				18.00	19.00	Bentonite		
												19.00	20.00	Gravel		

Appendix C

Contract No:	# Cable Percussion Borehole Log	Borehole No:
5836		**BH01**

Contract:	Balscadden	Easting:	728766.929	Date Started:	16/06/2021
Location:	Howth, Co. Dublin	Northing:	739199.986	Date Completed:	18/06/2021
Client:	Marlet	Elevation:	19.98	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Depth	Stratum Description	Level (mOD) Depth
0.20	MADE GROUND: tarmacadam.	19.78
0.50	MADE GROUND: grey silty sandy gravel.	19.48
2.80	Medium dense brown silty sandy GRAVEL with low cobble content.	17.18
5.50	Loose becoming medium dense light brown silty gravelly SAND.	14.48
6.00	Light brown slightly silty gravelly SAND.	13.98
	Medium dense becoming dense light brown slightly silty gravelly SAND.	

Samples and Insitu Tests Depth	Type	Result
1.00	B	JOT01
1.00	C	N=17 (2,4/4,5,4,4)
2.00	B	JOT02
2.00	C	N=12 (1,2/2,3,3,4)
3.00	B	JOT03
3.00	C	N=7 (1,1/1,2,2,2)
4.00	B	JOT04
4.00	C	N=15 (1,2/3,3,4,5)
5.00	B	JOT05
5.00	C	N=20 (2,2/3,4,6,7)
6.00	B	JOT06
6.00	C	N=21 (2,2/4,5,6,6)
7.00	B	JOT07
7.00	C	N=28 (2,4/5,7,7,9)
8.00	B	JOT08
8.00	C	N=30 (1,3/6,7,7,10)
9.00	B	JOT09
9.00	C	N=36 (2,4/7,9,9,11)
~~10.00~~	~~B~~	~~JOT10~~

Chiselling: From:	To:	Time:
15.00	15.20	00:45
16.40	16.50	00:45
16.80	17.00	01:00

Water Strikes: Strike:	Rose:	Depth Sealed

Water Details: Date:	Hole Depth:	Water Depth:
16/06	9.30	Dry
17/06	12.30	Dry
18/06	17.00	Dry

Installation: From:	To:	Pipe:
0.00	14.00	Solid
14.00	17.00	Slotted

Backfill: From:	To:	Type:
0.00	0.70	Bentonite
0.70	12.00	Gravel
12.00	13.00	Bentonite
13.00	17.00	Gravel

Remarks:
Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No:	Cable Percussion Borehole Log	Borehole No:
5836		**BH01**

Contract:	Balscadden	Easting:	728766.929	Date Started:	16/06/2021
Location:	Howth, Co. Dublin	Northing:	739199.986	Date Completed:	18/06/2021
Client:	Marlet	Elevation:	19.98	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Scale	Depth (m) Depth	Stratum Description	Legend	Level (mOD) Scale	Level (mOD) Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike	Backfill
		Medium dense becoming dense light brown slightly silty gravelly SAND.				10.00	C	N=18 (2,3/4,4,5,5)		
10.5	10.50	Very stiff brown slightly sandy gravelly silty CLAY with low cobble content and bands of gravelly sand.		9.5	9.48					
11.0				9.0		11.00 11.00	B C	JOT11 N=24 (3,4/5,6,6,7)		
11.5				8.5						
12.0				8.0		12.00 12.00	B C	JOT12 N=35 (4,5/7,9,9,10)		
12.5				7.5						
13.0				7.0		13.00 13.00	B C	JOT13 50 (25 for 125mm/50 for 90mm)		
13.5				6.5						
14.0				6.0		14.00 14.00	B C	JOT14 N=50 (4,9/50 for 235mm)		
14.5				5.5						
15.0				5.0		15.00 15.00	B C	JOT15 50 (10,15/50 for 125mm)		
15.5				4.5						
16.0				4.0		16.00 16.00	B C	JOT16 50 (11,14/50 for 100mm)		
16.5				3.5						
	16.80	Obstruction - possible boulders.			3.18					
17.0	17.00	End of Borehole at 17.00m		3.0	2.98	17.00	C	50 (25 for 5mm/50 for 5mm)		
17.5				2.5						
18.0				2.0						
18.5				1.5						
19.0				1.0						
19.5				0.5						

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Depth Sealed	Water Details: Date:	Hole Depth:	Water Depth:	Installation: From:	To:	Pipe:	Backfill: From:	To:	Type:	Remarks:
15.00	15.20	00:45							0.00	14.00	Solid	0.00	0.70	Bentonite	Borehole terminated due to obstruction.
16.40	16.50	00:45							14.00	17.00	Slotted	0.70	12.00	Gravel	
16.80	17.00	01:00										12.00	13.00	Bentonite	
												13.00	17.00	Gravel	

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No: 5836	**Cable Percussion Borehole Log**				Borehole No: **BH02**
Contract:	Balscadden	Easting:	728791.582	Date Started:	21/06/2021
Location:	Howth, Co. Dublin	Northing:	739163.531	Date Completed:	23/06/2021
Client:	Marlet	Elevation:	19.58	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Level (mOD)		Samples and Insitu Tests			Water Strike
Scale	Depth		Scale	Depth	Depth	Type	Result	
	0.20	MADE GROUND: tarmacadam.	19.5	19.38				
		Grey slightly silty very sandy GRAVEL.						
0.5			19.0					
1.0			18.5		1.00 1.00	B C	JOT17 N=12 (1,2/2,3,3,4)	
1.5			18.0					
2.0			17.5		2.00 2.00	B C	JOT18 N=15 (2,3/3,4,4,4)	
2.5			17.0					
3.0	3.00	Loose becoming medium dense brown silty very gravelly SAND.	16.5	16.58	3.00 3.00	B C	JOT19 N=10 (1,1/2,2,3,3)	
3.5			16.0					
4.0			15.5		4.00 4.00	B C	JOT20 N=8 (2,2/2,2,2,2)	
4.5			15.0					
5.0			14.5		5.00 5.00	B C	JOT21 N=11 (2,2/3,3,2,3)	
5.5			14.0					
6.0			13.5		6.00 6.00	B C	JOT22 N=8 (2,1/2,2,2,2)	
6.5			13.0					
7.0			12.5		7.00 7.00	B C	JOT23 N=11 (3,3/2,3,3,3)	
7.5			12.0					
8.0			11.5		8.00 8.00	B C	JOT24 N=15 (3,3/4,4,3,4)	
8.5	8.50	Medium dense becoming dense light brown silty gravelly SAND.	11.0	11.08				
9.0			10.5		9.00 9.00	B C	JOT25 N=13 (2,2/3,3,3,4)	
9.5			10.0					
	9.70	Very stiff brown slightly sandy gravelly silty CLAY with		9.88				
					~~10.00~~	~~B~~	~~JOT26~~	

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:		
17.10	17.20	01:00				21/06 22/06 23/06	3.00 12.00 17.20	Dry Dry Dry	0.00 9.00	9.00 17.20	Solid Slotted	0.00 1.00 7.00 8.00	1.00 7.00 8.00 17.20	Bentonite Gravel Bentonite Gravel	Borehole terminated due to obstruction.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water C: Cone SPT S: Split spoon SPT

Contract No:	# Cable Percussion Borehole Log	Borehole No:
5836		**BH02**

Contract:	Balscadden	Easting:	728791.582	Date Started:	21/06/2021
Location:	Howth, Co. Dublin	Northing:	739163.531	Date Completed:	23/06/2021
Client:	Marlet	Elevation:	19.58	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
		low cobble content.		9.5		10.00	C	N=38 (6,7/7,9,11,11)		
10.5	10.50	Very stiff brown slightly sandy slightly gravelly silty CLAY.		9.0	9.08					
11.0				8.5		11.00 11.00	B C	JOT27 N=40 (7,8/9,9,10,12)		
11.5				8.0						
12.0				7.5		12.00 12.00	B C	JOT28 N=37 (5,7/9,9,9,10)		
12.5				7.0						
13.0				6.5		13.00 13.00	B C	JOT29 N=44 (4,6/10,11,11,12)		
13.5				6.0						
14.0				5.5		14.00 14.00	B C	JOT30 N=39 (3,5/7,11,10,11)		
14.5	14.60	Very stiff brown slightly sandy gravelly silty CLAY with low cobble content and bands of gravelly sand.		5.0	4.98					
15.0				4.5		15.00 15.00	B C	JOT31 50 (5,11/50 for 60mm)		
15.5				4.0						
16.0				3.5		16.00 16.00	B C	JOT32 50 (6,12/50 for 115mm)		
16.5				3.0						
17.0	17.10 17.20	Obstruction - possible boulders. End of Borehole at 17.20m		2.5	2.48 2.38	17.00 17.10	C B	50 (23 for 95mm/50 for 5mm) JOT33		
17.5				2.0						
18.0				1.5						
18.5				1.0						
19.0				0.5						
19.5				0.0						

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	Borehole terminated due to obstruction.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water C: Cone SPT S: Split spoon SPT
17.10	17.20	01:00							0.00 9.00	9.00 17.20	Solid Slotted	0.00 1.00 7.00 8.00	1.00 7.00 8.00 17.20	Bentonite Gravel Bentonite Gravel		

Contract No:	# Cable Percussion Borehole Log	Borehole No:
5836		**BH03**

Contract:	Balscadden	Easting:	728739.243	Date Started:	24/06/2021
Location:	Howth, Co. Dublin	Northing:	739069.592	Date Completed:	28/06/2021
Client:	Marlet	Elevation:	19.42	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Depth	Stratum Description	Level (mOD) Depth
0.10	MADE GROUND: tarmacadam.	19.32
0.60	MADE GROUND: grey sandy gravel with medium cobble content and some red brick and concrete fragments.	18.82
2.80	Medium dense light brown silty gravelly SAND.	16.62
4.90	Medium dense yellow slightly silty SAND.	14.52
6.40	Medium dense light brown silty gravelly SAND.	13.02
7.50	Stiff brown slightly sandy gravelly silty CLAY with low cobble content.	11.92
	Very stiff black slightly sandy gravelly silty CLAY with low cobble content.	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5

Level scale: 19.0, 18.5, 18.0, 17.5, 17.0, 16.5, 16.0, 15.5, 15.0, 14.5, 14.0, 13.5, 13.0, 12.5, 12.0, 11.5, 11.0, 10.5, 10.0, 9.5

Samples and Insitu Tests

Depth	Type	Result
1.00	B	JOT34
1.00	C	N=18 (2,3/4,4,5,5)
2.00	B	JOT35
2.00	C	N=21 (2,4/5,5,5,6)
3.00	B	JOT36
3.00	C	N=23 (4,5/5,6,6,6)
4.00	B	JOT37
4.00	C	N=19 (2,4/4,5,5,5)
5.00	B	JOT38
5.00	C	N=15 (2,2/3,4,4,4)
6.00	B	JOT39
6.00	C	N=24 (2,4/5,6,6,7)
7.00	B	JOT40
7.00	C	N=30 (2,5/7,7,7,9)
8.00	B	JOT41
8.00	C	50 (25 for 135mm/50 for 10mm)
9.00	B	JOT42
9.00	C	50 (5,7/50 for 100mm)
10.00	B	JOT43

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	
12.80	13.00	01:00	4.80	4.50	6.80	24/06 25/06 28/06	3.50 10.50 13.00	Dry 10.20 3.80	0.00 4.00	4.00 13.00	Solid Slotted	0.00 3.00	3.00 13.00	Bentonite Gravel	Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No: 5836	# Cable Percussion Borehole Log	Borehole No: **BH03**

Contract:	Balscadden	Easting:	728739.243	Date Started:	24/06/2021
Location:	Howth, Co. Dublin	Northing:	739069.592	Date Completed:	28/06/2021
Client:	Marlet	Elevation:	19.42	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
		Very stiff black slightly sandy gravelly silty CLAY with low cobble content.				10.00	C	50 (25 for 125mm/50 for 110mm)		
10.5				9.0						
11.0				8.5		11.00 11.00	B C	JOT44 50 (25 for 125mm/50 for 100mm)		
11.5				8.0						
12.0				7.5		12.00 12.00	B C	JOT45 50 (25 for 115mm/50 for 25mm)		
12.5				7.0						
	12.80	Obstruction - possible boulders.			6.62	12.80	B	JOT46		
13.0	13.00	End of Borehole at 13.00m		6.5	6.42	13.00	C	50 (25 for 5mm/50 for 5mm)		
13.5				6.0						
14.0				5.5						
14.5				5.0						
15.0				4.5						
15.5				4.0						
16.0				3.5						
16.5				3.0						
17.0				2.5						
17.5				2.0						
18.0				1.5						
18.5				1.0						
19.0				0.5						
19.5				0.0						
				-0.5						

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	Borehole terminated due to obstruction.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water C: Cone SPT S: Split spoon SPT
12.80	13.00	01:00	4.80	4.50	6.80				0.00 4.00	4.00 13.00	Solid Slotted	0.00 3.00	3.00 13.00	Bentonite Gravel		

Appendix D

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Minerex Environmental
Taney hall
Eglinton Terrace
Dundrum
Dublin
Dublin 14

Attention: Chris Fennell

CERTIFICATE OF ANALYSIS

Date of report Generation:	23 September 2021
Customer:	Minerex Environmental
Sample Delivery Group (SDG):	210914-80
Your Reference:	3330-COC1
Location:	Marlet - Balscadden
Report No:	614351
Order Number:	

This report has been revised and directly supersedes 613762 in its entirety.

We received 8 samples on Tuesday September 14, 2021 and 8 of these samples were scheduled for analysis which was completed on Thursday September 23, 2021. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan
Operations Manager

UKAS TESTING
1291

Version: 3.1 Version Issued: 23/09/2021

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
24972424	BH1		0.00 - 0.00	13/09/2021
24972431	BH2		0.00 - 0.00	13/09/2021
24972467	SP1		0.00 - 0.00	13/09/2021
24972476	SP2		0.00 - 0.00	13/09/2021
24972482	SP3		0.00 - 0.00	13/09/2021
24972439	SW1		0.00 - 0.00	13/09/2021
24972453	SW2		0.00 - 0.00	13/09/2021
24972460	SW3		0.00 - 0.00	13/09/2021

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG: 210914-80
Client Ref.: 3330-COC1
Report Number: 614351
Location: Marlet - Balscadden
Superseded Report: 613762

Results Legend

- X **Test**
- N **No Determination Possible**

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			24972424			24972431			24972467			24972476			24972482			24972439			24972453
Customer Sample Reference			BH1			BH2			SP1			SP2			SP3			SW1			SW2
AGS Reference																					
Depth (m)			0.00 - 0.00			0.00 - 0.00			0.00 - 0.00			0.00 - 0.00			0.00 - 0.00			0.00 - 0.00			0.00 - 0.00
Container			1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1lplastic (ALE221)
Sample Type			GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	SW	SW	SW	SW
Alkalinity as CaCO3	All	NDPs: 0 Tests: 8	X			X			X			X			X			X			X
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 8		X			X			X			X			X			X		
Anions by ion Chromatography	All	NDPs: 0 Tests: 8	X			X			X			X			X			X			X
Anions by Kone (w)	All	NDPs: 0 Tests: 8	X			X			X			X			X			X			X
Conductivity (at 20 deg.C)	All	NDPs: 0 Tests: 8	X			X			X			X			X			X			X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 8			X			X			X			X			X			X	
Phosphate by Kone (w)	All	NDPs: 0 Tests: 8	X			X			X			X			X			X			X

13:51:45 23/09/2021

24972460	SW3		0.00 - 0.00	HNO3 Filtered (ALE204)	SW											X			
				H2SO4 (ALE244)	SW				X										
				1lplastic (ALE221)	SW		X				X		X		X				X
24972453	SW2		0.00 - 0.00	HNO3 Filtered (ALE204)	SW											X			
				H2SO4 (ALE244)	SW				X										

Validated

CERTIFICATE OF ANALYSIS

SDG: 210914-80
Client Ref.: 3330-COC1
Report Number: 614351
Location: Marlet - Balscadden
Superseded Report: 613762

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4♦§@	Sample deviation (see appendix)

Customer Sample Ref.			BH1	BH2	SP1	SP2	SP3	SW1
Depth (m)			0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Sample Type			Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Surface Water (SW)
Date Sampled			13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Sample Time			00:00	00:00	00:00	00:00	00:00	00:00
Date Received			14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
SDG Ref			210914-80	210914-80	210914-80	210914-80	210914-80	210914-80
Lab Sample No.(s)			24972424	24972431	24972467	24972476	24972482	24972439
AGS Reference								
Component	**LOD/Units**	**Method**						
Alkalinity, Total as CaCO3	<2 mg/l	TM043	355 #	300 #	115 #	305 #	315 #	155 #
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	<0.2 #	<0.2 #	<0.2 #	<0.2 #	<0.2 #	<0.2 #
Ammoniacal Nitrogen as NH4	<0.3 mg/l	TM099	<0.3 #	<0.3 #	<0.3 #	<0.3 #	<0.3 #	<0.3 #
Conductivity @ 20 deg.C	<0.02 mS/cm	TM120	0.86 #	0.803 #	0.39 #	0.936 #	0.89 #	37.8 #
Manganese (diss.filt)	<3 µg/l	TM152	43.7 #	6.9 #	<3 #	<3 #	9.69 #	<18 #
Phosphorus (diss.filt)	<10 µg/l	TM152	<10 #	<10 #	<10 #	<10 #	23.9 #	78.6 #
Sodium (Dis.Filt)	<0.076 mg/l	TM152	42.3 #	44.3 #	22.1 #	56.4 #	93.7 #	8940 #
Magnesium (Dis.Filt)	<0.036 mg/l	TM152	20.5 #	18.9 #	5.86 #	20.5 #	19.5 #	1020 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152	8.36 #	5.71 #	2.94 #	7.27 #	11.9 #	299 #
Calcium (Dis.Filt)	<0.2 mg/l	TM152	123 #	116 #	52 #	122 #	81.4 #	343 #
Iron (Dis.Filt)	<0.019 mg/l	TM152	<0.019 #	<0.019 #	<0.019 #	<0.019 #	0.0433 #	<0.114 #
Sulphate	<2 mg/l	TM184	113 #	66.3 #	43 #	58.6 #	51.7 #	2240 #
Chloride	<2 mg/l	TM184	74.1 #	77.9 #	33.5 #	110 #	115 #	16300 #
Phosphate (Ortho as P)	<0.02 mg/l	TM184	<0.02 #	<0.02 #	<0.02 #	<0.02 #	0.0281 #	0.079 #
Nitrate as NO3	<0.07 mg/l	TM226	35.3 #	30.2 #	7.61 #	30.7 #	<0.35 #	4.27 #

Validated

CERTIFICATE OF ANALYSIS

SDG: 210914-80 **Report Number:** 614351 **Superseded Report:** 613762
Client Ref.: 3330-COC1 **Location:** Marlet - Balscadden

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4♦§@	Sample deviation (see appendix)

Customer Sample Ref.	SW2	SW3
Depth (m)	0.00 - 0.00	0.00 - 0.00
Sample Type	Surface Water (SW)	Surface Water (SW)
Date Sampled	13/09/2021	13/09/2021
Sample Time	00:00	00:00
Date Received	14/09/2021	14/09/2021
SDG Ref	210914-80	210914-80
Lab Sample No.(s)	24972453	24972460
AGS Reference		

Component	LOD/Units	Method	SW2	SW3
Alkalinity, Total as CaCO3	<2 mg/l	TM043	180 #	150 #
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	<0.2 #	<0.2 #
Ammoniacal Nitrogen as NH4	<0.3 mg/l	TM099	<0.3 #	<0.3 #
Conductivity @ 20 deg.C	<0.02 mS/cm	TM120	23 #	0.457 #
Manganese (diss.filt)	<3 µg/l	TM152	<3 #	44.4 #
Phosphorus (diss.filt)	<10 µg/l	TM152	91.9 #	54.5 #
Sodium (Dis.Filt)	<0.076 mg/l	TM152	5050 #	26 #
Magnesium (Dis.Filt)	<0.036 mg/l	TM152	624 #	8.85 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152	175 #	2.44 #
Calcium (Dis.Filt)	<0.2 mg/l	TM152	228 #	66.8 #
Iron (Dis.Filt)	<0.019 mg/l	TM152	<0.019 #	0.109 #
Sulphate	<2 mg/l	TM184	1210 #	50.5 #
Chloride	<2 mg/l	TM184	9290 #	40.1 #
Phosphate (Ortho as P)	<0.02 mg/l	TM184	0.0826 #	0.03 #
Nitrate as NO3	<0.07 mg/l	TM226	9.27 #	6.88 #

Table of Results - Appendix

Method No	Reference	Description
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM120	Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970	Determination of Electrical Conductivity using a Conductivity Meter
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM226	In-House Method	Determination of Anions in Waters using Ion Chromatography

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

Test Completion Dates

Lab Sample No(s)	24972424	24972431	24972467	24972476	24972482	24972439	24972453	24972460
Customer Sample Ref.	BH1	BH2	SP1	SP2	SP3	SW1	SW2	SW3
AGS Ref.								
Depth	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water	Surface Water
Alkalinity as CaCO3	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021
Ammoniacal Nitrogen	17-Sep-2021	20-Sep-2021	17-Sep-2021	17-Sep-2021	17-Sep-2021	20-Sep-2021	20-Sep-2021	20-Sep-2021
Anions by ion Chromatography	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021	16-Sep-2021
Anions by Kone (w)	18-Sep-2021	18-Sep-2021	18-Sep-2021	18-Sep-2021	18-Sep-2021	18-Sep-2021	18-Sep-2021	18-Sep-2021
Conductivity (at 20 deg.C)	23-Sep-2021	23-Sep-2021	23-Sep-2021	23-Sep-2021	23-Sep-2021	23-Sep-2021	23-Sep-2021	23-Sep-2021
Dissolved Metals by ICP-MS	17-Sep-2021	17-Sep-2021	17-Sep-2021	17-Sep-2021	17-Sep-2021	18-Sep-2021	18-Sep-2021	17-Sep-2021
Phosphate by Kone (w)	15-Sep-2021	15-Sep-2021	15-Sep-2021	15-Sep-2021	15-Sep-2021	15-Sep-2021	15-Sep-2021	15-Sep-2021

Appendix

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

General

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as “mixed hydrocarbons”. Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Unit 7-8 Hawarden Business Park
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Minerex Environmental
Taney hall
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Dundrum
Dublin
Dublin 14

Attention: Chris Fennell

CERTIFICATE OF ANALYSIS

Date of report Generation: 14 October 2021
Customer: Minerex Environmental
Sample Delivery Group (SDG): 211007-123
Your Reference: 3330-COC2
Location: Marlet - Balscadden
Report No: 617204
Order Number:

We received 2 samples on Thursday October 07, 2021 and 2 of these samples were scheduled for analysis which was completed on Thursday October 14, 2021. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan
Operations Manager

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
25113801	BH1		0.00 - 0.00	06/10/2021
25113808	BH2		0.00 - 0.00	06/10/2021

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG: 211007-123
Client Ref.: 3330-COC2
Report Number: 617204
Location: Marlet - Balscadden
Superseded Report:

Results Legend

- X **Test**
- N **No Determination Possible**

Sample Types -

- S - Soil/Solid
- UNS - Unspecified Solid
- GW - Ground Water
- SW - Surface Water
- LE - Land Leachate
- PL - Prepared Leachate
- PR - Process Water
- SA - Saline Water
- TE - Trade Effluent
- TS - Treated Sewage
- US - Untreated Sewage
- RE - Recreational Water
- DW - Drinking Water Non-regulatory
- UNL - Unspecified Liquid
- SL - Sludge
- G - Gas
- OTH - Other

Lab Sample No(s)			25113801			25113808		
Customer Sample Reference			BH1			BH2		
AGS Reference								
Depth (m)			0.00 - 0.00			0.00 - 0.00		
Container			1plastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	1plastic (ALE221)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)
Sample Type			GW	GW	GW	GW	GW	GW
Alkalinity as CaCO3	All	NDPs: 0 Tests: 2	X			X		
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 2		X			X	
Anions by ion Chromatography	All	NDPs: 0 Tests: 2	X			X		
Anions by Kone (w)	All	NDPs: 0 Tests: 2	X			X		
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2			X			X
Phosphate by Kone (w)	All	NDPs: 0 Tests: 2	X			X		

16:22:16 14/10/2021

Validated

CERTIFICATE OF ANALYSIS

SDG: 211007-123
Client Ref.: 3330-COC2
Report Number: 617204
Location: Marlet - Balscadden
Superseded Report:

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4♦§@	Sample deviation (see appendix)

		Customer Sample Ref.	BH1	BH2
		Depth (m)	0.00 - 0.00	0.00 - 0.00
		Sample Type	Ground Water (GW)	Ground Water (GW)
		Date Sampled	06/10/2021	06/10/2021
		Sample Time	00:00	00:00
		Date Received	07/10/2021	07/10/2021
		SDG Ref	211007-123	211007-123
		Lab Sample No.(s)	25113801	25113808
		AGS Reference		
Component	**LOD/Units**	**Method**		
Alkalinity, Total as CaCO3	<2 mg/l	TM043	348 #	390 #
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	<0.2 #	<0.2 #
Ammoniacal Nitrogen as NH4	<0.3 mg/l	TM099	<0.3 #	<0.3 #
Manganese (diss.filt)	<3 µg/l	TM152	5.78 #	<3 #
Phosphorus (diss.filt)	<10 µg/l	TM152	<10 #	<10 #
Sodium (Dis.Filt)	<0.076 mg/l	TM152	42.5 #	42.4 #
Magnesium (Dis.Filt)	<0.036 mg/l	TM152	20 #	19 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152	9.71 #	5.5 #
Calcium (Dis.Filt)	<0.2 mg/l	TM152	126 #	122 #
Iron (Dis.Filt)	<0.019 mg/l	TM152	<0.019 #	<0.019 #
Sulphate	<2 mg/l	TM184	113 #	66.5 #
Chloride	<2 mg/l	TM184	80 #	81 #
Phosphate (Ortho as P)	<0.02 mg/l	TM184	<0.02 #	<0.02 #
Nitrate as NO3	<0.07 mg/l	TM226	37.1 #	29.4 #

Table of Results - Appendix

Method No	Reference	Description
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM226	In-House Method	Determination of Anions in Waters using Ion Chromatography

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

Test Completion Dates

Lab Sample No(s)	25113801	25113808
Customer Sample Ref.	BH1	BH2
AGS Ref.		
Depth	0.00 - 0.00	0.00 - 0.00
Type	Ground Water	Ground Water
Alkalinity as CaCO3	11-Oct-2021	11-Oct-2021
Ammoniacal Nitrogen	12-Oct-2021	12-Oct-2021
Anions by ion Chromatography	12-Oct-2021	12-Oct-2021
Anions by Kone (w)	11-Oct-2021	11-Oct-2021
Dissolved Metals by ICP-MS	14-Oct-2021	14-Oct-2021
Phosphate by Kone (w)	11-Oct-2021	11-Oct-2021

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as “mixed hydrocarbons”. Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix F

Engineering Assessment Report

Balscadden Development, Howth, Co. Dublin

March 2022

Waterman Moylan Consulting Engineers Limited

Block S, East Point Business Park, Alfie Byrne Road, Dublin D03 H3F4
www.waterman-moylan.ie

Waterman Moylan
Engineering Consultants

Client Name: Balscadden GP3 Ltd.
Document Reference: 21-032r.002 Engineering Assessment Report
Project Number: 21-032

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015 and BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
1	17 August 2021	Stephen Dent-Neville	Richard Miles	Mark Duignan
2	23 March 2022	Stephen Dent-Neville	Joe Gibbons	

Comments

Waterman Moylan
Engineering Consultants

Disclaimer

Contents

Figures

Tables

Appendices

1. Introduction

1.1 Background of Report

This Engineering Assessment Report has been prepared by Waterman Moylan as part of the documentation in support of a Strategic Housing Development (SHD) application for a proposed residential development in Howth, located between the Balscadden Road, Main Street and Abbey Street.

This report assesses wastewater and surface water drainage, water supply infrastructure and the road and transportation network in the vicinity of the site, and details the criteria used to design the proposed wastewater and surface water drainage, water supply and transport networks.

1.2 Site Location and Description

The proposed development relates to lands located to the south of the Martello Tower on Balscadden Road & the former Baily Court Hotel, Main Street, Howth, County Dublin.

The subject site is bounded to the east by the Balscadden Road and by residential properties, to the west by residential and commercial buildings fronting onto Main Street and Abbey Street, and to the north by lands around Martello Tower. The overall site is approximately 1.43 Hectares, with a former leisure centre building at the northern portion of the lands. The site location is shown on the Figure below:

Figure 1 | *Site Location (Source: Google Maps)*

A topographic survey was carried out to determine the existing topography at the site. The site has two relatively flat areas, at the north and at the south, with a steep slope between the two, and with steep slopes around the boundary of the site.

The northern portion of the site is at a level generally between c.20m and c.21m OD Malin, while the southern portion of the site is at a level generally between c.33m and c.34.5m OD Malin. Levels fall away at the east of the site towards the Balscadden Road, while levels at the south of the site continue to rise. The site is higher than the adjacent Main Street and Abbey Street to the west.

1.3 Proposed Development

The development will consist of the demolition of existing structures on the proposed site including the disused sports building and the former Baily Court Hotel buildings and the construction of a residential development set out in 4 no. residential blocks, ranging in height from 2 to 5 storeys to accommodate 180 no. apartments with associated internal residential tenant amenity and external courtyards and roof terraces, 1 no. retail unit and 2 no. café/retail units.

The site will accommodate car parking spaces at basement level and bicycle parking spaces at basement and surface level. Landscaping will include new linear plaza which will create a new pedestrian link between Main Street and Balscadden Road to include the creation of an additional 2 no. new public plazas and also maintains and upgrades the pedestrian link from Abbey Street to Balscadden Road below the Martello Tower. Please see the accompanying Statutory Notices for a more detailed description.

The residential schedule of accommodation is set out in the Table below:

Description	Studio	1-Bed	2-Bed	3-Bed	Total
Block A	-	-	2	-	2
Block B	-	51	57	18	126
Block C	-	8	28	7	43
Block D	4	3	2	-	9
Total	**4**	**62**	**89**	**25**	**180**

Table 1 | *Schedule of Accommodation*

The development will include a single level basement under Block B, containing 139 car spaces, cycle parking spaces, plant, storage areas, waste storage areas and other associated facilities. Additional visitor cycle spaces are provided for at ground level.

The development includes all other ancillary site development works to facilitate construction and the provision of the basement car park, site services, piped infrastructure, a sub-station, public lighting, plant, signage, bin stores, bike stores, boundary treatments and hard and soft landscaping.

2. Foul Water Network

2.1 Existing Foul Water Network

Irish Water records for the surrounding area have been consulted as part of this assessment, and are extracted below:

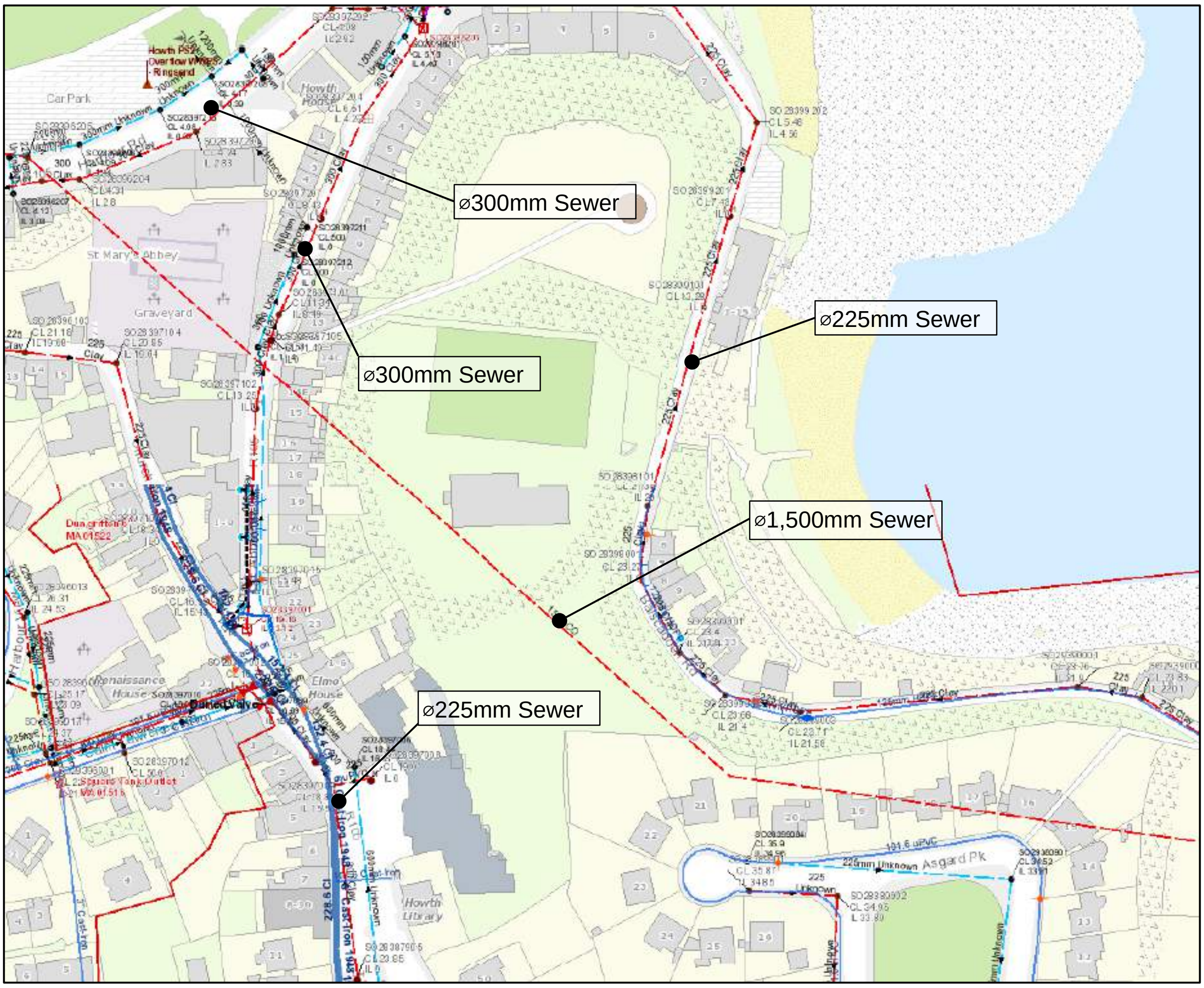


Figure 2 | *Extract of Irish Water's Wastewater Drainage Records*

There is an existing 225mm diameter foul water sewer in Main Street, continuing north along Abbey Street, to the west of the site, where it increases to 300mm. There is an existing 225mm diameter foul water sewer in Balscadden Road to the east of the site, also discharging in a northerly direction. Both sewers combine to discharge west along Harbour Road.

There is also a large 1,500mm diameter concrete wastewater sewer traversing the site.

2.2 Proposed Foul Water Network

It is proposed to discharge wastewater from the site by gravity to the existing foul water sewer in Main Street. Any internal drainage within basement areas will generally drain by gravity via slung drainage to be strapped to the underside of the ground floor slab within a dedicated service zone and by gravity below ground to its outfall location in all other areas. The basements will not generate any foul water, and no pumping is proposed.

Irish Water issued a Confirmation of Feasibility letter for the proposal on 3 August 2021 (reference number CDS21002487), which is included in Appendix A. The letter notes that connection to the existing wastewater network is feasible subject to upgrade works. The required upgrades comprise approximately 100m of network extension, from the site to the existing 300mm sewer in Abbey Street. This upgrade is not currently on Irish Water's investment plan, and the applicant will therefore be required to fund the upgrade works.

A Statement of Design Acceptance has also been received from Irish Water for the proposed development and is included in Appendix B.

A Build-Over Agreement will be required for the 1,500mm diameter concrete wastewater sewer. Early engagement to proceed with such an agreement is recommended.

2.3 Foul Water Drainage Calculations

The calculated foul water flows at the subject development are set out in the Table below. Domestic wastewater loads have been calculated based on 2.7 persons per unit with a per capita wastewater flow of 150 litres per head per day along with a 10% unit consumption allowance, in line with Section 3.6 of the Irish Water Code of Practice for Wastewater Infrastructure. A peak flow multiplier of 6 has been used, as per Section 2.2.5 of Appendix B of the Code of Practice.

Description	**Total Population**	**Load per Capita**	**Daily Load**	**Total DWF**	**Peak Flow**
	No. People	*l/day*	*l/day*	*l/s*	*l/s*
Block A	5.4	150	891.0	0.010	0.062
Block B	340.2	150	56,133.0	0.650	3.898
Block C	116.1	150	19,156.5	0.222	1.330
Block D	24.3	150	4,009.5	0.046	0.278
Total	**486.0**	**-**	**80,190.0**	**0.928**	**5.569**

Table 2 | *Calculation of Total Foul Water Flow from the Development*

The total dry weather flow from the development is 0.928 l/s, with a peak flow of 5.569 l/s.

2.4 Foul Water Drainage – General

Foul water sewers will be constructed strictly in accordance with Irish Water requirements. No private drainage will be located within public areas.

Drains will be laid to comply with the requirements of the latest Building Regulations, and in accordance with the recommendations contained in the Technical Guidance Document H.

3. Surface Water Network

3.1 Existing Surface Water Network

The subject site is generally a vacant site with an abandoned former leisure centre building in the north and no natural watercourses running through the site. Surface water currently infiltrates the ground, and any excess surface water discharges to the adjacent roads and ultimately to the existing public drainage network.

The public drainage network comprises of an existing 600mm diameter sewer in Main Street, continuing north along Abbey Street.

3.2 Proposed Surface Water Network and SuDS Strategy

It is proposed to discharge surface water from the site by gravity to the existing surface water sewer in Main Street.

The proposed development will be designed to incorporate best drainage practice. Surface water discharging to the public network will be restricted to the greenfield equivalent runoff rate via a Hydrobrake or similar approved flow control device. The surface water network will be designed to accommodate the 1-in-5 year storm, with attenuation storage provided for the 1-in-100 year storm. Section 3.3, below, sets out the methodology used in determining the existing greenfield runoff rates and calculating attenuation storage requirements for the site. The relevant calculations are included in full in Appendix C.

It is proposed to incorporate a Storm Water Management Plan through the use of various SuDS techniques to treat and minimise surface water runoff from the site. The methodology involved in developing a Storm Water Management Plan for the subject site is based on recommendations set out in the Greater Dublin Strategic Drainage Study (GDSDS) and in the SuDS Manual (Ciria C753). Based on three key elements – Water Quantity, Water Quality and Amenity – the targets of the SuDS train concept have been implemented in the design, providing SuDS devices for each of the following:

- Source Control
- Site Control
- Regional Control

3.2.1 Source Control

Source control measures seek to detain or infiltrate runoff as close as possible to the point of origin. The use of such source control devices reduces the peak runoff rate and attenuates flows, thus reducing stress on downstream facilities. Infiltration ensures that pollutants are treated where practicable. It is proposed to introduce several source control measures, including the following:

Green Roof:

Green roofing is proposed at portions of each block's roof area. The substrate and the plant layers in a sedum roof absorb large amounts of rainwater and release it back into the atmosphere by transpiration and evaporation. They also filter water as it passes through the layers, so the run-off, when it is produced, has fewer pollutants. Rainfall not retained by green roofs is detained, effectively increasing the time to peak and slowing peak flows.

Permeable Paving:

It is proposed to introduce permeable paving in courtyards and along pedestrian circulation paths to facilitate infiltration of surface water from paved areas. The goal of permeable paving is to control stormwater at the source to reduce runoff. In addition to reducing surface runoff, permeable paving has the dual benefit of improving water quality by trapping suspended solids and filtering pollutants in the substrata layers.

Filter Drains:

Filter drains are proposed around the perimeter of buildings, consisting of perforated pipes surrounded in filter stone. The filter drains will provide infiltration, optimise the retention time and provide quality improvement to the storm water runoff, in particular the first flush from hardstanding areas.

Bioretention Gardens and Planters:

Intensive bioretention gardens and planters are proposed at some public open spaces. These planted areas can absorb large amounts of rainwater and release it back into the atmosphere by transpiration and evaporation. They can also filter water as it passes through the layers, helping to treat pollutants.

3.2.2 Site Control

Site control comprises runoff and treatment installations to serve individual developments.

Tree Pits:

At the subject site, it is proposed to introduce roadside tree pits. Trees can help control storm water runoff because their leaves, stems, and roots slow rain from reaching the ground and capture and store rainfall to be released later. Trees help to attenuate flows, trap silts and pollutants, promote infiltration and prevent erosion. Incorporating tree planting offers multiple benefits, including attractive planting features, improved air quality and increased biodiversity whilst helping to ensure adaptation to climate change.

3.2.3 Regional Control

Regional control deals with runoff on a catchment scale rather than at source level.

Attenuation Storage and Flow Control:

Attenuation storage for up to the 1-in-100 year storm will be provided in a privately managed and maintained underground attenuation tank.

A Hydrobrake or similar approved flow control device will be used to limit the discharge to the greenfield equivalent runoff rate.

3.3 Interception or Treatment Storage and Attenuation Storage

As noted above, the methodology involved in developing the Storm Water Management Plan for the subject site is based on recommendations set out in the Greater Dublin Strategic Drainage Study (GDSDS) and in the SuDS Manual. Appendix E of the Greater Dublin Strategic Drainage Study (GDSDS) sets out criteria for determining the provision of interception or treatment storage, attenuation storage and long term storage at a development site. These calculations are summarised below:

3.3.1 Criterion 1: River Water Quality Protection

Criterion 1.1: Interception

The Greater Dublin Strategic Drainage Study (GDSDS) states that approximately 30% to 40% of rainfall events are sufficiently small that there is no measurable runoff from greenfield areas into the receiving waters. These events are generally considered as the first 5mm of rainfall. Assuming 80% runoff from paved surfaces and 0% from pervious surfaces for the first 5mm of rainfall yields the following:

Paved surfaces connected to drainage system	*14300m^2 x 0.6 x 1 =* 8,580.00m^2	*14,300m^2 site area* *60% of the site is paved* *100% of the paved area*
Volume of Interception Storage	*8580m^2 x 5mm x 0.8 =* **34.32m^3**	*Paved area directly drained* *5mm rainfall depth* *80% paved runoff factor*

Table 3 **|** *Interception Calculation*

The required interception volume for the site is approximately 34.32m^3.

Criterion 1.2: Treatment Volume

For events larger than 5mm, and in situations where interception storage cannot be provided, surface water runoff treatment is provided in accordance with the CIRIA design manual C521.

Assuming 80% runoff from paved surfaces and 0% from pervious surfaces for the first 15mm of rainfall:

Paved surfaces draining to river	*14300m^2 x 0.6 x 1 =* 8,580.00m^2	*14,300m^2 site area* *60% of the site is paved* *100% of the paved area*
Volume of Treatment Storage	*8580m^2 x 15mm x 0.8 =* **102.96m^3**	*Paved area directly drained* *15mm rainfall depth* *80% runoff from paved surfaces*

Table 4 **|** *Treatment Volume Calculation – Northern Portion of Site 4*

The required treatment volume is approximately 102.96m^3. The required interception and treatment volumes will be achieved through the use of source and site control SuDS devices as described in Section 3.2 above.

3.3.2 Criterion 2: River Regime Protection

Attenuation storage is provided to limit the discharge rate from the site into the public network. As per the GDSDS, the required attenuation volume is calculated assuming 100% runoff from paved areas, and has been calculated for the 1-year, 30-year and 100-year return periods, identifying the critical storm for each – refer to the calculations included in Appendix C.

Site Investigations have been carried out at the site by Site Investigations Ltd., and the Site Investigation Report is included in Appendix D. The fieldwork carried out comprised of 3 No. cable percussive boreholes and 3 No. trial pits, and laboratory testing included particle size analysis. The investigations revealed that the ground on the site primarily comprises silty, gravelly sand. Sandy ground allows for high groundwater permeability, and as such the attenuation calculations use a Soil Type 4 (SPR Index 0.47). The calculations use a Standard Average Annual Rainfall (SAAR) value of 902mm, taken from HR Wallingford's SuDS map.

Based on these calculations, the required attenuation storage volume for the site is approximately 424m^3. This volume is sufficient for the 1-in-100 year storm, accounting for a 20% increase due to climate change.

The required attenuation storage is to be provided in two underground tanks, one located adjacent to Block B and the other adjacent to the portion of the building between Blocks C and D. Surface water runoff will be restricted via a hydro-brake or similar approved flow control device, with the cumulative discharge from the site limited to the greenfield equivalent rate of 9.3l/s, before discharging to the public combined network.

3.3.3 Criterion 3: Levels of Service

There are four criteria for levels of service. These are:

Criterion 3.1:	No external flooding except where specifically planned (30-year high intensity rainfall event).
Criterion 3.2:	No internal flooding (100-year high intensity rainfall event).
Criterion 3.3:	No internal flooding (100-year river event and critical duration for site storage).
Criterion 3.4:	No flood routing off site except where specifically planned (100-year high intensity rainfall event).

Both internal and external flooding have been assessed in the Flood Risk Assessment report which accompanies this Engineering Assessment report. The Flood Risk Assessment has been carried out in accordance with the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009.

The assessment identifies the risk of both internal and external flooding at the site from various sources and sets out mitigation measures against the potential risks of flooding. The sources of possible flooding assessed in the report include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical errors.

As a result of the flood risk management and mitigation measures proposed, the residual risk of internal or external flooding for the 30-year and 100-year flood events is low, and accordingly all four of the above criteria have been met. Please refer to the accompanying Flood Risk Assessment report for the full analysis of the flood risk at the subject site.

3.3.4 Criterion 4: River Flood Protection

The long term storage volume is a comparison of pre- and post-development runoff volumes. The objective is to limit the runoff discharged after development to the same as that which occurred prior to development.

Of the three methods described in the GDSDS for establishing River Flood Protection by comparison of the pre- and post-development runoff volumes, (Criteria 4.1, 4.2 and 4.3 respectively), Criteria 4.3 is selected for use as the most practical criteria at this stage in the design.

The Criteria 4.3 approach is for all runoff to be limited to either Q_{BAR} or to 2 l/s/Ha, whichever is the greater. The proposed drainage system includes a flow control device to ensure that the discharge rate is limited to the greenfield equivalent and ample attenuation is provided for the 1-in-100 year storm, accounting for a 20% increase due to climate change.

The extra runoff volume of the development runoff over greenfield runoff, Vol_{XS}, as calculated in Appendix C is approximately 124m^3. Note that as stated in the GDSDS, this volume is not additional to the attenuation storage volume but is effectively an element of it.

3.4 Surface Water – General

Surface water sewers will generally consist of PVC (to IS 123) or concrete socket and spigot pipes (to IS 6) and laid strictly in accordance with Fingal County Council requirements for taking in charge. It is intended that all sewers within the public domain will be handed over to Fingal County Council for taking in charge.

All private outfall manholes will be built in accordance with the Greater Dublin Regional Code of Practice for Drainage Works. No private drainage will be located within public areas.

Drains will be laid in accordance with the requirements of the Building Regulations, Technical Guidance Document H.

3.5 Flood Risk Assessment

A site-specific Flood Risk Assessment has been carried out for the proposed development and accompanies this submission under separate cover.

4. Water Supply Network

4.1 Existing Water Supply Network

Irish Water records for the surrounding area have been consulted as part of this assessment, and are extracted below:

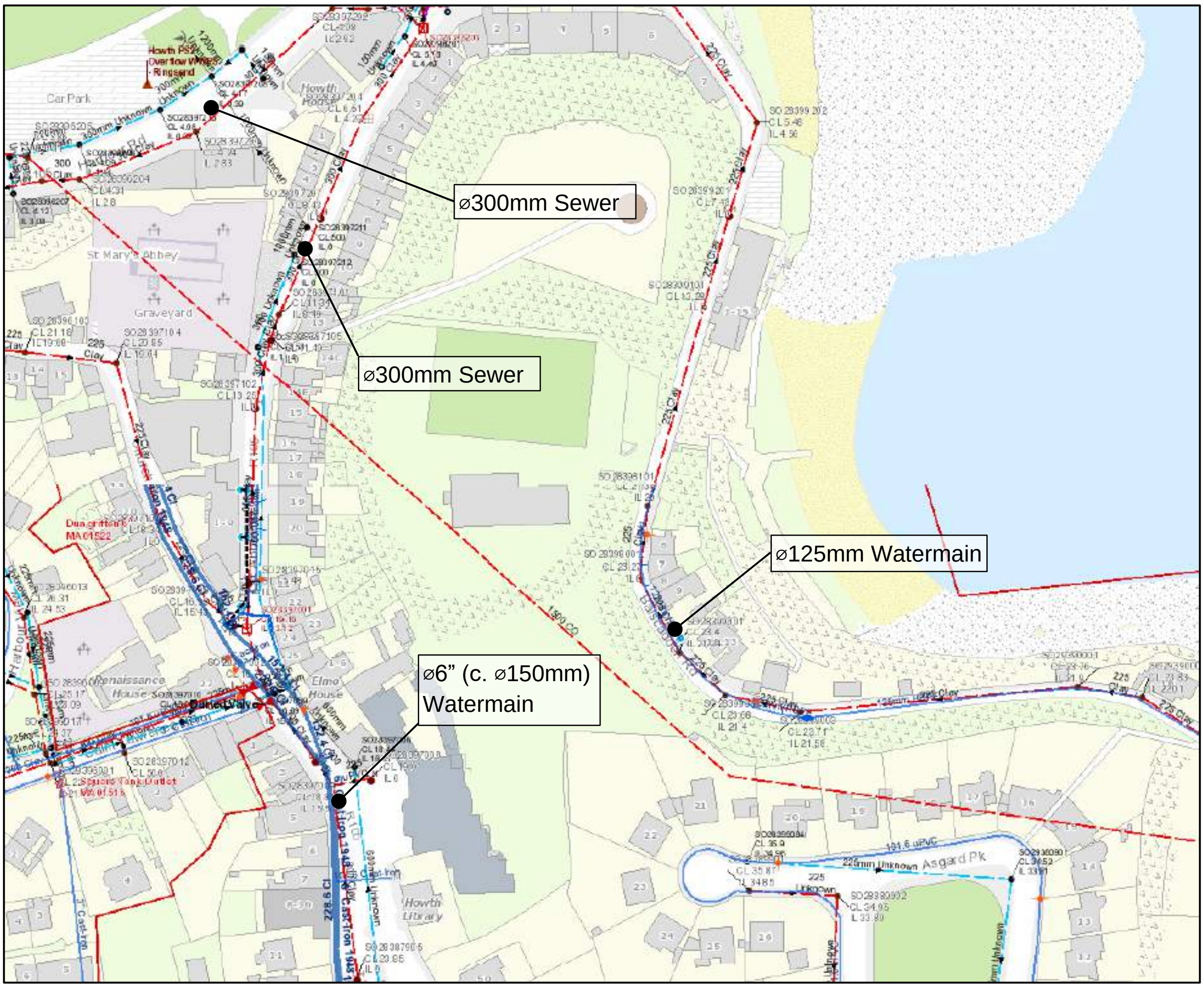


Figure 3 | *Extract of Irish Water’s Water Supply Service Records*

There is an existing 6” diameter (approximately 150mm) watermain adjacent to the subject site in Main Street / Abbey Street. There is an existing 125mm diameter watermain on Balscadden Road, terminating near the mid-point of the subject site.

4.2 Proposed Water Supply Network

It is proposed to supply water to the site via a new connection to the existing watermain in Main Street adjacent to the proposed site entrance.

Irish Water issued a Confirmation of Feasibility letter for the proposal on 3 August 2021 (reference number CDS21002487), which is included in Appendix A. The letter notes that connection to the existing water supply network is feasible without any upgrades to the existing infrastructure.

A Statement of Design Acceptance has also been received from Irish Water for the proposed development and is included in Appendix B.

4.3 Water Supply Network Calculations

The calculated water demand at the subject development is set out in the below table. The average domestic demand has been established based on an average occupancy ratio of 2.7 persons per dwelling with a daily domestic per capita consumption of 150 litres per head per day and with a 10% allowance factor. The average day/peak week demand has been taken as 1.25 times the average daily domestic demand, while the peak demand has been taken as 5 times the average day/peak week demand, as per Section 3.7.2 of the Irish Water Code of Practice for Water Infrastructure.

Description	**Total Population**	**Water Demand**	**Average Demand**	**Average Peak Demand**	**Peak Demand**
	No. People	*l/day*	*l/s*	*l/s*	*l/s*
Block A	5.4	891.0	0.010	0.013	0.064
Block B	340.2	56,133.0	0.650	0.812	4.061
Block C	116.1	19,156.5	0.222	0.277	1.386
Block D	24.3	4,009.5	0.046	0.058	0.290
Total	**486.0**	**80,190.0**	**0.928**	**1.160**	**5.801**

Table 5 | *Calculation of Water Demand for the Development*

The average demand for the development is 0.928 l/s, with a peak demand of 5.801 l/s.

4.4 Water Supply – General

All watermains will be laid strictly in accordance with Irish Water requirements for taking in charge.

Valves, hydrants, scour and sluice valves and bulk water meters will be provided in accordance with the requirements of Irish Water.

5. Roads and Transport Network

5.1 Existing Road Layout

The site is bounded to the east by the Balscadden Road, to the west by residential and commercial buildings fronting onto Main Street and Abbey Street, and to the north and south by greenfield lands. The subject site can currently be accessed from the Balscadden Road, as shown in the figure below:

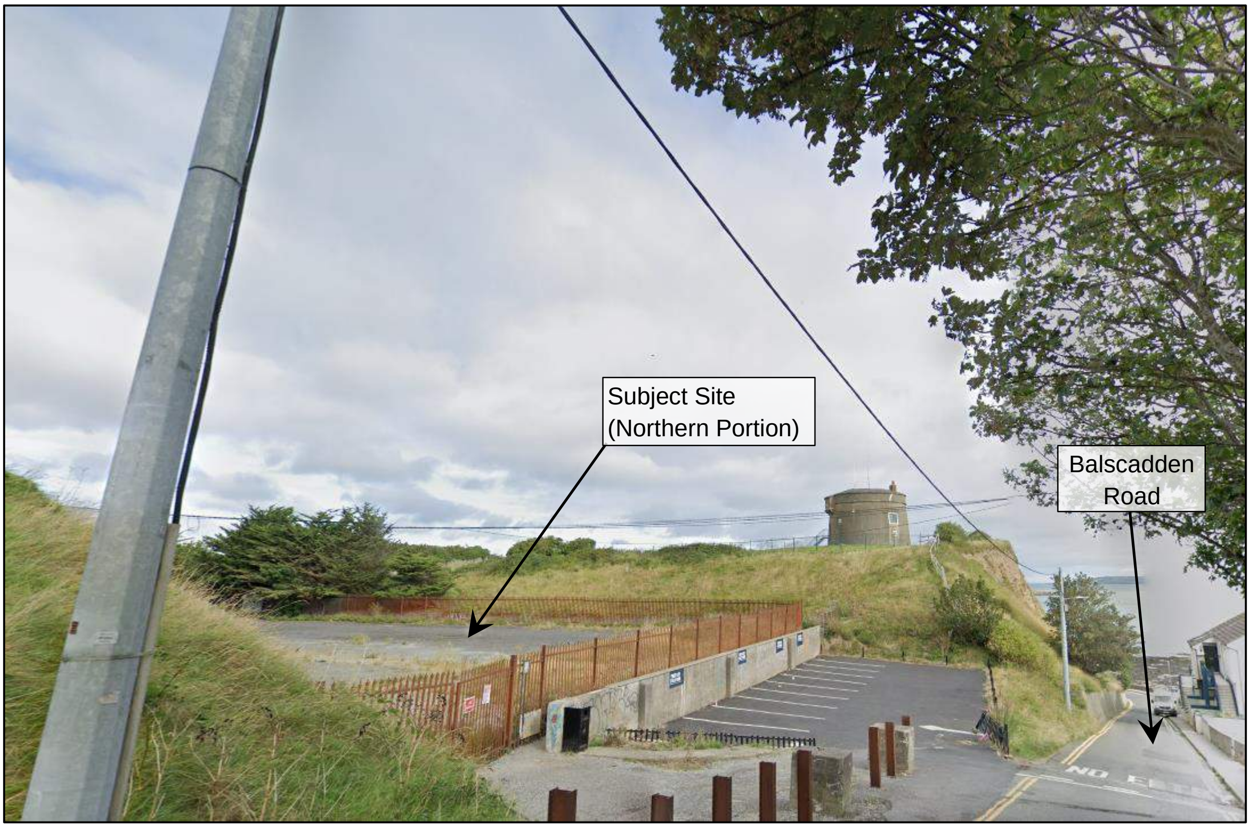


Figure 3 | *View of Site from Balscadden Road (Source: Google Maps)*

Balscadden Road is a 1-way south-east bound road, continuing east towards the Howth cliffs. It connects with the southbound Kilrock Road, which continues to the Nashville Road to connect back with the R105.

The main access to the site will be provided from the R105 (Main Street). This is the main road looping from Sutton Cross around the Howth peninsula.

5.2 Existing Public Transport Network

5.2.1 Rail

The entire site is within 1km of the Howth Railway Station. The walking distance from the proposed site entrance at the west of the development is approximately 800m, equivalent to a c. 10-minute walk.

The Howth Railway Station is served by DART and Dublin Commuter routes, and operates from 5:45am to 00:30am Monday to Saturday, and from 8:30am to 00:30am on Sundays. Service is provided from Howth to Greystones via Dublin City Centre.

5.2.2 Bus

The site is served by bus Routes 6 and H3, both operated by Dublin Bus. These routes were launched on 27 June 2021 as part of Phase 1 of the BusConnects scheme, replacing the old 31 and 31A bus route service to Howth.

The closest bus stops are southbound Stop ID 560 and northbound Stop ID 575, which are located on Main Street (R105) south-west of the site, just outside the proposed site access. Both of these stops are served by Routes 6 and H3.

Both routes operate from Howth to Abbey Street Lower in Dublin City Centre. Route 6 travels via Howth Station, Howth Summit, Sutton Cross, Killester and Fairview, whilst Route H3 travels via Howth Summit, Raheny, Killester and Fairview.

5.2.3 Bicycle Sharing

The Bleeper Bike scheme is Ireland's first stationless bike sharing scheme, and has been implemented widely in Dublin. Stationless bikes are equipped with a fixed smart lock that controls usage of the bike by communicating with the app. Bleeper Bikes do not require custom build docking bays; however, they must be parked at designated bike racks.

There are two Bleeper Bike racks in Howth, one at East Pier, approximately 400m (c. 5-minute walk) from the proposed site entrance on Main Street, and the other at Howth Railway Station, approximately 800m (C. 10-minute walk) from the proposed site entrance.

5.2.4 Car Sharing

Car Sharing contributes to sustainable travel modes by decreasing car ownership, limiting private car journeys to occasions when alternative modes of transport are unsuitable. The following outlines the benefits of car sharing:

- Each car can be accessed by multiple drivers, 24/7, and is bookable at a moment's notice;
- Reduces reliance on the private car;
- Reduce the need for car parking spaces;
- Helps reduce the number of cars on the road, traffic congestion, noise and air pollution, frees up land traditionally used for parking spaces, and increases use of public transport, walking and cycling; and
- The vehicles used are newer than the average car, and therefore are generally more environmentally friendly and safer.

Each car sharing vehicle that is placed in a community has the potential to replace the journeys of up to 15 private cars.

There is a GoCar Base located at the Howth Railway Station, approximately a 10-minute walk from the subject site.

5.3 Proposed Road Layout

vehicular access is proposed from west via Main Street (R105), which, via an internal road, will provide access to the Block B basement car park. Pedestrian and cycle access are from Main Street and from Balscadden Road, with an internal pedestrian/cycle route through the centre of the development, running south-west to north-east between the southern and northern portions of the site, connecting Main Street with the Balscadden Road. While this proposed through-route is not intended for frequent vehicular use, it has been designed to facilitate emergency vehicles.

5.3.1 Servicing

The proposed development will be serviced from the entrance from Main Street. Sufficient turning space is provided to allow a refuse vehicle to turn around at the top of the basement ramp – refer to the accompanying drawing no. 21-032-P016 Swept Path Layout for Refuse Vehicle. The management company will arrange for bins to be brought to the top of the ramp prior to bin collection.

This turning area can also be utilised by other delivery vehicles. If large delivery vehicles are required, the through-route to Balscadden Road can be utilised. This requires the proposed bollard to be dropped, and as such will require advance notice and agreement with the management company. This is anticipated to be infrequent, with the majority of delivery and other service vehicles utilising the turning/set-down area provided.

5.3.2 DMURS Statement

Given that the proposed development is primarily an infill site with little new road infrastructure proposed, a standalone DMURS Statement was not deemed to be necessary, and the DMURS Statement is instead included below.

Waterman Moylan Consulting Engineers considers that the proposal is consistent with the principles and guidance outlined in the Design Manual for Urban Roads and Streets (DMURS). Public areas fronting and within the proposed development are designed by a multidisciplinary design team to accommodate pedestrians and cyclists in accordance with the appropriate principles and guidelines set out in DMURS. Outlined below are some of the specific design features that have been incorporated within the proposed scheme with the objective of delivering a design that is in full compliance with DMURS.

The proposed development has been designed with pedestrian and cyclist connections onto Main Street and Balscadden Road. In this regard, footpaths are provided throughout the development, including routes through the development connecting Main Street to Balscadden Road. Vehicular access is provided via the Main Street entrance only.

Active edges are recommended in DMURS to enliven the edges of the street, creating a more interesting and engaging environment. An active frontage is achieved along Main Street and Balscadden Road with access points and commercial units fronting the road that ensure the street is overlooked and generate pedestrian activity as people come and go from buildings.

The proposed access road will be designed as a Local Street in accordance with the classifications set out in Section 3.2.1 of the Design Manual for Urban Roads and Streets (DMURS).

Suitable sightlines are provided at the Main Street site entrance, which as noted above will be the main vehicular access point, ensuring that adequate unobscured visibility is provided as vehicles make turning manoeuvres. A Stopping Sight Distance of at least 23m is provided in both directions, in accordance with Section 4.4.4 of DMURS.

Suitable sightlines are also provided at the exit onto Balscadden Road, ensuring that cyclists, emergency vehicles and any occasional delivery vehicles that avail of this exit point can do so safely. Although Balscadden Road is a 1-way road, with traffic flowing in a southerly direction, adequate sightlines are provided in both directions. This exit onto Balscadden Road has been designed to accommodate large emergency vehicles, with a 6m radius corner.

Refer to the accompanying Sightlines Layout drawing no. 21-032-P018.

5.4 Car Parking

5.4.1 Fingal Development Plan

The Fingal Development Plan includes standards which limit the amount of car parking at new developments. These car parking standards are set out in Table 12.8 of the Development Plan, and the relevant standards for apartments are extracted below (note that no differentiation is made between 1-bed and studio apartments):

Description	Resident's Parking	Visitor Parking
1-Bed Apt.	1	1 space per 5 units
2-Bed Apt.	1.5	1 space per 5 units
3-Bed Apt.	2	1 space per 5 units

***Table 6** | Fingal Development Plan Car Parking Standards for Apartments*

Note that the car parking standards above are not maximum or minimum requirements, but are norms for typical apartment developments. Parking requirements will vary between developments and should be addressed on a case-by-case basis.

5.4.2 Sustainable Urban Housing: Design Standards for New Apartments

The Department of Housing, Local Government and Heritage published the document "*Sustainable Urban Housing: Design Standards for New Apartments*" in December 2020. This document states that planning authorities must consider a reduced overall car parking standard and apply an appropriate maximum car parking standard for intermediate urban locations, and that in larger-scale and higher-density developments, comprising wholly of apartments in more central locations that are well served by public transport, the default policy is for car parking provision to be minimised, substantially reduced or wholly eliminated in certain circumstances.

5.4.3 Proximity of Amenities

The proposed development is located in the centre of Howth, with the main access to the site from Main Street. In the immediate vicinity of the site entrance, within a 1-minute walk, there are convenience grocery stores, a post office, pharmacies, bars, restaurants and cafés, a hair studio, a church, and various other businesses and amenities. Along Harbour Road, a few minutes' walk from the development, are various more restaurants and bars. The site is also located in close proximity to popular cliff walks around Howth, to Deer Park Golf Club and to the Howth Yacht Club.

5.4.4 Proximity of Public Transport

As set out in Section 5.2, above, the proposed development is well served by public transport services:

- The Howth Railway Station is a c.10-minute walk from the site and is served by DART and Dublin Commuter routes, providing frequent service from Howth to Greystones via Dublin City Centre.
- Dublin Bus Routes 6 and H3, launched as part of Phase 1 of the BusConnects scheme, have stops located on Main Street (R105) south-west of the site, just outside the proposed site access, with both routes operating from Howth to Abbey Street Lower in Dublin City Centre. Route 6 travels via Howth Station, Howth Summit, Sutton Cross, Killester and Fairview, whilst Route H3 travels via Howth Summit, Raheny, Killester and Fairview.

- There are two Bleeper Bike racks in Howth, one at East Pier, approximately 400m (c. 5-minute walk) from the proposed site entrance on Main Street, and the other at Howth Railway Station, approximately 800m (C. 10-minute walk) from the proposed site entrance.
- There is a GoCar Base located at the Howth Railway Station, approximately a 10-minute walk from the subject site.

Residents have various options to travel by public transport to a range of destinations throughout Dublin, including local destinations in and around Howth and destinations in Dublin City Centre.

5.4.5 Proposed Car Parking

Given the density of the proposed residential development, the urban setting of the development, the proximity of amenities, and given the close proximity of the Howth Railway Station, the adjacent bus stops, Bleeper Bike stands and a GoCar car-sharing base, it is proposed to provide a reduce car parking ratio in accordance with the new national guidelines set out in *Sustainable Urban Housing: Design Standards for New Apartments*. It is proposed to provide 139 no. car parking spaces, including 7 no. accessible spaces, at a ratio of c.0.77 spaces per apartment. If there is sufficient demand, car parking spaces within the development can also be reallocated for a Car Sharing space with GoCar or a similar car sharing service.

5.5 Bicycle Parking

The Fingal Development Plan sets out bicycle parking standards for new developments. These bicycle parking standards are set out in Table 12.9 of the Development Plan, and the relevant standard for apartments is extracted below (note that no differentiation is made between 1-bed and studio apartments):

Description	**Bicycle Parking Norm**		**No. of Units Proposed**	**Required Parking**
	Resident's Parking	*Visitor Parking*		
1-Bed Apt.	1	1 space per 5 units	66	79
2-Bed Apt.	2	1 space per 5 units	89	196
3-Bed Apt.	3	1 space per 5 units	25	80
Total	**-**	**-**	**180**	**355**

Table 7 **|** *Fingal Development Plan Bicycle Parking Standards*

Sustainable Urban Housing: Design Standards for New Apartments states that planning authorities must ensure new development proposals in central urban and public transport accessible locations, which feature appropriate reductions in car parking provision, are at the same time comprehensively equipped with high quality cycle parking and storage facilities for residents and visitors.

This document recommends a general minimum standard of 1 cycle storage space per bedroom, which conforms with the Fingal Development Plan, but gives an increased visitor parking standard of 1 space per 2 residential units. Applying this higher standard yields a cycle parking requirement of 410 spaces, as set out in the table below:

Description	**Bicycle Parking Norm**		**No. of Units Proposed**	**Required Parking**
	Resident's Parking	*Visitor Parking*		
1-Bed Apt.	1	1 space per 2 units	66	99
2-Bed Apt.	2	1 space per 2 units	89	223
3-Bed Apt.	3	1 space per 2 units	25	88
Total			**180**	**410**

Table 8 **|** *Sustainable Urban Housing: Design Standards for New Apartments Bicycle Parking Standards*

The proposed development will include 410 no. bicycle spaces for residents and visitors, in accordance with *Sustainable Urban Housing: Design Standards for New Apartments.* Cycle storage will be provided in dedicated cycle parking rooms located at the ground floor and basement level, within the building footprint, with direct access from outdoor areas. In total, there are 290 bicycle parking spaces proposed at the basement level, and 120 spaces at ground level.

Appendices

A. Irish Water Confirmation of Feasibility Letter

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

Stephen Dent-Neville

Waterman Moylan,
Eastpoint Business Park,
Block S, Alfie Byrne Road
Dublin 3
Co. Dublin
D03H3F4

3 August 2021

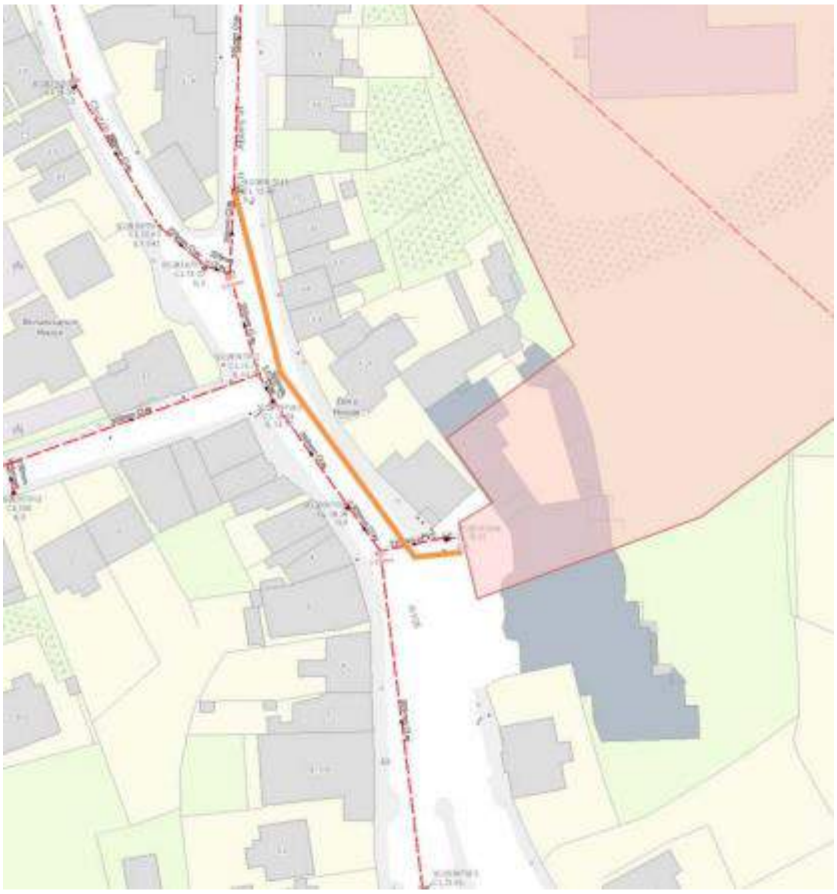
Re: CDS21002487 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 195 units at Balscadden, Howth, Dublin

Dear Sir/Madam,

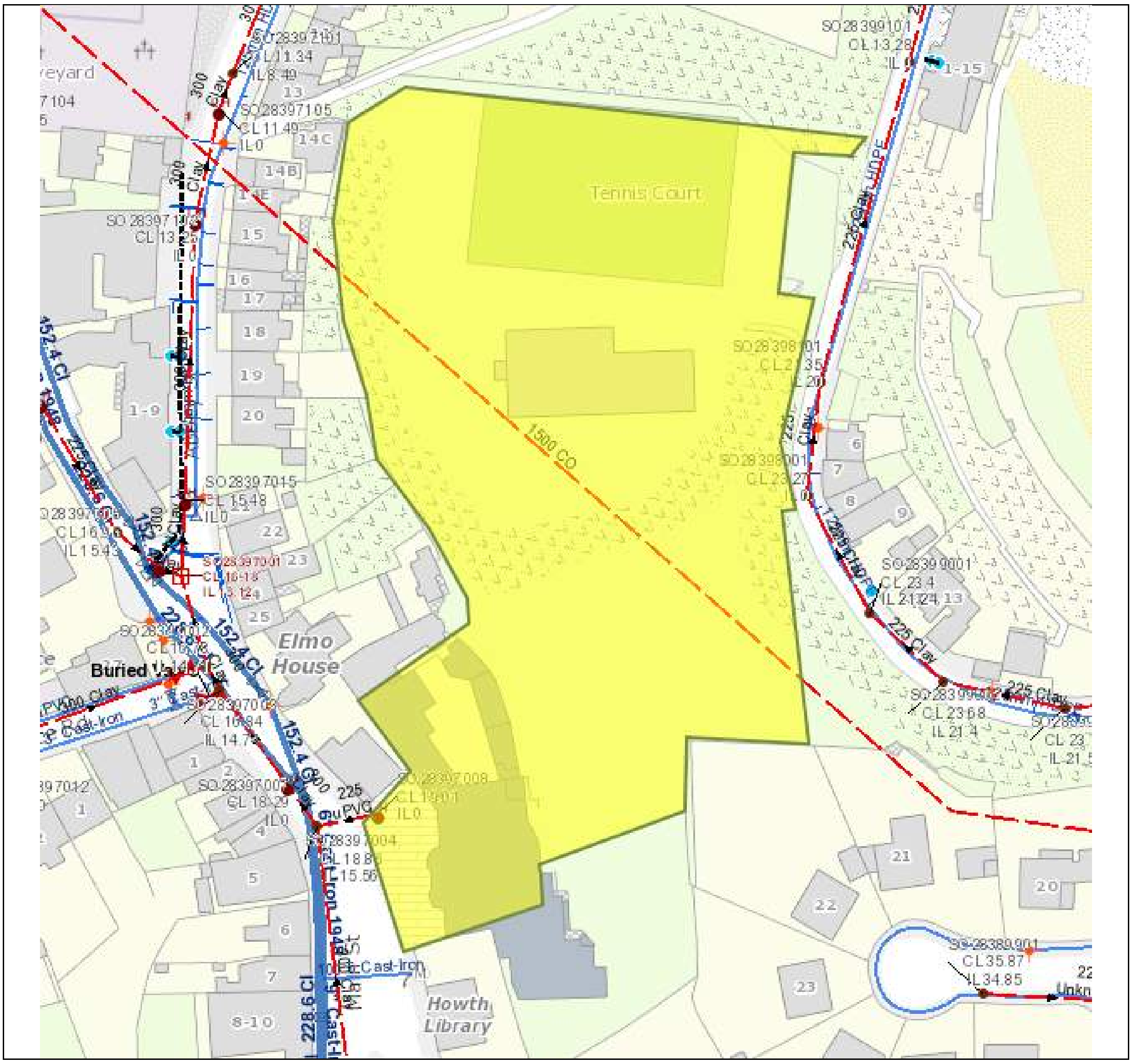
Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Balscadden, Howth, Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible Subject to upgrades
SITE SPECIFIC COMMENTS	
Water Connection	The Development can be supplied from 9’’ CI main in Main St.
Wastewater Connection	Approximately 100m network extension, from the site to the existing 300mm sewer in Abbey St. (amber line in the map below), will be required for the connection. These extension works are not currently on Irish Water investment plan therefore, the applicant will be required to fund these local upgrades.

	 The proposed Development indicates that Irish Water assets are present on the site. The Developer has to demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the assets during and after the works. Drawings (showing clearance distances, changing to ground levels) and Method Statements should be included in the Detailed Design of the Development. For design submissions and queries related to build near or over, please contact IW Diversion Team via email address diversions@water.ie

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**

2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Byrne from the design team via email mzbyrne@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Yvonne Harris

Head of Customer Operations

B. Irish Water Statement of Design Acceptance

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

Stephen Dent-Neville
Eastpoint Business Park
Block S
Alfie Byrne Road
Dublin 3, Co. Dublin D03H3F4

14 February 2022

Re: Design Submission for Balscadden, Howth, Dublin (the "Development") (the "Design Submission") / Connection Reference No: CDS21002487

Dear Stephen Dent-Neville,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:
Name: Marina Byrne
Phone: 01 89 25991/ 087619321
Email: mzbyrne@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- [21-032-P030 Proposed Watermain Layout]

- [21-032-P029 Proposed Foul Drainage Longitudinal Sections, 21-032-P020 Proposed Drainage Layout]

For further information, visit ***www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

NOTES:

1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS.
3. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ALL WORKS ARE CONSTRUCTED IN ACCORDANCE WITH THE IRISH WATER CODE OF PRACTICE AND STANDARD DETAILS. THE CODE OF PRACTICE AND STANDARD DETAILS ARE AVAILABLE TO DOWNLOAD FROM THE IRISH WATER WEBSITE AT WWW.WATER.IE/CONNECTIONS/DEVELOPER-SERVICES/ WHERE THE DETAILS CONTAINED ON THIS DRAWING DIFFER FROM THE IRISH WATER CODE OF PRACTICE OR STANDARD DETAILS THIS MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER IMMEDIATELY. IRISH WATER STANDARDS WILL TAKE PRECEDENCE.
4. ALL PROPOSED PUBLIC STORM WATER DRAINAGE WORKS TO BE IN ACCORDANCE WITH FINGAL COUNTY COUNCIL'S REQUIREMENTS FOR TAKING IN CHARGE AND IN ACCORDANCE WITH THE GREATER DUBLIN REGIONAL CODE OF PRACTICE FOR DRAINAGE WORKS.
5. ALL PROPOSED PUBLIC FOUL WATER DRAINAGE WORKS TO BE IN ACCORDANCE WITH IRISH WATER REQUIREMENTS.
6. ALL PRIVATE DRAINAGE WORKS SHALL BE IN ACCORDANCE WITH THE BUILDING REGULATIONS PART H.
7. ALL COVER LEVELS ARE INDICATIVE ONLY AND SHOULD BE SET TO SUIT THE FINISHED ROAD OR PAVED LEVEL. LEVELS IN REAR GARDENS HAVE BEEN ASSUMED AS STRAIGHT GRADE TO ADJACENT BOUNDARY FROM FFL – 150mm. EXTERNAL LEVELS TO BE CONFIRMED BY ARCHITECT

GRAVITY SEWER PIPE MATERIAL TYPES

WASTEWATER PIPE MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 3.13 OF THE IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE.

THE TYPES AND FITTINGS OUTLINED HEREIN SHALL BE USED IN THE CONSTRUCTION OF THE GRAVITY SEWERS. PIPE MATERIAL SHOULD NOT CHANGE BETWEEN MANHOLES. THE LIST BELOW DOES NOT APPLY TO PIPES INSTALLED BY PIPE JACKING OR MICRO TUNNELLING.

CONCRETE: CONCRETE SEWER PIPES WITH SPIGOT AND SOCKET JOINTS AND RUBBER RING FITTINGS SHALL COMPLY WITH IS EN 1916 (2002), BS 5911, PART 1

(2002 –2010) AND IS 6 (2004) OR EQUIVALENT STANDARD, STRENGTH CLASS 120 WITH MINIMUM CRUSHING LOADS IN ACCORDANCE WITH TABLE 8 OF

BS 5911–1 (20022010).

ALL PIPES AND FITTINGS SHALL HAVE GASKET TYPE JOINTS OF SPIGOT AND SOCKET OR REBATED FORM (PIPE DIAMETERS 225MM AND ABOVE).

THERMOPLASTIC STRUCTURED WALL PIPES: THERMOPLASTIC STRUCTURED WALL PIPES SHALL COMPLY WITH THE PROVISIONS OF IS EN 13476 (2007/2009). PIPES TO BE OF STIFFNESS CLASS 8KN/M2 AND TO BE CAPABLE OF DEMONSTRATING A JETTING RESISTANCE OF 2,600 PSI (180 BAR) WITHOUT DAMAGE WHEN TESTED IN ACCORDANCE WITH SECTION 3.3 OF WIS 4–35–01 (2008). (SEWER DIAMETERS 150MM UP TO 450MM, SERVICE CONNECTIONS OF 100MM DIAMETER).

UNPLASTICISED PVC: UNPLASTICISED PVC PIPES AND FITTINGS SHALL COMPLY WITH THE PROVISIONS IS EN 1401 2009/2012. PIPES TO BE APPLICATION AREA CODE "UD", STIFFNESS CLASS 8KN/M2. PROVISION FOR JETTING SHALL BE BASED ON THE WRC SEWER JETTING CODE OF PRACTICE, JUNE 1997. PIPES TO BE CAPABLE OF RESISTING A MAXIMUM JETTING PUMP PRESSURE OF 2,600PSI (180 BAR) WITHOUT DAMAGE. (SEWER DIAMETERS 150MM UP TO 450MM, SERVICE CONNECTIONS OF

100MM DIAMETER);

NOTES: THE USE OF ALTERNATIVE PIPE TYPES AND MATERIALS WILL REQUIRE THE PRIOR WRITTEN AGREEMENT OF IRISH WATER.

WHERE 1.2m COVER TO FOUL WATER PIPE SOFFIT IS NOT ACHIEVABLE IN ROADWAYS, CONCRETE SURROUND SHALL BE PROVIDED IN ACCORDANCE WITH STD–WW–08 OF WASTEWATER INFRASTRUCTURE STANDARD DETAILS.

SERVICE LAYOUT DISTANCES:

HORIZONTAL AND VERTICAL SERVICE LAYOUT DISTANCES SHALL BE AS PER IRISH WATER STANDARD DETAIL STD–WW–05.

THE EXTERNAL FACE OF MANHOLES SHALL BE AT LEAST 0.5m FROM KERB LINE.

RESTRICTIONS ON PLANTING:

PLANTING ADJACENT TO WASTEWATER INFRASTRUCTURE SHALL BE IN COMPLIANCE WITH IRISH WATER STANDARD DETAILS STD–WW–06 AND STD–WW–06A.

LEGEND:

XXXø @ 1/XXX	EX SMH CL X.XX IL X.XX	EXISTING SURFACE WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
XXXø @ 1/XXX	EX FMH CL X.XX IL X.XX	EXISTING FOUL WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
XXXø @ 1/XXX	SMH CL X.XX IL X.XX	PROPOSED SURFACE WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
XXXø @ 1/XXX	FMH CL X.XX IL X.XX	PROPOSED FOUL WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
150ø SIC		PRIVATE STORM WATER DRAIN WITH INSPECTION CHAMBER INDIVIDUAL
150ø FIC		PRIVATE FOUL WATER DRAIN WITH INSPECTION CHAMBER
150ø SIC		PRIVATE BASEMENT SLUNG STORM WATER DRAINAGE
150ø SIC		PROPOSED FILTER DRAIN WITH ACCESS JUNCTION/ INSPECTION CHAMBER
G		PROPOSED GULLY AND CONNECTION
🟦		PROPOSED ATTENUATION TANK
▨		PROPOSED PERMEABLE PAVING
🟩		PROPOSED GREEN ROOF
🟩		PROPOSED TREE PIT

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REV.	DATE	AMENDMENT	DRN	APPD

STATUS **FOR PLANNING**
NOT FOR CONSTRUCTION

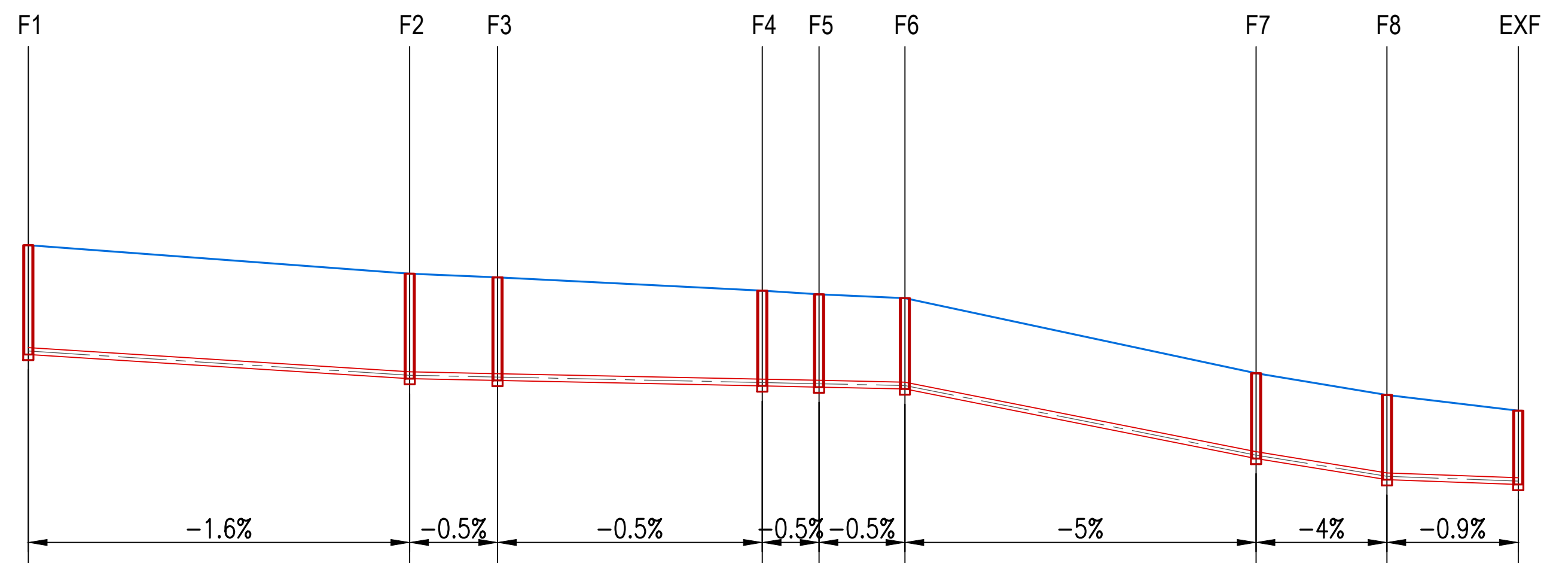
Waterman Moylan
Engineering Consultants
BLOCK S, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD,
DUBLIN D03 H3F4 IRELAND.
Tel: (01) 664 8900 Fax: (01) 661 3618
Email: info@waterman-moylan.ie www.waterman-moylan.ie

CLIENT MARLET PROPERTY GROUP
ARCHITECT PLUS ARCHITECTURE
PROJECT
BALSCADDEN, HOWTH
TITLE
PROPOSED DRAINAGE LAYOUT

DRAWN	DESIGNED	APPROVED	DATE
PJD	SDN	MD	JULY 21'
SCALE	JOB NO.	DRG. NO.	REVISION
1:250 @ A1	21–032	P020	

NOTES:

1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS.

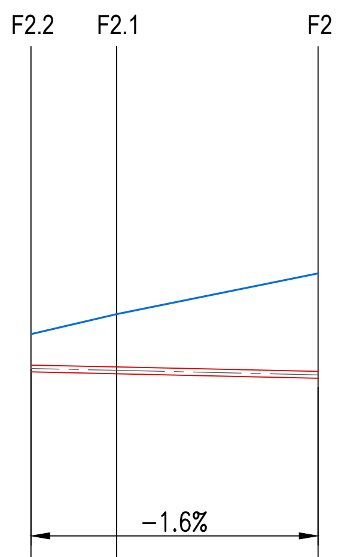


DATUM RL 8.000

	F1	F2	F3	F4	F5	F6	F7	F8	EXF
PIPE SIZE (mm)	225	225	225	225	225	225	225	225	225 300
SURFACE LEVEL (M)	20.950	20.010	19.890	19.450	19.330	19.200	16.720	16.000	15.480
INVERT LEVEL (M)	17.340	16.540	16.480	16.300	16.260	16.200	13.900	13.200	13.040
CHAINAGE (M)	0.000	50.460	62.080	97.110	104.630	115.980	162.450	179.760	197.140

LONGITUDINAL SECTION FROM MANHOLE F1 TO EXF

SCALES - 1:1000 H
1:250 V



DATUM RL 8.000

	F2.2	F2.1	F2
PIPE SIZE (mm)	225	225	225
SURFACE LEVEL (M)	18.000	18.660	20.010
INVERT LEVEL (M)	16.750	16.690	16.540
CHAINAGE (M)	0.000	11.330	37.980

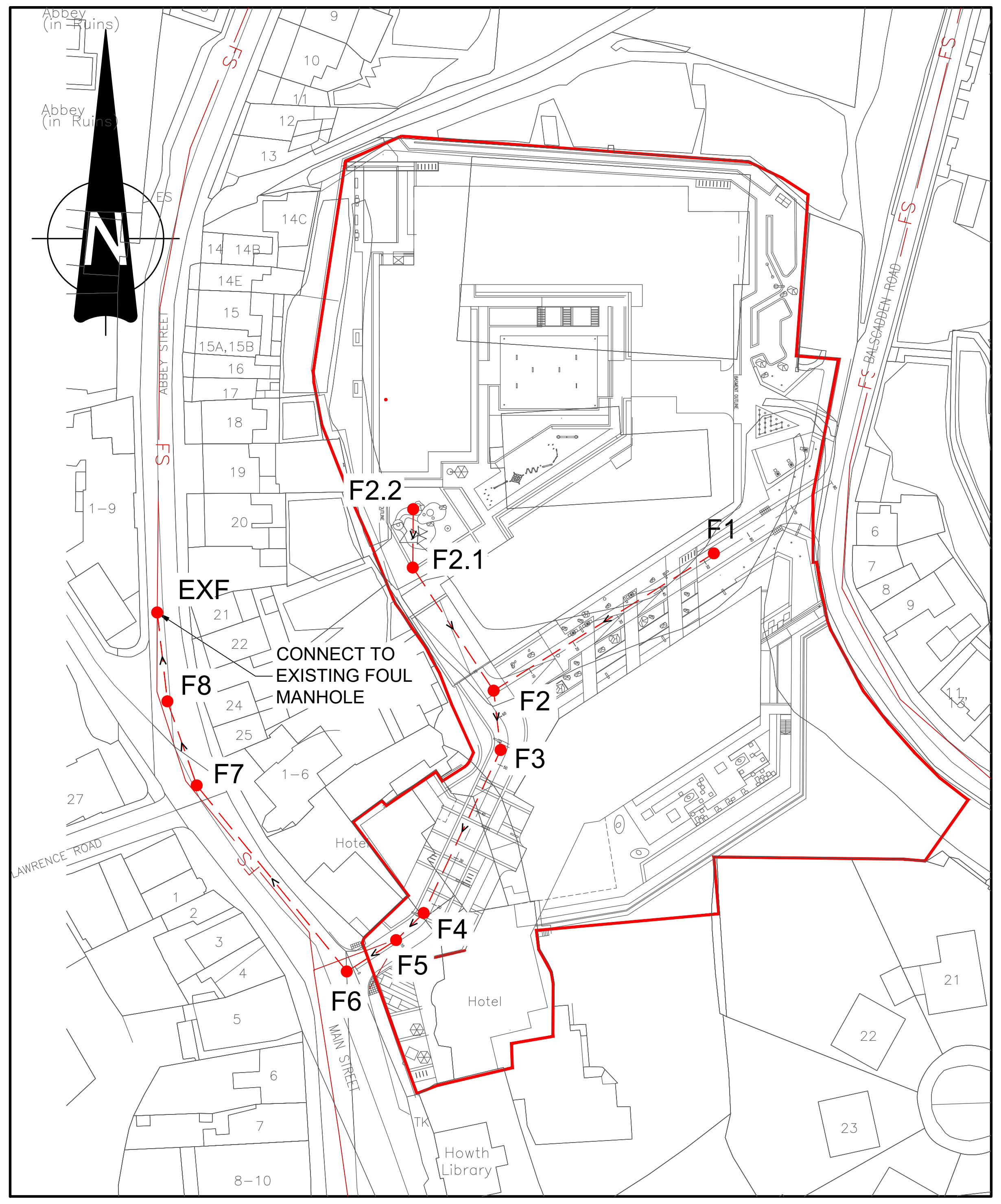
LONGITUDINAL SECTION FROM MANHOLE F2.2 TO F2

SCALES - 1:1000 H
1:250 V

LEGEND

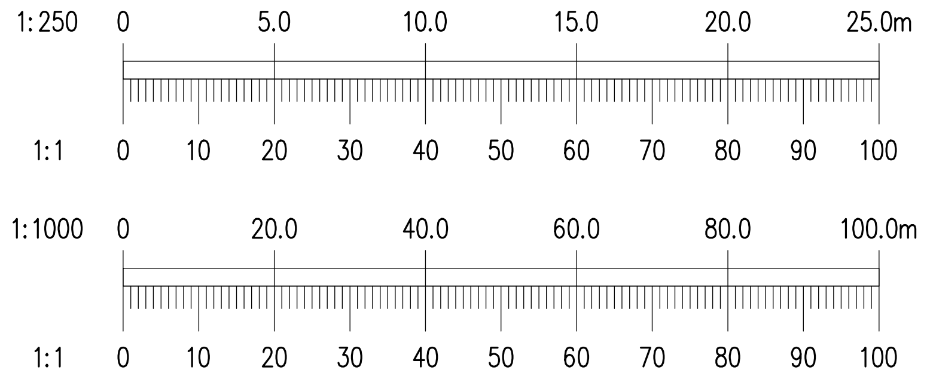
— INDICATES PROPOSED GROUND LEVEL

— INDICATES PROPOSED uPVC SN8 FOUL PIPE



FOUL DRAINAGE SCHEMATIC

SCALE 1:1000



REV.	DATE	AMENDMENT	DRN	APPD

NOTE:
REFER TO DRAWING 21-032, P20
FOR DRAINAGE LAYOUT

NOTE:
WHERE PIPE COVER IS LESS THAN 1.2m IN
ROAD PIPE TO BE ENCASED IN CONCRETE SURROUND

STATUS **FOR PLANNING**
NOT FOR CONSTRUCTION

Waterman Moylan
Engineering Consultants
BLOCK S, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD,
DUBLIN D03 H3F4 IRELAND. Tel: (01) 664 8900
Email: info@waterman-moylan.ie www.waterman-moylan.ie

CLIENT **MARLET PROPERTY GROUP**
ARCHITECT **PLUS ARCHITECTURE**

PROJECT
BALSCADDEN, HOWTH

TITLE
PROPOSED FOUL DRAINAGE
LONGITUDINAL SECTIONS

DRAWN	DESIGNED	APPROVED	DATE
PJD	SDN	MD	FEB 22'
SCALE	**JOB NO.**	**DRG. NO.**	**REVISION**
1:1000H, 1:250V @ A1	21-032	P029	

LEGEND:

XXXmm ø	EXISTING WATERMAIN WITH PIPE SIZE
XXXmm ø	PROPOSED 150ø HDPE WATERMAIN
— — —	PROPOSED 150ø HDPE SLUNG WATERMAIN
SV	PROPOSED SLUICE VALVE
H	PROPOSED HYDRANT
ScV	PROPOSED SCOUR VALVE
AV	PROPOSED AIR VALVE
NRV	PROPOSED NON-RETURN VALVE
WM	PROPOSED WATER METER
SWMH	SURFACE WATER MANHOLE
WATERMAIN ScV NRV SWMH	TYPICAL SCHEMATIC CONNECTION OF OFFLINE SCOUR VALVE
BB	PROPOSED BOUNDARY BOX AND CONNECTION

NOTES:

1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS.
3. ALL PIPE MATERIALS SHALL BE IN ACCORDANCE WITH SECTION 3.9 OF THE IRISH WATER CODE OF PRACTICE FOR WATER INFRASTRUCTURE. WATERMAINS SHALL BE EITHER DUCTILE IRON (DI) OR POLYETHYLENE (PE), WITH PE80 OR PE100 RATING (MDPE, HDPEOR HPPE). ALL PLASTIC WATER PIPES SHALL BE BLUE IN COLOUR.
4. ALL SERVICE CONNECTIONS TO BE 25ø HDPE(SDR-17).
5. ALL WATERMAINS UNDER ROADS OR AT ROAD CROSSINGS TO BE HDPE OR DUCTILE IRON.
6. HDPE DISTRIBUTION PIPES TO BE PE-100(SDR-17).
7. DUCTILE IRON PIPES TO IS EN 545 WITH C40 POWER RATING.
8. AIR VALVE AND HYDRANTS COVERS, WHERE LOCATED IN GRASS AREAS, SHALL BE SURROUNDED BY A CONCRETE PLINTH, 200mm ALL ROUND AND 100mm DEEP FORMED WITH C20/25 CONCRETE, 20mm AGGREGATE SIZE, BEDDED IN CLAUSE 804 MATERIAL. THE PLINTH SHALL INCORPORATE MILD STEEL REINFORCED LINKS AND SHALL HAVE BULL-NOSE FINISH AROUND ITS EXTERNAL PERIMETER.
9. THRUST BLOCKS SHALL BE PROVIDED AT EACH BEND ALONG THE COURSE OF THE WATERMAIN.
10. PLANTING ADJACENT TO WATER INFRASTRUCTURE SHALL COMPLY WITH IRISH WATER STANDARD DETAIL STD-W-12A.
11. HORIZONTAL AND VERTICAL SERVICE LAYOUT DISTANCES SHALL BE AS PER IRISH WATER STANDARD DETAIL STD-W-11.
12. IT IS THE CONTRACTORS RESPONSIBILITY TO ENSURE THAT ALL WORKS ARE CONSTRUCTED IN ACCORDANCE WITH THE IRISH WATER CODE OF PRACTICE AND STANDARD DETAILS. THE CODE OF PRACTICE AND STANDARD DETAILS ARE AVAILABLE TO DOWNLOAD FROM THE IRISH WATER WEB SITE AT WWW.WATER.IE/CONNECTIONS/DEVELOPER-SERVICES/ WHERE THE DETAILS CONTAINED ON THIS DRAWING DIFFER FROM THE IRISH WATER CODE OF PRACTICE OR STANDARD DETAILS THIS MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER IMMEDIATELY. IRISH WATER STANDARDS WILL TAKE PRECEDENCE.

1:250 0 5.0 10.0 15.0 20.0 25.0m
1:1 0 10 20 30 40 50 60 70 80 90 100

REV.	DATE	AMENDMENT	DRN	APPD

STATUS **FOR PLANNING**
NOT FOR CONSTRUCTION

Waterman Moylan
Engineering Consultants
BLOCK S, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD,
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Tel: (01) 664 8900 Fax: (01) 661 3618
Email: info@waterman-moylan.ie www.waterman-moylan.ie

CLIENT **MARLET PROPERTY GROUP**
ARCHITECT **PLUS ARCHITECTURE**

PROJECT
BALSCADDEN, HOWTH

TITLE
PROPOSED WATERMAIN LAYOUT

DRAWN	DESIGNED	APPROVED	DATE
PJD	SDN	MD	JULY 21'

SCALE	JOB NO.	DRG. NO.	REVISION
1:250 @ A1	21-032	P030	

C. GDSDS Attenuation Calculations

Waterman Moylan
Engineering Consultants

Block S, EastPoint Business Park,
Alfie Byrne Road, Dublin D03 H3F4
t 01 664 8900 f 01 661 3618 e info@waterman-moylan.ie

Calculation By:	SDN
Approved by:	JG

Project Data

Project Name	Balscadden, Howth
Project Number	21-032
Client	Balscadden GP3 Ltd.
Architect	Plus Architecture
Status	Planning
Date	16/03/2022

Description		%	Area
Total Site Area		-	14,300m²
Paved Area	Total	60%	8,580m²
	Drained	100%	8,580m²
Soil Area	Total	40%	5,720m²
	Drained	0%	0m²

Soil Type:	Type 4
SPR Index (from FSR):	0.47
SAAR:	902mm
Rain Data:	Dublin Airport
Climate Change Factor:	20%

Greenfield Runoff:

$Q_{BARrural}$ = $0.00108 \times Area^{0.89} \times SAAR^{1.17} \times Soil^{2.17}$

Area = 0.0143km² *… Total site area in km²*
SAAR = 902mm *… Standard Average Annual Rainfall in mm*
SOIL = 0.47 *… The "SPR" index from FSR*

Note: Where a site is <0.5km², the $Q_{BARrural}$ formula should be applied for 0.5km² and the result factored based on the ratio of the actual site area and the applied area.

$Q_{BARrural}$ = 0.009m³/s
$Q_{BARrural}$ = 9.288 l/s
$Q_{BARrural}$ = 6.495 l/s/Ha

Return Period	1-year	30-year	100-year
Growth Factor	0.85	2.10	2.60
Q_{BAR} (l/s)	7.89	19.50	24.15
Q_{BAR} (l/s/Ha)	5.52	13.64	16.89
Allowable Discharge	9.29	9.29	9.29

Rainfall Data:

Rain Data From: Dublin Airport
Climate Change Factor: 20%

Duration	Return Period *(Years)*						
(Hours)	1	5	10	20	30	50	100
0.5	9.0	14.4	17.9	22.0	24.2	28.8	33.6
1	12.0	18.6	22.9	27.6	30.4	36.0	42.0
2	15.7	23.8	28.8	34.8	37.6	43.2	50.4
4	21.2	31.2	37.2	43.2	46.4	52.8	61.2
6	25.6	37.2	43.2	50.4	54.4	62.4	70.8
12	32.4	46.8	18.0	63.6	68.0	76.8	86.4

Waterman Moylan
Engineering Consultants

Block S, EastPoint Business Park,
Alfie Byrne Road, Dublin D03 H3F4
t 01 664 8900 f 01 661 3618 e info@waterman-moylan.ie

Calculation By:	SDN
Approved by:	JG

Summary

Project Name	Balscadden, Howth
Project Number	21-032
Client	Balscadden GP3 Ltd.
Architect	Plus Architecture
Status	Planning
Date	16/03/2022

Summary of GDSDS Calculations:

Criterion 1: River Protection Volume

Interception Volume	**34.32m³**
Treatment Volume	**102.96m³**

Criterion 2: River Regime Protection

1-in-1-Year Storm	86.90m³
1-in-30-Year Storm	196.58m³
1-in-100-Year Storm	140.75m³
Reduction of Long-Term Storage	-124.33m³
Volume Required	**299.90m³**

… Includes head-loss correction

Criterion 4: River Flood Protection

Long Term Storage *(no interception provided)*	**124.33m³**
Long Term Storage *(Interception provided)*	**90.01m³**

Total Attenuation Volume Requirement:

1-in-100 Year Storm

1-in-1-Year Storm	86.90m³
1-in-30-Year Storm	196.58m³
1-in-100-Year Storm	140.75m³
Total	**424.23m³**

The maximum attenuation volume required is 424.23m³

Waterman Moylan
Engineering Consultants

Block S, EastPoint Business Park,
Alfie Byrne Road, Dublin D03 H3F4
t 01 664 8900 f 01 661 3618 e info@waterman-moylan.ie

Calculation By:	SDN
Approved by:	JG

Criterion 1
River Protection Volume

Project Name	Balscadden, Howth
Project Number	21-032
Client	Balscadden GP3 Ltd.
Architect	Plus Architecture
Status	Planning
Date	16/03/2022

1.1 Interception

Paved surfaces connected to drainage system	*14300m² x 0.6 x 1 =* 8,580.00m²	*14,300m² site area* *60% of the site is paved* *100% of the paved area*
Volume of Interception Storage	*8580m² x 5mm x 0.8 =* **34.32m³**	*Paved area directly drained* *5mm rainfall depth* *80% paved runoff factor*

1.2 Treatment Volume

Paved surfaces draining to river	*14300m² x 0.6 x 1 =* 8,580.00m²	*14,300m² site area* *60% of the site is paved* *100% of the paved area*
Volume of Treatment Storage	*8580m² x 15mm x 0.8 =* **102.96m³**	*Paved area directly drained* *15mm rainfall depth* *80% runoff from paved surfaces*

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Criterion 2
River Regime Protection

Project Name	Balscadden, Howth
Project Number	21-032
Client	Balscadden GP3 Ltd.
Architect	Plus Architecture
Status	Planning
Date	16/03/2022
Calculation By:	SDN
Approved by:	JG

1-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff *= Rainfall Rate x Area x Soil Type*				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m^3	l/s	m^3	l/s	m^3
0.5	50.00	42.90	0.00	42.90	77.2	9.29	16.7	33.61	60.5
1	33.33	28.60	0.00	28.60	103.0	9.29	33.4	19.31	69.5
2	21.83	18.73	0.00	18.73	134.9	9.29	66.9	9.45	68.0
4	14.75	12.66	0.00	12.66	182.2	9.29	133.7	3.37	48.5
6	11.83	10.15	0.00	10.15	219.3	9.29	200.6	0.87	18.7
12	7.50	6.44	0.00	6.44	278.0	6.44	278.0	0.00	0.0

30-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff *= Rainfall Rate x Area x Soil Type*				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m^3	l/s	m^3	l/s	m^3
0.5	134.67	115.54	0.00	115.54	208.0	9.29	10.6	106.26	121.7
1	84.43	72.44	0.00	72.44	260.8	9.29	23.2	63.16	157.8
2	52.22	44.80	0.00	44.80	322.6	9.29	48.7	35.51	186.2
4	32.23	27.65	0.00	27.65	398.1	9.29	98.6	18.36	194.9
6	25.18	21.61	0.00	21.61	466.7	9.29	148.2	12.32	196.6
12	15.74	13.51	0.00	13.51	583.5	9.29	248.2	4.22	112.7

100-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff *= Rainfall Rate x Area x Soil Type*				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m^3	l/s	m^3	l/s	m^3
0.5	186.67	160.16	0.00	160.16	288.3	9.29	0.3	150.87	5.5
1	116.67	100.10	0.00	100.10	360.4	9.29	6.2	90.81	60.8
2	70.00	60.06	0.00	60.06	432.4	9.29	18.2	50.77	99.5
4	42.50	36.47	0.00	36.47	525.1	9.29	42.8	27.18	125.3
6	32.78	28.12	0.00	28.12	607.5	9.29	69.4	18.84	140.7
12	20.00	17.16	0.00	17.16	741.3	9.29	87.3	7.87	74.0

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Criterion 4

River Flood Protection

Project Name	Balscadden, Howth
Project Number	21-032
Client	Balscadden GP3 Ltd.
Architect	Plus Architecture
Status	Planning
Date	16/03/2022

Calculation By:	SDN
Approved by:	JG

Vol_{XS} = RD x A x 10 [(PIMP/100 x α0.8) + (1 - (PIMP/100))(β x Soil) - Soil]

Vol_{XS} *… Extra runoff volume of development over Greenfield runoff*
RD = 71 mm *… Rainfall depth of the 100 year, 6 hour event mm*
A = 1.430 Ha *… Area of site*
PIMP = 60% *… Impermeable area of total site*
α0.8 = 100% *… Proportion of paved area drained to drainage network or river with 80% runoff*
β = 60% *… Proportion of pervious area drained to the network or river*
Soil = 0.47 *… SPR index*

Vol_{XS} = 124.33m³

D. Site Investigation Report

S.I. Ltd Contract No: 5836

Client:	Marlet
Engineer:	Waterman Moylan
Contractor:	Site Investigations Ltd

Balscadden,
Howth, Co. Dublin
Site Investigation Report

Prepared by:

....

Stephen Letch

Issue Date:	13/07/2021
Status	Final
Revision	2

Contents: Page No.

Appendices:

1. Introduction

On the instructions of Waterman Moylan, Site Investigations Ltd (SIL) was appointed to complete a ground investigation at Balscadden, Howth, Co. Dublin. The investigation was completed for a residential development on the site and was completed on behalf of the Client, Marlet. The investigation was completed in June 2021.

2. Site Location

The site is located on the Balscadden Road, Howth, Co. Dublin, on the Howth peninsula to the east of Dublin city. The map of the Dublin (below left) shows the location of Howth and the second map shows the boundary of the site in Howth.

3. Fieldwork

The fieldworks comprised a programme of cable percussive boreholes and trial pits. All fieldwork was carried out in accordance with BS 5930:2015, Engineers Ireland GI Specification and Related Document 2nd Edition 2016 and Eurocode 7: Geotechnical Design.

The fieldworks comprised the following:

- 3 No. cable percussive boreholes
- 3 No. trial pits

3.1. Cable Percussion Boreholes with Rotary Coreholes

Cable percussion boring was undertaken at 3 No. locations using a Dando 150 rig and constructed 200mm diameter boreholes. The boreholes terminated at depths ranging from 13.00mbgl (BH03) to 17.20mbgl (BH02) when obstructions were encountered. It was not possible to collect undisturbed samples due to the granular soils encountered so bulk disturbed samples were recovered at regular intervals.

To test the strength of the stratum, Standard Penetration Tests (SPT's) were performed at 1.00m intervals in accordance with BS 1377 (1990). In soils with high gravel and cobble content it is appropriate to use a solid cone (60°) (CPT) instead of the split spoon and this was used throughout the testing. The test is completed over 450mm and the cone is driven 150mm into the stratum to ensure that the test is conducted over an undisturbed zone. The cone is then driven the remaining 300mm and the blows recorded to report the N-Value. The report shows the N-Value with the 75mm incremental blows listed in brackets (e.g., BH01 at 1.00mbgl where N=17(2,4/4,5,4,4). Where refusal of 50 blows across the test zone was encountered was achieved during testing, the penetration depth is also reported (e.g., BH01 at 13.00mbgl where N=50-(25 for 125mm/50 for 90mm)).

Groundwater monitoring standpipes were installed, upon instruction from Minerex Ltd, and consisted of slotted pipe surrounded by a gravel response zone with bentonite seals.

The cable percussive borehole logs are presented in Appendix 1.

3.2. Trial Pits

3 No. trial pits were excavated using a wheeled excavator. The strata were logged and photographed by SIL geotechnical engineer and groundwater ingresses and pit wall stability was also recorded. Representative disturbed bulk samples were recovered as the pits were excavated, which were returned to the laboratory for geotechnical testing.

The trial pit logs and photographs are presented in Appendix 2.

3.3. Surveying

Following completion of all the fieldworks, a survey of the exploratory hole locations was completed using a GeoMax GPS Rover. The data is supplied on each individual log and along with a site plan in Appendix 4.

4. Laboratory Testing

Laboratory testing has been performed on representative soil samples, as scheduled by ByrneLooby,and these were completed in accordance of BS1377: 1990 or the relevant specification. Testing included:

- 2 No. Moisture contents
- 2 No. Atterberg limits
- 8 No. Particle size gradings
- 5 No. pH
- 5 No. Water soluble sulphate

Specialist geotechnical testing was completed on the samples by NMTL Ltd and consisted of the following:

- 1 No. Shear box

The soil laboratory test results are presented in Appendix 3.

Appendix 1

Cable Percussive Borehole Logs

Contract No:	# Cable Percussion Borehole Log	Borehole No:
5836		**BH01**

Contract:	Balscadden	Easting:	728766.929	Date Started:	16/06/2021
Location:	Howth, Co. Dublin	Northing:	739199.986	Date Completed:	18/06/2021
Client:	Marlet	Elevation:	19.98	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)	Stratum Description	Level (mOD)	Samples Depth	Type	Result	Water Strike	Backfill
0.20	MADE GROUND: tarmacadam.	19.78					
0.50	MADE GROUND: grey silty sandy gravel.	19.48					
	Medium dense brown silty sandy GRAVEL with low cobble content.		1.00 1.00	B C	JOT01 N=17 (2,4/4,5,4,4)		
			2.00 2.00	B C	JOT02 N=12 (1,2/2,3,3,4)		
2.80	Loose becoming medium dense light brown silty gravelly SAND.	17.18	3.00 3.00	B C	JOT03 N=7 (1,1/1,2,2,2)		
			4.00 4.00	B C	JOT04 N=15 (1,2/3,3,4,5)		
			5.00 5.00	B C	JOT05 N=20 (2,2/3,4,6,7)		
5.50	Light brown slightly silty gravelly SAND.	14.48					
6.00	Medium dense becoming dense light brown slightly silty gravelly SAND.	13.98	6.00 6.00	B C	JOT06 N=21 (2,2/4,5,6,6)		
			7.00 7.00	B C	JOT07 N=28 (2,4/5,7,7,9)		
			8.00 8.00	B C	JOT08 N=30 (1,3/6,7,7,10)		
			9.00 9.00	B C	JOT09 N=36 (2,4/7,9,9,11)		
			~~10.00~~	~~B~~	~~JOT10~~		

Chiselling:

From:	To:	Time:
15.00	15.20	00:45
16.40	16.50	00:45
16.80	17.00	01:00

Water Strikes:

Strike:	Rose:	Depth Sealed

Water Details:

Date:	Hole Depth:	Water Depth:
16/06	9.30	Dry
17/06	12.30	Dry
18/06	17.00	Dry

Installation:

From:	To:	Pipe:
0.00	14.00	Solid
14.00	17.00	Slotted

Backfill:

From:	To:	Type:
0.00	0.70	Bentonite
0.70	12.00	Gravel
12.00	13.00	Bentonite
13.00	17.00	Gravel

Remarks:

Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No: 5836	# Cable Percussion Borehole Log				Borehole No: **BH01**
Contract:	Balscadden	Easting:	728766.929	Date Started:	16/06/2021
Location:	Howth, Co. Dublin	Northing:	739199.986	Date Completed:	18/06/2021
Client:	Marlet	Elevation:	19.98	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Depth	Stratum Description	Level (mOD) Depth	Samples and Insitu Tests Depth	Type	Result
	Medium dense becoming dense light brown slightly silty gravelly SAND.		10.00	C	N=18 (2,3/4,4,5,5)
10.50	Very stiff brown slightly sandy gravelly silty CLAY with low cobble content and bands of gravelly sand.	9.48			
			11.00 11.00	B C	JOT11 N=24 (3,4/5,6,6,7)
			12.00 12.00	B C	JOT12 N=35 (4,5/7,9,9,10)
			13.00 13.00	B C	JOT13 50 (25 for 125mm/50 for 90mm)
			14.00 14.00	B C	JOT14 N=50 (4,9/50 for 235mm)
			15.00 15.00	B C	JOT15 50 (10,15/50 for 125mm)
			16.00 16.00	B C	JOT16 50 (11,14/50 for 100mm)
16.80	Obstruction - possible boulders.	3.18			
17.00	End of Borehole at 17.00m	2.98	17.00	C	50 (25 for 5mm/50 for 5mm)

Chiselling: From:	To:	Time:
15.00	15.20	00:45
16.40	16.50	00:45
16.80	17.00	01:00

Water Strikes: Strike:	Rose:	Depth Sealed	Water Details: Date:	Hole Depth:	Water Depth:

Installation: From:	To:	Pipe:
0.00	14.00	Solid
14.00	17.00	Slotted

Backfill: From:	To:	Type:
0.00	0.70	Bentonite
0.70	12.00	Gravel
12.00	13.00	Bentonite
13.00	17.00	Gravel

Remarks:
Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No: 5836	# Cable Percussion Borehole Log	Borehole No: **BH02**

Contract:	Balscadden	Easting:	728791.582	Date Started:	21/06/2021
Location:	Howth, Co. Dublin	Northing:	739163.531	Date Completed:	23/06/2021
Client:	Marlet	Elevation:	19.58	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Depth	Stratum Description	Level (mOD) Depth	Samples Depth	Type	Result
	MADE GROUND: tarmacadam.				
0.20	Grey slightly silty very sandy GRAVEL.	19.38			
			1.00 1.00	B C	JOT17 N=12 (1,2/2,3,3,4)
			2.00 2.00	B C	JOT18 N=15 (2,3/3,4,4,4)
3.00	Loose becoming medium dense brown silty very gravelly SAND.	16.58	3.00 3.00	B C	JOT19 N=10 (1,1/2,2,3,3)
			4.00 4.00	B C	JOT20 N=8 (2,2/2,2,2,2)
			5.00 5.00	B C	JOT21 N=11 (2,2/3,3,2,3)
			6.00 6.00	B C	JOT22 N=8 (2,1/2,2,2,2)
			7.00 7.00	B C	JOT23 N=11 (3,3/2,3,3,3)
			8.00 8.00	B C	JOT24 N=15 (3,3/4,4,3,4)
8.50	Medium dense becoming dense light brown silty gravelly SAND.	11.08			
			9.00 9.00	B C	JOT25 N=13 (2,2/3,3,3,4)
9.70	Very stiff brown slightly sandy gravelly silty CLAY with	9.88			
			10.00	B	JOT26

Depth scale (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5

Level scale (mOD): 19.5, 19.0, 18.5, 18.0, 17.5, 17.0, 16.5, 16.0, 15.5, 15.0, 14.5, 14.0, 13.5, 13.0, 12.5, 12.0, 11.5, 11.0, 10.5, 10.0

Water Strike | Backfill

Chiselling: From:	To:	Time:
17.10	17.20	01:00

Water Strikes: Strike:	Rose:	Depth Sealed

Water Details: Date:	Hole Depth:	Water Depth:
21/06	3.00	Dry
22/06	12.00	Dry
23/06	17.20	Dry

Installation: From:	To:	Pipe:
0.00	9.00	Solid
9.00	17.20	Slotted

Backfill: From:	To:	Type:
0.00	1.00	Bentonite
1.00	7.00	Gravel
7.00	8.00	Bentonite
8.00	17.20	Gravel

Remarks:
Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No: 5836	# Cable Percussion Borehole Log				Borehole No: **BH02**

Contract:	Balscadden	Easting:	728791.582	Date Started:	21/06/2021
Location:	Howth, Co. Dublin	Northing:	739163.531	Date Completed:	23/06/2021
Client:	Marlet	Elevation:	19.58	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Depth	Stratum Description	Level (mOD) Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike
	low cobble content.		10.00	C	N=38 (6,7/7,9,11,11)	
10.50	Very stiff brown slightly sandy slightly gravelly silty CLAY.	9.08				
			11.00	B	JOT27	
			11.00	C	N=40 (7,8/9,9,10,12)	
			12.00	B	JOT28	
			12.00	C	N=37 (5,7/9,9,9,10)	
			13.00	B	JOT29	
			13.00	C	N=44 (4,6/10,11,11,12)	
			14.00	B	JOT30	
			14.00	C	N=39 (3,5/7,11,10,11)	
14.60	Very stiff brown slightly sandy gravelly silty CLAY with low cobble content and bands of gravelly sand.	4.98				
			15.00	B	JOT31	
			15.00	C	50 (5,11/50 for 60mm)	
			16.00	B	JOT32	
			16.00	C	50 (6,12/50 for 115mm)	
			17.00	C	50 (23 for 95mm/50 for 5mm)	
17.10	Obstruction - possible boulders.	2.48	17.10	B	JOT33	
17.20	End of Borehole at 17.20m	2.38				

Chiselling: From:	To:	Time:
17.10	17.20	01:00

Water Strikes: Strike:	Rose:	Depth Sealed

Water Details: Date:	Hole Depth:	Water Depth:

Installation: From:	To:	Pipe:
0.00	9.00	Solid
9.00	17.20	Slotted

Backfill: From:	To:	Type:
0.00	1.00	Bentonite
1.00	7.00	Gravel
7.00	8.00	Bentonite
8.00	17.20	Gravel

Remarks:
Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No:		Borehole No:
5836	**Cable Percussion Borehole Log**	**BH03**

Contract:	Balscadden	Easting:	728739.243	Date Started:	24/06/2021
Location:	Howth, Co. Dublin	Northing:	739069.592	Date Completed:	28/06/2021
Client:	Marlet	Elevation:	19.42	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)	Stratum Description	Level (mOD)
0.10	MADE GROUND: tarmacadam.	19.32
0.60	MADE GROUND: grey sandy gravel with medium cobble content and some red brick and concrete fragments.	18.82
2.80	Medium dense light brown silty gravelly SAND.	16.62
4.90	Medium dense yellow slightly silty SAND.	14.52
6.40	Medium dense light brown silty gravelly SAND.	13.02
7.50	Stiff brown slightly sandy gravelly silty CLAY with low cobble content.	11.92
	Very stiff black slightly sandy gravelly silty CLAY with low cobble content.	

Samples and Insitu Tests

Depth	Type	Result
1.00	B	JOT34
1.00	C	N=18 (2,3/4,4,5,5)
2.00	B	JOT35
2.00	C	N=21 (2,4/5,5,5,6)
3.00	B	JOT36
3.00	C	N=23 (4,5/5,6,6,6)
4.00	B	JOT37
4.00	C	N=19 (2,4/4,5,5,5)
5.00	B	JOT38
5.00	C	N=15 (2,2/3,4,4,4)
6.00	B	JOT39
6.00	C	N=24 (2,4/5,6,6,7)
7.00	B	JOT40
7.00	C	N=30 (2,5/7,7,7,9)
8.00	B	JOT41
8.00	C	50 (25 for 135mm/50 for 10mm)
9.00	B	JOT42
9.00	C	50 (5,7/50 for 100mm)
10.00	B	JOT43

Chiselling:

From:	To:	Time:
12.80	13.00	01:00

Water Strikes:

Strike:	Rose:	Depth Sealed
4.80	4.50	6.80

Water Details:

Date:	Hole Depth:	Water Depth:
24/06	3.50	Dry
25/06	10.50	10.20
28/06	13.00	3.80

Installation:

From:	To:	Pipe:
0.00	4.00	Solid
4.00	13.00	Slotted

Backfill:

From:	To:	Type:
0.00	3.00	Bentonite
3.00	13.00	Gravel

Remarks:

Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No:	Cable Percussion Borehole Log	Borehole No:
5836		**BH03**

Contract:	Balscadden	Easting:	728739.243	Date Started:	24/06/2021
Location:	Howth, Co. Dublin	Northing:	739069.592	Date Completed:	28/06/2021
Client:	Marlet	Elevation:	19.42	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)	Stratum Description	Level (mOD) Depth	Samples Depth	Type	Result	Water Strike
	Very stiff black slightly sandy gravelly silty CLAY with low cobble content.		10.00	C	50 (25 for 125mm/50 for 110mm)	
			11.00	B	JOT44	
			11.00	C	50 (25 for 125mm/50 for 100mm)	
			12.00	B	JOT45	
			12.00	C	50 (25 for 115mm/50 for 25mm)	
12.80	Obstruction - possible boulders.	6.62	12.80	B	JOT46	
13.00	End of Borehole at 13.00m	6.42	13.00	C	50 (25 for 5mm/50 for 5mm)	

Chiselling:			Water Strikes:			Water Details:		
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:
12.80	13.00	01:00	4.80	4.50	6.80			

Installation:			Backfill:		
From:	To:	Pipe:	From:	To:	Type:
0.00	4.00	Solid	0.00	3.00	Bentonite
4.00	13.00	Slotted	3.00	13.00	Gravel

Remarks:
Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Appendix 2

Trial Pit Logs and Photographs

Contract No:	# Trial Pit Log	Trial Pit No:
5836		**TP01**

Contract:	Balscadden	Easting:	728786.136	Date:	15/06/2021
Location:	Howth, Co. Dublin	Northing:	739106.863	Excavator:	JCB 3CX
Client:	Marlet	Elevation:	29.92	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	2.50 x 1.10 x 2.50	Status:	FINAL

Level (mbgl)		Stratum Description	Legend	Level (mOD)		Samples / Field Tests			Water Strike
Scale:	Depth			Scale:	Depth:	Depth	Type	Result	
	0.05	TOPSOIL.	▨		29.87				
		Brown silty slightly gravelly fine to coarse SAND with low cobble content and some gravel laminas. Gravel is fine to coarse, subrounded to rounded of various lithologies. Cobbles are subrounded to rounded of various lithologies.	⁘						
				29.5					
0.5									
				29.0					
1.0						1.00	B	MK01	
				28.5					
1.5									
				28.0					
2.0									
				27.5					
2.5	2.50	**Pit terminated at 2.50m**			27.42	2.50	B	MK02	
				27.0					
3.0									

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5836	# Trial Pit Log				Trial Pit No: **TP02**
Contract:	Balscadden	Easting:	728754.368	Date:	15/06/2021
Location:	Howth, Co. Dublin	Northing:	739110.303	Excavator:	JCB 3CX
Client:	Marlet	Elevation:	23.98	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	2.90 x 1.10 x 2.70	Status:	FINAL

Level (mbgl)		Stratum Description	Legend	Level (mOD)		Samples / Field Tests			Water Strike
Scale:	Depth			Scale:	Depth:	Depth	Type	Result	
		TOPSOIL.	▨						
	0.20	Brown silty very gravelly fine to coarse SAND with low cobble content and some gravel laminas. Gravel is fine to coarse, subrounded to rounded of various lithologies. Cobbles are subrounded to rounded of various lithologies. (Possible MADE GROUND: traces of plastic identified in pit).	⁘		23.78				
0.5				23.5					
1.0				23.0		1.00	B	MK05	
1.5				22.5					
2.0				22.0		2.00	B	MK06	
2.5				21.5					
	2.70	**Pit terminated at 2.70m**			21.28				
3.0				21.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No:	Trial Pit Log				Trial Pit No:
5836					**TP03**
Contract:	Balscadden	Easting:	728736.781	Date:	15/06/2021
Location:	Howth, Co. Dublin	Northing:	739134.128	Excavator:	JCB 3CX
Client:	Marlet	Elevation:	20.47	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	2.50 x 1.10 x 3.00	Status:	FINAL

Level (mbgl) Scale:	Level (mbgl) Depth	Stratum Description	Legend	Level (mOD) Scale:	Level (mOD) Depth:	Samples / Field Tests Depth	Samples / Field Tests Type	Samples / Field Tests Result	Water Strike
	0.05	TOPSOIL.	▨		20.42				
		MADE GROUND: grey brown silty very gravelly sand with low cobble content and some plastic fragments.	▨						
	0.20	Brown silty gravelly fine to coarse SAND with some gravel laminas. Gravel is fine to coarse, subrounded to rounded of various lithologies.	▨		20.27				
0.5				20.0					
	0.90	Grey brown silty very gravelly fine to coarse SAND with medium cobble content. Gravel is fine to coarse, subrounded to rounded of various lithologies. Cobbles are subrounded to rounded of various lithologies.	▨		19.57				
1.0				19.5		1.00	B	MK03	
1.5				19.0					
2.0				18.5		2.00	B	MK04	
2.5				18.0					
3.0	3.00	**Pit terminated at 3.00m**		17.5	17.47				

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

TP01 Sidewall

TP01 Spoil

TP02 Sidewall

TP02 Spoil

TP03 Sidewall

TP03 Spoil

Appendix 3

Geotechnical Laboratory Test Results

Classification Tests in accordance with BS1377: Part 4

Client	Marlet
Site	Balscadden, Howth
S.I. File No	5836 / 21
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email info@siteinvestigations.ie
Report Date	6th July 2021

Hole ID	Depth	Sample No	Lab Ref No.	Sample Type	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plastic Index %	Min. Dry Density Mg/m^3	Particle Density Mg/m^3	% passing 425um	Comments	**Remarks** **C**=Clay; **M**=Silt **Plasticity**: **L**=Low; **I**=Intermediate; **H**=High; **V**=Very High; **E**=Extremely High
BH01	12.00	JOT12	21/838	B	12.1	34	20	14			63.2		CL
BH02	16.00	JOT32	21/842	B	18.5	38	24	14			50.9		CI

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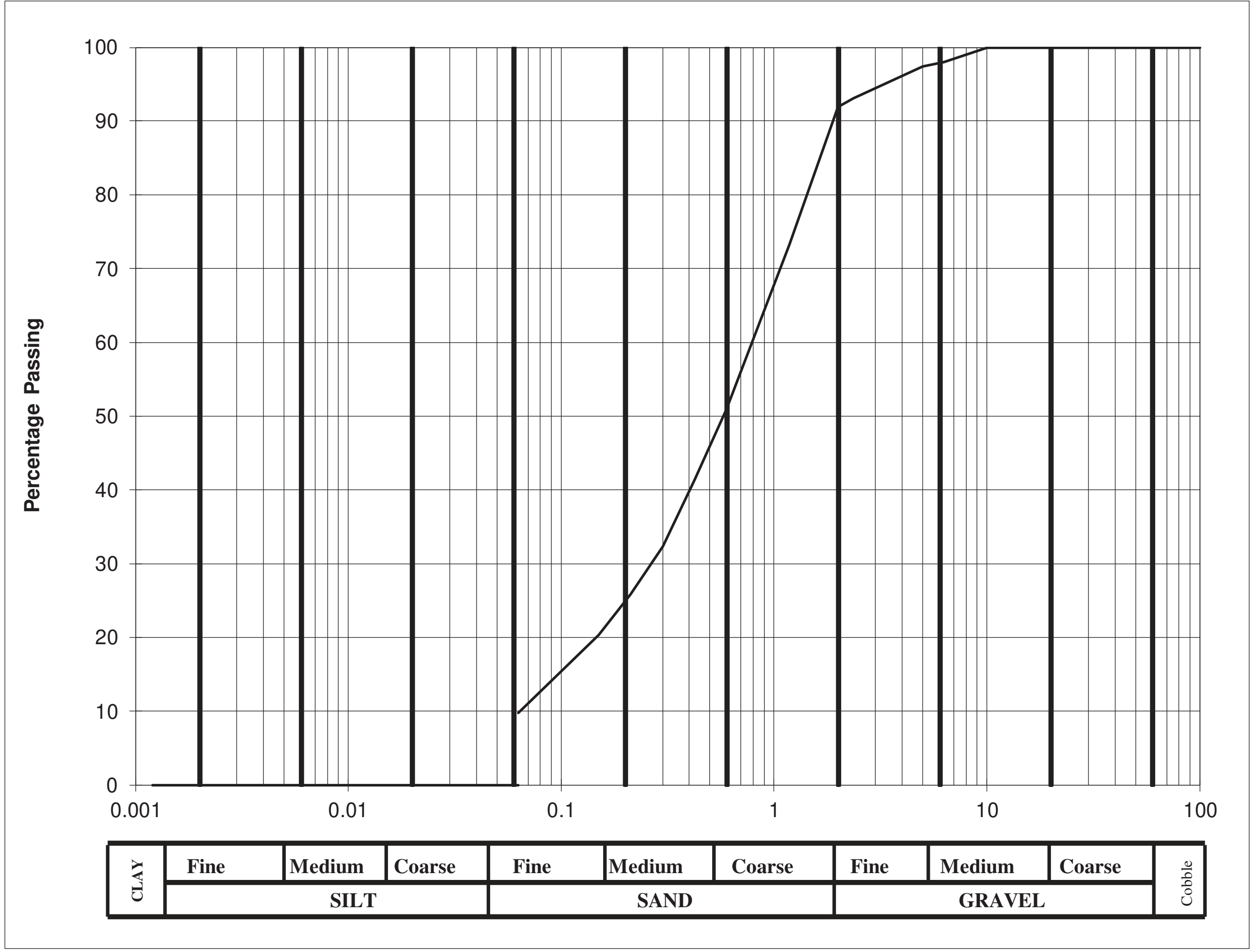
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	98		
5.0	97.4		
2.36	93.1		
2.00	91.9		
1.18	73.2		
0.600	50.9		
0.425	41.4		
0.300	32.3		
0.212	25.8		
0.150	20.3		
0.063	10		

Cobbles, %	0
Gravel, %	8
Sand, %	82
Clay / Silt, %	10



Client :	Marlet	Lab. No :	21/836	Hole ID :	BH 01
Project :	Balscadden, Howth	Sample No :	JOT04	Depth, m :	4.00

Material description :	silty gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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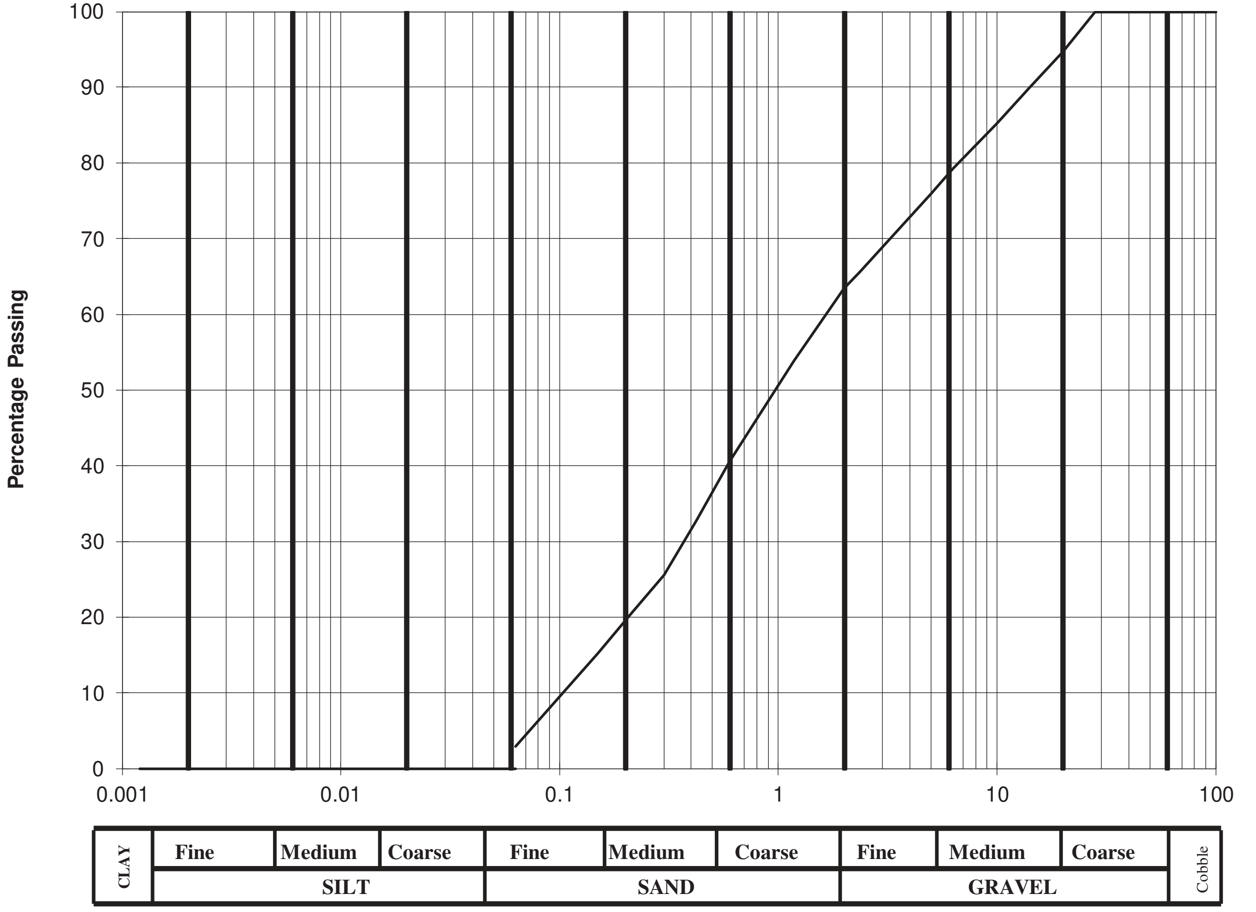
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis Diameter, mm	 % passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	94.7		
14	89.9		
10	85.2		
6.3	79.2		
5.0	75.9		
2.36	65.6		
2.00	63.4		
1.18	53.9		
0.600	40.5		
0.425	32.8		
0.300	25.6		
0.212	20.4		
0.150	15.3		
0.063	3		

Cobbles, %	0
Gravel, %	37
Sand, %	60
Clay / Silt, %	3



Client :	Marlet	Lab. No :	21/837	Hole ID :	BH 01
Project :	Balscadden, Howth	Sample No :	JOT08	Depth, m :	8.00

Material description :	slightly silty gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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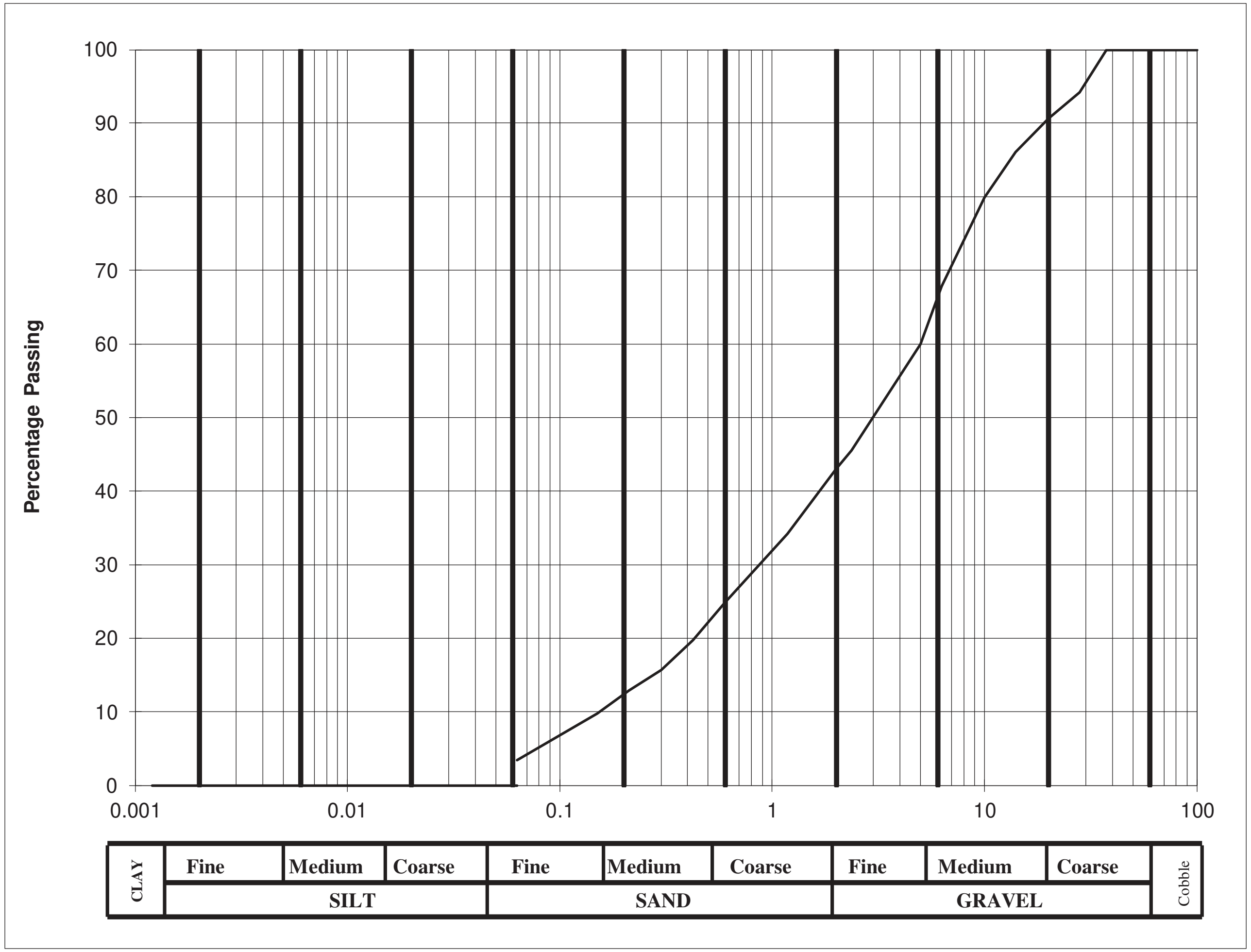
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	94.2		
20	90.6		
14	86.1		
10	79.9		
6.3	67.8		
5.0	60		
2.36	45.5		
2.00	43		
1.18	34.2		
0.600	24.8		
0.425	19.7		
0.300	15.7		
0.212	12.9		
0.150	9.8		
0.063	4		

Cobbles, %	0
Gravel, %	57
Sand, %	39
Clay / Silt, %	4



Client :	Marlet	Lab. No :	21/839	Hole ID :	BH 02
Project :	Balscadden, Howth	Sample No :	JOT18	Depth, m :	2.00

Material description :	slightly silty very sandy GRAVEL
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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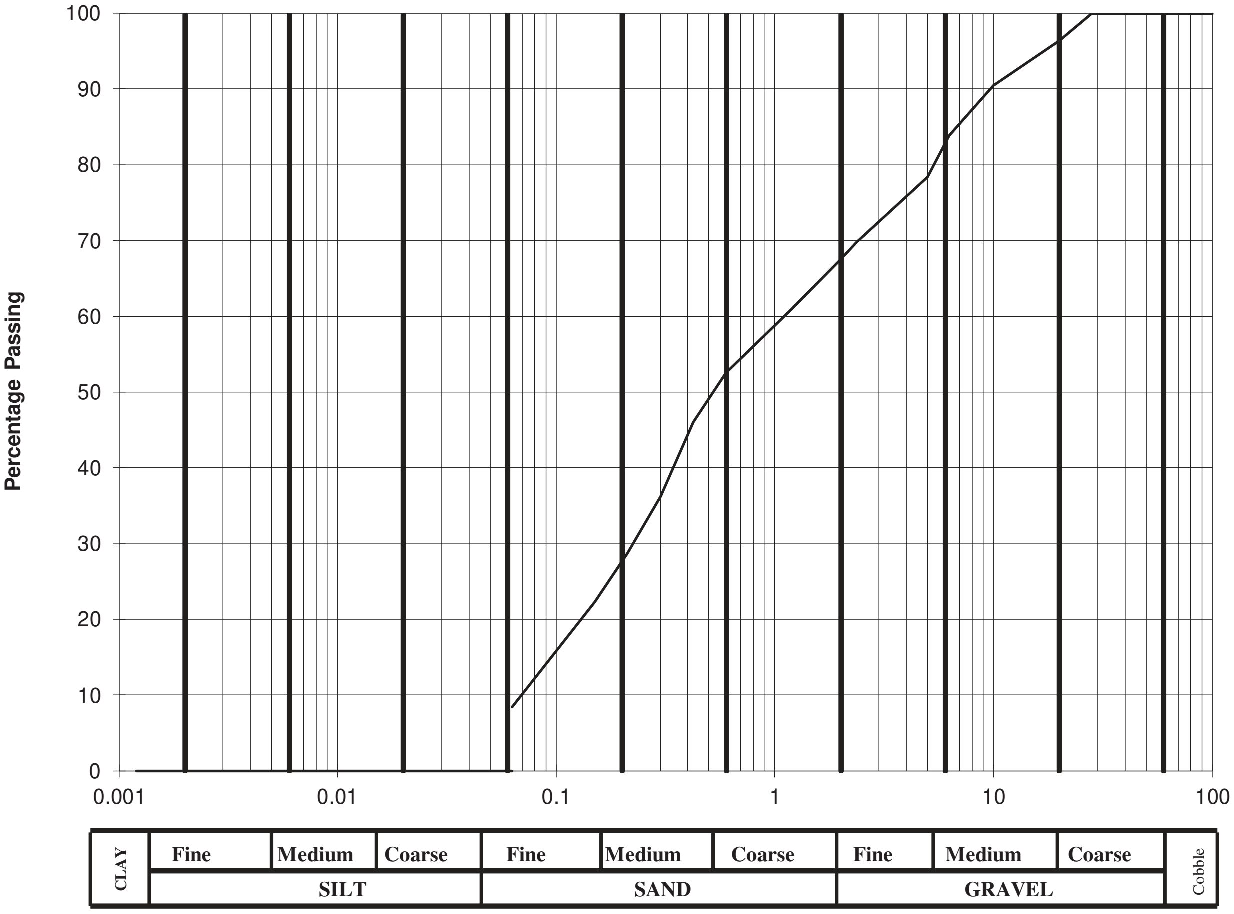
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	96.4		
14	93.3		
10	90.5		
6.3	83.9		
5.0	78.4		
2.36	69.8		
2.00	67.5		
1.18	60.8		
0.600	52.5		
0.425	46		
0.300	36.2		
0.212	28.7		
0.150	22.3		
0.063	9		

Cobbles, %	0
Gravel, %	33
Sand, %	59
Clay / Silt, %	9



Client :	Marlet		Lab. No :	21/840		Hole ID :	BH 02
Project :	Balscadden, Howth		Sample No :	JOT21		Depth, m :	5.00

Material description :	silty very gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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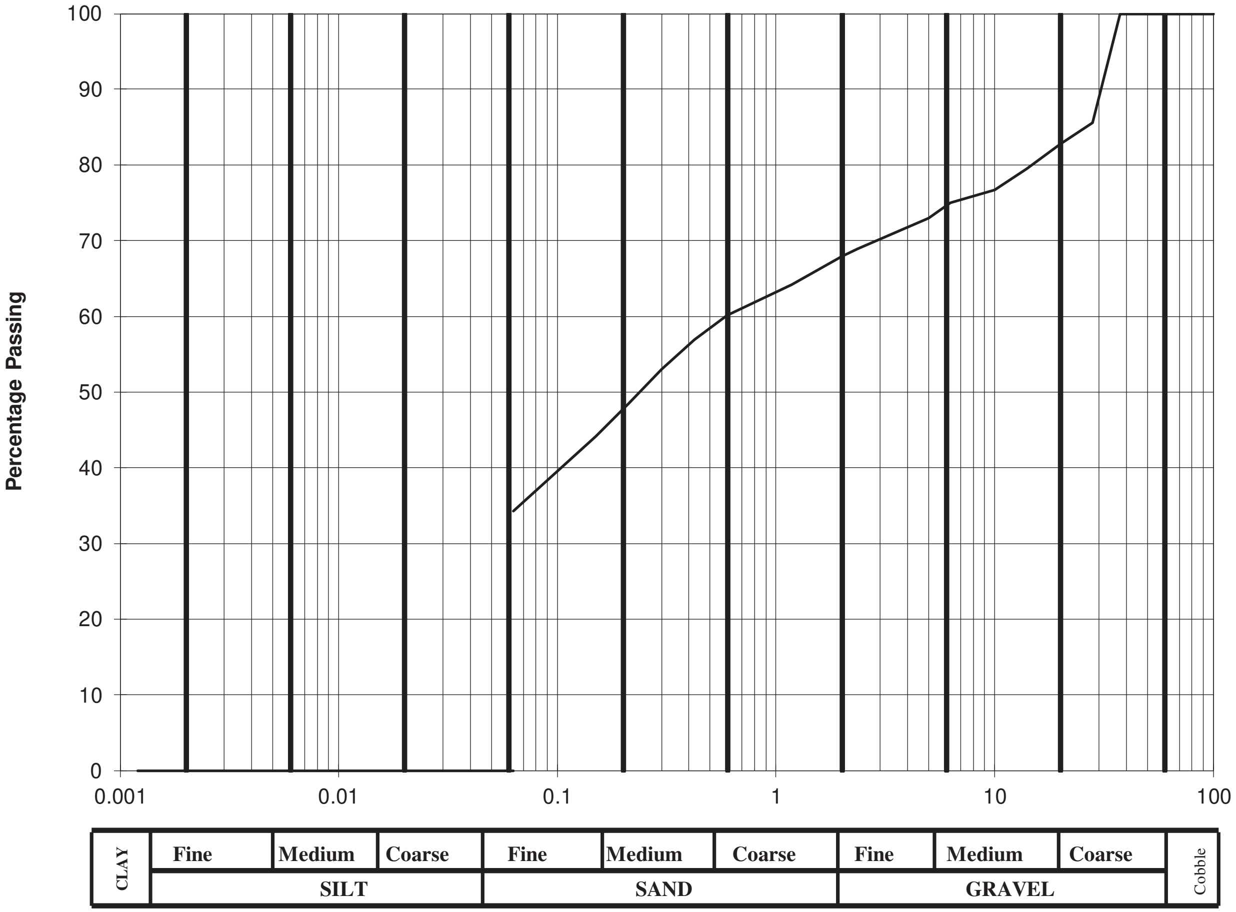
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	85.6		
20	82.8		
14	79.5		
10	76.7		
6.3	75		
5.0	73		
2.36	68.9		
2.00	67.9		
1.18	64.2		
0.600	60.1		
0.425	56.9		
0.300	53		
0.212	48.5		
0.150	44.2		
0.063	34		

Cobbles, %	0
Gravel, %	32
Sand, %	34
Clay / Silt, %	34



Client :	Marlet	Lab. No :	21/841	Hole ID :	BH 02
Project :	Balscadden, Howth	Sample No :	JOT29	Depth, m :	13.00

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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Site Investigations Ltd

BS 1377 Particle Size Analysis

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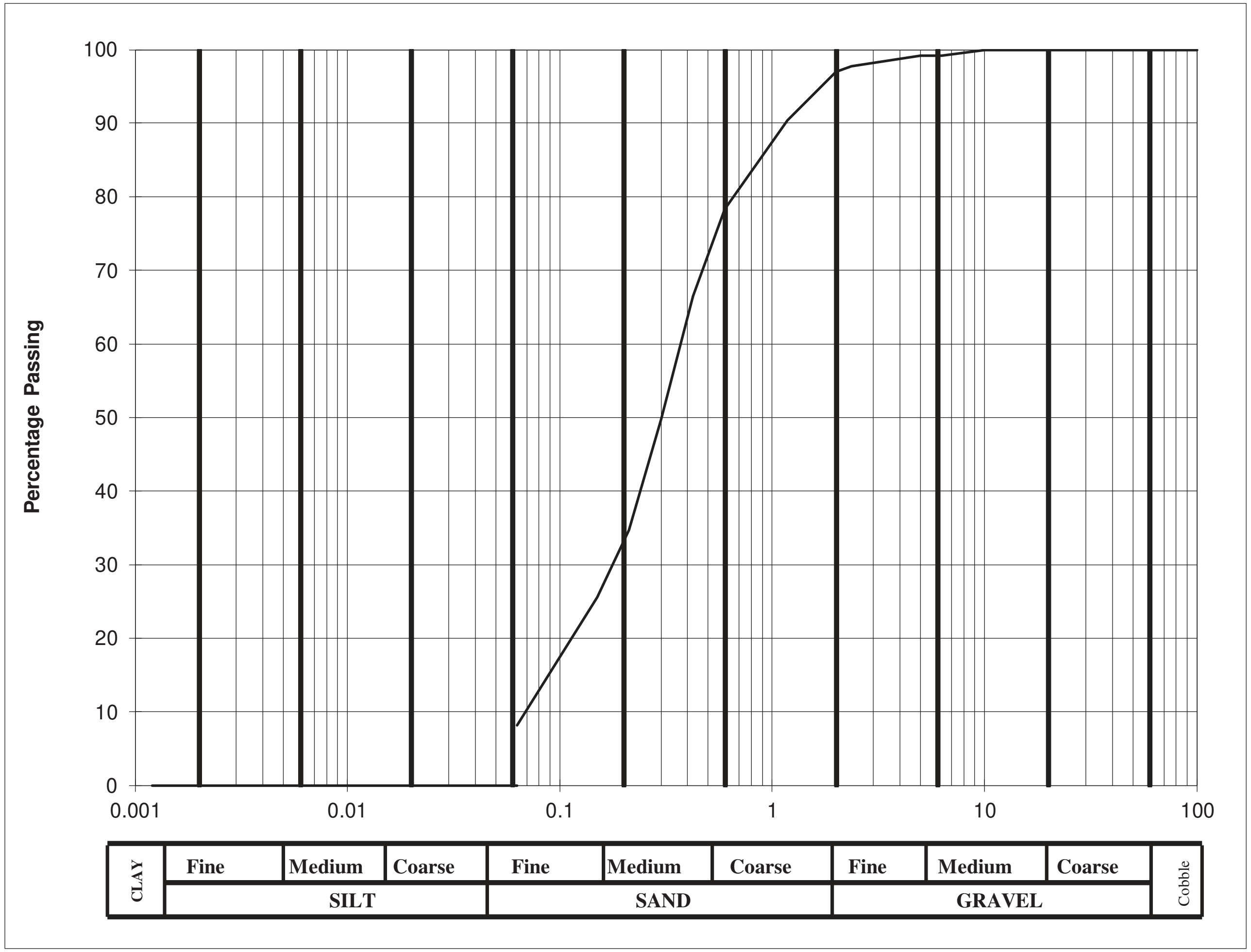
BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99.2		
5.0	99.2		
2.36	97.7		
2.00	97		
1.18	90.4		
0.600	78.3		
0.425	66.5		
0.300	49.8		
0.212	34.7		
0.150	25.6		
0.063	8		

Cobbles, %	0
Gravel, %	3
Sand, %	89
Clay / Silt, %	8



Client :	Marlet		Lab. No :	21/833	Hole ID :	TP 01
Project :	Balscadden, Howth		Sample No :	MK01	Depth, m :	1.00

Material description :	silty slightly gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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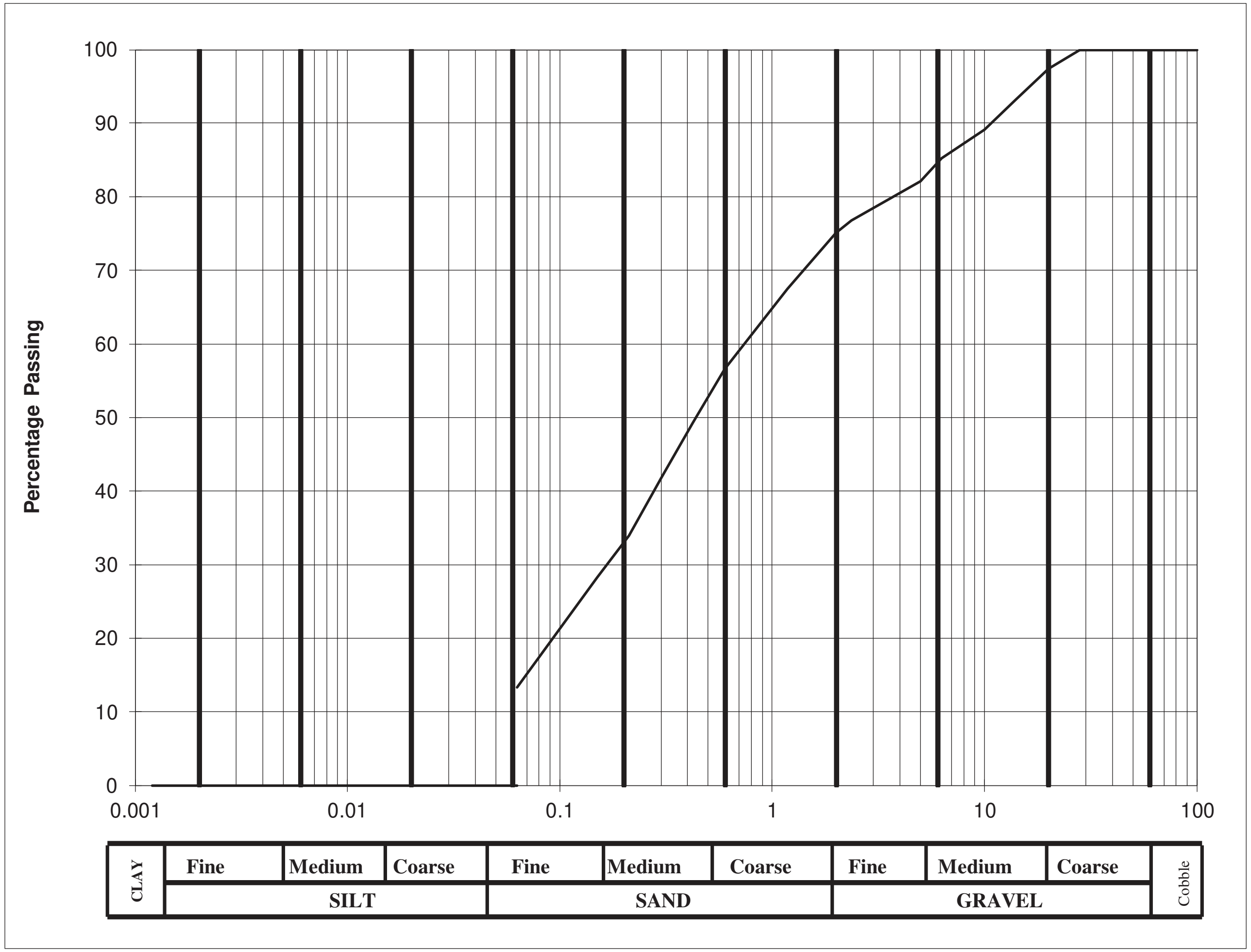
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	97.4		
14	93.2		
10	89.1		
6.3	85.2		
5.0	82.1		
2.36	76.8		
2.00	75.1		
1.18	67.5		
0.600	56.6		
0.425	49.3		
0.300	41.8		
0.212	33.9		
0.150	28.3		
0.063	13		

Cobbles, %	0
Gravel, %	25
Sand, %	62
Clay / Silt, %	13



Client :	Marlet		Lab. No :	21/834		Hole ID :	TP 02
Project :	Balscadden, Howth		Sample No :	MK06		Depth, m :	2.00

Material description :	silty very gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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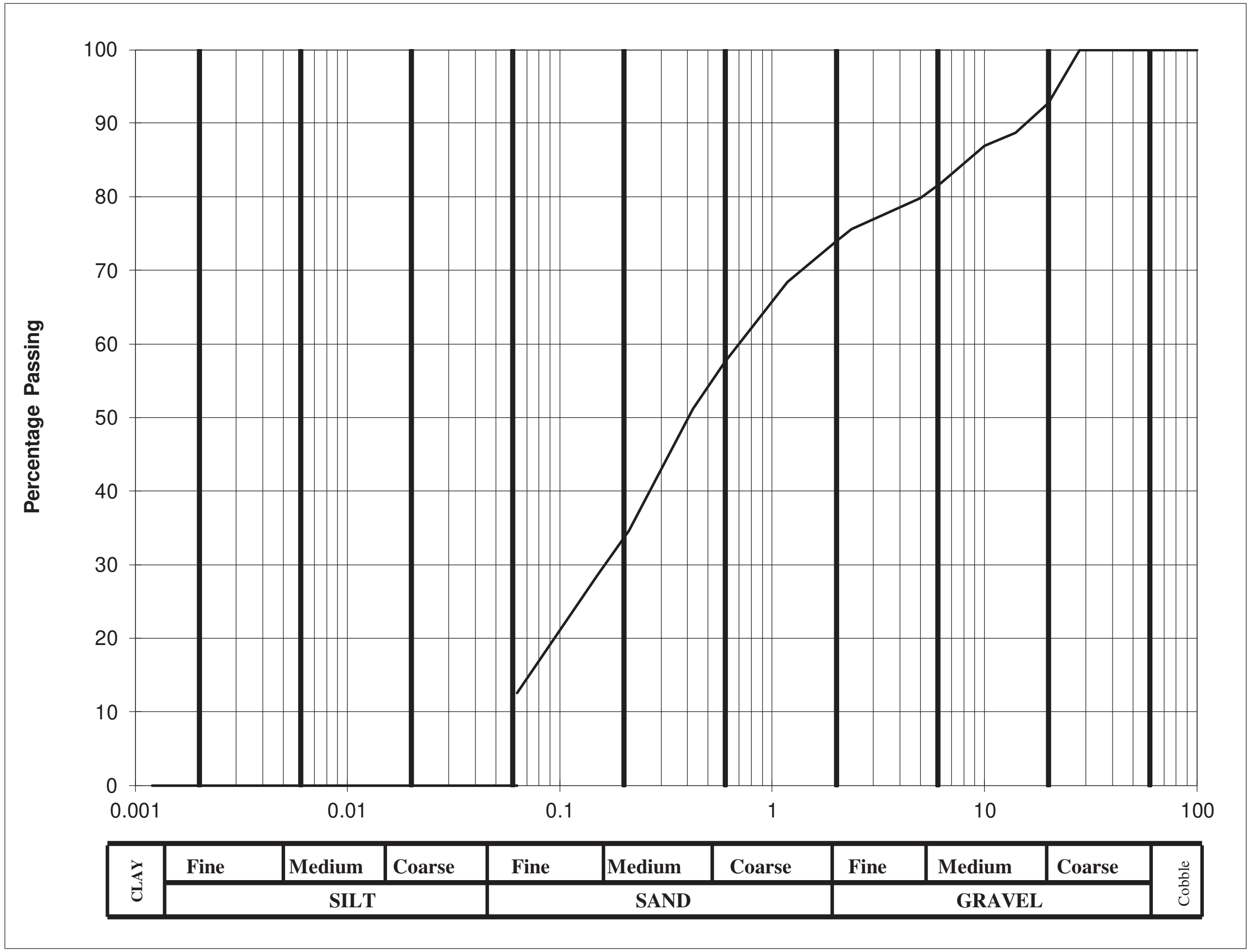
Site Investigations Ltd

BS 1377 Particle Size Analysis

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	92.7		
14	88.7		
10	86.9		
6.3	81.9		
5.0	79.8		
2.36	75.6		
2.00	73.9		
1.18	68.4		
0.600	57.5		
0.425	51.2		
0.300	43		
0.212	34.6		
0.150	28.5		
0.063	13		

Cobbles, %	0
Gravel, %	26
Sand, %	61
Clay / Silt, %	13



Client :	Marlet		Lab. No :	21/835		Hole ID :	TP 03
Project :	Balscadden, Howth		Sample No :	MK04		Depth, m :	2.00

Material description :	silty very gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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Chemical Testing
In accordance with BS 1377: Part 3

Client	Marlet
Site	Balscadden, Howth
S.I. File No	5836 / 21
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email:info@siteinvestigations.ie
Report Date	6th July 2021

Hole Id	Depth (mBGL)	Sample No	Lab Ref	pH Value	Water Soluble Sulphate Content (2:1 Water-soil extract) (SO_3) g/L	Water Soluble Sulphate Content (2:1 Water-soil extract) (SO_3) %	Loss on Ignition (Organic Content) %	Chloride ion Content (water:soil ratio 2:1) %	% passing 2mm	Remarks
BH01	4.00	JOT04	21/836	8.57	0.119	0.109			91.9	
BH02	5.00	JOT21	21/840	8.57	0.120	0.081			67.5	
TP01	1.00	MK01	21/833	8.56	0.122	0.118			97.0	
TP02	2.00	MK06	21/834	8.49	0.117	0.088			75.1	
TP03	2.00	MK04	21/835	8.50	0.117	0.087			73.9	

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Site Investigations Ltd.

SHEAR BOX TEST

Test Method **BS 1377 : Part 7 : 1990 : Method 4**

Preparation procedure **Remoulded with 2.5 kg rammer at natural moisture content.**
Material screened on 2mm sieve

Description **Reb/brown slightly silty slightly gravelly fine to coarse SAND.**

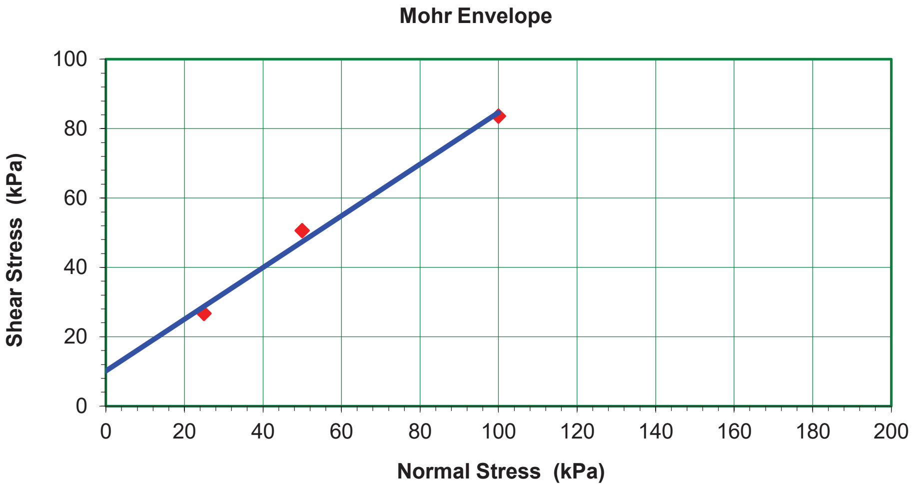
Weighings		**Stage 1**	**Stage 2**	**Stage 3**
Wet soil	gms	345.2	344.5	344.9
Dry soil	gms	160.9	160.5	160.7
Wet soil	gms	190.5	189.9	190.4
Dry soil	gms	160.9	160.5	160.7
Water	gms	29.7	29.4	29.7
Moisture Content (%)		18.4	18.3	18.5
Bulk Density (Mg/m3)		2.12	2.11	2.12
Dry density (Mg/m3)		1.79	1.78	1.79
Voids ratio e		0.5104	0.5140	0.5121
Degree of saturation (%)		97.5	96.2	97.3

Nominal Dimensions		
Length	L1 mm	60
	L2 mm	60
Area	A mm2	3600
Height	H mm	25
Volume	V cm3	90
Particle density	Mg/m3	2.70

Final Details

	Stage 1	**Stage 2**	**Stage 3**
Normal Loads(kPa)	25	50	100
Shear stress (kPa)	26.7	50.6	83.6
Horizontal Displacement (mm)	1.743	2.227	2.039
Vertical displacement (mm)	-0.169	0.015	-0.040
Rate of displacement (mm/min)		0.5000	

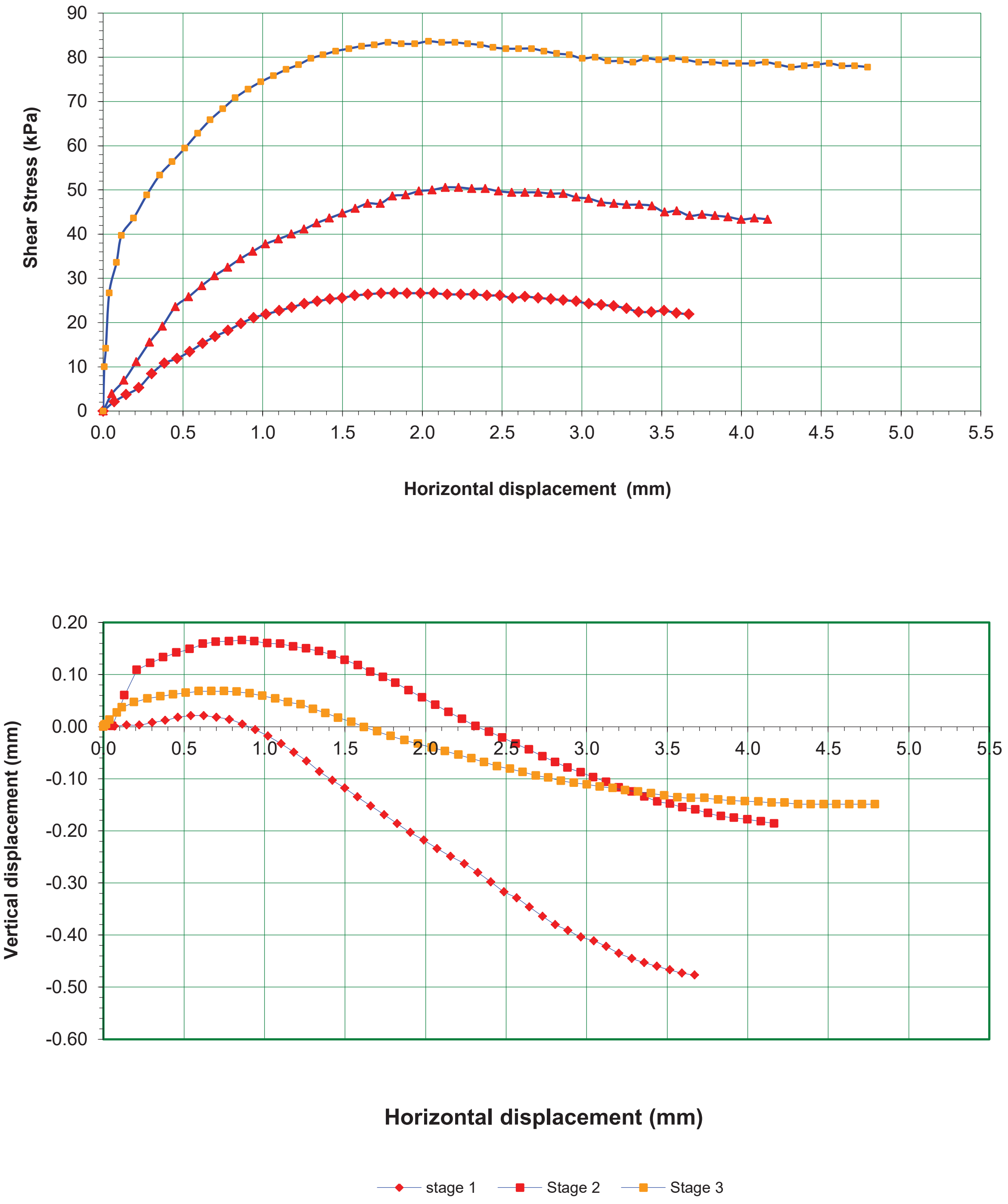
Date sampled	n/a		Peak
Date received	25/06/2021	Cohesion c' (kPa)	10.2
Date tested	08/07/2021	Friction angle phi'	36.1°



SIL PROJECT ID: 5836-21

NM T L Ltd	**Quick drained shear box in 60mm square shear box**		Job No. NMTL_3403 Borehole No. TP01
	Project Balscadden, Howth		Sample No. MK02
Operator Sb	Checked Nc	Approved Bc	Depth. 2.50m

SHEAR STAGE



SIL PROJECT ID: 5836-21

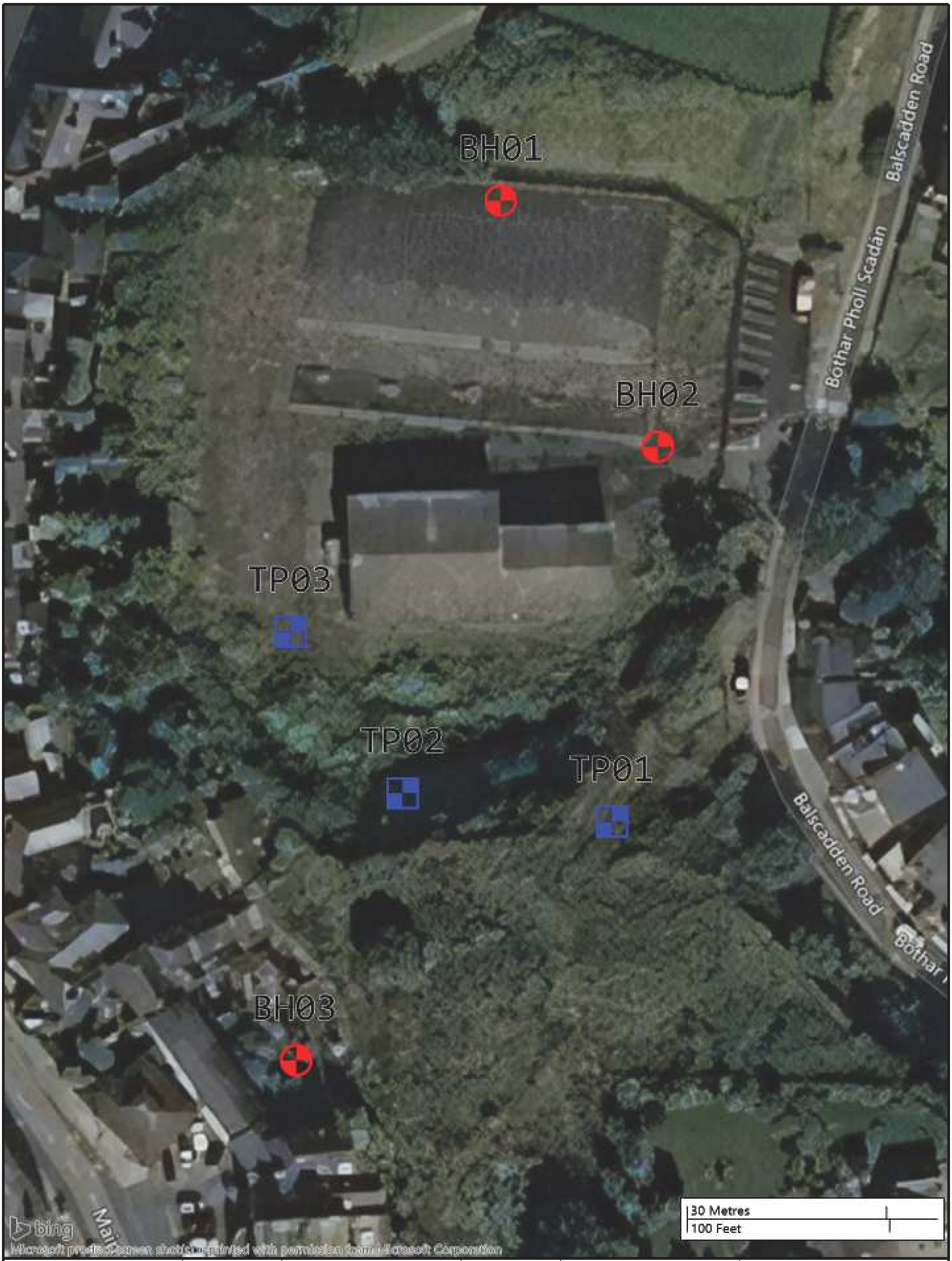
NM T L Ltd	**Quick drained shear box in 60mm square shear box**		Job No. NMTL_3403 Borehole No. TP01
	Project Balscadden, Howth		Sample No. MK02
Operator Sb	Checked Nc	Approved Bc	Depth. 2.50m

Appendix 4

Survey Data

Survey Data

Location	Irish Transverse Mercator		Elevation	Irish National Grid	
	Easting	Northing		Easting	Northing
Boreholes					
BH01	728766.929	739199.986	19.98	328844.016	239174.894
BH02	728791.582	739163.531	19.58	328868.675	239138.431
BH03	728739.243	739069.592	19.42	328816.326	239044.471
Trial Pits					
TP01	728786.136	739106.863	29.92	328863.228	239081.751
TP02	728754.368	739110.303	23.98	328831.454	239085.191
TP03	728736.781	739134.128	20.47	328813.863	239109.021

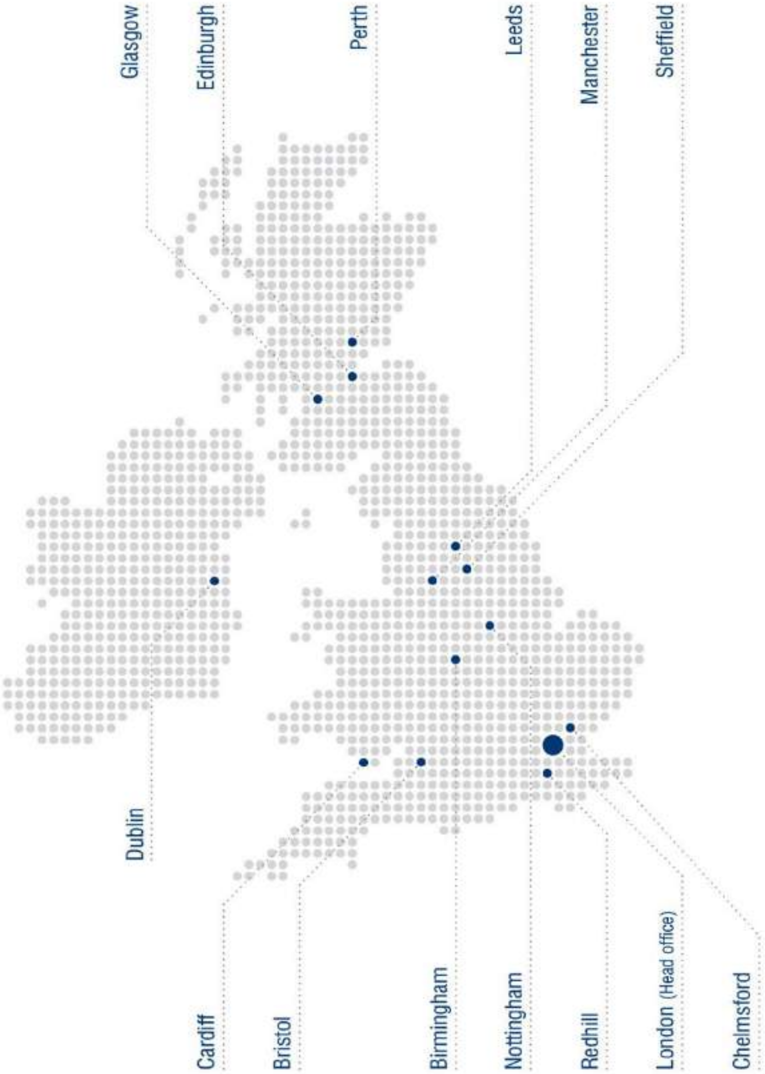


Contract No:	5836	Client:	Marlet
Contract:	Balscadden	Engineer:	Waterman Moylan
Location:	Howth, Co. Dublin	Scale:	1:750
Title:	Site Plan	Drawn By:	SL

Legend Key

- 🔴 Locations By Type - CP
- 🟦 Locations By Type - TP

UK and Ireland Office Locations



Appendix G

Flood Risk Assessment

Balscadden Development, Howth, Co. Dublin

March 2022

Waterman Moylan Consulting Engineers Limited

Block S, East Point Business Park, Alfie Byrne Road, Dublin D03 H3F4
www.waterman-moylan.ie

Client Name:	Balscadden GP3 Ltd.
Document Reference:	21-032r.007 Flood Risk Assessment
Project Number:	21-032

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015 and BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
1	17 August 2021	Stephen Dent-Neville	Richard Miles	Mark Duignan
2	16 March 2022	Stephen Dent-Neville	Joe Gibbons	

Comments

Waterman Moylan
Engineering Consultants

Disclaimer

Contents

Figures

Tables

1. Introduction

1.1 Background of Report

This Flood Risk Assessment has been prepared by Waterman Moylan as part of the documentation in support of a Strategic Housing Development (SHD) application for a proposed residential development in Howth, located between the Balscadden Road, Main Street and Abbey Street.

This Flood Risk Assessment has been carried out in accordance with the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009. This assessment identifies the risk of flooding at the site from various sources and sets out possible mitigation measures against the potential risks of flooding. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical errors. This report provides an assessment of the subject site for flood risk purposes only.

1.2 Site Location and Description

The proposed development relates to lands located to the south of the Martello Tower on Balscadden Road & the former Baily Court Hotel, Main Street, Howth, County Dublin.

The subject site is bounded to the east by the Balscadden Road and by residential properties, to the west by residential and commercial buildings fronting onto Main Street and Abbey Street, and to the north by lands around Martello Tower. The overall site is approximately 1.43 Hectares, with a former leisure centre building at the northern portion of the lands. The site location is shown on the Figure below:

Figure 1 *| Site Location (Source: Google Maps)*

A topographic survey was carried out to determine the existing topography at the site. The site has two relatively flat areas, at the north and at the south, with a steep slope between the two, and with steep slopes around the boundary of the site.

The northern portion of the site is at a level generally between c.20m and c.21m OD Malin, while the southern portion of the site is at a level generally between c.33m and c.34.5m OD Malin. Levels fall away at the east of the site towards the Balscadden Road, while levels at the south of the site continue to rise. The site is higher than the adjacent Main Street and Abbey Street to the west.

1.3 Proposed Development

The development will consist of the demolition of existing structures on the proposed site including the disused sports building and the former Baily Court Hotel buildings and the construction of a residential development set out in 4 no. residential blocks, ranging in height from 2 to 5 storeys to accommodate 180 no. apartments with associated internal residential tenant amenity and external courtyards and roof terraces, 1 no. retail unit and 2 no. café/retail units.

The site will accommodate car parking spaces at basement level and bicycle parking spaces at basement and surface level. Landscaping will include new linear plaza which will create a new pedestrian link between Main Street and Balscadden Road to include the creation of an additional 2 no. new public plazas and also maintains and upgrades the pedestrian link from Abbey Street to Balscadden Road below the Martello Tower. Please see the accompanying Statutory Notices for a more detailed description.

The residential schedule of accommodation is set out in the Table below:

Description	**1-Bed**	**2-Bed**	**3-Bed**	**Total**
Block A	-	2	-	2
Block B	51	57	18	126
Block C	8	28	7	43
Block D	7	2	-	9
Total	**66**	**89**	**25**	**180**

Table 1 | *Schedule of Accommodation*

The development will include a single level basement under Block B, containing 139 car spaces, cycle parking spaces, plant, storage areas, waste storage areas and other associated facilities. Additional visitor cycle spaces are provided for at ground level.

The development includes all other ancillary site development works to facilitate construction and the provision of the basement car park, site services, piped infrastructure, a sub-station, public lighting, plant, signage, bin stores, bike stores, boundary treatments and hard and soft landscaping.

1.4 Assessment Methodology

This Flood Risk Assessment report follows the guidelines set out in the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009. The components to be considered in the identification and assessment of flood risk are as per Table A1 of the above guidelines:

- Tidal – flooding from high sea levels
- Fluvial – flooding from water courses
- Pluvial – flooding from rainfall / surface water
- Groundwater – flooding from springs / raised groundwater

- Human/mechanical error – flooding due to human or mechanical error

Each component will be investigated from a Source, Pathway and Receptor perspective, followed by an assessment of the likelihood of a flood occurring and the possible consequences.

1.4.1 Assessing Likelihood

The likelihood of flooding falls into three categories of low, moderate and high, which are described in the OPW Guidelines as follows:

Flood Risk Components	**Likelihood: % chance of occurring in a year**		
	Low	***Moderate***	***High***
Tidal	*Probability < 0.1%*	*0.5% > Probability > 0.1%*	*Probability > 0.5%*
Fluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*
Pluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*

Table 2 **|** *From Table A1 of "DEHLG/OPW Guidelines on the Planning Process and Flood Management"*

For groundwater and human/mechanical error, the limits of probability are not defined and therefore professional judgment is used. However, the likelihood of flooding is still categorized as low, moderate and high for these components.

From consideration of the likelihoods and the possible consequences a risk is evaluated. Should such a risk exist, mitigation measures will be explored, and the residual risks assessed.

1.4.2 Assessing Consequence

There is not a defined method used to quantify a value for the consequences of a flooding event. Therefore, in order to determine a value for the consequences of a flooding event, the elements likely to be adversely affected by such flooding will be assessed, with the likely damage being stated, and professional judgement will be used in order to determine a value for consequences. Consequences will also be categorized as low, moderate, and high.

1.4.3 Assessing Risk

Based on the determined 'likelihood' and 'consequences' values of a flood event, the following 3x3 Risk Matrix will then be referenced to determine the overall risk of a flood event.

		Consequences		
		Low	***Moderate***	***High***
Likelihood	**Low**	*Extremely Low Risk*	*Low Risk*	*Moderate Risk*
	Moderate	*Low Risk*	*Moderate Risk*	*High Risk*
	High	*Moderate Risk*	*High Risk*	*Extremely High Risk*

Table 3 **|** *3x3 Risk Matrix*

2. Tidal

2.1 Source

Tidal flooding occurs when normally dry, low-lying land is flooded by seawater. The extent of tidal flooding is a function of the elevation inland flood waters penetrate, which is controlled by the topography of the coastal land exposed to flooding.

2.2 Pathway

The site is located close to the coast, with the nearest coastline just 60m east of the eastern boundary of the site. The Dublin Coastal Protection Project indicated that the 2002 record high tide event reached 2.95m OD Malin. The lowest proposed finished floor level at the development is to be constructed at 18m OD Malin, well above the historic high tide event.

Coastal Flood Extent Maps available on the OPW's National Flood Information Portal have been consulted as part of this assessment. These maps outline existing and potential flood hazard and risk areas which are being incorporated into a Flood Risk Management Plan. An extract of the map is shown in the Figure below:

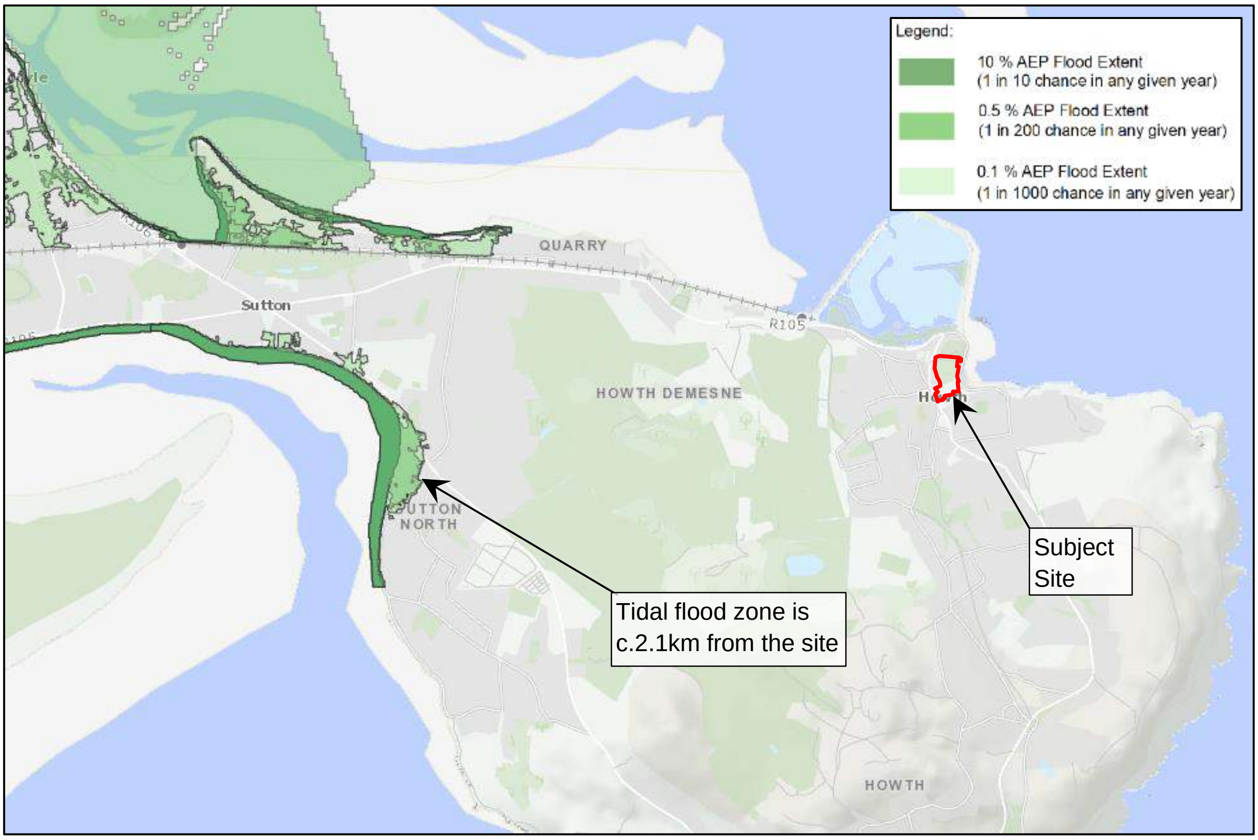


Figure 2 | *Extract from the OPW's Tidal Flood Extents Map*

High probability flood events, as shown in the above map, are defined as having approximately a 1-in-10 chance of occurring or being exceeded in any given year (10% Annual Exceedance Probability), medium probability flood events are defined as having an AEP of 0.5% (1-in-200 year storm), while low probability events are defined having an AEP of 0.1% (1-in-1,000 year storm). The map indicates that the subject development is not at risk of flooding for the 1-in-1,000 year event, with the closest tidal flood zone located approximately 2.1km to the west of the site.

Despite the close proximity of the site to the coast, the steep gradients at the adjacent coastline ensure that the site is well above the tidal flood zone.

Given that the site is located 2.1km from the nearest 1-in-1,000 year flood zone and that there is at least a 15m level difference between the high tide event and the proposed buildings, it is evident that a pathway does not exist between the source and the receptor. A risk from tidal flooding is therefore extremely low and no flood mitigation measures need to be implemented.

3. Fluvial

3.1 Source

Fluvial flooding occurs when a river's flow exceeds its capacity, typically following excessive rainfall.

3.2 Pathway

There are no significant above-ground watercourses in the vicinity of the site. Surface water from the surrounding area drains to the underground sewer in Main Street. The nearest above-ground watercourse is the Bloody Stream, a watercourse flowing northwards approximately 800m west of the site, flowing adjacent to the Howth Castle.

Fluvial Flood Extent Maps available on the OPW's National Flood Information Portal have been consulted as part of this assessment. These maps outline existing and potential flood hazard and risk areas which are being incorporated into a Flood Risk Management Plan. An extract of the map is shown in the Figure below:

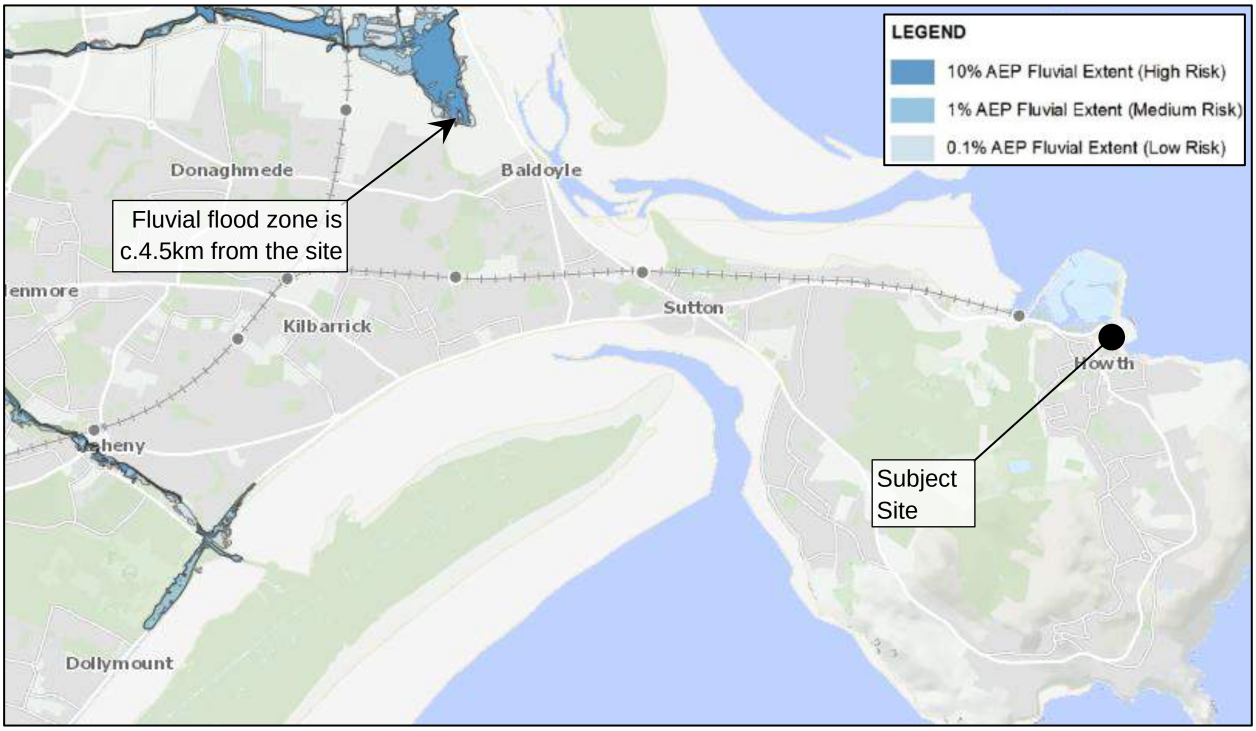


Figure 3 | *Extract from the FEM FRAMS Fluvial Flood Extents Map*

High probability flood events, as shown in the above map, are defined as having approximately a 1-in-10 chance of occurring or being exceeded in any given year (10% Annual Exceedance Probability), medium probability flood events are defined as having an AEP of 1% (1-in-100 year storm), while low probability events are defined having an AEP of 0.1% (1-in-1,000 year storm).

The nearest fluvial flood zone identified is approximately 4.5km north-west of the subject site, at Baldoyle Bay.

Given that there are no watercourses in the vicinity of the subject site and that the site is outside of any identified fluvial flood zone, it is evident that a pathway does not exist between the source and the receptor. A risk from fluvial flooding is therefore extremely low and no flood mitigation measures need to be considered.

4. Pluvial

4.1 Source

Pluvial flooding occurs when heavy rainfall creates a flood event independent of an overflowing water body. Pluvial flooding can happen in any urban area, including higher elevation areas that lie above coastal and river floodplains.

4.2 Pathway & Receptors

During periods of extreme prolonged rainfall, pluvial flooding may occur through the following pathways:

	Pathway	**Receptor**
1	Surcharging of the proposed internal drainage systems during heavy rain events leading to internal flooding	Proposed development – properties and roads
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes	Proposed development – properties and roads
3	Surface water discharging from the subject site to the existing drainage network leading to downstream flooding	Downstream properties and roads
4	Overland flooding from surrounding areas flowing onto the subject site	Proposed development – properties and roads
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

Table 4 | *Pathways and Receptors*

4.3 Likelihood

The likelihood of each of the 5 pathway types are addressed individually as follows:

4.3.1 Surcharging of the proposed on-site drainage systems:

The proposed on-site surface water drainage sewers will be designed to accommodate flows from a 5-year return event, which indicates that on average the internal system may surcharge during rainfall events with a return period in excess of five years. Therefore, the likelihood of the on-site drainage system surcharging is considered high.

4.3.2 Surcharging from the existing surrounding drainage system:

The OPW’s National Flood Hazard Maps, extracted below, have been consulted to identify recorded instances of flooding in the vicinity of the site. The nearest recorded flood event occurred approximately 600m west of the site at the Howth Dart Station, due to coastal/estuarine waters flooding the banks of the Bloody Stream.

Figure 4 | *Extract from the OPW's Past Flood Events Map*

With no history of flooding in the area due to surcharging, the likelihood of such flooding occurring is considered low.

4.3.3 Surface water discharge from the subject site:

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of surface water discharge from the site leading to downstream flooding. As such, the likelihood can be considered moderate.

4.3.4 Overland flooding from surrounding areas:

With no recorded flood events in the immediate area that could have an impact on the subject site, as per the OPW records referred to above, it is considered that there is a low likelihood of flooding from surrounding areas.

4.3.5 Overland flooding from the subject site:

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of overland flooding from the site leading to downstream flooding. As such, the likelihood can be considered moderate.

4.4 Consequence

Surface water flooding would result in damage to roads and landscaped areas, and could impact the basement and ground floor levels of buildings. The consequences of pluvial flooding are considered moderate.

4.5 Risk

The risk of each of the 5 pathway types is addressed individually as follows:

4.5.1 Surcharging of the proposed on-site drainage systems:

With a high likelihood and moderate consequence of flooding the site from surcharging the on-site drainage system, the resultant risk is high.

4.5.2 Surcharging from the existing surrounding drainage system:

With a low likelihood and moderate consequence of flooding the site from the existing surface water network, the resultant risk is low.

4.5.3 Surface water discharge from the subject site:

With a moderate likelihood and moderate consequence of surface water discharge from the subject site, the resultant risk is moderate.

4.5.4 Overland flooding from surrounding areas:

With a low likelihood and moderate consequence of overland flooding from the surrounding areas, the resultant risk is low.

4.5.5 Overland flooding from the subject site:

With a moderate likelihood and moderate consequence of overland flooding from the subject site, the resultant risk is moderate.

4.6 Flood Risk Management

The following are flood risk management strategies proposed to minimise the risk of pluvial flooding for each risk:

4.6.1 Surcharging of the proposed on-site drainage systems:

The risk of flooding is minimised with adequate sizing of the on-site surface water network and SuDS devices. Open areas with low level planting and roadside trees act as soft scape and will significantly slow down and reduce the amount of surface water runoff from the site. Green roofing is proposed at the apartment blocks, to cover 60% of the total roof area. Green roofing will significantly reduce rainfall runoff through retention and evapotranspiration. Downpipes from the buildings will direct rainwater to planter boxes before discharging to the surface water network. Permeable paving is in courtyards and along pedestrian circulation paths which will provide some treatment volume.

These proposed source and site control devices will intercept and slow down the rate of runoff from the site to the on-site drainage system, reducing the risk of surcharging.

Furthermore, a hydro-brake or similar approved flow control device will provide a runoff limited to the greenfield equivalent runoff rate for each catchment, with excess storm water to be attenuated in private underground tanks. Sufficient attenuation volume will be provided for the 1-in-100 year storm (accounting for a 20% increase due to climate change). This will limit the runoff from the site and minimise the discharge rate into receiving waters.

As a result of these proposed measures, the likelihood of surcharging of the proposed on-site drainage systems is low.

4.6.2 Surcharging from the existing surrounding drainage system:

The risk of flooding due to surcharging of the existing surface water network is minimised with overland flood routing away from the buildings. The overland flood route is shown on the accompanying Waterman Moylan drawing 21-032-P027 Overland Flood Route.

The risk to the buildings is further mitigated by setting finished floor levels at least 200mm above the adjacent road channel line.

In order to mitigate the risk of the basement flooding due to water backing up into the new onsite drainage system, non-return valves will be provided in the last manholes on site to prevent the public sewers from surcharging into the private drainage system.

4.6.3 Surface water discharge from the subject site:

Surface water discharge from the subject site is intercepted and slowed down through the use of source control devices, as described in Section 4.6.1 above, minimising the risk of pluvial flooding from the subject site. Surface water discharge from the site is restricted by flow control devices to the greenfield equivalent rate, with sufficient attenuation storage provided for the 1-in-100 year storm, accounting for a 20% increase due to climate change. As such, the rate at which surface water discharges from the subject site will not be increased as a result of the proposed development.

4.6.4 Overland flooding from surrounding areas:

The risk from overland flooding from surrounding areas is low. The site is at the top of a hill, above the surrounding roads and buildings. Overland flood routing and raised finished floor levels will provide protection for the proposed buildings, as described in Section 4.6.2 above. The proposed basement will be suitably tanked to prevent ingress of water.

4.6.5 Overland flooding from the subject site:

The risk of overland flooding from the subject site is minimised by providing SuDS features to intercept and slow down the rate of runoff from the site to the sewer network, as described in Section 4.6.1 above. Sufficient attenuation is provided for the 1-in-100 year storm, accounting for a 20% increase due to climate change. Thus, even under extreme storm conditions, the surface water can be attenuated without causing flooding downstream.

4.7 Residual Risk

As a result of the design measures detailed above in Section 4.6, there is a low residual risk of flooding from each of the surface water risks.

5. Groundwater

5.1 Source

Groundwater flooding occurs when the water table rises above the ground surface. This typically happens during periods with prolonged rainfall which exceeds the natural underground drainage system's capacity.

5.2 Pathway

The pathway for groundwater flooding is from the ground. Note that although groundwater flooding is typically considered to be when the water table rises above the ground surface, underground services and building foundations could also be affected by high water tables that do not reach the ground surface.

5.3 Receptor

The receptors for ground water flooding would be the underground services and the basement and ground floors of buildings.

5.4 Likelihood

Geological Survey Ireland (GSI) produces a wide range of datasets, including groundwater vulnerability mapping. From the GSI groundwater vulnerability map, extracted below, the site lies within an area with high to extreme groundwater vulnerability.

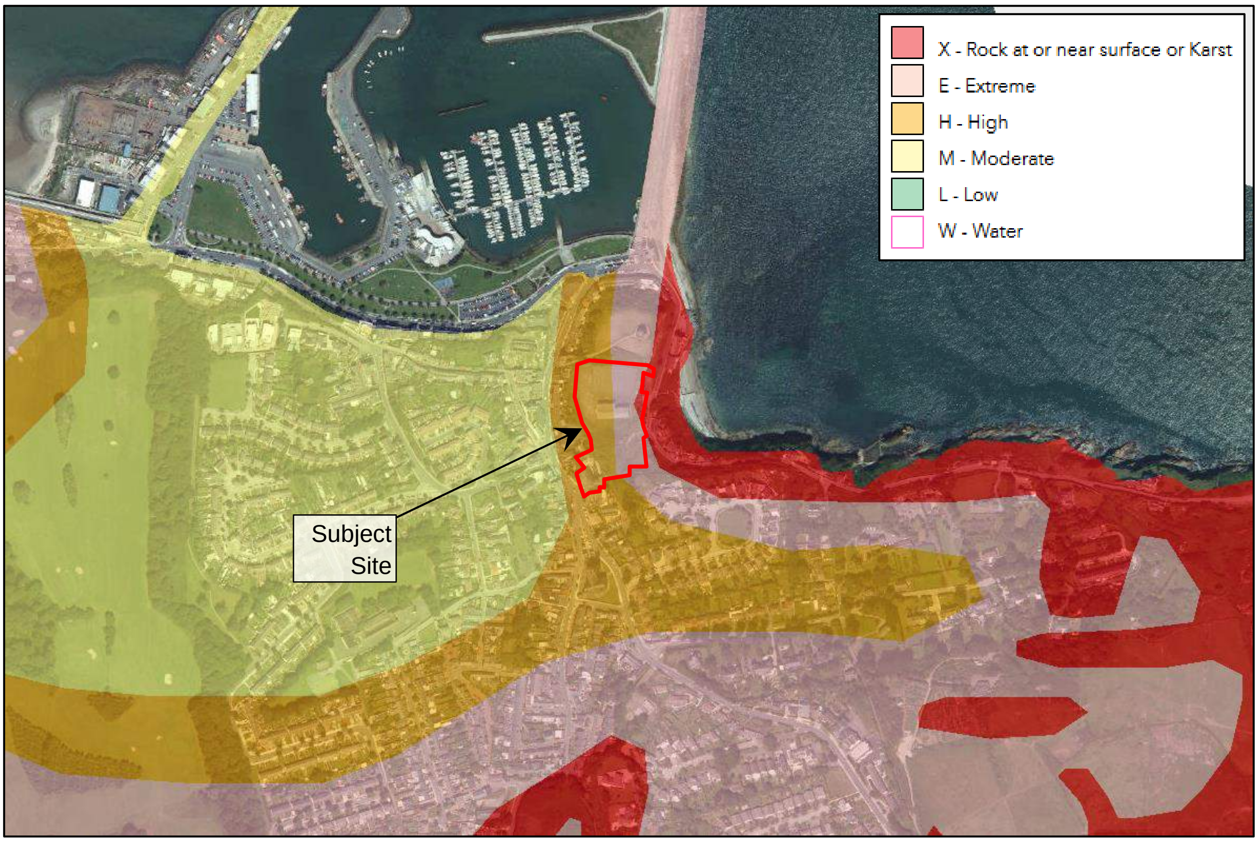


Figure 5 | *Extract of Groundwater Vulnerability Map*

With the site falling within an area with high to extreme groundwater vulnerability, the likelihood of groundwater rising through the ground and causing potential flooding on site during prolonged wet periods is high.

5.5 Consequence

The consequence of ground water flooding would be some minor temporary seepage of ground water through the ground around the proposed buildings. Underground services could be inundated from high water tables. Over time, groundwater could seep into the basement. Therefore, the consequence of ground water flooding occurring at the proposed development is considered moderate.

5.6 Risk

With a high likelihood and moderate consequences of flooding due to groundwater, the risk is considered high.

5.7 Flood Risk Management

Finished floor levels will be set above the adjacent road and ground levels, as described in Section 4.6, to ensure that any seepage of ground water onto the development does not flood into the buildings. In the event of ground water flooding on site, this water can escape from the site via the overland flood routing, also described in Section 4.6.

The buildings' design will incorporate suitable damp proof membranes to protect against damp and water ingress from below ground level. To mitigate the risks of groundwater entering the basement it must be adequately waterproofed. Any penetrations through the basement wall or slab must also be appropriately sealed to prevent ingress of groundwater.

It is proposed to install a granular blanket surrounding the basement structure, which will allow groundwater to seep around the basement, maintaining any long-term sub-surface perched water movement. This will minimise the effect that the proposed basement will have on the local water table, mitigating the risk to surrounding areas including other basements in the vicinity of the site.

5.8 Residual Risk

There is a low residual risk of flooding from ground water.

6. Human/Mechanical Errors

6.1 Source

The subject site will be drained by an internal private storm water drainage system, discharging to the existing surface water network in Main Street at the west of the site. The internal surface water network is a source of possible flooding were it to become blocked.

6.2 Pathway

If the proposed private drainage system blocks this could lead to possible flooding within the private and public areas.

6.3 Receptor

The receptors for flooding due to human/mechanical error would be the ground and basement levels of the buildings, the roads and the open landscaped areas around the site.

6.4 Likelihood

There is a high likelihood of flooding on the subject site if the surface water network were to become blocked.

6.5 Consequence

The surface water network would surcharge and overflow through gullies and manhole lids. It is, therefore, considered that the consequences of such flooding are moderate.

6.6 Risk

With a high likelihood and moderate consequence, there is a high risk of surface water flooding should the surface water network block.

6.7 Flood Risk Management

As described in Section 4.6, finished floor levels have been designed to be generally above the adjacent road network, which will reduce the risk of flooding if the surface water network were to block. In the event of the surface water system surcharging, much of the surface water can still escape from the site by overland flood routing, as described in Section 4.6, without causing damage to the proposed buildings.

The surface water network (drains, gullies, manholes, AJs, attenuation system) will need to be regularly maintained and where required cleaned out. A suitable maintenance regime of inspection and cleaning should be incorporated into the safety file/maintenance manual for the development.

6.8 Residual Risk

As a result of the flood risk management outlined above, there is a low residual risk of overland flooding from human / mechanical error.

7. Conclusions and Recommendations

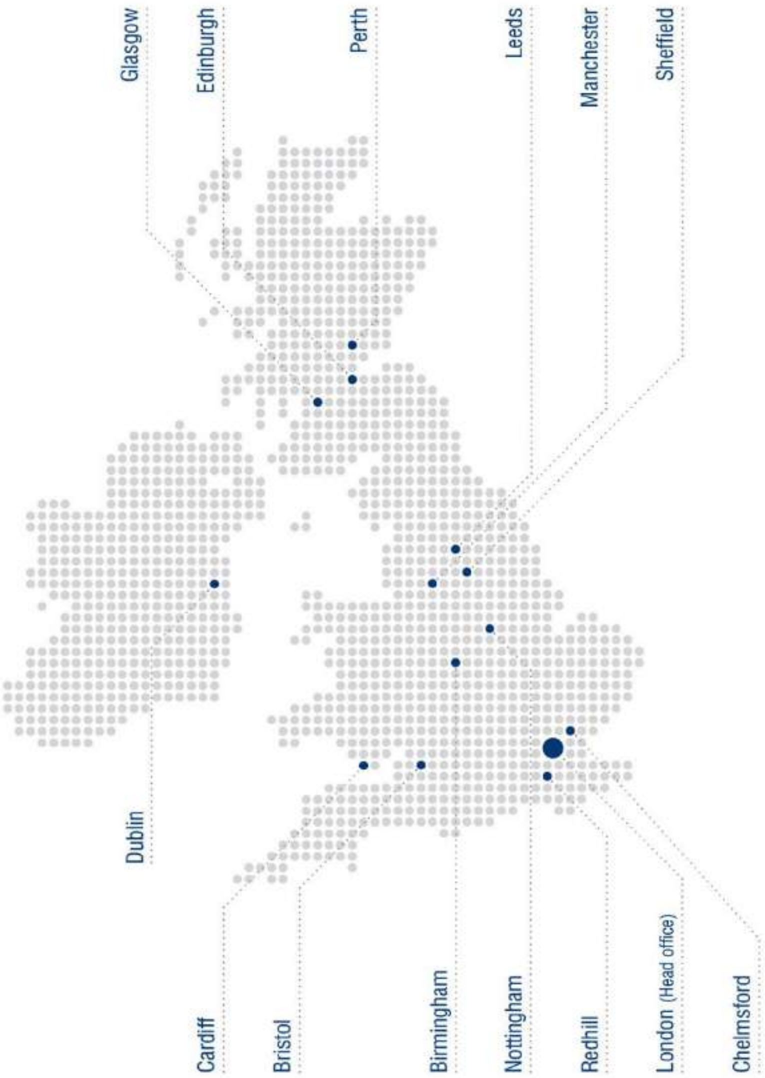
The subject lands have been analysed for risks from tidal flooding from the Irish Sea at Balscadden Bay, fluvial flooding from the Bloody Stream, pluvial flooding, ground water and failures of mechanical systems. Table 4, below, presents the various residual flood risks involved.

Source	**Pathway**	**Receptor**	**Likelihood**	**Consequence**	**Risk**	**Mitigation Measure**	**Residual Risk**
Tidal	*Irish Sea / Balscadden Bay*	*Proposed development*	*Extremely low*	*None*	*Negligible*	*None*	Extremely low
Fluvial	*Bloody Stream*	*Proposed development*	*Extremely Low*	*None*	*Negligible*	*None*	Extremely low
Pluvial	*Private & Public Drainage Network*	*Proposed development, downstream properties and roads*	*Ranges from high to low*	*Moderate*	*Ranges from high to low*	*Appropriate drainage, SuDS and attenuation design, setting of floor levels, overland flood routing*	Low
Ground Water	*Ground*	*Underground services, basement and ground level of buildings*	*High*	*Moderate*	*High*	*Appropriate setting of floor levels, flood routing, damp proof membranes, adequate waterproofing at the basement structure and sealing of all openings in the basement*	Low
Human/ Mechanical Error	*Drainage network*	*Proposed development*	*High*	*Moderate*	*High*	*Setting of floor levels, overland flood routing, regular inspection of SW network*	Low

Table 5 **|** *Summary of the Flood Risks from the Various Components*

As indicated in the above table, the various sources of flooding have been reviewed, and the risk of flooding from each source has been assessed. Where necessary, mitigation measures have been proposed. As a result of the proposed mitigation measures, the residual risk of flooding from any source is low.

UK and Ireland Office Locations



Appendix H

BALSCADDEN SHD:
LANDS AT BALSCADDEN
AND FORMER BAILY COURT HOTEL
MAIN STREET,
HOWTH
CO. DUBLIN

ARCHITECTURAL HERITAGE
IMPACT ASSESSMENT

15th March 2022

Historic Building Consultants
Old Bawn
Old Connaught
Bray

940/03

Contents

Introduction

This report has been prepared for Balscadden GP3 Limited as part of the documentation to be submitted with a planning application.

The development will consist of:

> The proposed development relates to lands located to the south of the Martello tower on Balscadden Road & the former Baily Court Hotel, Main Street, Howth, County Dublin. The development will consist of the demolition of existing structures on the proposed site including the disused sports building and the former Baily Court Hotel buildings and the construction of a residential development set out in 4 residential blocks, ranging in height from 2 to 5 storeys to accommodate 180 apartments with associated internal residential tenant amenity and external courtyards and roof terraces, 1 retail unit and 2 café/retail units. The site will accommodate car parking spaces at basement level and bicycle parking spaces at basement and surface level. Landscaping will include new linear plaza which will create a new pedestrian link between Main Street and Balscadden Road to include the creation of an additional 2 new public plazas and also maintains and upgrades the pedestrian link from Abbey Street to Balscadden Road below the Martello tower. Please see the accompanying statutory notices for a more detailed description.

The site was inspected for the purposes of preparing this report on 28th June 2021 and 16th November 2021, on which occasions the photographs incorporated in the report were taken and the site examined to prepare the descriptions contained therein. Some archive photographs are also included.

Historical research was carried out on the background history of the property and its vicinity, and the results are set down below.

Scope and purpose

The scope and purpose of this report is to assess the potential impacts of the proposed development on architectural heritage. In particular, it examines the possible impacts on the character and setting of protected structures in the vicinity and on the Howth Historic Core Architectural Conservation Area.

While this report contains comment on aspects of the condition of the buildings it is not a condition report or a structural report and must not be read as such.

This report has been prepared by Rob Goodbody BA(mod), DipEnvPlanning, DipABRC, MA, MUBC, MIPI.

Site and its environs

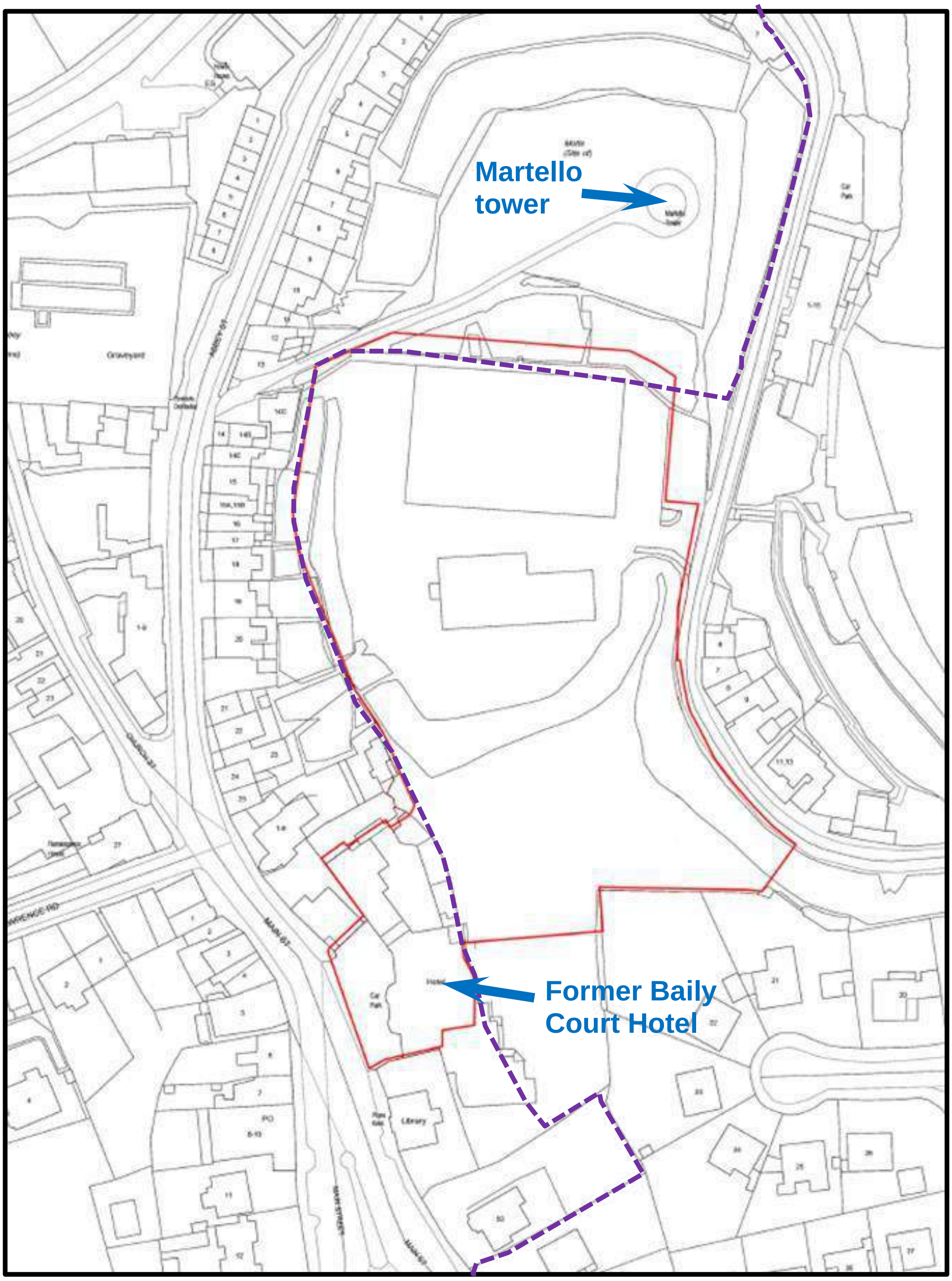


Figure 1: Location of site

In the map above the application site is outlined in red. The broken purple line shows the approximate location of the eastern boundary of the Howth Historic Core Architectural Conservation Area for guidance purposes only – for the official boundary see Fingal Development Plan 2017-23, map sheet 10.

The application site lies to the east of Main Street and Abbey Street, Howth and to the west of Balscadden Road. The land between those to roads rises to a height above the prevailing ground, representing the remnants of an esker formed during the ice age and the hill is formed with sand and gravel. At the northern end of this promontory a Martello tower stands in a strategic location overlooking the harbour and Balscadden Bay. The tower is surrounded by an area of relatively level ground, beyond which it falls away sharply in all directions.

To the south of the Martello tower and its grounds the steep slope falls away into the application site, where there is a sports pavilion and the flat ground that was formerly used as a sports pitch. It is likely that this lower ground is the result of quarrying in the past. To the south of the sports facilities the ground within the application site rises again to a level similar to the ground on which the Martello tower stands.

The eastern boundary of the site is bounded by Balscadden Road, which curves along the margin of the site. This road was cut out of the hillside in 1810 and the slope above it is not a natural feature.

To the south of the application site lie the grounds of houses in Asgard Park and an area of land associated with number 60 Main Street, Howth.

The western side of the application site includes the now derelict former Baily Court Hotel with its stable yard and outbuildings that lie to the north of the hotel. This is the only part of the application site with a street frontage to Main Street. The remainder of the western boundary of the site runs along the rear of properties in Main Street and Abbey Street and the site is on higher ground than the buildings on those properties.

Methodology

The assessment of architectural heritage has been conducted under the relevant legislation and planning frameworks applicable to the Republic of Ireland. These include:

- The Planning and Development Acts 2000 to 2021
- Heritage Act, 1995, as amended
- National Monuments Acts, 1930-2004
- The Planning and Development (Strategic Infrastructure) Act, 2006
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999

The project is located entirely within the administrative area of Fingal County Council and the relevant policies relating to the area are contained within the Fingal Development Plan 2017-2023, in particular, section 10.3 of the plan that addresses architectural heritage.

Guidelines

The preparation of an architectural heritage impact assessment is carried out in the context of the *Architectural Heritage Protection Guidelines for Planning Authorities* published by the Department of the Environment, Heritage and Local Government in 2004 and reissued by the Department of Arts, Heritage and the Gaeltacht in 2011. These guidelines still represent professional best practice. The main thrust of the guidelines relates to works to protected structures, though they are also relevant to projects such as the present proposal, where there are no protected structures on the site but there is an architectural conservation area the vicinity as well as protected structures and the potential impact of the development on these may be properly assessed.

The section of the guidelines that addresses development control contains the following paragraph:

> 6.4.15 For more extensive or complex works with a potential to have a major impact on the architectural heritage, a planning authority may require an applicant to submit a more detailed impact statement. This may be necessary to allow the planning authority to assess the full implications of the proposals and allow an informed decision to be made on the appropriateness of the development. An outline of the type of information that could be included in such an architectural heritage impact assessment is found in Appendix B of these guidelines.

This paragraph relates mainly to more extensive or complex works to a protected structure but is taken in this report to be of relevance in view of the extent of the proposed development.

The guidelines do not determine the extent of a study area that is to be adopted in assessing the potential impact of a building development on architectural heritage. The *Guidelines for the Assessment of Architectural Heritage Impacts on National*

Roads Schemes published by the National Roads Authority (now TII) proposes that the width of the study area for architectural heritage in the case of national roads schemes should be 50 metres either side of the centre line of the new road but extending further where professional opinion considers that a wider area would be warranted. This approach has not been adopted in this report as it is considered that it is of more relevance to consider the potential impact of the proposed development when it would be seen in proximity to any protected structure or architectural conservation area.

The guidelines are discussed further in the appendix.

Sources of Information to inform the Assessment

The identification of buildings and structures to be assessed for impact was based in the first instance on an analysis of current Ordnance Survey maps. The potential for any building or other structure in the vicinity of the proposed development to have special architectural significance was also gauged through examination of the following sources:

- Fingal Development Plan 2017-2023
- Pre-Ordnance Survey maps by John Rocque, John Taylor and William Duncan
- Ordnance Survey six-inch maps of 1843, 1871 and 1909
- Ordnance Survey 1:2500 maps of 1907
- National Inventory of Architectural Heritage, www.buildingsofireland.ie
- Historic Environment Viewer, https://maps.archaeology.ie/HistoricEnvironment/
- Google Earth Pro

Site inspection

The site and its vicinity have been inspected on a number of occasions and for the purpose of preparing this report was visited on 28th June and 16th November 2021. The interior of the former Baily Court Hotel was examined as far as it was safe to do so on the latter date and it had previously been inspected by the present author in 2012 when more of the interior was accessible.

The findings of the site inspections informed the writing of the report.

Historical background

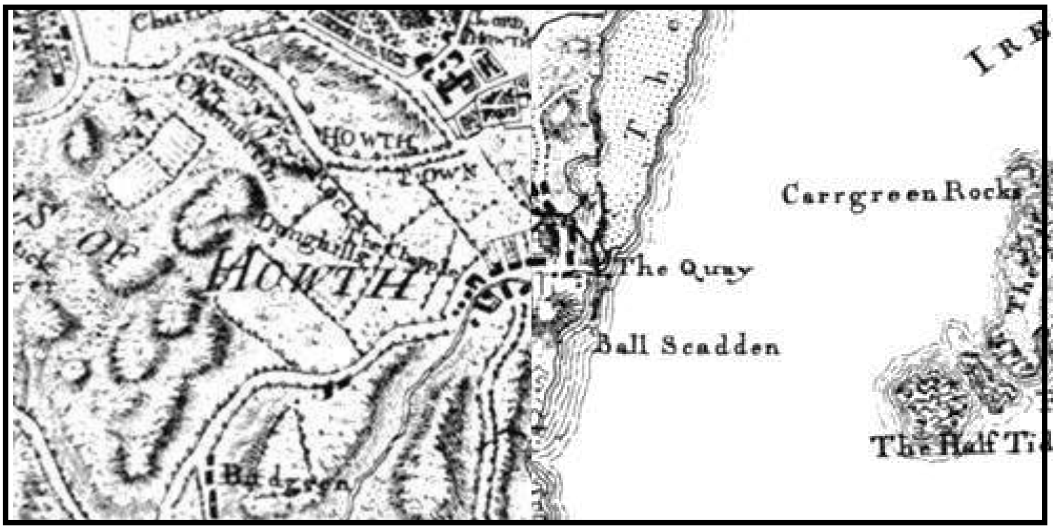


Figure 2: Detail of Rocque's map of the Environs of Dublin, 1760

The town of Howth is of medieval origin, and there are records of its use as the origin and destination of shipping in the fourteenth century. It was probably more used as a fishing harbour, however, and for this purpose it has remained significant since those early times. The early harbour was little more than an anchorage in the lee of a shoal of rocks that projected northwards from a headland, on which a medieval fort or castle was built. John Rocque's map of county Dublin, published in 1760, shows the town with a quay, rather than piers, at the harbour.

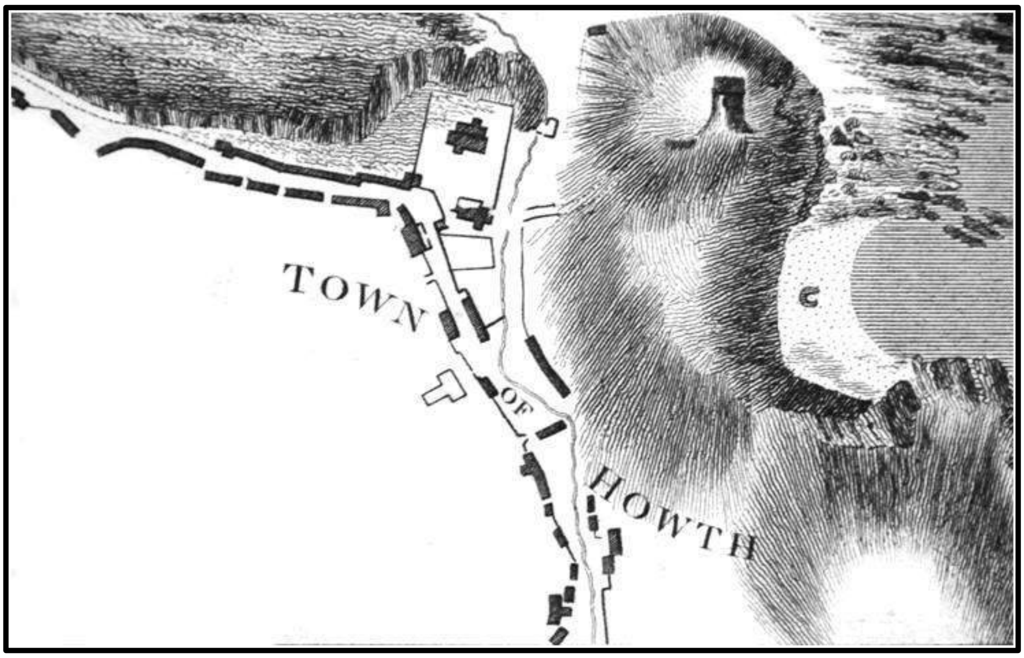


Figure 3: Detail of map of Howth of 1810

A more detailed map of the town was produced in 1810, as seen in figure 2, reproduced above, and it shows how it was laid out before the construction of the harbour. At that time there were no buildings along the shoreline. The town was approached from the west along Dunbro Hill and Church Street, while Abbey Street ran down to the water's edge with no buildings alongside it. To the east of the town the site of the medieval fort had become the location for the Martello tower that was built in 1804-05 to protect the landing place at the harbour from a potential attack by French forces.

The construction of the harbour had commenced in 1807 but had come to a halt for a time in 1809 due to concerns about the design and construction of the piers. By that stage the eastern pier had been partially built. John Rennie was taken on as the engineer on the project and altered the scheme significantly. Amongst the changes made by John Rennie was the type of stone to be used in the construction and he opened up a quarry at Kilrock, to the east of the harbour, as a source of quartzite to be used as the rubble core of the piers. To bring the stone down Rennie designed a railway and a platform was carved out of the side of the cliffs to accommodate this railway. Rennie's map showing this railway is reproduced below and the line of the railway is now Balscadden Road. At the lower end of the railway, after it turns towards the north-east, the route is steep and wagons loaded with stone were lowered down this section on chains, using a system known as an *inclined plane*, as horses could not haul heavy wagons down such a steep slope.

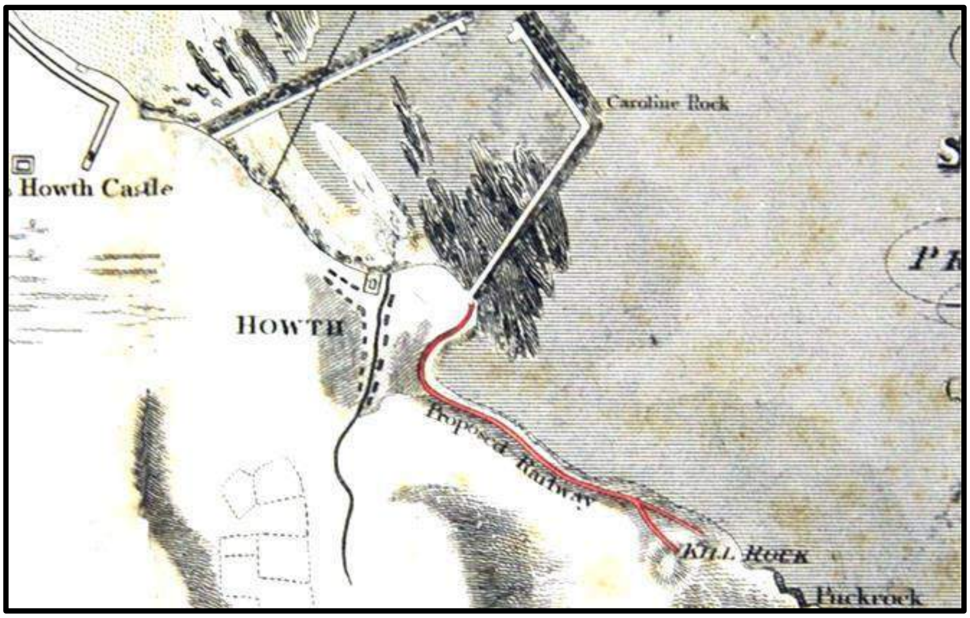


Figure 4: Rennie's plan for a railway, 1810

By 1816 the project was almost complete and was shown on John Taylor's map of the Environs of Dublin, published in that year, as seen in the map extract reproduced above. The difference between the way that Taylor showed the harbour and how it is in reality is an indication that his map was published before the harbour was fully completed. By this stage, however, Harbour Road and the railway along what was to become Balscadden Road had been laid out, and although the layout of the town and its buildings had changed little since 1810, the process of change was clearly under way.

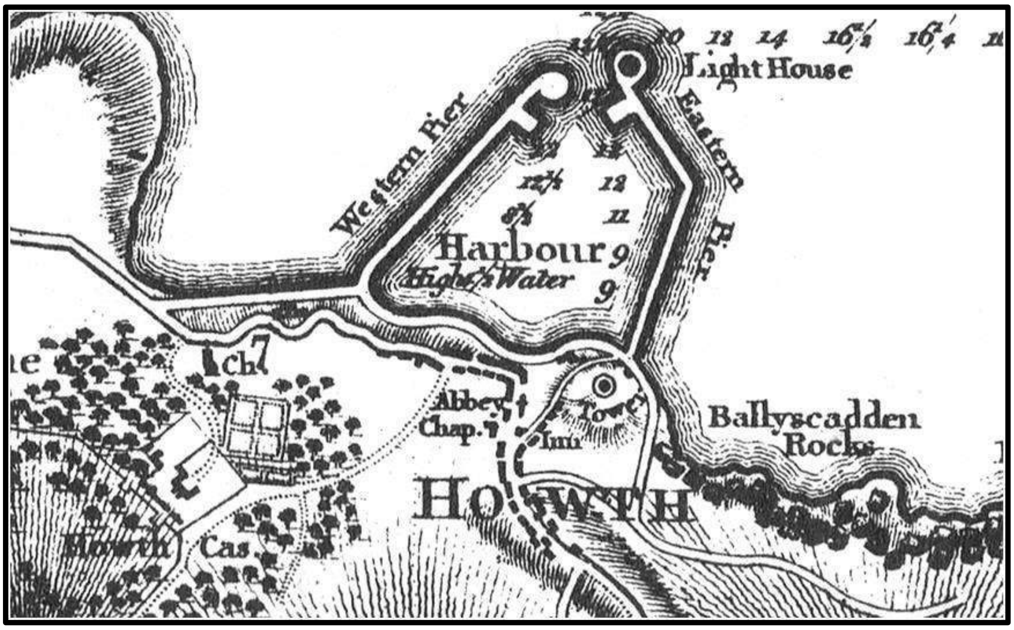


Figure 5: Detail of John Taylor's map of Dublin, 1816

Most significantly, Taylor showed the inn on the eastern side of Main Street. Howth was built as a harbour for mail packet boats, which were small sailing ships at the time that the harbour was designed. The first steamship to cross between Britain and Ireland made the journey in 1816 and in a very short time the carriage of the mails was being undertaken by steamships. Hotels were of vital importance at any port that catered for passenger ships in the days of sail, as it was usually necessary to wait for suitable weather conditions before a ship could sail, and this could extend to several weeks. Even with a single day's delay the passengers would expect to have a good quality hotel in which to await the decision to sail and it is no surprise that a hotel was provided in Howth as soon as the packet boats began to run from the harbour.

The name "Royal Hotel" was probably adopted in August 1821 when king George IV arrived in Howth. He did not visit the hotel, however. His arrival in Howth was unexpected, as the royal yacht was supposed to have landed at the Pigeonhouse, whereas the king took the mail packet instead and landed at Howth. From Howth harbour he was taken directly by carriage to the viceregal lodge in the Phoenix Park and did not spend any time in Howth.

The Royal Hotel changed hands a number of times over its first two centuries. In the 1830s it was McDowell's Royal Hotel, and by the early 1840s it was being run by Patrick McKenny, whose family ran the hotel for the rest of the century. In about 1900 the hotel was acquired by Findlaters', the well-known Dublin family of grocers, brewers, distillers and hoteliers. The family also owned the St Lawrence Hotel in Howth, and a few years later the firm opened one of its chain of grocery shops in Main Street, Howth. One of the sons of the family, William Findlater, managed the hotel for a time, after which it was managed by Mrs Fairweather and then Miss Kearns. The hotel was back in the hands of the McKenny family in the later 1920s before being acquired by James Gibney and his wife.

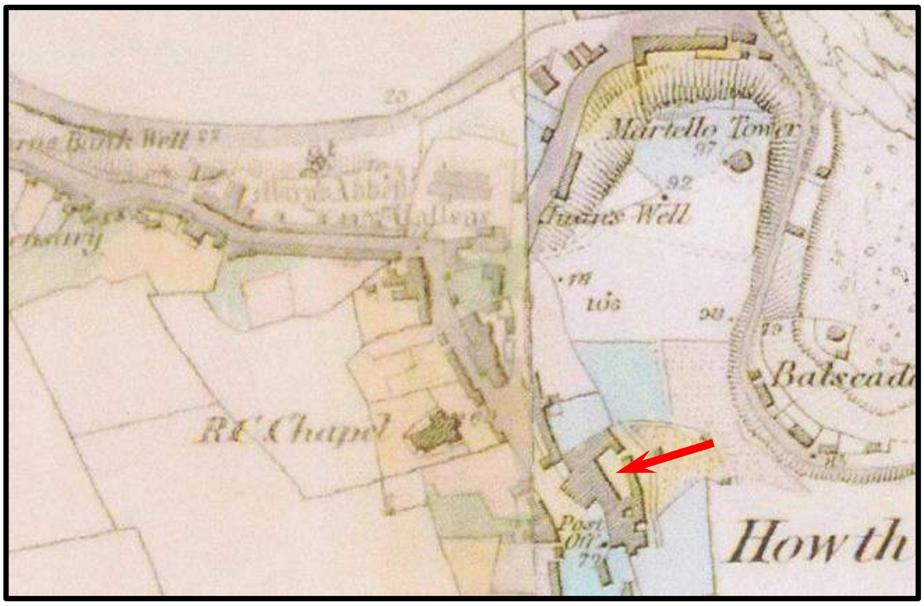


Figure 6: Detail of first edition Ordnance Survey map, 1843
Dublin sheets 15 and 16

The first edition Ordnance Survey map of the Howth area was published in 1843 and showed the hotel as it was at that time, denoted by the arrow. The scale is relatively small, at six inches to the mile, and is enlarged in the extract reproduced above. This shows the main hotel building with a small projection on the southern side, towards the rear of the building. At this scale it is not possible to tell where one building ends and the next begins, but there appears to be a continuous range of buildings stretching to the north from the hotel until it meets the large building that projects further into the main street. The open area to the north of the hotel to the north of the main building and to the east of the main street is probably the stable yard of the hotel, given that it had been advertised as having livery stables associated with the hotel use. Beyond this, to the north, the ground is open, though the map does not convey any impression of the contours, except through a number of spot heights, noted in feet above sea level.

Plate 1: Royal Hotel in about 1900

The photograph above shows the hotel as it was at the time and as it was through much of the nineteenth century, as a hotel with livery stables, presumably in the yard to the left of the main building, behind the two-storey house. There is a two-storey building to the left, but no attached building to the right. The porch to the front is visible. The facade is rendered, with a raised area around the windows simulating stone quoins. A similar pattern is visible around the windows of the adjacent two-storey building, suggesting that it was in the same ownership, which is consistent with its location between the main building and the stable yard.

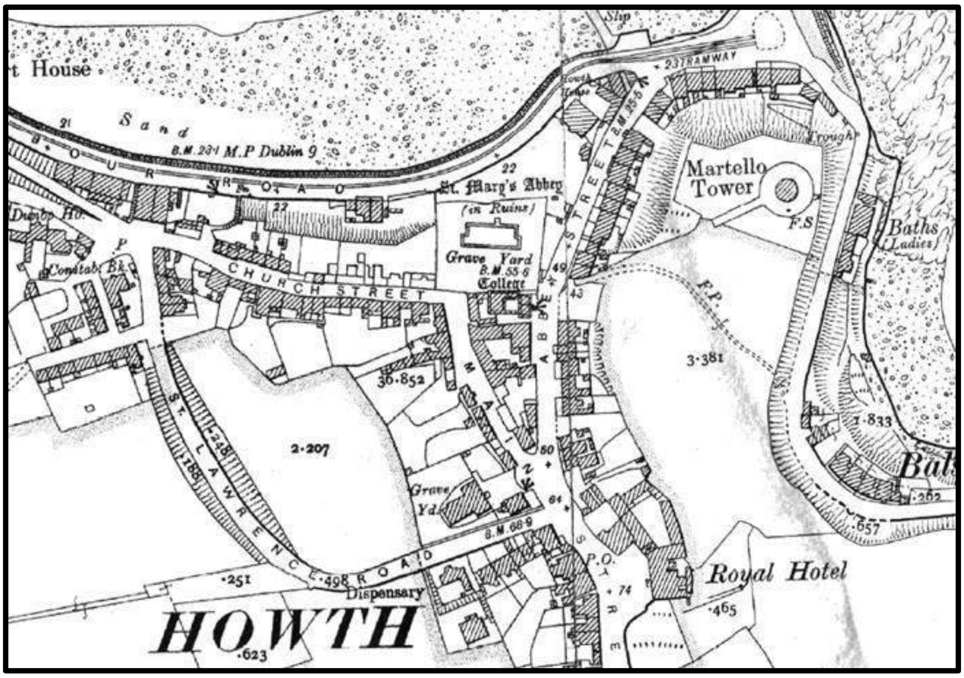


Figure 7: Ordnance Survey map of 1907 showing Royal Hotel
Dublin sheets 15-16 and 16-5

A larger scale map was published at a scale of 1 : 2500 in 1907 and this is reproduced above. The larger scale allows for a greater amount of detail, and a porch may be seen at the front of the building. There is no projection on the southern side of the main hotel, while the buildings to the north include the stable yard with an archway through the building on the frontage to the yard at the rear. Beyond the hotel to the north the rising ground is still open, through to the Martello tower on the high ground overlooking the harbour. As with the earlier map, no indication is given as to the slope of the ground, other than the markings to the north, east and west of the Martello tower showing the steep fall of the ground in those locations, with no hint of the drop in the ground to the south of the tower, or the climb back up towards the hotel.

During the twentieth century the hotel was enlarged on a number of occasions. The rateable valuation through that century had been £26-15s-0d, but at the beginning of the twentieth century, when William Findlater was in charge, the valuation was increased to £39-10s-0d, and it increased again in the 1920s to £60, suggesting that there were improvements at those times. A major and sustained programme of enlargement took place under the proprietorship of the Gibneys, particularly when Mrs Gibney was in charge from the mid-1940s. The valuation went up to £81-5s-0d by 1945, £101-5s-0d by 1948 and £151-15s by 1954. This coincided with a boom in tourism from the end of the Second World War, mainly arising from Britain, where food rationing was still in force until the early 1950s and many people opted for holidays in Ireland where food was plentifully available. Rationing came to an end in Ireland in 1951, while meat was still rationed in Britain until July 1954.

The Royal Hotel had survived the transition from sailing ships to steamships by catering for those for whom Howth was their holiday destination. This is shown in *Black's Picturesque Tourist Guide to Ireland*, published in 1855 had this to say of Howth:

> Having become a sea-bathing station, a few more comfortable and commodious houses have sprung into existence of late, and the Royal Hotel, which is well conducted, affords good accommodation to casual visitors.

More recently the name of the hotel was changed to the Baily Court Hotel, and it closed for business in about 2007.

The Martello tower was one of the first to be relinquished by the military. In 1852 the first telegraph cable was laid between Great Britain and Ireland, coming ashore at Howth, where the Martello tower acted as the receiving station. Telegraph was succeeded by radio, when the tower was used for demonstrations of transmissions between Howth and Holyhead in 1903 and 1905. The tower remained in the ownership of successive telecommunications operators until the late 1980s, when it was sold to the county council. It is now “Ye Olde Hurdy-Gurdy Museum of Vintage Radio”, dedicated to communications heritage.

Conservation context

Record of Protected Structures

The application site lies within the administrative area of Fingal County Council. The Record of Protected Structures for Fingal is set down in the Fingal County Development Plan 2017-2023. The Baily Court Hotel is not included and hence is not a protected structure. There are no protected structures on the application site. The Martello tower, to the north of the application site, is a protected structure, as denoted by the yellow symbol carrying the reference number 570 on the map extract below. There are no other protected structures on the lands adjoining the application site. The Martello tower is also included in the Record of Monuments and Places under reference DU016-002002-.

Conservation areas

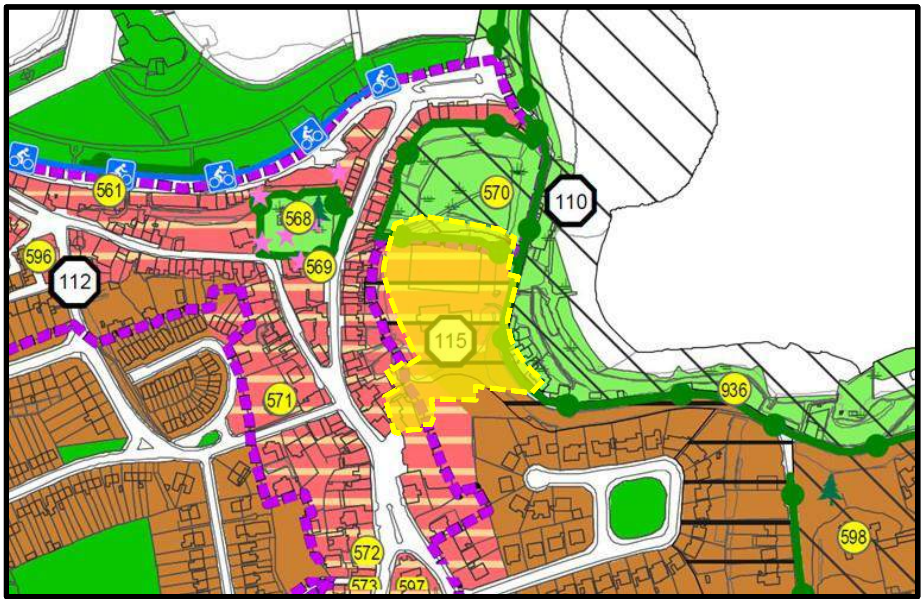


Figure 8: Detail of Fingal Development Plan 2017-2023 showing Howth Approximate extent of site outlined and shaded in yellow

The map extract from the Fingal Development Plan 2017-2023 shows a broken purple line surrounding the town centre. This indicates the Howth Historic Core Architectural Conservation Area (ACA). The Baily Court Hotel is within the boundary of this ACA, while the ACA boundary runs along western and northern boundaries of the application site.

National Inventory of Architectural Heritage

The National Inventory of Architectural Heritage (NIAH) included Fingal amongst its surveys during 2005 and the results have been published. The Baily Court Hotel was amongst the buildings surveyed, reference 11359019. It was assigned Regional rating for its Architectural and Artistic interest. The Howth Martello tower is also included within the NIAH, reference 11359033 and was assigned a National rating.

The NIAH Handbook defines its Regional rating as:

> Structures or sites that make a significant contribution to the architectural heritage within their region or area. They also stand in comparison with similar structures or sites in other regions or areas within Ireland. Examples would include many Georgian terraces; Nenagh Courthouse, Co. Tipperary; or the Bailey Lighthouse, Howth. Increasingly, structures that need to be protected include structures or sites that make a significant contribution to the architectural heritage within their own locality. Examples of these would include modest terraces and timber shopfronts.[1]

At the time that this survey was carried out the NIAH recorded only a description of the building, with some other criteria, while in later surveys carried out elsewhere the record included an appraisal of each structure. No appraisal was included for the Baily Court Hotel. The hotel was still in use at the time, while it is derelict now. The description given in the 2005 survey was:

> Semi-detached three-bay three-storey double-pile former house, c.1800. Two-bay three-storey extension, c.1850, to south-east corner. Projecting bow to ground floor, c.1990. Two-bay two-storey extension to south-west corner, c.1995. Now in use as hotel. ROOF: Double-pitched behind parapet; double-pile; replacement fibre-cement slate, c.1990; concrete ridge tiles; nap rendered chimney stacks; clay pots; concrete coping; upvc rainwater goods; flat-roof to bowed projection. WALLS: Nap rendered; painted. OPENINGS: Square-headed window openings -tripartite to upper floors; concrete sills; original 2/2 and 6/6 timber sash windows to first floor; replacement upvc casement windows, c.1990, to second floor; replacement timber casement windows, c.1990: rope moulded pillars with cast-iron dressings; tripartite door opening to right; round-headed door opening to centre; square-headed flanking door openings; glazed timber panelled doors; fanlight.

It is unlikely that the building was formerly a house, and it is probable that it was built in about 1818 when the harbour was completed and mail ships began to operate on the route to Holyhead, carrying passengers and mails.

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[1] NIAH Handbook, 2017 edition, Department of Culture Heritage and the Gaeltacht, p. 20.

Application site

The application site lies to the east of the village of Howth and to the west of Balscadden Bay. To the north lies the Howth Martello tower, which sits on high ground that falls away at cliffs to the west, north and east, while to the south the ground slopes steeply towards the application site.

Plate 2: Application site, seen from grounds of Martello tower

The site is in three sections. The northern part is in a hollow between the ground occupied by the Martello tower and the southern part of the site. This is seen in the photograph above, with the former sports pavilion building and the hard-surfaced ground to the front. The western part, towards the village, is seen at centre of the photograph below. The ground slopes down to the east to Balscadden Road and to the west towards the village of Howth. The central part is on higher ground, sloping steeply away at its eastern and western margins. This is seen in the middle distance in the photograph above, beyond the lower ground on which the building stands.

Plate 3: Grounds of Martello tower, with site beyond

Plate 4 : Baily Court Hotel

The south-western part of the site lies along Main Street and Abbey Street and is occupied by the Baily Court Hotel, which is a complex of buildings and is now vacant and boarded up. The main hotel building is three-storey and three-bay, with a single-storey, flat-roofed section to the front. This is flanked by two-storey elements, beyond which, to the north, is a range of single-storey structures. To the north of the hotel building is a stable yard

Plate 5: View northwards towards site and hotel

The hotel is set back from the carriageway by an area of parking. To the rear the ground rises steeply to the higher, southern, portion of the application site.

Plate 6: Interior of Baily Court Hotel, 2021

The interior of the hotel was examined in 2012 and it was found that a great deal of the interior fit-out dated from the mid- to late-twentieth century. Original cornicing remained in limited areas on the first floor, along with shutters and architraves, though throughout the rest of the building the features were of later date. Extensive water penetration had occurred at that time and there were extensive signs of resulting damage, including staining indicative of significant quantities of water in the walls, while fruiting bodies of fungal attack were also evident, including in original cornicing. On a return visit in 2021 the building was found to be very extensively damaged and was largely too dangerous to allow examination beyond a limited area.

Plate 7: Stable yard to north of hotel

The stable yard has the shells of buildings, without roofs, on the eastern side, while on the western side there is a two-storey range of buildings mainly constructed of rubble stone, but with some areas where walls are of concrete blockwork.

Proposed development

It is proposed to develop the site to provide residential accommodation with tenant accommodation and retail and café use. To facilitate the development the existing buildings on the site would be demolished, including the former Baily Court Hotel.

The present site includes a substantial tract of land to the east and north-east of the former hotel and this would be included in the development.

As was noted in the site survey above, there are significant changes in level within the application site. From the northern end of the site, where it adjoins the site of the Martello tower, the ground falls away into a hollow, before climbing back up again towards the south, while the ground falls sharply away on both the eastern and western sides. The Baily Court Hotel is at a lower level than much of the rest of the application site, though it is relatively high up on the slope of Main Street.

The proposal would involve a significant degree of cutting into the ground to alter the levels, reducing them to ensure that the proposed development does not dominate the landscape. The buildings would vary in height, with three-storey buildings at the entry to the site from Main Street, to two/five-storey over a basement car park elsewhere within the site.

Assessment

In this assessment each of the potentially sensitive elements in the vicinity of the application site are examined to determine the possible effect of the development on their character or setting. This is followed by a discussion of each of the proposed buildings within the application site to assess the potential impacts each may have on the architectural heritage of Howth.

Sensitive elements in the vicinity

The assessment set out below commences with an assessment of the former Baily Court Hotel, which would be demolished, followed by an assessment of the potential impacts of the proposed development on the historic landscape of Howth, commencing with the adjacent Martello tower to the north of the application site, followed by the Howth Historic Core Architectural Conservation Area, Howth Abbey and, finally, a brief look at Balscadden Road.

Baily Court Hotel

The Baily Court Hotel was built in the early years of the nineteenth century as a hotel, intending initially to serve those who were availing of the cross-channel packet boats from the new harbour, which had commenced construction in 1807. It served as a hotel until about 2007 and has been vacant since the closure.

The present writer inspected the interior of the hotel in 2012 and observed that there was little left of the original internal features within the hotel. At that time there were many places where water was penetrating into the building, with consequent warping of flooring, collapsing of some ceilings, fungal attack, water staining and mould growth.

It would be the norm that hotels would be completely refurbished at intervals, and this trend has been particularly prevalent since the advent of package holidays in the 1960s since which time hotels have had to work hard at attracting business. In the case of the Baily Court the large-scale refurbishment appears to have begun in the 1940s and had a particularly active phase until the mid-1950s. It seems likely that many of the original internal features disappeared at that time. There appears to have been a very comprehensive remodelling of the interior in the later years of the twentieth century, when even those fittings and features that may have been installed in the mid-twentieth century were removed.

Externally the render to the front of the hotel appears to be of sand and cement and to be a later modification. The original facade appears to have been rendered, ruled and lined, and this survives on the gable ends of the main building. The front elevation, however, lacks the ruling and lining. The pattern of cracks running from the window opes suggests that the render is not flexible, and these may have resulted from the settling that occurred when the ground floor window opes were enlarged. The render has left a very small amount of the window sills projecting, indicating that the render is thicker than it was originally.

The building is generally in poor condition, with water penetrating down through the building to ground floor level, causing severe buckling in the floor coverings and extensive water staining in places on the walls and ceilings, much of it accompanied by brown staining that suggests that fungal attack is concealed behind the surface. The substantial level of water penetration has severely damaged the building and there has been further damage through vandalism.

The general lack of surviving earlier elements within the building and the very poor condition of the building would have been contributory factors in the decision by Fingal County Council to decide to grant permission for the demolition of the former hotel in 2013 and the decision of an Bord Pleanála to grant permission in the following year. The condition of the building has become considerably worse since that time. Even in 2012 the building was of such poor quality that planning permission was granted for its demolition (planning reference F13A/0110, An Bord Pleanála reference PL06F.242595). It is now in considerably worse condition, and in its current state detracts from the architectural conservation area. Accordingly, its removal would represent a benefit to the architectural conservation area.

Howth Martello Tower

Plate 8: Approach to Howth Martello tower

The Martello tower at Howth is approached via a steep pathway that leads from Abbey Street. To the right of the pathway, on the slope up to the tower, there is dense planting that screens the view towards the application site. At the top of the slope a pair of stone gate piers marks the entry to the relatively flat ground on which the tower stands, though the tower sits in a slight hollow. The ground is surfaced with grass, cut short, and is surrounded by a steel railing at the top of the cliffs and sloping ground that surround the grounds of the tower.

The trees within the application site to the right of the approach path are to be removed and replaced as part of the landscaping scheme. These are lower down the slope than the trees shown in the view above and while the proposed apartment building B would be visible from the path the ground on which it will sit will be at a much lower level than the Martello tower and the presence of the apartments will not have an adverse effect on the character and setting of the Martello tower.

Plate 9: Howth Martello tower

The tower itself is a circular building with its main door at first floor, approached via a flight of steel stairs. There is one window, facing north away from the application site. The tower is rendered and has a machicolation over the door. The machicolation – seen projecting above the doorway, was an overhanging feature that provided the opportunity for those defending the tower to shoot pistols or muskets down at anyone who was attempting to force their way through the door. In this view of the tower there would be no impact on the character or setting of the tower, as the application site is off to the right in this view.

Plate 10 : Howth Martello tower seen from the east

The site on which the tower stands allows for movement around the perimeter of the tower to view it from all sides, though it is a small enough site that it is not possible to get distant views of the tower from within its grounds. In the above view, from the east, the proposed development would have no impact on the character or setting of the tower as it would be to the rear of the viewer.

Plate 11: View southwards past tower towards application site

From the northern perimeter of the Martello tower site the application site may be seen in the view past the tower. This is the only viewpoint within the grounds of the tower where any reasonable view of both the tower and the application site may be seen. As seen in the photograph the tower dominates this view, being much closer to the viewer than the site in the distance. The proposed development would be relatively low in this view and would read as part of the gathering of buildings that is already seen in this view on either side of the application site. It is not considered that the proposed development would have any significant impact on the character or setting of the Martello tower from within its grounds.

Plate 12 : View of Martello tower from landward end of East Pier

The significant height of the platform on which the Martello tower stands ensures that the tower is partially concealed from view when seen from relatively close by, as illustrated in the photograph above. In a view such as this the application site and its proposed development would not be seen.

Plate 13: View of Martello tower from the East Pier

At longer distances this effect still applies. The photograph above was taken from the East Pier, at a point approximately 300 metres from the tower. The viewer still looks upwards at the tower and the proposed development would not be visible in this view, though it would become more visible in views from a greater distance, as is discussed below. There would be no impact on the character or setting of the Martello tower in this view.

Plate 14: View of Martello tower from East Pier

The photograph above was taken from near the first turn in the East Pier, on its lower walkway, at a distance of approximately 450 metres from the tower, using a telephoto lens. From this viewpoint the tower is seen with the rising ground beyond as a backdrop and to a significant extent it blends into the background. The top of the tower of the Church of the Assumption in Main Street is seen to the right of the Martello tower. This church is located significantly higher up the street than the Baily Court Hotel and it gives an indication of the extent to which the high ground on which the Martello tower stands masks the land beyond. The proposed buildings would begin to be visible from this point, as seen in montage View 17 reproduced below, from the Verified Photomontages document produced by Digital Dimensions and submitted with this application. The proposed buildings would not stand out in this view due to the backdrop of the Hill of Howth behind it. As View 17 shows, there would be no appreciable impact.

Plate 15: Photomontage View 17, showing proposed development from the East Pier

Plate 16: View from Ireland's Eye

The photograph above was taken from the summit of Ireland's Eye. This view is not visible to the naked eye with this clarity, as it was taken with a long telephoto lens. The Martello tower is barely visible against the background, while the houses and other buildings around and beyond it provide a clutter of coloured buildings into which the proposed development would blend with no impact on this view.

Montage View 18 reproduced below, from the Verified Photomontages document produced by Digital Dimensions and submitted with this application, shows the view from the West Pier. The proposed buildings would be barely discernible in this view due to the backdrop of the Hill of Howth behind them. As View 18 shows, there would be no appreciable impact.

Plate 17: Photomontage View 18, showing proposed development from the West Pier

Plate 18: View of Martello tower across harbour from west

When viewed from further to the west the Martello tower stands in silhouette against the sky, though the lower part of the tower is still concealed. In this view the application site is off to the right and at a significant separation from the tower, with a belt of trees between the viewer and the site for the proposed development.

Plate 19: View of Martello tower from green alongside Harbour Road

The view from an alternative viewing point on the grass alongside Harbour Road is similar to that in the previous photograph, though closer. The application site is towards the right in this view, at a significant angular separation from the Martello tower and with numerous trees separating the application site from the viewer.

Plate 20: View from Kilrock

From some locations along Balscadden Road to the east of the application site there are views of the Martello tower on its high ground. The application site is located to the left of the Martello tower in this view. The proposed buildings that would be closest to the tower would be 3-4-storey in height above ground level at this point, with a basement car park below. The base of the tower would be close to the floor level of the top-floor apartments in the building closest to the tower, as seen in site sections submitted with the application. The closest distance between the nearest proposed building and the tower would be approximately 47 metres and at this distance the small height to which the building would rise above the base of the tower would ensure that the proposed building would have little or no impact on the setting of the tower as seen from this angle. The proposal is shown in View 16 reproduced below taken from the Verified Photomontages document produced by Digital Dimensions and submitted with this application.

Plate 21: Photomontage View 16, showing proposed development from Balscadden Road

Martello tower and St Mary's Abbey

Plate 22: View towards application site from grounds of abbey

From the greater part of the grounds of St Mary's Abbey the view of the application site would be obscured by the buildings along Abbey Street. This is illustrated in the photograph above. Parts of the proposed development would be seen from the grounds of the Abbey, but this would not result in any adverse impact as the new buildings would be masked to a large extent by the houses seen in this photograph. The proposed development as seen from this location is seen in View 11 reproduced below taken from the Verified Photomontages document produced by Digital Dimensions and submitted with this application. As can be seen, the development will be visible on the hillside behind Abbey Street, but the houses in the street will remain the dominant element.

Plate 23: Photomontage View 11, showing proposed development from Howth Abbey

Plate 24: View from high ground at entry to St Mary's Abbey

The Abbey grounds are entered from higher ground along Church Street. From this higher level a small part of the application site can be seen, and this lies to the right of the red-brick houses in the centre of the photograph. From this angle the Martello tower is largely concealed behind trees and there is no vista of the tower that would be affected by the proposed development. The proposed buildings would blend with the existing houses seen in the photograph and would have no adverse impact on the character or setting of St Mary's Abbey.

Architectural Conservation Area

Plate 25: View towards site from junction of Main Street and Church Street

The application site lies to the east of Main Street and in general would not be seen from Main Street due to the presence of buildings along the street frontage. Views towards the site from Church Street and from St Lawrence Road provide scope to see the application site and the proposed buildings from a greater distance. The buildings along Main Street that back on to the site are generally more modest than many of the buildings in Howth village, being two-storey and with hipped roofs.

Plate 26: View towards site from junction of Main Street with St Lawrence Road

Opposite the end of St Lawrence Road there is larger building of more recent date, while further up the street, towards the Baily Court Hotel, there are trees and a small single-storey building of twentieth-century date.

Balscadden Road

Plate 27: View up Balscadden Road towards the application site

Balscadden Road has an industrial heritage significance, as the route of the railway that carried the stone from the quarries at Kilrock to the site for the construction of the harbour. The road is associated with the eminent engineer, John Rennie, who designed the railway, including cutting the route of Balscadden Road out of the side of the cliffs. The straight section of Balscadden Road, from a point adjacent to the application site, was an inclined plane, down which wagons loaded with stone were lowered along the rails with a system of chains, which also returned the empty wagons to the top using a funicular system.

The proposed development would not have any adverse impact on the route of the former railway line or on its setting as there are no visible remnants of the former railway at this location other than the road itself, which has been altered significantly since the railway ceased to exist.

Proposed buildings

The proposal includes changes to the contours of the site followed by the erection of four buildings of differing sizes. Block A is to be close to Main Street, to the rear of the existing health centre and is to be a relatively small building. Block B is the largest of the proposed buildings, to be located in the northern part of the site and built around a central courtyard. Block C would lie to the south of Block B, set back from Main Street and it is proposed to provide a new street running between Blocks B and C and providing a pedestrian route to connect Main Street with Balscadden Road. Block D is to be erected on the site of the former Baily Court Hotel, fronting onto Main Street at the southern end of the site.

Block A

The proposed Block A is to be three storeys in height. Its plan form is to be based on a rectangle, but with the southern wall at an angle, parallel to the proposed street adjacent. The roof is to be pyramidal with a raised section at the apex, in recognition of the lantern on the pyramidal roof of the adjacent existing health centre and the elevations are to be rendered. This building will rise higher than the health centre, but, being set back from the street, and having a pitched roof, it will sit in well with the character of the architectural conservation area.

Block B

Block B will take up a substantial proportion of the site. It is to vary from two- to five-storey, over a basement car park, and will have a flat roof. The northern section will be closest to the Martello tower and will be three-storey over the basement. There is a steep bank at the northern end of the site and this slope is to be cut into and held back by a retaining wall. The difference in levels between Block B and the Martello tower will ensure that the building will be relatively low when seen from the tower, as seen in View 9 in the Verified Photomontages document prepared by Digital Dimensions and submitted with the application. The proposal to plant trees along the northern margin of the application site, alongside the proposed Block B will further reduce the visibility of the building as seen from the Martello tower and its surrounding lands. Views 10, 16, 18 and 20 of the

Verified Views submitted with the application show the proposed Block B in the context of the Martello tower and demonstrate that the building will not have an adverse effect on its character or setting in view of the low level of the proposed Block B in relation to the Martello tower, the distance separation between the tower and Block B and the cleans lines of the proposed building.

Block B will also be visible from Abbey Street, Main Street and Church Street, within the Howth Historic Core Architectural Conservation Area (ACA). Views 2, 3, 11 and 12 submitted with the application show the proposed Block B as seen from the ACA and from the grounds of Howth Abbey. These demonstrate that the apartment building will not be dominant in the street scene or from the abbey or the ACA in general and accordingly the proposed development will not have an adverse effect on the architectural heritage of the street, the abbey or the Howth Historic Core Architectural Conservation Area.

Block C

The proposed Block C will be part four-storey and part five-storey and will be located at a distance from the Martello tower and Howth Abbey, as a result of which it will have no impact on the character of either of these sites. The block will also be set back from Main Street, with the closest part of the proposed building being 4-storey. The building will be visible from the junction of Main Street with the proposed new street but will be set back at a sufficient distance to have little or no impact on the character of the ACA.

Block D

Block D is to be located on the site of the former Baily Court Hotel and its design draws its influence from that of the hotel building. It is to be set back from the street behind a pergola, reflecting the form of the Baily Court, which has a single-storey structure across the front elevation. The block is to be mainly three-storey, plus a top floor at dormer level, with a two-storey element at the southern end. The building is to be gable-ended with a double-A roof, the two sections separated by a valley. From the street Block D will have the appearance of a three-storey building. The design, location and massing of Block D will ensure that it will blend into the streetscape as a suitable replacement for the Baily Court in the ACA.

Assessment

It is proposed to provide 180 residential units, tenant facilities, two retail units and a retail/café on a site between Main Street and Balscadden Road, Howth. This will require the demolition of the former Baily Court Hotel, with its associated outbuildings and a disused sports hall. Ground levels will be reduced within the site. The main vehicular entrance is to be from Main Street, with a secondary access from Balscadden Road.

As the photographs above have shown, the views of the Martello tower from various points around Howth vary considerably. In some places the tower is barely visible because of the significant scarp at the edge of the grounds of the tower and from these locations the application site would not be visible. In the distant views, such as those from the further points along the piers and from the extreme distance of Ireland’s Eye the tower becomes almost invisible as its muted colour blends into the background, while the houses in Howth and its suburbs are more visible. In these views the proposed development would be visible, though not noticeable, given the backdrop of other houses, while the Martello tower would not be particularly visible and hence the proposed development would have little or no impact on the setting of the tower. At intermediate distances the tower is visible against the skyline, while the application site is obscured either by the high ground on which the tower stands or by the buildings in Abbey Street and the trees behind.

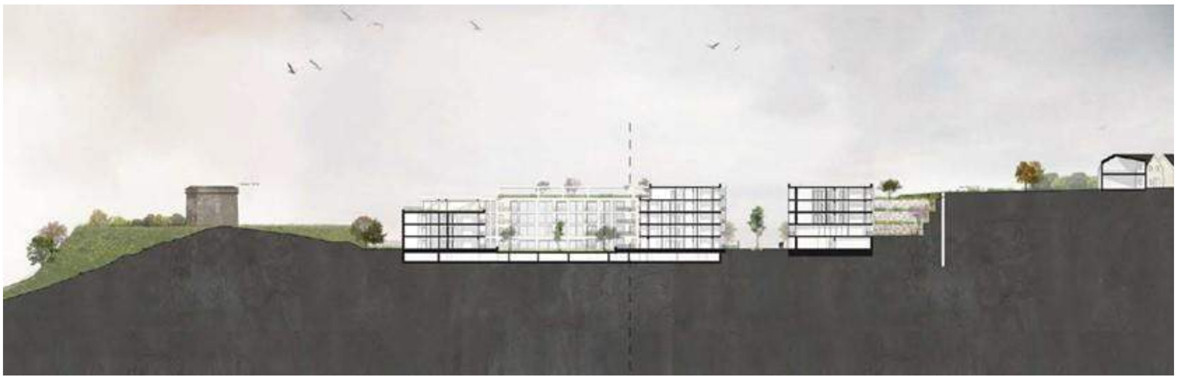

Figure 9: Section through site from north to south

The image above shows a section through the application site, looking to the east, with the proposed development seen in the centre. The Martello tower is seen toward the left. It may be seen from this that the proposed buildings at the northern end of the site are lower than the tower and are separated by a significant distance. The view also illustrates how the high elevation of the ground on which the Martello tower sits ensures that any viewer from the harbour to the north is looking up at the tower, while the proposed development is concealed by the rising ground when looking from the north.

One of the viewpoints from which the Martello tower and the proposed development would both be most visible is the view from Kilrock, along

Balscadden Road. However, there is a significant angular distance between the proposed buildings and the tower when seen from this viewpoint and this is illustrated in View V16 submitted with the application. The tower stands high and proud in this view, while the proposed buildings would be significantly lower and would be set into the hollow ground, thereby being less visible than the tower and having little or no impact on its setting. It should be noted that there is no public access to the roof of the Martello tower, which is used for the location of antennae in connection with the Hurdy Gurdy Museum of Radio and hence the view from the roof, or gun emplacement, is not a significant factor in the impact on the Martello tower.

The photographs and text above have also shown that the proposed development would have no appreciable impact on the setting of St Mary's Abbey. The development and the abbey would not be readily visible together in any view that would detract from the setting of the abbey. It would be possible to view parts of the development from the grounds of the abbey, as discussed above in the section that addresses the abbey, but the proposed buildings as seen in those views are in the background behind existing buildings and would not form a prominent feature in the vista.

The boundary of the Howth Historic Core Architectural Conservation Area (ACA) runs along the western and northern boundaries of the application site. The impact on the northern side is equivalent to the impact on the Martello tower and has been discussed above. From the west the proposed development would have no significant impact on the ACA. The significant changes in levels within the ACA and the enclosure resulting from the buildings lined along either side of the streets ensure that the land to the rear is not generally visible from along Main Street within the ACA. As a result, the proposed development would not be a significant element within the ACA on Main Street and would not have any appreciable impact on its character.

When seen from the junctions with Church Street and St Lawrence Road the longer range of the view allows for the proposed development to be seen above the roofs of the buildings in Main Street. The present views from these junctions are shown in plates 25 and 26 above. The development will be visible from these angles, due to the rise in ground level and the height of the proposed buildings. However, this is an urban context and the choice of materials and finishes on the new buildings will ensure that the new development will blend in with the backdrop as seen from the street. The existing buildings will be in the foreground in views from those junctions and hence will remain the dominant element in the views, with the proposed buildings to the rear appearing as a backdrop.

The Baily Court Hotel has been discussed above. During discussions with the Conservation Officer, Fingal County Council, some years ago it was clear that the demolition of the former hotel to facilitate new development would be acceptable and planning permission has subsequently been granted for its demolition. The factors that led to the decision being made to grant permission for its demolition still pertain, though they are more extreme as the building is now in far worse condition than it was at that time. Furthermore, the hotel has been seen to have been altered from its original historic form. The design of the buildings to be erected on the site of the hotel and its outbuildings has been carefully considered in order to blend the new buildings in with the character of the street and the character of the hotel that is to be removed.

Development plan policies

The Fingal County Development Plan 2017-2023 contains a number of policies in relation to architectural heritage. Some of these are specific to works being carried out on protected structures, which would not be of relevance in the present proposal, while others relate to specific sites or areas within the county that are not in the vicinity of the application site. The following are relative objectives of the development plan:

> Objective CH20
>
> Ensure that any development, modification, alteration, or extension affecting a protected structure and/or its setting is sensitively sited and designed, is compatible with the special character, and is appropriate in terms of the proposed scale, mass, height, density, layout, materials, impact on architectural or historic features, and junction with the existing protected structure.
>
> Objective CH25
>
> Ensure that proposals for large scale developments and infrastructure projects consider the impacts on the architectural heritage and seek to avoid them. The extent, route, services and signage for such projects should be sited at a distance from Protected Structures, outside the boundaries of historic designed landscapes, and not interrupt specifically designed vistas. Where this is not possible the visual impact must be minimised through appropriate mitigation measures such as high-quality design and/or use of screen planting
>
> Objective CH32
>
> Avoid the removal of structures and distinctive elements (such as boundary treatments, street furniture, paving and landscaping) that positively contribute to the character of an architectural conservation area.

Each of these objectives has been taken into account and the proposed development has been designed in such a way as to fulfil the objectives. Objective CH20 relates in part to works to protected structures, which is not relevant in the present proposal, while the rest of the objective concerns the settings of protected structures. The potential impacts on protected structures in the vicinity of the site have been discussed in this report and it has been shown that there would not be any adverse impact.

Objective CH25 seeks to avoid the impact on protected structures, designed landscapes and designed vistas of facilities such as services and signage and no utilities or signage in the present proposal would have any adverse impact on the character or setting of any protected structure. Similarly, the proposal would not involve the removal of any structures or distinctive elements that would positively contribute to the character of an architectural conservation area (ACA), in accordance with the requirements of objective CH32. The only significant structures within an ACA that would be removed would be the former Baily Court Hotel and its outbuildings and the text above assesses the removal of those structures, which lie within an ACA.

Conclusions

The proposed development seeks to remove a derelict hotel building and to provide four new buildings on a site that lies adjacent to a prominent Martello tower and to an architectural conservation area (ACA), while the front part of the application site lies within the ACA. The text above shows how the development has been designed in order to ensure that there is minimal impact on the Martello tower, the ACA and other elements of architectural heritage in the vicinity, any such impact being within acceptable limits.

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Appendix – Conservation guidelines

The preparation of an architectural heritage impact assessment is carried out in the context of the *Architectural Heritage Protection Guidelines for Planning Authorities* published by the Department of the Environment, Heritage and Local Government in 2004 and reissued by the Department of Arts, Heritage and the Gaeltacht in 2011. The main thrust of the guidelines relates to works to protected structures, though they are also relevant to projects such as the present proposal, where there are no protected structures on the site but there is an architectural conservation area the vicinity as well as protected structures and the potential impact of the development on these may be properly assessed.

The section of the guidelines that addresses development control contains the following paragraph:

> 6.4.15 For more extensive or complex works with a potential to have a major impact on the architectural heritage, a planning authority may require an applicant to submit a more detailed impact statement. This may be necessary to allow the planning authority to assess the full implications of the proposals and allow an informed decision to be made on the appropriateness of the development. An outline of the type of information that could be included in such an architectural heritage impact assessment is found in Appendix B of these guidelines.

This paragraph relates mainly to more extensive or complex works to a protected structure but is taken in this report to be of relevance in view of the extent of the proposed development.

Architectural Heritage Impact Assessments

Appendix B of the guidelines sets out the criteria that would normally be expected to be included in an architectural heritage impact assessment. The full text of this appendix is set out below, with comments added in blue to indicate how the present architectural impact assessments has met the guidelines.

B1.0 Requirement for a Report

B1.1 The requirement for an architectural heritage impact assessment will generally come about for one of two reasons:

a) as part of a development application in order to provide sufficient information for the planning authority to make an informed decision on the potential impact on the architectural heritage, or

b) where permission has been granted for works to a protected structure or a proposed protected structure, to record the existing fixtures or features which contribute to its special interest and which would be lost or altered as a result of the works.

This report has been prepared in response to paragraph (a).

B2.0 Scope of the Assessment

B2.1 The detail and extent of the assessment should be appropriate to the nature and scale of the proposed works. The object of the assessment should be to describe how the proposals would affect the character of the protected structure or any part of it. This will normally require a description of the existing structure, a description of the works proposed and a description of how any potential adverse impact on the architectural heritage is to be mitigated.

B2.2 Where comprehensive or wide-ranging works are proposed, the entire protected structure and the land and features within its curtilage may require to be included in the assessment. However, where proposals are limited in scale or relate to a specific part or parts of the structure, it will generally be sufficient to include a brief description of the structure as a whole, to provide a context for the proposals, but to concentrate the detailed assessment on those parts of the structure which will be impacted upon. If the application relates to a new building within the curtilage of a protected structure or proposed protected structure, the assessment should concentrate on the relationship between the structure and its setting, and the merits of, and impacts on, existing structures and features in the curtilage.

B2.3 Ideally, there should be full access to the structure for the author of the assessment in order for him/her to have a full understanding of the potential for the works to impact on the building.

As there are no protected structures on the application site the assessment concentrates on the relationship of the proposed development to the settings of protected structures in the vicinity and the architectural conservation area in line with the final sentence of paragraph B2.2. The Baily Court Hotel was visited by the present writer in 2012 and again, insofar as safety permitted, in 2021.

B3.0 Recording a Structure to be Altered or Demolished

B3.1 Where an assessment is intended as a permanent record of a structure, or part of a structure that is being altered or demolished, it may have to substitute for the structure itself and so must be capable of bearing on-going and repeated analysis, re-examination and reinterpretation. Specialist expertise may be necessary for the compilation of such architectural heritage impact assessments that describe and assess structural or other engineering matters or those relating to historic landscapes.

This paragraph is not relevant in the present report, the purpose of which is not to make a record of a structure, but to assess potential impacts.

B4.0 Competency of Author(s)

B4.1 The author(s) of an architectural heritage impact assessment should be appropriately qualified or competent to undertake the assessment. Where the works to the protected structure are unlikely to have more than a minor impact on the character of the structure, it may be acceptable that the assessment be undertaken by a person, or persons, without specialised expertise. However, where the protected structure is of high quality or rarity, or where the impact on the architectural heritage may be substantial, the planning authority could make it a requirement that the assessment be carried out by those with relevant competence or expertise.

The author of this report is fully qualified in conservation and has the relevant competence and expertise to prepare this architectural heritage impact assessment.

B5.0 Elements of the Assessment

B5.1 The content of the assessment will vary in individual cases depending on the relative significance of the structure for which the assessment is being prepared and the nature and extent of proposals under consideration. The information set out below can be used as a guide. Assessments should generally contain three distinct but interdependent elements:

a) a written account;

b) a set of well-presented drawings;

c) suitable photographs and/or other illustrations.

This report includes a written account, maps and drawings, suitable photographs and copies of views of the proposed development. Further drawings and particulars are submitted with the application including the Verified Montages document produced by Digital Dimensions in which twenty-two views of the proposed development are included, four of which, views 11, 16, 17 and 18 have been discussed and reproduced in the present report.

Written Account

B5.2 The written account of the building will usually comprise three parts:

a) core data;

b) short description of the building;

c) analysis.

This report includes core data, as set out below, a description of the vicinity of the application site, there being no protected structure on the site that needs to be described as set down in paragraph B5.2(b). The report also includes an analysis of the proposed development and its potential impacts on architectural heritage.

Core Data

B5.3 The following core data on the building should generally be included in every report:

a) purpose of the assessment. For example, where the assessment forms part of a planning application, this should be stated. Where the assessment is part of a response to a further information request from the planning authority, the planning reference and a copy of the further information request from the planning authority should be included with the assessment. Where the assessment is to fulfil the requirements of a condition of permission, the planning reference number should be given and a copy of grant of permission and relevant condition(s);

b) name and address of the structure, including any local reference by which the building is known, where this is necessary to identify it;

c) brief description of the typological aspects of the structure;

d) Ordnance Survey map reference for the structure;

e) National Grid reference, where necessary;

f) details of the form, or forms, of statutory protection which apply to the site, for example:

  i. Record of Protected Structures, including reference number;

  ii. Architectural Conservation Area designation;

  iii. Recorded Monument, including RMP reference number;

  iv. Zone of Archaeological Potential;

  v. Registered Monument, including RMP reference number;

  vi. Preservation Order or Temporary Preservation Order;

g) name of the individual (and their agency, if appropriate) who prepared the assessment, and his/her relevant qualifications or competency;

h) date of the assessment and of the inspection;

i) name of relevant planning authority;

j) details of any declaration issued regarding the structure;

k) National Inventory of Architectural Heritage registration number of the structure, where available[2].

All of the above are included in this assessment report, where relevant.

Description of the Structure

B5.4 This should be a concise description of the structure as it exists, noting all its salient features, and describing its external and internal appearance and setting, form, present function, type or purpose, materials, architect and date (where ascertainable). For large sites, where there is more than one structure, separate descriptions of each should be made together with an account of their relationship to each other.

The report includes a description of the architectural conservation area and the adjacent Martello tower and also refers to other structures in the vicinity.

Analysis of the Existing Structure

B5.5 Following on from the basic data contained in the short description, the written assessment should contain all or part of the following information as relevant to the particular case.

---

[2] *Available from published surveys or from the NIAH website*

B5.6 Where the development consists solely of new work, such as extensions or new build in the curtilage of a protected structure, items a) to c) can be briefly summarised:

a) a description of the structure, recording features of note or historical significance, architectural or engineering design, building materials, building techniques and craftsmanship. Where comprehensive works are proposed, it may be appropriate that this description be carried out on a floor-by-floor, room-by-room basis;

b) a description of the structure's overall development, noting evidence of successive building phases and supporting this analysis with annotated reference to stylistic elements, documentary sources or scientific dating methods, where appropriate. Reference should be made to original and present uses of the structure, or its parts;

c) a description of the current physical condition of both the fabric and the structure in order to establish the nature and extent of any apparent damage, including any indications of previous demolition or alteration to the structure;

d) a description of the relationship of the structure to its setting, noting the evolution and condition of the site, its impact on the landscape, ancillary structures (either current or removed) and their relationship to the principal structure in question. Where the proposal relates to new works this section should be comprehensive. However, it will not be relevant where internal works alone are proposed;

e) information on persons or organisations associated with the construction, development or use of the building, including architects, engineers or builders, proprietors or other occupants, where known. Historically significant events with which the building was associated should also be included.

f) certain structures may merit further investigation of record sources, such as Valuation Office records, deeds relating to the building in the Registry of Deeds, architectural drawings or other information in, for example, the Irish Architectural Archive, National Library of Ireland or the Archaeological Survey of Ireland, and historic census records.

This item relates to works to a protected structure.

Drawings

B5.7 Drawings of the structure, including site-plans, plans, sections and elevations, are generally necessary in order to locate the proposed works, the location and direction of the photographs included and to help in the assessment of the impact of the proposed development. Rooms or other spaces should be numbered and these numbers matched to written descriptions and illustrations where necessary to identify locations.

B5.8 Where alterations are proposed to only a small portion of the structure, it should not generally be necessary to include an exhaustive set of measured drawings for the entire protected structure. Indicative floor plans combined with photographs should be sufficient to support the assessment in such cases.

The architect's drawings are submitted with the application.

Maps

B5.9 Where the building or structure appears on early Ordnance Survey or other historic maps and its development, or earlier form, is relevant to the development proposals, it would be useful to include copies of the pertinent sections of the maps within the assessment and cross-referenced to other parts of the assessment as necessary.

Historic maps are included.

Photographs

B5.10 A photographic survey of the relevant parts of the structure should be an integral part of the assessment. Where comprehensive works are proposed, the photographic coverage required for assessments could include floor-by-floor, room-by-room coverage of the internal appearance, and building elements, decorative features, details, fixtures or fittings, whether internal or external, noted as contributing to its character in the detailed written analysis.

B5.11 Where minor or small-scale works are proposed, photographs can be limited to those parts of the structure which will be impacted upon by the development. In such cases, it will nonetheless be useful to include enough general photographs of the structure to allow the context of the development to be appreciated by anyone reading the assessment.

B5.12 Colour-print film and digital images can be used for assessments to be submitted prior to a decision being made on the planning application. Scanned or digitally produced photographs should be printed legibly in the assessment to allow detailed examination. All copies submitted to the planning authority should be to the same standard, and not black-and-white photocopies. Captions should identify the purpose of the image and the location of the feature or space.

B5.13 Copies of relevant historic photographs, where available, could usefully be included with the assessment. All photographs should be clearly marked, identifying the location and the subject of the image, and when the photograph was taken and by whom (if known).

Photographs are included in this report and all colour photographs were taken by the author of the report on the dates given for the site surveys.

Anticipating Concealed Features

B5.14 Where the proposed works consist of alterations to an existing structure, concealed architectural features, such as chimneypieces, fireplaces, earlier openings, panelling, or decorative finishes, may come to light during the course of the works. Where there is any likelihood of this, the assessment should contain a schedule of reversible exploratory and enabling works and note whether or not it is anticipated that further future approvals will be necessary as a result.

B5.15 Where feasible, the assessment should indicate alternative design details or methods of work which would allow such features to remain in situ. Alternatively, the planning authority could attach an appropriate condition to the planning permission to ensure that these features will be retained or properly recorded as appropriate to their importance. Where removal is unavoidable, the assessment should suggest alternative locations within the structure for found features.

This item relates to works to a protected structure.

Impact Assessment

B5.16 The author(s) of assessments compiled to accompany a planning application should be fully appraised of the development proposal. The assessment should contain an evaluation of the quality and importance of the structure. In addition, it should contain a comprehensive assessment of the implications of the development for the character of the structure and the area in which it is located. This should highlight how the elements of this character (those which contribute to its special architectural, historical, archaeological, artistic, cultural, scientific, social and/or technical interest) would be materially altered by the development.

This item relates to works to a protected structure, though the report includes full appraisal of the proposal, an evaluation of the importance of the historic structures in the vicinity and a comprehensive assessment of the implications of the development for the character of the conservation area and structures in the vicinity. The author was fully appraised of the development proposal and was part of the team throughout the design period.

Recommendations and Conclusions

B5.17 Any recommendations and mitigation measures should be set out in accordance with the conclusions of the impact assessment, including an outline of proposed conservation works for agreement with the planning authority. Any scope of works statement or methodology included should be specifically written for the structure that is the subject of the assessment.

B5.18 It may not always be necessary or desirable to include conclusions or recommendations in the assessment. In some cases it will be sufficient for the assessment to describe and assess the structure, with clear and relevant illustrations cross-referenced to the text. Such assessments should describe in detail the existing architectural heritage, the impacts of the proposals, and the potential to mitigate any negative impacts in order to allow the planning authority to arrive at its own conclusions regarding the appropriateness of the proposed development.

The report includes conclusions, though this section of the guidelines relates mainly to works to a protected structure.

Appendix I

digital dimensions
architectural visualisation

Proposed Residential Development
Balscadden Road, Howth, County Dublin

Verified Photomontages

Our Ref: 21-106 Balscadden

NOTES AND METHODOLOGY

PROJECT DETAILS

Title: Proposed Residential Development - Balscadden Road, Howth, County Dublin

Development Description:

Demolition of existing structures on site , construction of 181 no. of apartments and associated site works. Balscadden Road and 66 Main Street, Howth, Co. Dublin.

Design team:

Client:	Balscadden 3 Limited Partnership
Architect:	Plus Architecture
Planning Cunsultant:	Brady Shipman Martin
LVIA Consultant:	Macroworks

Prepared by Digital Dimensions

Issue Date	17/01/21	11/02/22	17/02/22	18/03/22	
Revision	A	B	C	D	
Status	Draft	Draft	Draft	Final	

PROFILE

Digital Dimensions are specialists in computer generated visualisations for all forms of planning applications. The company was established in 2000 by John Healy and Jim Manning in Dublin, Ireland. Digital Dimensions is one of Ireland's leading architectural visualisation companies with 20+ years of experience covering a wide range of solutions in the areas of architectural visualisation, environmental design and digital media.

Method Statement - Photo-montage production using guidance in The Landscape Institute TGN-06-19 Visual Representation of Development Proposals.

1. Photographs are taken from locations as advised by the planning consultant with a full frame SLR digital camera and prime lens. Photographs are taken using the most appropriate combination of lens focal lengths to ensure that the field of view covers the proposed scheme environment or landscape context. The photographs are taken horizontally with a survey level attached to the camera. The photographic positions are marked (for later surveying), the height of the camera and the focal length of the image recorded.

2. In each photograph, a minimum of 3no. visible fixed points are marked for surveying. These are control points for model alignment within the photograph. All surveying is carried out by a qualified topographical surveyor using Total Station / GPS devices.

3. The photographic positions and the control points are geographically surveyed and this survey is tied in to the site topographical survey supplied by the Architect / client.

4. The buildings are accurately modelled in 3D cad software from cad drawings or BIM model supplied by the Architect. Material finishes are applied to the 3D model and scene element are place like trees and planting to represent the proposed landscaping.

5. Virtual 3D cameras are positioned according to the survey co-ordinates and the focal length is set to match the photograph. Pitch and rotation are adjusted using the survey control points to align the virtual camera to the photograph. Lighting is set to match the time of day the photograph is taken.

6. The proposed development is output from the 3D software using this camera and the image is then blended with the original photograph to give an accurate image of what the proposed development will look like in its proposed setting.

7. In the event of the development not being visible, the roof line of the development will be outlined in red if re-quested.

8. The document contains:

   a. Site location map with view locations plotted.
   b. Photomontage sheet with existing or proposed conditions.
   c. Reference information including field of view/focal length, range to site / development, date of photograph.

9. For the views, we provide two images:

   a. The existing view
   b. The proposed photomontage (or scheme outline as appropriate)

digital dimensions
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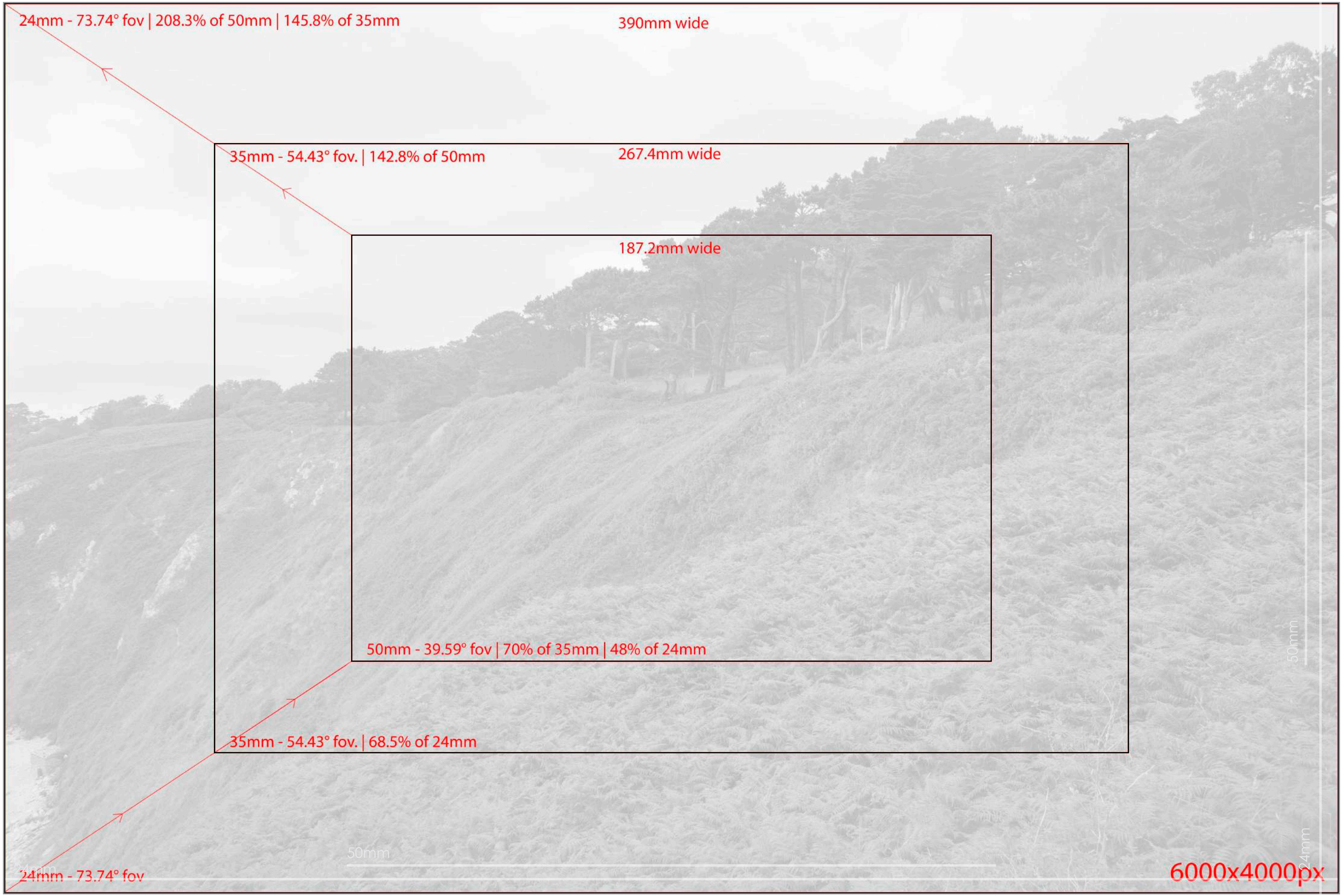
View Location Map
This map is for view location purposes only. Please refer to Architects drawings for site layout and redline boundary.

digital dimensions
architectural visualisation



< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
						Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 1 Existing	Main Street Howth from Bus Stop No 575 looking North	18/05/21	74°	24mm	25.5m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 1 Proposed	Main Street Howth from Bus Stop No 575 looking North	18/05/21	74°	24mm	25.5m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 1a Existing	Main Street Howth from Bus Stop No 575 looking East	18/05/21	74°	24mm	25.5m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 1a Proposed	Main Street Howth from Bus Stop No 575 looking East	18/05/21	74°	24mm	25.5m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 1b Existing	Main Street Howth from Bus Stop No 575 looking South East	18/05/21	74°	24mm	25.5m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 1b Proposed	Main Street Howth from Bus Stop No 575 looking South East	18/05/21	74°	24mm	25.5m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 2 Existing	Outside No 4 Main Street Howth looking North	18/05/21	74°	24mm	12.6m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 2 Proposed	Outside No 4 Main Street Howth looking North	18/05/21	74°	24mm	12.6m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 2aExisting	Outside No 4 Main Street Howth looking East	18/05/21	74°	24mm	12.6m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 2a Proposed	Outside No 4 Main Street Howth looking East	18/05/21	74°	24mm	12.6m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 2b Existing	Outside No 4 Main Street Howth looking South East	18/05/21	74°	24mm	12.6m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 2b Proposed	Outside No 4 Main Street Howth looking South East	18/05/21	74°	24mm	12.6m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 3 Existing	Outside No 14 Main Street Howth looking North	18/05/21	74°	24mm	67.9m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7°	< 35mm / 54.4°	< 50mm / 39.6°	Lens Information: Focal Length / Field of View	50mm / 39.6° >	35mm / 54.4° >	24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 3 Proposed	Outside No 14 Main Street Howth looking North	18/05/21	74°	24mm	67.9m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 4 Existing	Outside No 10 Thornmanby Road Howth looking North	18/05/21	74°	24mm	209xm	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 4 Proposed	Outside No 10 Thornmanby Road Howth looking North	18/05/21	74°	24mm	209m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 5 Existing	Opposite No 19 Asgard Park looking West	18/05/21	74°	24mm	90.3m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 5 Proposed	Opposite No 19 Asgard Park looking West	18/05/21	74°	24mm	90.3m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 5a Existing	Opposite No 19 Asgard Park looking North West	18/05/21	74°	24mm	90.3m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 5a Proposed	Opposite No 19 Asgard Park looking North West	18/05/21	74°	24mm	90.3m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 5b Existing	Opposite No 19 Asgard Park looking North	18/05/21	74°	24mm	90.3m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 5b Proposed	Opposite No 19 Asgard Park looking North	18/05/21	74°	24mm	90.3m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 6 Existing	Outside No 13 Balscadden Road Howth looking West	18/05/21	74°	24mm	12m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 6 Proposed	Outside No 13 Balscadden Road Howth looking West	18/05/21	74°	24mm	12m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 6a Existing	Outside No 13 Balscadden Road Howth looking West	18/05/21	74°	24mm	12m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 6a Proposed	Outside No 13 Balscadden Road Howth looking West	18/05/21	74°	24mm	12m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 6b Existing	Outside No 13 Balscadden Road Howth looking Nth West	18/05/21	74°	24mm	12m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 6b Proposed	Outside No 13 Balscadden Road Howth looking Nth West	18/05/21	74°	24mm	12m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 7 Existing	Outside No 7 Balscadden Road Howth looking North West	18/05/21	74°	24mm	6m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 7 Proposed	Outside No 7 Balscadden Road Howth looking North West	18/05/21	74°	24mm	6m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 8 Existing	Balscadden Rd at Pedestrian access to Bay looking Sth West	18/05/21	74°	24mm	9.1m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 8 Proposed	Balscadden Rd at Pedestrian access to Bay looking Sth West	18/05/21	74°	24mm	9.1m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 8a Existing	Balscadden Rd at Pedestrian access to Bay looking West	18/05/21	74°	24mm	9.1m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 8 Proposed	Balscadden Rd at Pedestrian access to Bay looking West	18/05/21	74°	24mm	9.1m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 8b Existing	Balscadden Rd at Pedestrian access to Bay looking North West	18/05/21	74°	24mm	9.1m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7°	< 35mm / 54.4°	< 50mm / 39.6°	Lens Information: Focal Length / Field of View	50mm / 39.6° >	35mm / 54.4° >	24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 8b Proposed	Balscadden Rd at Pedestrian access to Bay looking North West	18/05/21	74°	24mm	9.1m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 8c Existing	Balscadden Rd at Pedestrian access to Bay looking North West	18/05/21	74°	24mm	9.1m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 8c Proposed	Balscadden Rd at Pedestrian access to Bay looking North West	18/05/21	74°	24mm	9.1m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 9 Existing	At base of steps up to Martello Tower looking South West	18/05/21	74°	24mm	35m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° | |< 35mm / 54.4° | |< 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | | 35mm / 54.4° > | | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 9 Proposed	At base of steps up to Martello Tower looking South West	18/05/21	74°	24mm	35m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 9a Existing	At base of steps up to Martello Tower looking South	18/05/21	74°	24mm	35m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 9a Proposed	At base of steps up to Martello Tower looking South	18/05/21	74°	24mm	35m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 10 Existing	On pedestrian path up to Martello Tower looking East	18/05/21	74°	24mm	8.1m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 10 Proposed	On pedestrian path up to Martello Tower looking East	18/05/21	74°	24mm	8.1m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 10a Existing	On pedestrian path up to Martello Tower looking South East	18/05/21	74°	24mm	8.1m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 10a Proposed	On pedestrian path up to Martello Tower looking South East	18/05/21	74°	24mm	8.1m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 10b Existing	On pedestrian path up to Martello Tower looking South	18/05/21	74°	24mm	8.1m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 10b Proposed	On pedestrian path up to Martello Tower looking South	18/05/21	74°	24mm	8.1m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 11 Existing	From St Marys Abbey looking South East	18/05/21	74°	24mm	64m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 11 Proposed	From St Marys Abbey looking South East	18/05/21	74°	24mm	64m	Canon EOS 5DS

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 12 Existing	Opp. Pedestrian Path to Martello Tower, Abbey St looking East	18/05/21	74°	24mm	35.5m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 12 Proposed	Opp. Pedestrian Path to Martello Tower, Abbey St looking East	18/05/21	74°	24mm	35.5m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 12a Existing	Opp. Pedestrian Path to Martello Tower, Abbey St looking South East	18/05/21	74°	24mm	35.5m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 12a Proposed	Opp. Pedestrian Path to Martello Tower, Abbey St looking South East	18/05/21	74°	24mm	35.5m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 12b Existing	Opp. Pedestrian Path to Martello Tower, Abbey St looking South	18/05/21	74°	24mm	35.5m	Canon EOS 5DS

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 12b Proposed	Opp. Pedestrian Path to Martello Tower, Abbey St looking South	18/05/21	74°	24mm	35.5m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 13 Existing	Opp. juntion of St Lawrence Rd & Harbour View looking East	18/05/21	74°	24mm	160.4m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

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Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 14 Existing	Opposite No 75 Balglass Road looking North	18/05/21	74°	24mm	453m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 14 Proposed	Opposite No 75 Balglass Road looking North	18/05/21	74°	24mm	453m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 15 Existing	From viewing bench in open space East of Balglass Rd looking North	18/05/21	74°	24mm	486m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 15 Proposed	From viewing bench in open space East of Balglass Rd looking North	18/05/21	74°	24mm	486m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 16 Existing	Beside 28 Balscadden Road looking West	18/05/21	74°	24mm	314m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 16 Proposed	Beside 28 Balscadden Road looking West	18/05/21	74°	24mm	314m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 17 Existing	From upper deck of Howth East Pier looking South	18/05/21	74°	24mm	505m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7°	< 35mm / 54.4°	< 50mm / 39.6°	Lens Information: Focal Length / Field of View	50mm / 39.6° >	35mm / 54.4° >	24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 17 Proposed	From upper deck of Howth East Pier looking South	18/05/21	74°	24mm	505m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° >| 35mm / 54.4° >| 24mm / 73.7° >|

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 18 Existing	From end of Howth West Pier looking South East	18/05/21	74°	24mm	617m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 18 Proposed	From end of Howth West Pier looking South East	18/05/21	74°	24mm	617m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° | Lens Information: Focal Length / Field of View | 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 19 Existing	From Car Park at Howth Yacht Club looking East	18/05/21	74°	24mm	289m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 19 Proposed	From Car Park at Howth Yacht Club looking East	18/05/21	74°	24mm	289m	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

< 24mm / 73.7° | < 35mm / 54.4° | < 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 20 Existing	From Top of Howth Hill looking North	18/05/21	74°	24mm	1374m	Canon EOS 5DS

digital dimensions
architectural visualisation

< 24mm / 73.7°	< 35mm / 54.4°	< 50mm / 39.6°	Lens Information: Focal Length / Field of View	50mm / 39.6° >	35mm / 54.4° >	24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 20 Proposed	From Top of Howth Hill looking North	18/05/21	74°	24mm	1374m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

© Photos by Tom Coakley, Barrow Coakley Photo & Video - Ph: 0872856527 - Date: 17th June 2021

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 21 Existing	Drone View from Balscadden Bay looking West	17/06/21	65.4°	28mm	unknown	Canon EOS 5DS

Our Ref: 21-106 Balscadden

digital dimensions
architectural visualisation

© Photos by Tom Coakley, Barrow Coakley Photo & Video - Ph: 0872856527 - Date: 17th June 2021

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 21 Proposed	Drone View from Balscadden Bay looking West	18/05/21	65.4°	24mm	unknown	Canon EOS 5DS

Our Ref: 21-106 Balscadden

|< 24mm / 73.7° |< 35mm / 54.4° |< 50mm / 39.6° Lens Information: Focal Length / Field of View 50mm / 39.6° > | 35mm / 54.4° > | 24mm / 73.7° > |

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 22 Existing	On pedestrian path up to Martello Tower looking East	20/01/22	74°	24mm	6.95m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

< 24mm / 73.7°	< 35mm / 54.4°	< 50mm / 39.6°	Lens Information: Focal Length / Field of View	50mm / 39.6° >	35mm / 54.4° >	24mm / 73.7° >

Location	Description	Photography Date	Field of view	35mm equivalent	Distance to site boundary	Camera model
View 22 Proposed	On pedestrian path up to Martello Tower looking East	20/01/22	74°	24mm	6.95m	Canon EOS 5DS

digital dimensions
architectural visualisation

Our Ref: 21-106 Balscadden

Appendix J

BUILDING LIFECYCLE REPORT

PROPOSED DEVELOPMENT:
BALSCADDEN SHD

HOWTH, Co. DUBLIN

CLIENT:

BALSCADDEN
GP3 LIMITED

aramark

TABLE OF CONTENTS

01

INTRODUCTION

1.0 INTRODUCTION

Aramark Property were instructed by Balscadden GP3 Limited, to provide a Building Lifecycle Report for their proposed ‘Build-to-Sell’ residential development to lands located to the south of the Martello Tower on Balscadden Road & the former Baily Court Hotel, Main Street, Howth, County Dublin.

The purpose of this report is to provide an initial assessment of long-term running and maintenance costs as they would apply on a per residential unit basis at the time of application, as well as demonstrating what measures have been specifically considered to effectively manage and reduce costs for the benefit of the residents. This is achieved by producing a Building Lifecycle Report.

This Building Lifecycle Report has been developed on foot of the revised guidelines for Sustainable Urban Housing: Design Standards for New Apartments - Guidelines for Planning Authorities issued under Section 28 of the Planning and Development Act 2000 (as amended) December 2020. Within these guidelines, current guidance is being provided on residential schemes.

Section 6.13 of the Apartments and the Development Management Process guidelines for Sustainable Urban Housing: Design Standards for New Apartments (December 2020) requires that:

> “planning applications for apartment development shall include a building lifecycle report which in turn includes an assessment of long-term running and maintenance costs as they would apply on a per residential unit basis at the time of application, as well as demonstrating what measures have been specifically considered by the proposer to effectively manage and reduce costs for the benefit of residents.”

02

DESCRIPTION OF DEVELOPMENT

2.0 DESCRIPTION OF DEVELOPMENT

The proposed development relates to lands located to the south of the Martello Tower on Balscadden Road & the former Baily Court Hotel, Main Street, Howth, County Dublin.

The development will consist of the demolition of existing structures on the proposed site including the disused sports building and the former Baily Court Hotel buildings and the construction of a residential development set out in 4 no. residential blocks, ranging in height from 2 to 5 storeys to accommodate 180 no. apartments with associated internal residential tenant amenity and external courtyards and roof terraces, 1 no. retail unit and 2 no. café/retail units.

The site will accommodate car parking spaces at basement level and bicycle parking spaces at basement and surface level. Landscaping will include new linear plaza which will create a new pedestrian link between Main St and Balscadden Rd to include the creation of an additional 2 no. new public plazas and also maintains and upgrades the pedestrian link from Abbey Street to Balscadden Road below the Martello Tower. Please see the accompanying Statutory Notices for a more detailed description.

03

EXECUTIVE SUMMARY

3.0 EXECUTIVE SUMMARY – BUILDING LIFE CYCLE REPORT

Measures to effectively manage and reduce costs for the benefit of residents

The following document reviews the outline specification set out for the proposed 'Build-to-Sell' residential development to lands located to the south of the Martello Tower on Balscadden Road & the former Baily Court Hotel, Main Street, Howth, County Dublin and explores the practical implementation of the design and material principles which has informed design of building roofs, façades, internal layouts and detailing of the proposed development.

Building materials proposed for use on elevations and in the public realm achieve a durable standard of quality that will not need regular fabric replacement or maintenance outside general day to day care. The choice of high quality and long-lasting materials, as well as both soft and hardscape in the public, semi-public and private realm will contribute to lower maintenance costs for future residents and occupiers.

Please note that detailed specifications of building fabric and services have not been provided at this stage. This report reflects the outline material descriptions contained within PLUS Architecture's planning drawings received.

For any elements where information was not available, typical examples have been provided of building materials and services used for schemes of this nature and their associated lifespans and maintenance requirements. All information is therefore indicative subject to further information at detailed design stage.

As the building design develops this document will be updated and a schedule will be generated from the items below detailing maintenance and replacement costs over the lifespan of the materials and development constituent parts in a summary document. This will enable a robust schedule of building component repair and replacement costs which will be available to the property management company so that running, and maintenance costs of the development are kept within the agreed Annual operational budget, this will take the form of a Planned Preventative Maintenance Schedule (PPM)* at operational commencement of the development.

*PPM under separate instruction

04

EXTERNAL BUILDING FABRIC SCHEDULE

4.0 EXTERNAL BUILDING FABRIC SCHEDULE

4.1 Roofing

4.1.1 Green Roofs (Manufacturer / Supplier TBC)

Location	All flat roof areas (maintenance access only)
Description	Extensive green roof system to engineer's specification.
Lifecycle	Average lifecycle of 35 years on most green roofs. As used across the industry nationally and in the UK, long lifecycle typically achieved by robust detailing to adjoining roof elements, regular inspection and maintenance regime to ensure the upkeep of roofing product / materials.
Required maintenance	Quarterly maintenance visits to include inspection of drainage layer and outlets and removal of any blockages to prevent ponding. Inspection of vegetation layer for fungus and decay. Carry out weeding as necessary. No irrigation necessary with sedum blankets.
Year	Quarterly
Priority	Medium
Selection process	A green roof will add to the character of the overall scheme, as well as providing attenuation to storm water run-off and less burden on rainwater goods, increased thermal and sound insulation to the building and increased biodiversity. Natural soft finishes can provide visual amenity for residents where roof areas are visible or accessible from within areas of the scheme. Sedum roofs are a popular and varied choice for green roofs requiring minimal maintenance.
Reference	PLUS Architecture's planning drawings & Design Statement.

4.1.2 Roof Terraces (Manufacturer / Supplier TBC)

Location	Communal Terrace (Block B)
Description	• Light weight precast concrete/stone paving slabs on support system. • Resin bound gravel surfacing. • Roof build up to architects' and engineers' instructions.
Lifecycle	Average lifecycle of 30 years. As used across the industry nationally and the UK, typically longer lifecycle is achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Regular maintenance visits to include inspection of drainage outlets and removal of any blockages. General repair works, watching out for displacement of slabs, mortar decay and removal of organic matter. Power-washing of hard surfaces.
Year	Quarterly / annual
Priority	Medium
Selection process	Paving slabs provide a robust and long-lasting roof terrace surface, requiring considerably less maintenance when compared to timber decking or gravel surfaces.
Reference	PLUS Architecture's drawings & design statement.

4.1.3 Pitched Roofs **(Manufacturer / Supplier TBC)**

Location	Blocks A + D
Description	Natural roof slates to select finish.
Lifecycle	Lifecycle of 80 -100 years for roof tiles. As used across the industry nationally and in the UK, long lifecycle typically achieved by regular inspection and maintenance regime to ensure the upkeep of roofing tiles.
Required maintenance	Annual inspection internally and externally for slipped/cracked tiles and flashings, leaks etc. Carry out localised repairs as required.
Year	Annual
Priority	Medium
Selection process	Roof tiles are chosen for its aesthetic qualities and is a durable and long-lasting material which few other roofing materials can achieve. Pitched roofs by design ensure run-off of rainwater and therefore less deterioration to roofing materials.
Reference	PLUS Architecture’s planning drawings & Design Statement.

4.1.4 Fall Arrest System for Roof Maintenance Access **(Manufacturer / Supplier TBC)**

Location	Flat roof areas to Blocks B + C (maintenance access only)
Description	• Fall Protection System on approved anchorage device. • Installation in accordance with BS 7883:2019 (Anchor System designed to protect people working at height) by the system manufacturer or a contractor approved by the system manufacturer.
Lifecycle	25-30 years dependent on quality of materials. Generally, steel finishes to skyward facing elements can be expected to maintain this life expectancy. As used across the industry nationally and the UK, long lifecycle is typically achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Check and reset tension on the line as per manufacturer’s specifications. Check all hardware components for wear (shackles, eye bolts, turn buckles). Check elements for signs of wear and/or weathering. Lubricate all moving parts. Check for structural damage or modifications.
Year	Annually
Priority	High
Selection process	Fall protection systems are a standard life safety system, provided for safe maintenance of roofs and balconies where there is not adequate parapet protection. Fall protection systems must comply with relevant quality standards.
Reference	N/A

4.1.5 Roof Cowls **(Manufacturer / Supplier TBC)**

Location	Selected Flat Roof Areas
Description	Roof Cowl System to be supplied with weather apron for flat roofs.
Lifecycle	25-35 years. As used across the industry nationally and the UK, typically longer lifecycle is achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Check fixings annually, inspect for onset of leading-edge corrosion if epoxy powder coat finish and treat.
Year	Annually

Priority	Low
Selection process	Standard fitting for roof termination of mechanical ventilation system.
Reference	N/A

4.1.6 Flashings (Manufacturer / Supplier TBC)

Location	All flashing locations
Description	Lead to be used for all flashing and counter flashings.
Lifecycle	Typical life expectancy of 70 years recorded for lead flashings. Recessed joint sealing will require regular inspections. Longer lifecycle achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Check joint fixings for lead flashing, ground survey annually and close-up inspection every 5 years. Re-secure as necessary.
Year	Ground level inspection annually and close-up inspection every 5 years
Priority	Medium
Selection process	Lead has longest life expectancy of comparable materials such as copper (60 years) and zinc (50 years). Provided appropriate safety precautions are taken, lead is the recommended choice for large residential, commercial or industrial builds. Lead is easily formed into the required shapes for effective weathering of building junctions according to standard Lead Sheet Association details.
Reference	N/A

4.2 Rainwater Drainage (Manufacturer / Supplier TBC)

Location	All buildings
Description	• *Rainwater outlets:* Suitable for specified roof membranes • *Pipework:* Mixture of zinc/aluminium/uPVC downpipes • *Below ground drainage:* To Engineers' design and specification • *Disposal:* To surface water drainage to Engineers' design • *Controls:* To Engineers design and specification • *Accessories:* allow for outlet gradings, spigots, downspout nozzle, hopper heads, balcony and main roof outlets
Lifecycle	Metal gutters and downpipes have an expected life expectancy of 40 years in rural and suburban conditions (25 years in industrial and marine conditions), this is comparable to cast iron of 50 years and plastic, less so at 30 years. As used across the industry nationally and the UK, typically longer lifecycle is achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	As with roofing systems routine inspection is key to preserving the lifecycle of rainwater systems. Regular cleaning and rainwater heads and gutters, checking joints and fixings and regularly cleaning polyester coated surfaces (no caustic or abrasive materials).
Year	Annually, cleaning bi-annually
Priority	High
Selection process	As above, metal fittings compare well against cast iron (in terms of cost) and plastic (in terms of lifespan and aesthetic).
Reference	N/A

4.3 External Walls

4.3.1 Metal (Manufacturer / Supplier TBC)

Location	Façades
Description	• Metal panels to bronze finish over Bay windows. • Extruded metal cover cap to bronze finish.
Lifecycle	Lifespan expectancy generally in excess of 40 years. As used across the industry nationally and the UK, typically longer lifecycle is achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Selected paneling requires little maintenance and is resistant to corrosion. It can contribute to lower ongoing maintenance costs in comparison to exposed porous materials which may be liable to faster deterioration. Long term cleaning requirements should be taken into consideration.
Year	Inspection annually; cleaning 5 yearly
Priority	Low
Selection process	Selected paneling protects the building's structure from rainwater and weathering. Metal paneling systems are also chosen for their aesthetic impact, durability, and weathering properties.
Reference	PLUS Architecture's drawings & design statement.

4.3.2 Stone (Manufacturer / Supplier TBC)

Location	Facades
Description	Granite base expressed in large rubble format on support system.
Lifecycle	Stone is expected to have a lifespan in the region of 60-80 years.
Required maintenance	In general, given its durability, stone requires little maintenance and weathers well. Most maintenance is preventative; check for deterioration of mortar, plant growth, or other factors that could signal problems or lead to eventual damage.
Year	Annual
Priority	Low
Selection process	Stone is a natural and highly durable material offering a robust aesthetic. Has a high durability and has similar mechanical properties to precast concrete.
Reference	PLUS Architecture's planning drawings & Design Statement.

4.3.3 Render

Location	Façades
Description	Self-colouring render to select finish.
Lifecycle	Renders in general are expected to have a lifecycle of circa 25 years. Longer lifecycle achieved by regular inspection and maintenance regime.
Required maintenance	Regular inspections to check for cracking and de-bonding. Most maintenance is preventative. Coloured render requires less maintenance than traditional renders.
Year	Annually
Priority	Medium
Selection process	Appropriate detailing will contribute to a long lifespan for this installation. Insulated render is a durable and low-maintenance finish with the added benefit of this product being British Board of Agrément (BBA) certified against other render systems.
Reference	PLUS Architecture's drawings & design statement.

4.4 External Windows & Doors

Location	Façades
Description	- Dark bronze full height, clear glazed windows with aluminium frame. - All units to be double glazed with thermally broken frames. - All opening sections in windows to be fitted with suitable restrictors. Include for all necessary ironmongery; include for all pointing and mastic sealant as necessary; fixed using stainless steel metal straps screwed to masonry reveals; include for all bends, drips, flashings, thermal breaks etc.
Lifecycle	Aluminium has a typical lifespan of 45-60 years in comparison to uPVC which has a typical lifespan of 30-40 years. As used nationwide and in the UK, typically longer lifecycle is achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Check surface of windows and doors regularly so that damage can be detected. Vertical mouldings can become worn and require more maintenance than other surface areas. Lubricate at least once a year. Ensure regular cleaning regime. Check for condensation on frame from window and ensure ventilation.
Year	Annual
Priority	Medium
Selection process	Aluminium is durable and low maintenance with an average lifespan of 45-60 years, exceeding uPVC (30-40 years).
Reference	PLUS Architecture's drawings & design statement.

4.5 Balconies

4.5.1 Structure

Location	Apartment Blocks Façades
Description	- Concrete balcony system to engineer's detail, or - Powder-coated steel frame balcony system to engineer's detail - Thermally broken farrat plate connections to main structure of building.
Lifecycle	- Metal structure has a typical life expectancy of 70 years dependent on maintenance of components. - Precast concrete structures have a high embodied energy; however, it is an extremely durable material. Concrete frame has a typical life expectancy of 80 years. As used across the industry nationally and the UK, longer lifecycle is achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Relatively low maintenance required. Check balcony system as per manufacturer's specifications. Check all hardware components for wear. Check elements for signs of wear and/or weathering. Check for structural damage or modifications.
Year	Annual
Priority	High
Selection process	Engineered detail; designed for strength and safety.
Reference	N/A

4.5.2 Balustrades and Handrails

Location	Balconies
Description	• Metal balustrade with PPC steel handrail to selected finish. • Fixings in accordance with manufacturer's details.
Lifecycle	Typical life expectancy of over 40 years. As used nationwide and in the UK, typically longer lifecycle is achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Regular visual inspection of connection pieces for impact damage or alterations
Year	Annual
Priority	High
Selection process	Designed for strength and safety. Metal finish are chosen for their aesthetic impact, durability and weathering properties.
Reference	N/A

05

INTERNAL BUILDING FABRIC SCHEDULE

5.0 INTERNAL BUILDING FABRIC SCHEDULE

5.1 Floors

5.1.1 Common Areas

Location	Apartment Blocks Entrance Foyer
Description	• Selected anti-slip porcelain or ceramic floor tile complete with inset matwell. • Selected loop pile carpet tiles.
Lifecycle	• Lifespan expectation of 20-25 years in heavy wear areas, likely requirement to replace for modernisation within this period also. • 10-15 year lifespan for carpet. Likely requirement to replace for modernisation within this period also.
Required maintenance	Visual inspection with regular cleaning, intermittent replacement of chipped / loose tiles
Year	• Annual for floor tiles. • Quarterly inspection and cleaning of carpets as necessary
Priority	Low
Selection process	Durable, low maintenance floor finish. Slip rating required at entrance lobby, few materials provide this and are as hard wearing. Using carpet allows flexibility to alter and change as fashions alter and change providing enhanced flexibility.
Reference	N/A

Location	Stairwells, landings / half landings
Description	Selected carpet covering. Approved anodised aluminium nosings to stairs.
Lifecycle	• 10-15 year lifespan for carpet. Likely requirement to replace for modernisation within this period also. • 20-year lifespan for aluminium nosings.
Required maintenance	Visual inspection with regular cleaning.
Year	Quarterly inspection and cleaning as necessary.
Priority	Low
Selection process	Using carpet allows flexibility to alter and change as fashions alter and change providing enhanced flexibility.
Reference	N/A

Location	Lift Lobbies
Description	Carpet/vinyl and porcelain tiles to match adjacent apartment common lobbies.
Lifecycle	• Lifespan expectation of 20-30 years in heavy wear areas, likely requirement to replace for modernisation within this period also. • 10-15 year lifespan for carpet. Likely requirement to replace for modernisation within this period also.
Required maintenance	Visual inspection with regular cleaning, intermittent replacement of chipped / loose tiles.
Year	Annual
Priority	Low
Selection process	Slip rating required for lifts, few materials provide this and are as hard wearing. Using carpet allows flexibility to alter and change as fashions alter and change providing enhanced flexibility.
Reference	N/A

5.2 Walls

5.2.1 Common Areas

Location	Apartment Blocks Entrance Foyer
Description	Selected paint finish with primer to skimmed plasterboard.
Lifecycle	2-10 years for finishes; 40 years for plasterboard. Longer lifecycle achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Regular maintenance required and replacement when damaged.
Year	Bi-annually
Priority	Low
Selection process	Decorative and durable finish.
Reference	N/A

Location	Lift cores / corridors / stairs
Description	Selected paint finish with primer to skimmed plasterboard.
Lifecycle	2-10 years for finishes; 40 years for plasterboard. Longer lifecycle achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Regular maintenance required and replacement when damaged.
Year	Bi-annually
Priority	Low
Selection process	Decorative and durable finish.
Reference	N/A

5.3 Ceilings

Location	Common areas
Description	Selected paint finish with primer to skimmed plasterboard ceiling on M/F frame. Acoustic ceiling to lift core and apartment lobbies. Moisture board to wet areas.
Lifecycle	2-10 years for finishes; 40 years for plasterboard. Longer lifecycle achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Regular maintenance required and replacement when damaged.
Year	Bi-annually
Priority	Low
Selection process	Decorative and durable finish
Reference	N/A

5.4 Internal Handrails & Balustrades

Location	Stairs & landings
Description	Mild steel painted balustrade and handrail.
Lifecycle	Over 40 years typical lifecycle. Longer lifecycle achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	Regular inspections of holding down bolts and joints
Year	Annually
Priority	High
Selection process	Hard-wearing long-life materials against timber options
Reference	N/A

5.5 Carpentry & Joinery

5.5.1 Internal Doors and Frames

Location	All buildings
Description	• Selected white primed and painted/varnished solid internal doors, or hardwood veneered internal doors • All fire rated doors and joinery items to be manufactured in accordance with B.S. 476. Timber saddle boards. • Brushed aluminium door ironmongery or similar
Lifecycle	30 years average expected lifespan. Longer lifecycle achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	General maintenance in relation to impact damage and general wear and tear
Year	Annual
Priority	Low, unless fire door High
Selection process	Industry standard
Reference	N/A

5.5.2 Skirtings & Architraves

Location	All buildings
Description	Painted timber/MDF skirtings and architraves
Lifecycle	30 years average expected lifespan. Longer lifecycle achieved by regular inspection and maintenance regime to ensure the upkeep of materials.
Required maintenance	General maintenance in relation to impact damage and general wear and tear
Year	Annual
Priority	Low
Selection process	Industry standard
Reference	N/A

5.5.3 Window Boards

Location	All Buildings
Description	Painted timber/MDF window boards
Lifecycle	30 years average expected lifespan
Required maintenance	General maintenance in relation to impact damage and general wear and tear
Year	Annual
Priority	Low
Selection process	Industry standard
Reference	N/A

06

BUILDING SERVICES

6.0 BUILDING SERVICES

6.1 Mechanical Systems

6.1.1 Mechanical Plant

Location	Plant Rooms
Description	Centralised Heating Plant with High Efficiency Condensing Boilers and Combined Heat and Power Units – Specification to be further detailed by the Design Team
Lifecycle	• Annual Maintenance / Inspection to Heating System • Annual Maintenance / Inspection of CHP Units • Annual Maintenance / Inspection to Heating and Water Pumps. • Annual Maintenance / Inspection to Water Tanks. • Annual Maintenance / Inspection to Booster-sets. • Annual Maintenance / Inspection to DHS Tanks. • Annual Maintenance / Inspection of district heating system pipework, valves, accessories and insulation. Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage. Replacement of equipment at (End of Life) EOL to be determined at detailed design stage.
Required maintenance	Annual Service Inspections to be included as part of Development Planned Preventative Maintenance (PPM) Programme
Year	Annually
Priority	Medium
Selection process	All equipment to be detailed as part of the detailed design section of the development. This equipment will be selected in conjunction with the design and management team to meet and exceed the Chartered Institution of Building Services Engineers of Ireland's (CIBSE) recommended lifecycles.
Reference	N/A

6.1.2 Soils and Wastes

Location	All Areas / Kitchens / Bathrooms etc
Description	Soils and Wastes Pipework – uPVC above basement and High Density Poly Ethylene (HDPE) in basement.
Lifecycle	• Annual inspections required for all pipework within landlord areas. • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Annual Service Inspections to be included as part of Development Planned Preventative Maintenance (PPM) Programme
Year	Annually
Priority	Medium
Selection process	All equipment to be detailed as part of the detailed design section of the development. This equipment will be selected in conjunction with the design and management team to meet and exceed the Chartered Institution of Building Services Engineers of Ireland's (CIBSE) recommended lifecycles.
Reference	N/A

6.1.3 Water Services

Location	Apartments, Kitchens, Common Area Water where required.
Description	Copper Water Services Pipework and associated fittings and accessories.
Lifecycle	• Annual inspections required for all pipework within landlord areas. • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Annual Inspections, including legionella testing to be included as part of Development Planned Preventative Maintenance (PPM) Programme
Year	Annually
Priority	High
Selection process	All equipment to be detailed as part of the detailed design section of the development. This equipment will be selected in conjunction with the design and management team to meet and exceed the Chartered Institution of Building Services Engineers of Ireland's (CIBSE) recommended lifecycles.
Reference	N/A

Location	Retail/Café Areas
Description	The hot water strategy within the Retail and Café Areas is dependent on Tenant fit-out.
Lifecycle	Annual Inspection and required replacement form part of Tenant's routine maintenance.
Required maintenance	Annual Inspections, including legionella testing form part of Tenant's routine maintenance.
Year	Annually
Priority	High
Selection process	All equipment to be detailed / selected as part of tenant's design section of the fitout. The proposed equipment, are to meet and exceed the Chartered Institution of Building Services Engineers of Ireland's (CIBSE) recommended lifecycles.
Reference	N/A

6.1.4 Gas Services

Location	Plant Room
Description	Gas Detection Systems.
Lifecycle	• Annual Maintenance / Inspection Gas detection systems within landlord plant rooms. • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Annual Service Inspections, testing and certification to be included as part of Development Planned Preventative Maintenance (PPM) Programme
Year	Annually
Priority	High
Selection process	All equipment to be detailed as part of the detailed design section of the development. This equipment will be selected in conjunction with the design and management team to meet and exceed the Chartered Institution of Building Services Engineers of Ireland's (CIBSE) recommended lifecycles.
Reference	N/A

6.1.5 Heating Services

Location	Apartment
Description	Heat interface Units (HIU) / Boiler Specification to be Confirmed
Lifecycle	• Annual Inspection of Heat Interface Unit in each unit. • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Annual Service Inspections to be included as part of Development Planned Preventative Maintenance (PPM) Programme
Year	Annually
Priority	Medium
Selection process	All equipment to be detailed as part of the detailed design section of the development. This equipment will be selected in conjunction with the design and management team to meet and exceed the Chartered Institution of Building Services Engineers of Ireland's (CIBSE) recommended lifecycles.
Reference	N/A

Location	Retail / Café Areas
Description	Heating and Cooling plant is proposed to consist of Variable Refrigerant Flow (VRF) multi-split Air-conditioning systems. The Ventilation strategy within the Retail and Café Areas is dependent on Tenant fit-out. Mechanical Ventilation shall be used and sized according to purpose.
Lifecycle	Annual Inspection and required replacement form part of Tenant's routine maintenance.
Required maintenance	Annual Inspections, including legionella testing form part of Tenant's routine maintenance.
Year	Annually
Priority	High
Selection process	All equipment to be detailed / selected as part of tenant's design section of the fitout. The proposed equipment is to meet and exceed the Chartered Institution of Building Services Engineers of Ireland's (CIBSE) recommended lifecycles.
Reference	N/A

6.1.6 Ventilation Services

Location	Apartments
Description	Heat Recovery Units, Ducting & Grilles
Lifecycle	• Annual inspection of extract fan and grilles. • Annual Inspection of Building Management System (BMS) link and operation of fan and boost / setback facility. • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Annual Service Inspections to be included as part of Development Planned Preventative Maintenance (PPM) Programme
Year	Annually
Priority	Medium
Selection process	All equipment to be detailed as part of the detailed design section of the development. This equipment will be selected in conjunction with the design and management team to meet and exceed the Chartered

	Institution of Building Services Engineers of Ireland’s (CIBSE) recommended lifecycles.
Reference	N/A

6.2 Electrical / Protective Services

6.2.1 Electrical Infrastructure

Location	Switch rooms / Risers
Description	Maintenance of Electrical Switchgear
Lifecycle	• Annual Inspection of Electrical Switchgear and switchboards. • Thermographic imagining of switchgear 50% of Medium Voltage (MV) Switchgear Annually and Low Voltage (LV) switchgear every 3 years. • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Annual / Every three years to be included as part of Development Planned Preventative Maintenance (PPM) Programme
Year	Annually
Priority	High
Selection process	All equipment to meet and exceed the Electricity Supply Board (ESB), the National Standards Authority of Ireland’s National Rules for Electrical Installations (I.S.10101:2020), Chartered Institution of Building Services Engineers of Ireland’s (CIBSE) recommendations and be code compliant in all cases.
Reference	N/A

6.2.2 Lighting Services internal

Location	All Areas – Internal
Description	Lighting – Light-Emitting Diode (LED) throughout with Presence detection in circulation areas and locally controlled in apartments.
Lifecycle	• Annual Inspection of All Luminaires • Quarterly Inspection of Emergency Lighting. • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Annual / Quarterly Inspections certification as required per above remedial works.
Year	Annually / Quarterly
Priority	High
Selection process	All equipment to meet requirements and be in accordance with the current National Standards Authority of Ireland’s National Rules for Emergency Lighting Installations (IS3217:2013 + A1 2017), Part M and Disability Access Certificate (DAC) Requirements.
Reference	N/A

6.2.3 Lighting Services External

Location	All Areas – Internal
Description	Lighting – All Light-Emitting Diode (LED) with Vandal Resistant Diffusers where exposed.
Lifecycle	• Annual Inspection of All Luminaires • Quarterly Inspection of Emergency Lighting • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Annual / Quarterly Inspections certification as required as per the Planned Preventative Maintenance (PPM) schedule.
Year	Annually / Quarterly
Priority	High
Selection process	All equipment to meet requirements and be in accordance with the current IS3217:2013 + A1 2017, Part M and Disability Access Certificate (DAC) Requirements.
Reference	N/A

6.2.4 Protective Services – Fire Alarm

Location	All areas – Internal
Description	Fire alarm
Lifecycle	• Quarterly Inspection of panels and 25% testing of devices as per IS3218:2013 + A1 2019 requirements. • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Annual / Quarterly Inspections certification as required as per the Planned Preventative Maintenance (PPM) schedule.
Year	Annually / Quarterly
Priority	High
Selection process	All equipment to meet requirements and be in accordance with the current IS3218:2013 + A1 2019 and the Fire Cert
Reference	N/A

6.2.5 Protective Services – Fire Extinguishers

Location	All Areas – Internal
Description	Fire Extinguishers and Fire Blankets
Lifecycle	Annual Inspection
Required maintenance	Annual with Replacement of all extinguishers at year 10
Year	Annually
Priority	Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Selection process	All fire extinguishers must meet the requirements of I.S 291:2015 Selection, commissioning, installation, inspection and maintenance of portable fire extinguishers.
Reference	N/A

6.2.6 Protective Services – Apartment Sprinkler System (Where Applicable by Fire Cert)

Location	Apartments only.
Description	Apartment Sprinkler System
Lifecycle	Weekly / Annual Inspection
Required maintenance	Weekly Check of Sprinkler Pumps and plant and annual testing and certification of plant by specialist.
Year	All
Priority	Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Selection process	The Apartment sprinkler system shall be installed in accordance with BS 9251:2005 – Sprinkler Systems for Residential and Domestic Occupancies – Code of Practice
Reference	N/A

6.2.7 Protective Services – Dry Risers

Location	Common Area Cores of apartments
Description	Dry Risers
Lifecycle	Weekly / Annual Inspection
Required maintenance	Visual Weekly Checks of Pipework and Landing Valves with Annual testing and certification by specialist.
Year	Annually
Priority	Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Selection process	The system shall be installed in accordance with BS 5041 – Fire Hydrant Systems Equipment & BS 9999 – Effective Fire Safety in the Design, Management and Use of Buildings.
Reference	N/A

6.2.8 Fire Fighting Lobby Ventilation (To Fire Consultants Design and Specification)

Location	Common Area Lobbies
Description	Smoke Extract / Exhaust Systems
Lifecycle	• Regular Tests of the system • Annual inspection of Fans • Annual inspection of automatic doors and Automatic Opening Vents (AOV) • All systems to be backed up by life safety systems.
Required maintenance	Annual Service Inspections to be included as part of Development Planned Preventative Maintenance (PPM) Programme
Year	Weekly / Annually
Priority	Medium
Selection process	All equipment to be detailed as part of the detailed design section of the development. This equipment will be selected in conjunction with the design and management team to meet and exceed the Chartered Institution of Building Services Engineers of Ireland’s (CIBSE) recommended lifecycles.
Reference	N/A

6.2.9 Sustainable Services

Location	Apartment
Description	Heat Pump
Lifecycle	• Annual Maintenance of Exhaust Air Source Heat Pumps • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Annual Service Inspections to be included as part of Development Planned Preventative Maintenance Programme
Year	Annually
Priority	Medium
Selection process	All equipment to be detailed as part of the detailed design section of the development. This equipment will be selected in conjunction with the design and management team to meet and exceed the Chartered Institution of Building Services Engineers of Ireland's (CIBSE) recommended lifecycles.
Reference	N/A

Location	Roof
Description	Photovoltaic (PV) Array on roof supply each residential unit with renewable electrical energy, supporting Part L/NZEB requirements in conjunction with Exhaust Air Source Heat Pumps. Full Details to be provided at detailed stage.
Lifecycle	• Quarterly Clean • Annual Inspection • Cost for replacement equipment to be updated on completion of design matrix of equipment at detailed design stage.
Required maintenance	Quarterly / Annual
Year	Annually
Priority	Medium
Selection process	All equipment to be detailed as part of the detailed design section of the development. This equipment will be selected in conjunction with the design and management team to meet and exceed the Chartered Institution of Building Services Engineers of Ireland's (CIBSE) recommended lifecycles.
Reference	N/A

07

CONCLUSION & CONTACT DETAILS

7.0 CONCLUSION & CONTACT DETAILS

Based on the information provided, Aramark Property have considered the schemes proposals. From our experience to date of similar schemes we manage, we have set out an overview of how we believe the overarching management of the scheme can be successfully managed in best practice for the benefit of the owners of this scheme, the future occupiers, and the wider community.

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DOCUMENT CONTROL SHEET

Client:	BALSCADDEN GP3 LIMITED
Project Title:	BALSCADDEN SHD
Document Title:	BUILDING LIFECYCLE REPORT

Rev.	Status	Author	Reviewed By	Issue Date
AP 01.	DRAFT	Conor Fahey	Dean Brassington	17/02/2022
AP 02.	REVISED	Conor Fahey	Dean Brassington	21/02/2022
AP 03.	FINAL	Conor Fahey	Dean Brassington	15/03/2022

Appendix K

Calculation Reference: AUDIT-561501-210805-0810

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL
Category : C - FLATS PRIVATELY OWNED

TOTAL VEHICLES

Selected regions and areas:

12	CONNAUGHT		
	GA	GALWAY	1 days
13	MUNSTER		
	WA	WATERFORD	1 days
14	LEINSTER		
	LU	LOUTH	3 days
15	GREATER DUBLIN		
	DL	DUBLIN	6 days
16	ULSTER (REPUBLIC OF IRELAND)		
	MG	MONAGHAN	1 days
17	ULSTER (NORTHERN IRELAND)		
	AN	ANTRIM	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: No of Dwellings
Actual Range: 20 to 140 (units:)
Range Selected by User: 18 to 200 (units:)

Parking Spaces Range: All Surveys Included

Parking Spaces per Dwelling Range: All Surveys Included

Bedrooms per Dwelling Range: All Surveys Included

Percentage of dwellings privately owned: All Surveys Included

<u>Public Transport Provision:</u>
Selection by: Include all surveys

Date Range: 01/01/13 to 22/11/16

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	2 days
Tuesday	6 days
Wednesday	1 days
Thursday	2 days
Friday	2 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	13 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:

Edge of Town Centre	4
Suburban Area (PPS6 Out of Centre)	6
Edge of Town	1
Neighbourhood Centre (PPS6 Local Centre)	2

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

C3	13 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 500m Range:
All Surveys Included

Population within 1 mile:

1,001 to 5,000	1 days
5,001 to 10,000	3 days
15,001 to 20,000	2 days
20,001 to 25,000	1 days
25,001 to 50,000	6 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,001 to 25,000	1 days
25,001 to 50,000	3 days
50,001 to 75,000	2 days
125,001 to 250,000	1 days
250,001 to 500,000	1 days
500,001 or More	5 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	3 days
1.1 to 1.5	10 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	13 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	13 days

This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1 AN-03-C-02 BLOCK OF FLATS ANTRIM
SUMMERHILL AVENUE
BELFAST
KNOCK
Edge of Town
Residential Zone
Total No of Dwellings: 22
Survey date: FRIDAY 28/11/14 Survey Type: MANUAL

2 DL-03-C-11 BLOCK OF FLATS DUBLIN
WYCKHAM WAY
DUBLIN
DUNDRUM
Neighbourhood Centre (PPS6 Local Centre)
Residential Zone
Total No of Dwellings: 96
Survey date: TUESDAY 10/09/13 Survey Type: MANUAL

3 DL-03-C-12 BLOCK OF FLATS DUBLIN
BOOTERSTOWN AVENUE
DUBLIN

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 47
Survey date: TUESDAY 10/09/13 Survey Type: MANUAL

4 DL-03-C-13 BLOCK OF FLATS DUBLIN
SANDYFORD ROAD
DUBLIN

Neighbourhood Centre (PPS6 Local Centre)
Built-Up Zone
Total No of Dwellings: 52
Survey date: TUESDAY 10/09/13 Survey Type: MANUAL

5 DL-03-C-14 BLOCKS OF FLATS DUBLIN
BALLINTEER ROAD
DUBLIN
DUNDRUM
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 140
Survey date: TUESDAY 10/09/13 Survey Type: MANUAL

6 DL-03-C-15 BLOCKS OF FLATS DUBLIN
MONKSTOWN ROAD
DUBLIN
MONKSTOWN
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 20
Survey date: WEDNESDAY 01/10/14 Survey Type: MANUAL

7 DL-03-C-16 BLOCKS OF FLATS DUBLIN
BOTANIC AVENUE
DUBLIN
DRUMCONDRA
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 31
Survey date: TUESDAY 22/11/16 Survey Type: MANUAL

8 GA-03-C-01 FLATS GALWAY
BALLYLOUGHANE ROAD
GALWAY

Suburban Area (PPS6 Out of Centre)
No Sub Category
Total No of Dwellings: 34
Survey date: THURSDAY 31/10/13 Survey Type: MANUAL

LIST OF SITES relevant to selection parameters (Cont.)

9 LU-03-C-01 BLOCKS OF FLATS LOUTH
DONORE ROAD
DROGHEDA

Edge of Town Centre
Residential Zone
Total No of Dwellings: 52
Survey date: THURSDAY 12/09/13 Survey Type: MANUAL

10 LU-03-C-02 BLOCK OF FLATS LOUTH
NICHOLAS STREET
DUNDALK

Edge of Town Centre
Residential Zone
Total No of Dwellings: 33
Survey date: MONDAY 16/09/13 Survey Type: MANUAL

11 LU-03-C-03 BLOCK OF FLATS LOUTH
NICHOLAS STREET
DUNDALK

Edge of Town Centre
Residential Zone
Total No of Dwellings: 20
Survey date: MONDAY 16/09/13 Survey Type: MANUAL

12 MG-03-C-01 BLOCK OF FLATS MONAGHAN
MALL ROAD
MONAGHAN

Edge of Town Centre
No Sub Category
Total No of Dwellings: 28
Survey date: FRIDAY 06/09/13 Survey Type: MANUAL

13 WA-03-C-01 BLOCKS OF FLATS WATERFORD
UPPER YELLOW ROAD
WATERFORD

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total No of Dwellings: 51
Survey date: TUESDAY 12/05/15 Survey Type: MANUAL

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 03 - RESIDENTIAL/C - FLATS PRIVATELY OWNED

TOTAL VEHICLES

Calculation factor: 1 DWELLS

BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	13	48	0.045	13	48	0.216	13	48	0.261
08:00 - 09:00	13	48	0.061	**13**	**48**	**0.236**	13	48	0.297
09:00 - 10:00	13	48	0.061	13	48	0.107	13	48	0.168
10:00 - 11:00	13	48	0.029	13	48	0.067	13	48	0.096
11:00 - 12:00	13	48	0.053	13	48	0.061	13	48	0.114
12:00 - 13:00	13	48	0.072	13	48	0.091	13	48	0.163
13:00 - 14:00	13	48	0.077	13	48	0.059	13	48	0.136
14:00 - 15:00	13	48	0.093	13	48	0.058	13	48	0.151
15:00 - 16:00	13	48	0.091	13	48	0.062	13	48	0.153
16:00 - 17:00	13	48	0.099	13	48	0.073	13	48	0.172
17:00 - 18:00	13	48	0.203	13	48	0.062	13	48	0.265
18:00 - 19:00	**13**	**48**	**0.214**	13	48	0.096	**13**	**48**	**0.310**
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			1.098			1.188			2.286

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	20 - 140 (units:)
Survey date date range:	01/01/13 - 22/11/16
Number of weekdays (Monday-Friday):	13
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.