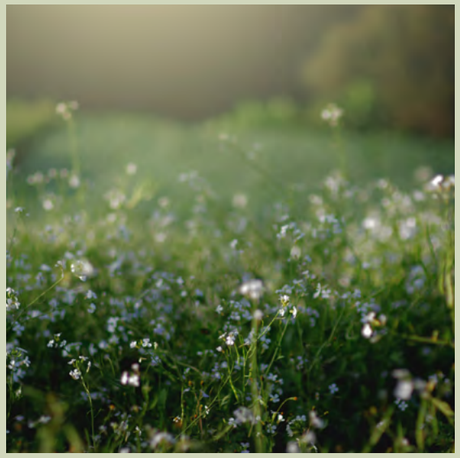

BESSBOROUGH, CORK

APPENDIX 2

Project Description

VOLUME III | APPENDICES

BESSBOROUGH, CORK

APPENDIX 2

Project Description

- Appendix 2-1 –Construction & Environmental Management Plan – Phase 1 ‘The Meadows’– prepared by JB Barry and Partners Limited, Consultant Engineers
- Appendix 2-2 –Construction & Environmental Management Plan – – Phase 2 ‘The Farms’– prepared by JB Barry and Partners Limited, Consultant Engineers
- Appendix 2-3 – Phase 1 ‘The Meadows’ Proposed Site Layout – prepared by Shipsey Barry Architects
- Appendix 2-4 – Phase 2 ‘The Farm’ Proposed Site Layout – prepared by Shipsey Barry Architects
- Appendix 2-5 - Phase 1 ‘The Meadows’ Primary Planting Plan prepared by Ilsa Rutgers Landscape Architecture
- Appendix 2-6 - Phase 2 ‘The Farm’ Primary Planting Plan prepared by Ilsa Rutgers Landscape Architecture
- Appendix 2-7 - Phase 1 ‘The Meadows’ Services Infrastructure Report prepared JB Barry and Partners Limited, Consultant Engineers
- Appendix 2-8 - Phase 2 ‘The Farm’ Services Infrastructure Report prepared JB Barry and Partners Limited, Consultant Engineers
- Appendix 2-9 - Phase 1 ‘The Meadows’ Energy Statement prepared by DKPartnership
- Appendix 2-10 - Phase 2 ‘The Farm’ Energy Statement prepared by DKPartnership

- Appendix 2-1 –Construction & Environmental Management Plan – Phase 1 ‘The Meadows’– prepared by JB Barry and Partners Limited, Consultant Engineers

Client:

Estuary View Enterprises 2020 Ltd.

Project:

Bessborough SHD Development

Report:

Construction & Environmental Management Plan (CEMP)

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Table of Contents

SECTION 1: INTRODUCTION

1.1 Introduction

This Construction and Environmental Management Plan (CEMP) has been prepared as part of the planning application for the Bessborough Strategic Housing Development (SHD). The CEMP considers the proposed works associated with the construction of 280 residential units at Bessborough, Ballinure, Blackrock, Cork and will assist with avoiding, reducing, or mitigating construction and environmental impacts arising from the proposed development.

This document has been prepared based on known assessment issues related to construction works management, traffic and transportation measures, air quality, noise and vibration, water and wastewater, landscape management, archaeology, waste management, emergency planning response and inspection and monitoring, all of which are associated with the construction works. This information will be built on prior to commencement of construction in an updated CEMP.

More detailed site-specific measures will be developed and agreed with Cork City Council prior to the commencement of construction works, subject to a successful planning application. The final CEMP will take into account any conditions attached to a grant of planning permission.

The Phase 1 application represents one of two phases of the development proposed by Estuary View Enterprises 2020 Ltd, for which planning permission is being sought from An Bord Pleanála under the Strategic Housing Development legislation. Zoning differences across the site have necessitated a dual approach being adopted to applying for planning permission, see Fig.1.1 below, including highlighted location of Phase 1. The area for Phase 1 is zoned under ZO4 – Residential, Local Services and Institutional Uses & SE4 – Landscape Preservation Zone. This CEMP details requirements for Phase 1 'The Meadows' and a separate document, 21207-JBB-PH2-XX-RP-C-05002_Construction_&_Environmental_Plan, has been prepared for the proposed Phase 2 development, 'The Farm'.

Figure 1-1: Zoning Differences across the proposed site (Cork City Development Plan 2015-2021)

1.2 Proposed Development

1.2.1 Existing Site

The application site is in Bessborough, Ballinure, Blackrock, considered within the south-eastern suburbs of Cork City as defined in the Cork City Development Plan 2015-2021. Access to/from the site is via an existing access road, Bessborough Road. Bessborough Road joins the wider road network at the junction with Skehard Road. Access to the site is by means of the existing access road serving Bessborough Day Care Centre and Bessborough Castle Folly. The existing development lands currently accommodate grasslands, and the site is predominately greenfield. Nearby buildings include Bessborough Day Care Centre to the north, Cork Community Mediation Service and the Bessborough Centre to the West.

The surrounding lands are predominantly a mix of residential, parklands and commercial/industrial buildings at Mahon Industrial Estate. There have been several residential developments north of the proposed site, close to the Mahon Industrial Estate, in recent years, one of which is currently at construction stage.

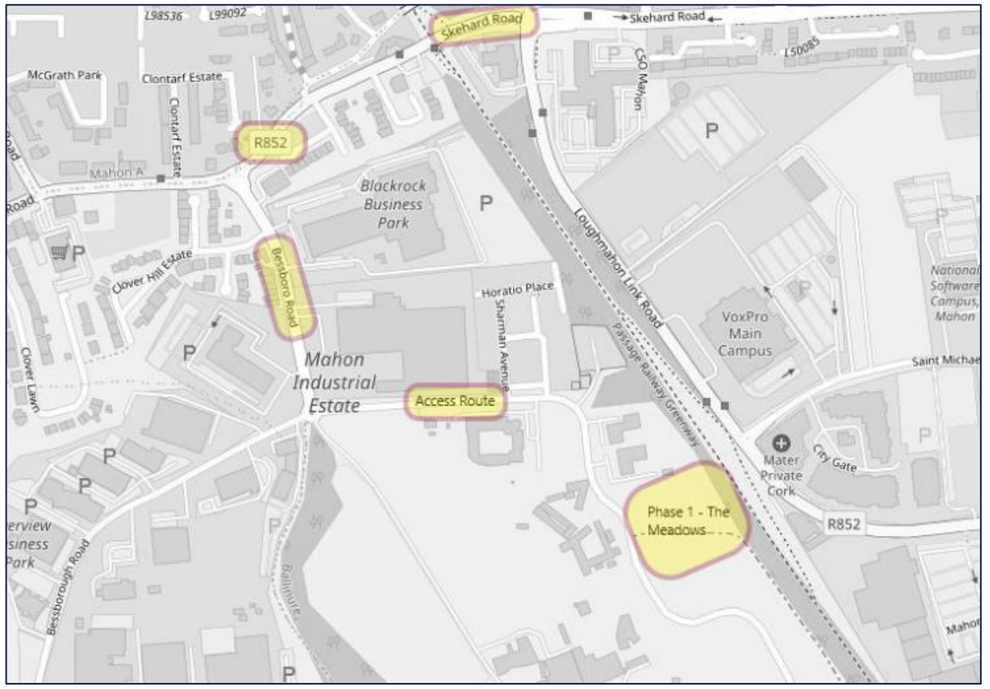

Figure 1-2: Site location and Access Route

1.2.2 Proposed Development Site Overview

The overall proposed development is ultimately intended to comprise 420 residential units with two creches, a café, tenant amenities, landscaping, pedestrian/cycleway infrastructure and associated site development works located on lands bounded by the N40, Bessborough Road, the Passage West Greenway and the Ballinure amenity walk.

Permission for the first two phases of the proposed development is being sought under two separate SHD planning applications. These two applications are named as Phase 1 The Meadows and Phase 2 The Farm. Further development of the site is to include Phase 3 North Fields, subject to appropriate zoning for this

portion of the overall lands, and this Phase 3 area is shown in the masterplan layout. See Appendix 1 for the proposed masterplan layout.

1.2.3 Proposed Development - Phase 1 'The Meadows'

This CEMP is prepared for the Phase 1 element of the development. The development will consist of the construction of a residential development of 280 no. residential apartment units with supporting tenant amenity facilities, café, crèche, and all ancillary site development works. The proposed development includes 280 no. apartments to be provided as follows: Block A (6 no. studio apartments, 14 no. 1-bedroom, 34 no. 2-bedroom & 1 no. 3-bedroom over 1-6 storeys), Block B (37 no. 1-bedroom & 49 no. 2-bedroom over 6-10 storeys), Block C (31 no. 1-bedroom, 36 no. 2-bedroom & 6 no. 3-bedroom over 5-9 storeys) and Block D (30 no. 1-bedroom, 31 no. 2-bedroom & 5 no. 3-bedroom over 6-7 storeys).

The proposal includes a new pedestrian/cycle bridge over the adjoining Passage West Greenway to the east, connecting into the existing down ramp from Mahon providing direct access to the greenway and wider areas.

The proposed development provides for outdoor amenity areas, landscaping, under-podium and street car parking, bicycle parking, bin stores, 2 no. substations one of which is single storey free standing, a single storey carpark access building, public lighting, roof mounted solar panels, wastewater infrastructure including new inlet sewer to the Bessborough Wastewater Pumping Station to the west, surface water attenuation, water utility services and all ancillary site development works. Vehicular access to the proposed development will be provided via the existing access road off the Bessboro Road (See Appendix 2).

SECTION 2: ROLES AND RESPONSIBILITIES

2.1 Client and Contractor

The Applicant will be responsible for ensuring that an appropriate Environmental Management Framework is adhered to, that competent parties are appointed to undertake construction and that sufficient resources are made available to facilitate the appropriate management of risks to the environment.

As part of the Environmental Management Framework, the Building Contractor will need to comply with all relevant environmental legislation, take account of published standards (ISO14001) and relevant documentation including the Environmental Impact Assessment Report (EIAR), any planning conditions from An Bord Pleanala (ABP), this CEMP and the subsequent detailed CEMP. Regarding the subsequent detailed CEMP, the Applicant is responsible for ensuring that this is developed in consultation with the design team and the local authority.

The Building Contractor is also responsible for ensuring that all members of the Project Construction Team, including sub-contractors comply with the procedures set out in the CEMP, including following any specific requirements set-out in the EIAR. The Contractor appointed will be responsible for the organisation, direction and execution of environmental-related activities during the construction of the proposed development. In addition, they will ensure that all persons allocated specific environmental responsibilities are notified of their appointment and confirm that their responsibilities are clearly understood.

2.2 Site Manager

A Site Manager will be appointed by the Contractor to oversee the day-to-day management of the site and ensure that effective, safe and planned construction activities are delivered on an ongoing basis to the highest standards. The Site Manager will be competent, suitably qualified and an experienced professional that will oversee site logistics, communicate regularly with construction staff, accommodate project-specific inductions for staff on-site and ensure that all work is complaint with the relevant design standards and health and safety legislation.

2.3 Site Environmental Manager (SEM)

A Site Environmental Manager will be appointed by the Contractor to ensure that the CEMP is effectively implemented. The Environmental Manager will be suitably qualified and competent. The responsibilities of the SEM include, but are not limited to:

- Preparing, maintaining and implementing the CEMP
- Completing site inspection and environmental compliance reports
- Providing guidance for the site team in dealing with environmental matters, including legal and statutory requirements affecting the works
- Reviewing environmental management content of method statements where relevant
- Reporting environmental performance to the Site Manager
- Liaising with statutory and non-statutory bodies and third parties with an environmental interest in the proposed development.
- Conducting regular environmental inspections as specified in the contract and checking adherence to the CEMP
- Keeping up-to-date with relevant environmental best practice and legislative changes
- Ensuring all personnel have undertaken adequate environmental inductions, awareness briefings sand training (including sub-contractors)
- Dealing with environmental complaints
- Managing and responding to environmental incidents and ensuring that all incidents are recorded and reported in an appropriate manner.

2.4 Environmental Specialists

Where relevant, and to fulfil obligations under the CEMP, the Contractor will be responsible for engaging suitably qualified specialists including (where necessary):

- Project archaeologist
- Project ecologist
- Project arborist
- Noise and vibration specialist
- Air Quality and dust specialist
- Land, soils and contamination specialist; and
- Water specialist

2.5 Training and Induction

2.5.1 Site Induction

All personnel involved in the proposed Phase 1 development will receive environmental awareness training. The environmental training and awareness procedure will ensure that staff are familiar with the principles of the CEMP, the environmental aspects and impacts associated with their activities, the procedures in place to control these impacts and the consequences of departure from these procedures.

2.5.2 Specific Training and Awareness Raising

A project specific training plan that identifies the competency requirements for all personnel allocated with environmental responsibilities will be produced by the Contractor. Training will be provided by the Contractor to ensure that all persons working on site have a practical understanding of environmental issues and management requirements prior to commencing activities. A register of completed training is to be kept by the SEM. The Site Manager will ensure that environmental emergency plans are drawn up and the SEM will conduct the necessary training/inductions.

SECTION 3: CONSTRUCTION WORKS MANAGEMENT

3.1 Proposed Construction Sequencing

The development of Phase 1 ‘The Meadows’ will include the construction and completion of 280 no. residential units comprising 4 apartment blocks and all ancillary works. Prior to any construction works being carried out, the proposed development will initially involve some site clearance and earthworks in order to clear and grade the site to accommodate the construction of all associated engineering works and subsequently the building foundations.

This will involve the delivery of machinery, site equipment/plant and materials and the removal of some material off-site. Any material that can be reused later in the construction process will be stockpiled in an appropriate location; this will reduce the number of vehicular movements on the public roads. Once the site access, parking and compound facilities are established, the main haulage of materials to the site will include stone, concrete, blocks, steel and other building materials. Appropriate traffic management measures will be provided to minimise the impact of construction traffic on the local road network as detailed in Section 4 below.

An indicative construction sequence is outlined below to illustrate the buildability of the project. This should be read in conjunction with Appendix 3 which illustrates the location of the site access, staff compound, staff parking, location of ped/cycle bridge, the construction runoff silt trap and wheel wash facility.

The actual construction sequence will be confirmed when any conditions of planning are received, and construction appointments confirmed.

To develop the complete site for Phase 1, the following works will be required to be carried out:

- Provision of a temporary construction access from the existing Bessborough Road into the site (at the location of the proposed permanent entrance), safe and secure site compound including welfare facilities for workers and the erection of temporary boundary fencing.
- Measures to reduce the potential risk of impacts to retained trees.
- Creation of a storage area for surplus plant and materials.
- Creation of a site batch concrete area.
- Creation of silt traps at the low point to the south of the construction site to prevent construction runoff towards natural vegetation and Cork Harbour estuary watercourse.
- Trenching for underground services including foul sewer, surface water drainage including attenuation, water mains, gas, telecommunications, electricity and lighting.
- Construction of a new pedestrian/cycle bridge over the existing Passage West Greenway and linking to the existing down ramp from Mahon to the greenway.
- Construction and connection of underground services to existing underground services.
- Foul sewer connection will be made across the Ballinure walkway to the west of the site to connect to the existing wastewater pumping station close to the western boundary of the site. The final section of the foul sewer connection to the existing Ballinure wastewater pumping station will be made using directional-drilling methods (and not open-cut trenching) to maintain the integrity of the existing boundary wall to the estate and to allow the walkway to remain in use while these works proceed. A pipe jacking chamber will be constructed on the eastern side of the existing boundary wall to facilitate this installation work.
- Surface water connection will be made to an existing surface water sewer in the south-western area of the site.
- Watermain connections will be made to the existing watermain in Bessborough Road.
- No dwelling unit will be occupied prior to the completion of an approved foul sewer outfall and no hard-standing area will be completed without an approved storm outfall.
- Excavation and concrete works for strip and pad footing foundations.
- Piling to some blocks, likely to be bored piles with in-situ concrete and rebar infilling.

- Construction of the apartment buildings, plant and storage areas, likely to be constructed in reinforced-concrete frames.
- Construction of ancillary site works including the provision of 2 substations, outdoor amenity area, landscaping, 102 car parking spaces, 10 motorbike spaces, 604 bicycle parking spaces, bin stores, public lighting and all supporting site development works.
- Erection of permanent boundary fencing, landscaping and lighting.

It is estimated that the construction stage of Phase 1 will take 24 months to complete.

3.2 Working Hours

It is envisaged that normal working hours will be between 7:00am and 6:00pm, Monday to Friday and 8:00am to 2:00pm on Saturdays, subject to any conditions set down by An Bord Pleanála/Cork City Council. No working will be allowed on Sundays or Bank Holidays. Subject to the agreement of the local authority, out-of-hours working may be required for water main connections, foul drainage connections, tower crane erection and removal etc. Any such arrangements will be agreed at construction stage.

3.3 Cranes and Lifting of Equipment

The proposed build method for the apartment blocks is likely to be as a reinforced concrete (RC) frame. Tower cranes and concrete placing booms will be required to erect the RC frame. A combination of goods hoists and telehandlers will offload and distribute materials for the construction and finishing trades.

Craneage will be required for the installation of the main structure of the pedestrian/cyclist bridge.

All lifting equipment and appliances will carry current test certificates and be inspected prior to use. Trained and competent bankmen will attend the cranes.

Road Closures may be required for a short period to enable the tower crane to be transported to/from site. The appropriate approvals and permits for any road closures will be applied for and agreed with Cork City Council. All relevant stakeholders will be kept informed of any such closures.

3.4 Site Storage

Due to the site restrictions, the storage of materials on site will be kept to the minimum. A construction programme will be developed to ensure that no large materials will be required to be stored on-site until they are needed. Materials such as glazing and cladding systems will be delivered in batches and loaded evenly on the required floors. Throughout the project, storage of materials outside the site boundary will not be permitted.

3.5 Site Safety and Access/Egress

A construction site compound and staff parking area will be set up before any construction works start on-site. Hoarding and boundary fencing will be erected to delineate all site works and separate same from the surrounding public areas located adjacent to the development. Appendix 3 illustrates the likely site compound and staff parking areas.

Appropriate management of the transport operations will be applied throughout the construction process. As the proposed car park for site staff may be located away from the site compound, there will be appropriate pedestrian facilities between the two which will segregate pedestrians from moving traffic and give priority to pedestrians at any crossing points. A detailed Construction Traffic Management Plan will be prepared by the Contractor and submitted to the Planning Authority prior to the commencement of any construction.

It is proposed to construct the bridge structure which will link the site to the Passage West Greenway as part of the Phase 1 works. This would enable a connection for construction workers to use active travel or public transport during future phases of development, reducing the requirement for dedicated parking spaces for some workers. See Appendix 4 for details of the proposed bridge.

The construction of the bridge structure over the greenway will require work on both sides of the proposed structure to install abutments/landing areas for what is likely to be a steel structure which is fabricated off-site and delivered and erected on site by crane in a single operation. The construction of a suitable abutment structure/landing area on the eastern side of the greenway will require temporary closure of the access ramp into which the bridge connects and the timing and sequencing of this work will be agreed with Cork City Council. The impacts on the use of the greenway will be limited in extent and significance for this stage of the works.

During the construction of the bridge, a closure will be required to construct the bridge supports and lift the bridge into place. When the pre-fabricated bridge structure is being lifted into place there will be a requirement to close the greenway and ramp access to allow this work to proceed safely. This closure is likely to be for a limited period only and again the details of such a closure will be agreed with Cork City Council in advance of construction work commencing on the development. Appropriate diversions will be in place from both the Blackrock and Rochestown side, using the facilities around the Mahon Retail Park. Travelling from Blackrock, users will exit the greenway at the Mater Hospital ramp and use the facilities on the R852 and re-join the greenway prior to the N40 overbridge. From the Rochestown direction, the reverse of the above route will enable users to continue their journey during the bridge construction.

Security of the site is an important issue with respect to restricting site entry to personnel solely involved in the construction process during working hours and preventing unauthorised access out of hours. Site access for all personnel and visitors will be strictly controlled and all visitors will report to the site office prior to entering the construction area.

SECTION 4: TRAFFIC & TRANSPORTATION MEASURES

4.1 Introduction

Chapter 5 of the EIAR and the Traffic and Transport Assessment (TTA) and Mobility Management Plan (MMP) prepared by MHL Consulting Engineers has not identified any significant potential impacts in respect of traffic during the construction phase:

- *'In general, the impact of the construction traffic will be temporary in nature and less significant than the final development operational stage'.*
- *'The surrounding road network is suitable to accommodate the construction traffic associated with the proposed development'.*

It is outlined in the TTA that a detailed Construction Traffic Management Plan (CTMP) will be prepared by the successful contractor in consultation with Cork City Council Roads and Transportation Department.

The principal objective of the CTMP is to ensure that the impacts of all building activities generated during the construction phase upon the public (off-site), visitors to the subject site (on-site) and internal (on-site) workers environment are fully considered and proactively managed/programmed, thereby ensuring that safety is maintained at all times, disruption is minimised, and that works are undertaken within a controlled, hazard-minimised environment.

4.2 Access Control

The proposed construction site is located off the access road which serves existing buildings including the Bessboro Day Care Centre and the Cork Community Mediation Service. See Figure 4.1. The proposed development is approximately 750m from the junction of Skehard Road and Bessboro Road. This is the main access point from the wider road network and will form the preferred haulage route to/from the site in agreement with Cork City Council. The geometry of the access route is appropriate for construction traffic and HGVs. A number of nearby residential developments were recently completed or are currently under construction and would have used the same access route, up to a point, for this development.

It is anticipated that heavy goods vehicles, HGVs, will be restricted to off-peak times on the local road network to reduce the impact on the road network during the morning and evening peaks. It is expected that HGV movements and general deliveries will otherwise arrive/leave throughout the day at a steady rate.

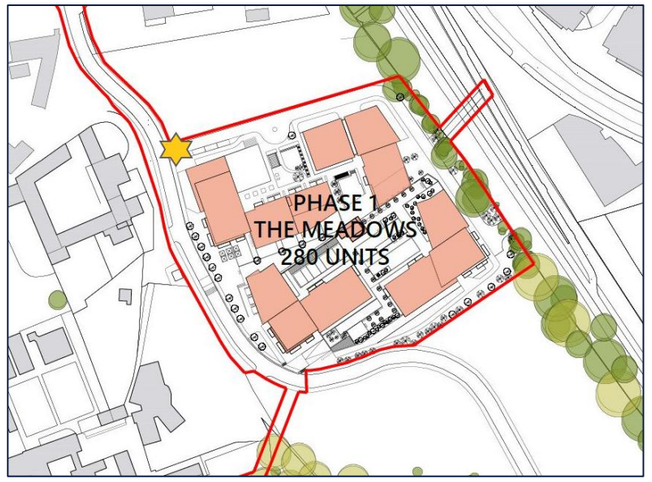

Figure 4-1: Proposed Construction Site Access

Appropriate signage for the site will be provided on the approach routes to provide clarity for construction vehicles, particularly deliveries who may not be familiar with the site location. This will provide wayfinding for drivers and limit the number of turning manoeuvres outside the site.

The following section includes a range of mitigation measures to minimise the construction traffic generation, ensure the safety of the workforce on the site and accessing the site, and ensuring the safety of the public on the surrounding roads.

4.3 Construction Related Traffic Movements

The demolition, site clearance, piling and general construction activities will generate a level of vehicle movement to and from the site as well as internally within the subject site.

The typical construction trips generated during site clearance and construction comprise:

- Construction employees arriving and leaving work
- Deliveries and removal of machinery; and
- Delivery and removal of materials.

Appropriate measures will be put in place to ensure safe access to/from the site. Measures will also be implemented on-site to ensure safe manoeuvres can be carried out within the construction site. An employee car park will be located within the Applicant's lands with a dedicated pedestrian route to the to the site accommodation. There will be designated areas on site for loading/unloading and a specified storage area for materials and machinery. A waste and recycling area will be established within the construction site boundary, close to the construction access, to prevent unnecessary trips through the site for collection. To ensure that the internal site routes and the public road to the construction site entrance is kept in good condition, a wheel washing facility will be located close to the exit from the construction area to minimize mud and dust.

The level of construction traffic throughout the working day is expected to be low to moderate, the highest volume of vehicles is expected when workers arrive to and leave work. Generally, workers are expected to travel by private vehicle and public transport. It is expected that there will be a typical average of approximately 80 no. construction employees on site during Phase 1 works.

Deliveries and HGV movement numbers are expected to be low to moderate and evenly spread throughout the day. The HGV traffic is expected to be greater during the initial stage of the development as larger machinery and materials will be delivered. This will, however, reduce as the construction of the buildings advance.

Deliveries of materials to site will be planned to avoid high volume periods where possible, particularly the AM peak hour. There may be occasions, however, when it is necessary to have deliveries within these periods. As previously stated, the Contractor will develop, agree and submit a detailed Construction Traffic Management Plan to the local authority for approval prior to commencement of construction works. The following section details some of the mitigation measures to be included in the detailed CTMP.

4.4 Mitigation Measures

A competent traffic co-ordinator and banksmen will be appointed by the contractor to oversee the following control measures which will be implemented as part of the final CTMP to reduce the risks associated with construction traffic. Some of the following measures also tie in with mitigation measures for dust and noise.

- A detailed site plan/layout of the construction site will be developed to identify locations for site offices/storage areas/waste management areas etc.
- Entrances and exits – separate entry and exit gateways will be provided for pedestrians and vehicles with a gate attendant employed to interface with the traffic and public to facilitate safe access and egress of vehicles.
- Where employees will need to cross the carriageway, a clearly signed and lit crossing point will be provided where drivers and pedestrians can see each other clearly.
- Visibility – the site operator will ensure that drivers driving out onto the public road have the appropriate visibility splays.
- All public and private walkways will be maintained free of obstructions
- All operators of construction machinery and vehicles will be trained and competent and have valid CSCS cards.
- All site staff will be made aware that there are residents and employees in the surrounding areas using the access road.
- Approach signage with good sightlines will be provided at the site access route and site entrance.
- Traffic management procedures will be communicated to suppliers and workers.
- Deliveries to site will be planned to arrive during working hours only, save for exceptional loads for which a detailed plan will be agreed with the local authority..
- The access route to the construction site entrance and internal site routes will be kept in good condition and clear of obstructions.
- The contractor will put measures in place to mitigate any excessive noise for nearby properties that may be created during construction activities.
- Internal trafficked areas will be watered twice daily on dry days to reduce dust, if required. Vehicles delivering or collecting material with dust potential will be covered with tarpaulin at all times to restrict the escape of dust.
- A stringent ‘clean as you go’ policy will be implemented on site to ensure no loose material is left on the ground within the construction access road and the public road.
- Vehicle wheel washing facilities will be in place for vehicles leaving the construction site area.
- A road sweep will be deployed if necessary to ensure the site access route between the site access and the Skehard Road junction will be kept clean at all times.
- Construction materials or equipment will not be stored outside the site boundary.
- Pedestrian/vehicular routes, crossing points, parking, loading and vehicle only areas will be clearly marked, signposted and segregated as appropriate.
- Where required site vehicles will be fitted with appropriate audible and visual devices.
- Loading and unloading will be carried out in a designated area within the construction site boundary and reversing activities will be kept to a minimum.
- Loads will be checked prior to unloading and loads will be adequately secured for travel.

- Visitors to site will be accompanied and a safe area will be provided for visiting drivers during loading and unloading.
- Speed limits signage will be used to control speeds on the access route and within the construction site.
- Construction vehicles and machinery will be maintained in good condition by a competent person as per the manufacturer’s instructions. A dedicated area for maintenance work will be provided within the construction site area.
- All operators will wear personal protective equipment on-site and seat belts where fitted by the manufacturer will be worn when operating equipment.

SECTION 5: AIR QUALITY

5.1 Introduction

As construction activities are likely to generate some dust emissions, dust management requirements will be developed and implemented as part of the detailed Dust Mitigation Plan during the construction phase of the project. The potential for dust to be emitted depends on the type of construction activity being carried out, the dust controls in place and also the weather conditions, such as the level of rainfall, wind speed and direction.

A preliminary Dust Management Plan has been prepared by the DK Partnership as part of the Environmental Impact Assessment Report (EIAR) for the project and this plan is attached as Appendix 5 of this document for information purposes.

5.2 Dust Sources

The potential impact for dust depends on the distance to potentially sensitive locations, such as neighbouring residential and commercial properties in this case. The main activities that give rise to dust emissions during construction include the following:

- Excavations and Piling
- Materials handling and storage
- Temporary stockpiling of any earthworks material for re-use
- Movement of vehicles, particularly HGVs.

The mitigation measures set out below will be put in place during the construction phase. The level of dust control to be implemented will depend on the weather conditions, the specific construction activities (e.g. earthworks activities, construction activities and site vehicle movements) and the potential for dust nuisance as a result of those activities.

5.3 Mitigation Measures

Mitigation measures for dust control will include:

- The contractor shall prepare a dust minimisation plan which shall be communicated to all staff.
- Internal trafficked areas will be watered twice daily on dry days to reduce dust if required. Vehicles delivering or collecting material with dust potential will be covered with tarpaulin at all times to restrict the escape of dust.
- A stringent ‘clean as you go’ policy will be implemented on site to ensure no loose material is left on the ground within the construction access road and the public road.
- Vehicle wheel washing facilities will be in place for vehicles leaving the construction site area.
- Bessboro public road will be inspected daily for cleanliness and a road sweep will be deployed if necessary to ensure the site access route between the site access and the Bessboro Road/Skehard Road junction will be kept clean at all times.
- Topsoil stockpiles will be located in a location so as not to necessitate double handling and topsoil stockpiles will be seeded to promote grass growth and reduce dust.
- Material handling systems and site stockpiling of materials will be laid out to minimise exposure to wind.
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.

Further mitigation measures are outlined in the preliminary Dust Management Plan prepared by the DK Partnership, see Appendix 5.

SECTION 6: NOISE AND VIBRATION CONTROL MEASURES

6.1 Introduction

In order to minimise the noise impact on the adjoining community, creche and residential properties it is proposed that heavy equipment and machinery including piling drills (if required), construction vehicles and generators only work between the hours detailed above. In addition, no deliveries and/or removal of materials will occur outside of these hours, save for exceptional situations when permissions will be sought from the Local Authority.

Normal working hours are outlined in Section 3.2 above, however these will be subject to detailed agreement with Cork City Council prior to commencement.

On occasions it may prove necessary to carry out construction activities outside of normal working hours. In such instances prior consultation will be carried out with Cork City Council, local residents, and businesses outlining the nature and reason for the works and their likely duration.

6.2 Noise and Vibration Regulations

During the works the contractor shall comply with the requirements of BS 5228-1:2009+ A1:2014 and BS 5228-2:2009 +A1:2014 (Code of Practice for Noise and Vibration Control on Construction and Open Sites) as well as Safety, Health and Welfare at Work (General Applications) Regulations 2007 Noise and Vibration.

Noise Limits

Noise limits to be applied for the duration of the construction works are as set out in BS 5528. This applies a noise limit of 70dBA between 07:00 and 19:00 outside the nearest window of the occupied room closest to the site boundary in suburban areas away from main road traffic and industrial noise.

For the duration of the construction works, a daytime noise limit (07:00 to 19:00) of 70 dBA shall apply (in accordance with BS 5228).

Vibration Limits

Vibration limits to be applied for the duration of construction works are as set out in BS 5228 (Code of Practice for Vibration Control on Construction and Open Sites) and BS 7385:1993 (Evaluation and measurement for vibration in buildings Part 2: Guide to daameg levels from ground borne vibration). Allowable vibration during the construction phase is summarised below in Figure 5.1.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 4Hz	15 to 40Hz	40Hz (and above)
12 mm/sa	12.5 mm/sa	50 mm/sa

Figure 6-1: Guidelines for Allowable Vibration

6.3 Mitigation Measures

In particular, the following practices are to be implemented during the construction phase:

- Limiting the hours during which site activities that are likely to create high levels of noise and vibration are permitted
- Erection of a barrier along the site boundary (e.g. standard 2.4m high construction hoarding) to remove direct line of sight between noise sources and receiver when construction works are being carried out in proximity to noise sensitive receivers

- Establish channels of communication between the contractor, local authority and local businesses and residents
- Appoint a site representative (SEM) responsible for matters relating to noise
- Selection of plant with low inherent potential for generation of noise
- Siting of noisy plant as far away from sensitive properties as permitted by site constraints and implementation of noise reduction measures such as acoustic enclosures when required
- Avoidance of unnecessary revving of engines and switching off of plant when idle
- All plant and equipment will be maintained in good working order in accordance with BS.5228 in order to minimise air and noise emissions.
- All ancillary pneumatic percussive tools shall be fitted with mufflers or silencers of the type recommended by the manufacturers, and where commercially available, dampening tools and accessories shall be used.
- Noise monitors will be erected and data collected to assess sound levels.
- Ear protection zones will be established and all personnel will be trained on ear protection.

SECTION 7: WATER AND WASTEWATER CONTROLS

7.1 Introduction

All works carried out as part of these works will comply with all Statutory Legislation including the Local Government (Water Pollution) Act, 1977 and 1990 (as amended) and the contractor will cooperate in-full with Irish Water and the Environmental Department of Cork City Council. There is no immediate watercourse in the vicinity of the site. The Douglas Estuary is located south of the site on the southern side of the N40.

The following description outlines the proposed water/wastewater works to be carried out during Phase 1:

- Surface Water - The proposed surface water network will include a drainage pipe network, attenuation storage and SuDS features. The restricted discharge from the site will be conveyed in a new surface water pipe laid from the western boundary of the Meadows in a westerly direction across the Bessborough site to connect to an existing 750mm diameter surface water sewer upstream of its connection to the 1350mm diameter surface water pipe which discharges to the Douglas Estuary south of the N40. A legal wayleave is in place across the Bessborough lands immediately to the south-west of The Meadows development to facilitate this connection.
- Foul Drainage - Wastewater collection within the proposed development will be via a network of 150mm and 225mm diameter gravity sewers, which will direct the flows to the southwest corner of the site. A new gravity sewer will then convey the flows in a westerly direction and will connect directly to the Bessborough wastewater pumping station. A legal wayleave is in place across the Bessborough lands immediately to the south-west of The Meadows development to facilitate this connection.
- Potable Water - A 150mm diameter ductile iron watermain is located in the existing road that forms the eastern boundary of The Meadows development. Irish Water have advised that the connection to serve the development is to be made to this existing main.

The mitigation measures outlined below provide the water management controls required to be implemented by potential Contractors and Sub-contractors and set out the proposed procedures and operations to be utilised on the proposed development to mitigate against any water related environmental impacts. The mitigation and control measures outlined herein will be employed on site during the construction phase of the development.

The main areas of water related concerns covered by this section are:

- Pre-Construction (Inc Site Clearance/Tree felling)
- Construction Phase drainage controls
- Earthworks (i.e. infrastructure & drainage) and surface water quality protection
- Temporary stockpiles water management and controls; and
- Fuel usage, storage and management.

7.2 Mitigation Measures

Surface water runoff during site clearance and construction stage can be potentially contaminated. The most likely forms of contamination are ‘siltation’ and spillage. Siltation occurs when soil and particulate matter are washed away in rainfall events by rainwater. Siltation will be mitigated on the project using stilling basins and strainers within the site to prevent silt being lost to the drainage network.

Excavation, Erosion and Sediment Control

- Measures will be implemented to capture and treat sediment laden water run off (e.g. silt traps; siltbuster)
- The area of exposed ground will be minimised and as much vegetation as possible will be retained for as long as is practical
- Delay clearing and topsoil stripping of each area until work is ready to proceed.

- Close and backfill trenches as soon as practically possible
- Any earthworks temporary stockpile areas will require silt fencing to be installed.
- Any on-site settlement areas are to include geotextile liners and riprapped inlets and outlets to prevent scour and erosion
- Surface water runoff from areas stripped of topsoil and surface water collected in excavations will be directed to on-site settlement areas, at the lower, south west end of the site, where measures will be implemented to capture and treat sediment laden runoff prior to discharge of surface water at a controlled rate.
- Surface water discharge points during the construction phase are to be agreed Cork City Council's Environment Section prior to commencing works on site.

As fuels and oils are required during construction stage, it is necessary to mitigate the possibility of there being an accidental leakage of these liquids. All fuels stored on site will be bunded and all chemicals will be stored in an appropriate tank. Should any spillage occur on site during construction, it is likely that there will be a localised moderate impact in the short term on the environment.

Accidental Spills and Leaks

- All oils, fuels, paints and other chemicals will be stored in a secure bunded hardstand (impervious) area
- Refuelling and servicing of construction machinery will take place in a designated hard stand area which is also remote from any surface water inlets.
- A response procedure will be put in place to deal with any accidental pollution events and spillage kits will be available and construction staff will be familiar with the emergency procedures and use of equipment.

Concrete

- Concrete batching will take place on-site and offsite. Wash down and wash out of concrete trucks will take place off site and any excess concrete will not be disposed of on site
- Pumped concrete will be monitored to ensure there is no accidental discharge
- Mixer washings are not to be discharged into surface water drains and will be directed to settlement areas.

Wheel Wash Areas

- Discharge from any vehicle wheel wash areas is to be directed to onsite settlement areas, debris and sediment captured by vehicle wheel washes are to be disposed off-site at a licensed facility.

Through consultation with the Site Manager (SM) /Site Environmental Manager (SEM), a schedule for surface water quality monitoring will be drawn up. This will be finalised prior to the start of construction. Where monitoring parameters are found to exceed the standards laid down, the SM/SEM will initiate and report corrective actions. This may necessitate the alteration of the environmental control measures and in turn the relevant construction method statement.

It is proposed to implement a programme for monitoring water quality at the outfall tie-in as part of the construction of this development, in agreement with the Planning Authority. This programme and sampling requirements will be agreed with Cork City Council.

SECTION 8: LANDSCAPE MANAGEMENT

During Phase 1 construction, site security fencing and solid hoarding will be used where appropriate to restrict visibility, minimise noise pollution and restrict visibility into the site, minimising the temporary landscape and visual impacts. There is a significant area of existing vegetation/trees to the south and east of the site and along the routes of foul and surface-water outfall/connections. These areas will require protection measures to be employed during construction works, particularly during the construction of the bridge and foul and storm drainage outfalls. It is expected that approximately thirteen trees will be required to be removed as part of the development of this phase.

The mitigation measures set out below will be implemented to minimise the impact on any trees/vegetation.

Although the removal of some trees will be required for the construction of the pedestrian/cycle bridge and the trenching and construction of watermains, foul and surface-water drainage, such tree removal will be restricted to that identified for removal in the application.

- All mitigation measures to be put in place to protect such trees and vegetation shall be prepared in consultation with a qualified Arborist, who shall supervise works for which an Arboriculture Method Statement is required.
- The specific Arboriculture Method Statement shall be prepared for any works within the root protection area of any tree to be retained and the measures outlined shall be strictly enforced on site.
- Trees will be protected in accordance with BS: 5837:2012 *Trees in relation to design, demolition and construction. Recommendations* and any further agreed procedures.
- The construction works for the new ped/cycle bridge shall be fenced off with solid hoarding and protected from the public. The contractor will liaise and co-ordinate these works with the Cork City Council.
- Reinstatement of trees and vegetation will be undertaken by a suitably qualified landscape contractor.

SECTION 9: ARCHAEOLOGY & HERITAGE

9.1 Pre-construction

Given the historic and sensitive nature of the site, prior to any construction commencing an archaeological and heritage assessment and surveys will be carried to include advance archaeological testing across the footprint of the development where machine or hand excavated test trenches allow for the early indication of relevant material. This allows for informed decisions to be made as to how best to progress with construction works and deal with any discovered archaeological finds should they arise.

Based on the results of the above assessments/surveys, detailed monitoring of all groundworks associated with the development may be recommended, with the provision for full excavation of any archaeologically significant material uncovered.

9.2 During Construction

Following the archaeological and heritage assessment, during the construction process, if deemed necessary, archaeological monitoring will be carried out where the construction works are suspected to be in the proximity to an archaeological site. This may involve a forensic archaeologist or human osteoarchaeologist maintaining a watching brief while groundworks are taking place in order to identify and record any archaeological remains that may be present. In the event of archaeological features or material being uncovered during construction monitoring, it is important that all machine work in the immediate area ceases to allow the archaeologist to assess, excavate and record any findings.

Should archaeological features or material be uncovered, adequate funds to cover excavation, fencing, post-excavation analysis and reporting will be made available. This work should be done under license in accordance with Section 26 of the National Monuments Act 1930-2014 and with a method statement agreed in advance with the National Monuments Service (Dept. of Culture, Heritage and the Gaeltacht) and the National Museum of Ireland.

9.3 Mitigation Measures

A programme of archaeological supervision/monitoring of all ground works will be undertaken by a suitably-qualified archaeologist. Given the developed nature of the portions of the site (especially within 'The Farm') and previous programmes of archaeological investigations (within the 'The Meadows'), the archaeological risk is considered to be low. In the unlikely event of an archaeological discovery, the National Monuments Service and Cork City Council will be consulted to agree how the encountered archaeological remains are recorded and resolved.

Site development works (especially ground reduction work and drainage excavation works) will be monitored by a forensic specialist and osteoarchaeologist to allow for the identification of any previously-unrecorded burials or human remains. In the event of such a discovery, An Garda Síochána will be immediately notified and the localised works in the affected area will be suspended subject to the direction of An Garda Síochána.

In relation to works to historic boundary walls, it is recommended that interventions to historic masonry boundary walls have intentionally been kept to a minimum. Where repair or rebuilding works to historic masonry walls are required (including the creation of a new pedestrian entrance in the boundary wall adjacent to the historic entrance to Bessborough Estate), such works will be undertaken by suitably-experienced conservation contractors with proven experience in the use of traditional lime mortars and rubble masonry.

SECTION 10: WASTE MANAGEMENT

10.1 Introduction

A detailed Construction Waste Management Plan will be agreed with Cork City Council and put in place in order to control waste management on site, ensure segregation of waste streams and minimise construction waste costs. Waste arising from the site will be considered in relation to the waste management hierarchy of prevention, reduce, reuse, recycle, energy recovery and disposal.

Construction and demolition waste is the largest "municipal" waste stream contributing to the current pressure on landfill facilities in the region. Unsustainable management and inappropriate disposal of this waste stream can result in impact on natural resources and lead to environmental pollution. The main source of waste material at the site will be construction waste.

Waste is defined as any substances or object belonging to a category of waste specified in the First Schedule (of the Waste Management Act 1996) or included in the European Waste Catalogue, which the holder discards or intends or is required to discard and anything which is discarded or otherwise dealt with as if it were waste shall be presumed to be waste until the contrary is proved.

There are two main types of construction waste – Hazardous and Non-hazardous as detailed below:

Non-hazardous

- Timber Waste
- Scrap Metal
- Plastic
- Paper / Cardboard
- Canteen Waste
- Litter

Hazardous

Hazardous Wastes are defined as wastes which can have a harmful effect on the environment and on human health as they exhibit ignitability, reactivity, corrosivity and/or toxicity and/or are listed as hazardous by the European Waste Catalogue and/or may be identified as hazardous by application of the EPA Waste Characterisation Tool compiled by The Clean Technology Centre.

The hazardous wastes that may be experienced at a development of this nature are as follows:

- Adhesives and Sealants
- Aerosols
- Batteries
- Chemicals
- Cleaning Products
- Oil (Contaminated absorbent Material or debris)
- Paints and Thinner
- Fuels (hydrocarbons such as diesel)
- Concrete waste

The Meadows (Phase 1) development will result in the generation of waste material from the following sources:

- Removal of existing boundaries
- Excavation of soil for site access, to foundations, ductwork and sewers/watermains
- Excavation of stone / made ground at infrastructure tie-ins to existing water mains, sewers, gas etc.
- Surplus material (off-cuts, damaged materials, packaging etc.) generated during the construction of the new development.

Soil will be excavated to facilitate construction of foundations, access roads, the installation of site services and general landscaping. Where possible, excavated topsoil will be reused on site for landscaping. It is anticipated that any additional soil will be removed from the site for reuse, recovery and/or disposal as there are limited suitable onsite re-use options.

The Waste Management Hierarchy states that the most preferred option for waste management is prevention and minimisation of waste, followed by reuse and recycling/recovery, energy recovery (i.e. incineration) and, least favoured of all, disposal. The excavations are required to facilitate construction so the preferred option (prevention and minimisation) cannot be accommodated for the bulk excavation phase.

The next option (beneficial reuse) may be possible for some and potentially all of the inert natural material (Category A1). This material could be used as fill material in other construction projects or engineering fill for waste licensed sites. Beneficial reuse of surplus excavation material as engineering fill may be subject to further testing to determine if materials meet the specific engineering standards for their proposed end-use.

Any nearby sites requiring clean fill/capping material will be contacted to investigate reuse opportunities for clean and inert material. If any of the material is to be reused on another site European Communities (Waste Directive) Regulations 2011, Article 27 requires that certain conditions are met and that by-product decisions are made to the EPA, via their online notification form.

If the material is deemed to be a waste, removal and reuse/recycling/ recovery/disposal of the material will be carried out in accordance with the Waste Management Acts 1996-2008, the Waste Management (Collection Permit) Regulations 2007 (as amended) the Waste Management (Facility Permit & Registration) Regulations 2007 (as amended). The volume of waste removed will dictate whether a Certificate of Registration (COR), Waste Facility Permit or Waste Licence is required by the receiving facility.

Once all available beneficial reuse options have been exhausted, the options of recycling and recovery at waste permitted and licensed sites will be considered. The option of disposal of inert natural material to landfill will only be considered once all available reuse options have been explored and where capacity cannot be secured at appropriately permitted/licensed facilities for recycling or recovery purposes.

Any soil/subsoil that is deemed to be contaminated will be stored separately to the clean and inert soil/subsoil. The material will be appropriately tested and classified as either non-hazardous or hazardous in accordance with the EPA publication ‘Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous’ using the HazWasteOnline application (or similar approved classification method). The material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the EC Council Decision 2003/33/EC.

The highest volume of materials generated will be topsoil and subsoil/stones from site clearance to accommodate access routes, bridge construction, footpaths, services, and foundation excavation to enable construction of the apartment blocks. Some of the material will be re-used on site for the car park podium and landscaping, however, some will be removed off-site. Given the proposed developable area is 1.53 hectares, the following estimations of excavated material have been calculated:

- An average depth of 100-200mm for topsoil strip will generate approx. 4860m3.
- Subsoil excavation for access route and footpath construction, piling and excavation for foundations will generate approx.4470m3.
- Excavation for watermains, foul and surface water sewer will generate approx. 2400m3 of material.
- Subsoil excavation to provide SUDS attenuation area amounts to approx. 800m3.
- The total subsoil excavation is therefore approximately 7670m3.

Approx. 1000m3 of topsoil and 1200m3 of subsoil will be required for backfilling the SUDS attenuation and trench excavation. As such, it is estimated that approx. 10,330m3 will need to be transported off-site for reuse/recycling (See Table 9.1).

A standard 4-axle rigid construction tipper capacity weight is 20 tonnes which is equivalent to approx. 15 cubic metres of soil. Therefore, approx. 690 loads will be required to export the excess soil off-site.

Table 10-1: Cut and Fill Calculation

Item	Excavate	Reuse	Export
Topsoil Strip	4860m3		
Topsoil Reuse		1000m3	
Topsoil for Export			3860m3
Subsoil from Excavation	7670m3		
Fill Required		1200m3	
Subsoil Excess for Export			6470m3
Total Surplus for Export off-site			10,330m3

SECTION 11: EMERGENCY PLANNING AND RESPONSE

A set of standardised emergency response procedures will govern the management of emergency incidents. The contractor will be required to outline emergency incident response procedures in the detailed CEMP and to develop an Emergency Incident Response Plan. These procedures will be as follows:

- Emergency preparedness and response procedure (incl. emergency phone numbers)
- Incident investigation procedure
- Nonconformity, corrective action and preventative action
- Spillage containment procedure
- Pollution prevention programme and corrective action reporting

In the event of spillages or other incidents, steps will be taken to prevent environmental pollution, for example through protection of drains by use of drain covers or booms, use of absorbent granules following a fuel or oil / chemical spill and turning off equipment or other sources of noise or dust.

Once the situation has been rectified, full details the incident and remedial actions undertaken will be provided to the City Council and relevant authorities and recorded appropriately.

Appropriate measures to prevent a recurrence of such incidents will be developed in consultation with these authorities.

SECTION 12: INSPECTIONS AND MONITORING

The environmental performance of the contractor will be monitored through site inspections. Monitoring will be carried out in accordance with the requirements of the EIAR so that construction activities are undertaken in a manner that does not give rise to significant negative effects. Suitable monitoring programmes will need to be developed, implemented, documented, and assessed in accordance with the measures outlined in the detailed CEMP and EIAR.

The results of all environmental monitoring activities will be reviewed by the Site Environmental Manager on an ongoing basis to enable trends to be identified and corrective actions to be implemented as necessary.

Routine inspections of construction activities will be carried out by the Site Environmental Manager on a daily basis to ensure all necessary environmental measures relevant to the construction activities are being effectively implemented by construction staff. Detailed inspections should be carried out weekly which would be appropriately documented by the Environmental Manager. The inspection routine should include:

- Summary of compliance/non-compliance with the detailed CEMP
- Results and interpretation of monitoring programmes
- Key issues noted during inspections
- Summary record of non-conformities, incidents and corrective actions
- Summary of environmental complaints and queries received in relation to environmental matters; and
- Summary record of environmental training undertaken by staff.

Appendix 1

PROPOSED MASTERPLAN LAYOUT

PHASE 2
FARM
140 UNITS

PHASE 1
THE MEADOWS
280 UNITS

PHASE 3
NORTH FIELDS
200 UNITS

NATIONAL MEMORIAL AND RECORDS CENTRE

SAINT MICHAEL'S DRIVE

DIVY GATE

SOUTH RING ROAD

ORDNANCE SURVEY MAP

Ordnance Survey Ireland

1:1,000 | 6428-05
1:1,000 | 6383-25
1:1,000 | 6429-01

NORTH POINT

Data Extraction Date:
==========
Date= 18-Mar-2021

Source Data Release:
==========
DCLMS Release V1.138.111

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

License / Copyright:
==========

1 PROPOSED SITE MASTER PLAN
1:1000 @ A1

SITE MASTER PLAN

SHiPSEYBARRY
place makers

PROJECT :	BESSBOROUGH			DRAWING DESCRIPTION:	SITE MASTER PLAN	CLIENT :	ESTUARY VIEW ENT. 2020 LTD.
SCALE :	1:1000 @ A1	DATE :	03.2022	DRAWN BY :	JJ	APPROVED BY :	GB	DRAWING NO. :	SB-2020-107-005

A For information 18/03/2022

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Appendix 2

PROPOSED SITE PLAN

THE MEADOWS BUILDINGS: A,B,C,D

280 APARTMENTS	NO.	%
STUDIO AP.	6	2.1 %
1 BEDROOM AP.	112	40.0 %
2 BEDROOM AP. 4P	150	53.6%
3 BEDROOM AP.	12	4.3 %
TOTAL NO.	280	100 %
DUAL ASPECT	121	43.2%
NO. OF UNITS WITH AREA 10% GREATER THAN REQUIRED	162	57.8%
TOTAL RESIDENT'S PRIVATE AMENITY AREA	2,172 sqm	
PUBLIC OPEN SPACE	3,958 sqm	63,5 %
PARKING SPACES	98	35.0%
CRECHE DROP OFF	4	
MOTORBIKE SPACES	10	
RESIDENT'S BIKE SPACES	464	
VISITOR'S BIKE SPACES	140	

LEGEND

- POND
- VEGETATIONS
- PATHS
- GREEN ROOF
- EXISTING TREES
- ROOT PROTECTION ZONE
- PROPOSED TREES
- TREE TO BE REMOVED

SITE BOUNDARY AREA: 2.3 ha

Site Centre Point Coordinates:
X,Y = 571940.0,570405.0

- SITE BOUNDARY
- OTHER LANDS UNDER APPLICANT'S OWNERSHIP

1 SITE PLAN
SCALE 1:500

280 UNITS 1:500 A1

C Client Meeting 03.2022
B For Planning 08.2021
A For Client Review 03.2021

SITE PLAN

SHiPSEYBARRY place makers

PROJECT:	THE MEADOWS- BESSBOROUGH	DRAWING DESCRIPTION:	SITE PLAN
SCALE:	1:500 @ A1	DATE:	03.2021
OVERSEEN BY:	MD	APPROVED BY:	GB
CLIENT:	ESTUARY VIEW ENT. LTD		
DRAWING NO.:	SB-2020-107-200		

Appendix 3

PROPOSED SITE FACILITIES

Temporary Construction Employee Car Park

Protected Walkway & Pedestrian Crossings

Construction Access

Site Compound/Storage/ Wheelwashing Facility

Ped/Cycle Bridge

Internal Construction Access Route

Construction run-off/silt trap

File Name: \\ecorkdc00\Projects\Barry's Project Files\21 Projects\21207 - Bessborough SHD Development\00 WIP\Dwg\21207-JBB-PH1-XX-DR-C-05003_Proposed_Site_Facilities P01.02.dwg

BIM QUALITY SHEET NO.: PIM-JBB-00-XX-TP-Z-0003

LEGEND:

Rev.	Suit.	Description	Drawn	Ch'kd	Date
P01	S3	Issued for Review	AO'N	TF	02.02.22

Client

Estuary View Enterprises 2020 Ltd.

Clients Representative:

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tel +353 21 475 7800
web www.jbbarry.ie
email cork@jbbarry.ie

Project

BESSBOROUGH SHD DEVELOPMENT

Drawing Title

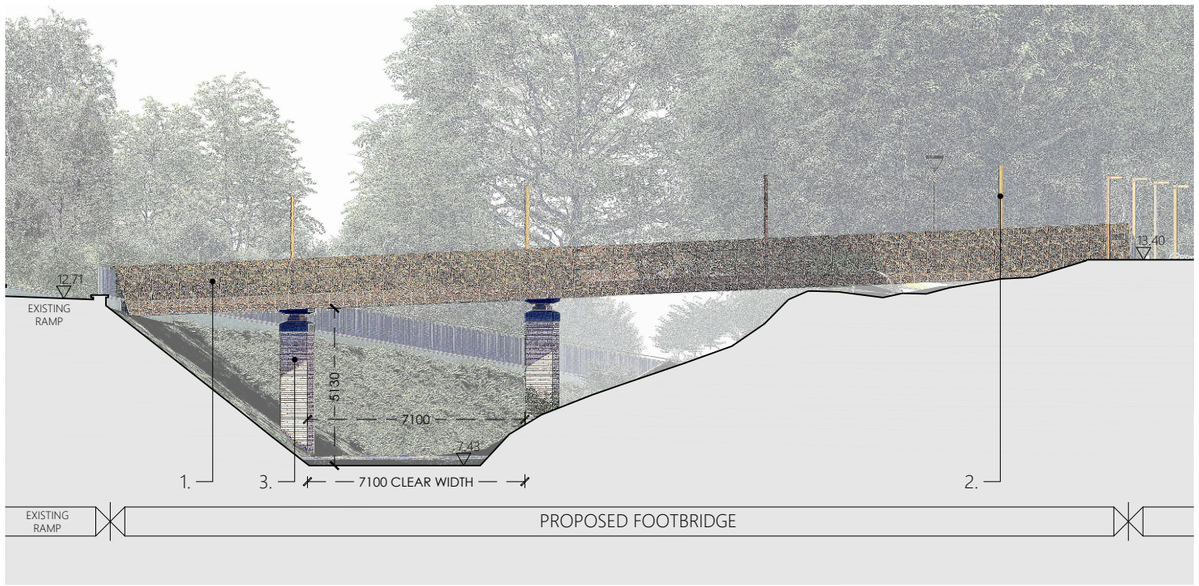
PROPOSED SITE FACILITIES

Drawn by :	AO'N	Date :	02.02.22
Checked by :	TF	Date :	02.02.22
Approved by :	TF	Date :	02.02.22
Internal Project REF :	JBB: 21207		
Scales :	1:500 @ A1, 1:1000 @ A3		
Stage :	PLANNING		

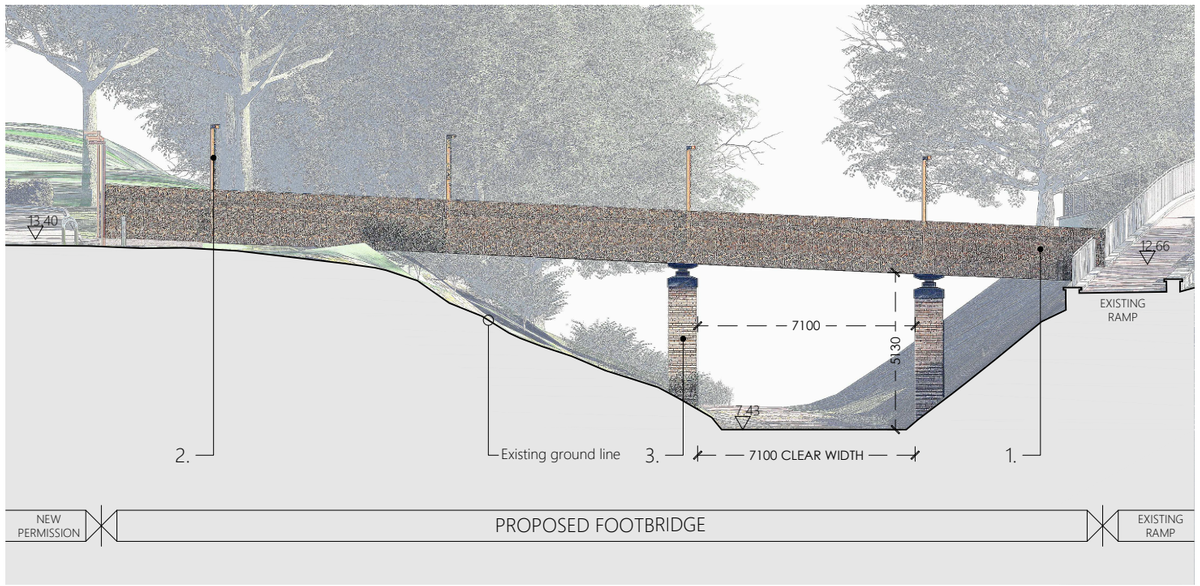
Drawing No. :	Revision	Suitability Code
21207-JBB-PH1-XX-DR-C-05003	P01	S3

Appendix 4

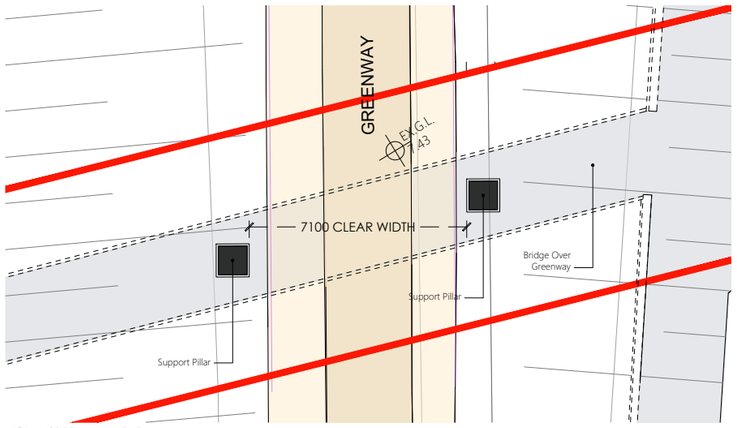
PROPOSED PEDESTRIAN/CYCLE BRIDGE



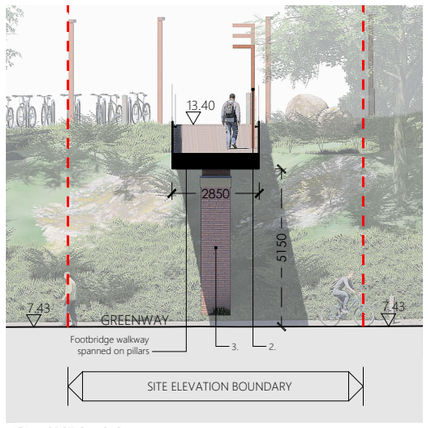
1 SECTION A-A
SCALE 1:100



2 SECTION B-B
SCALE 1:100

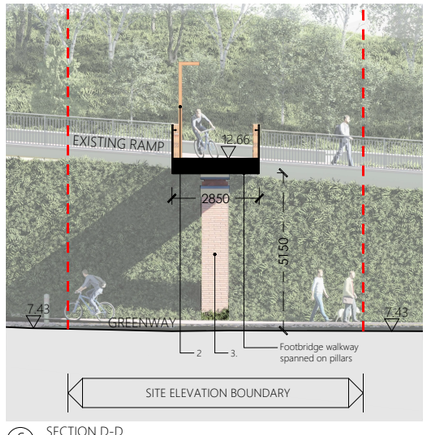


3 GREENWAY LEVEL
SCALE 1:100

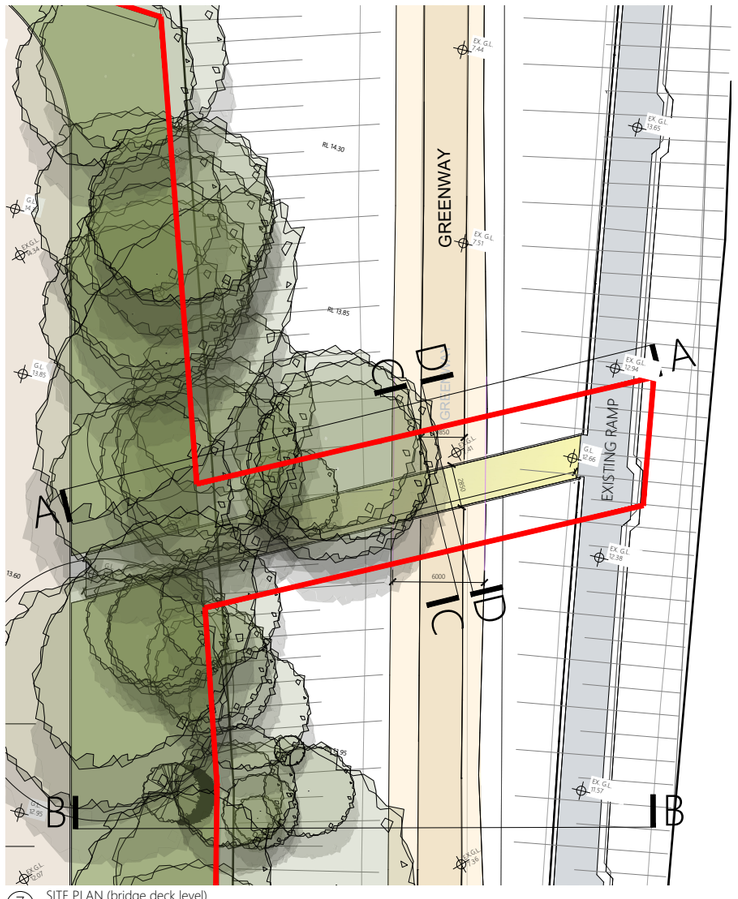


4 SECTION C-C
SCALE 1:100

5 PEDESTRIAN VIEW

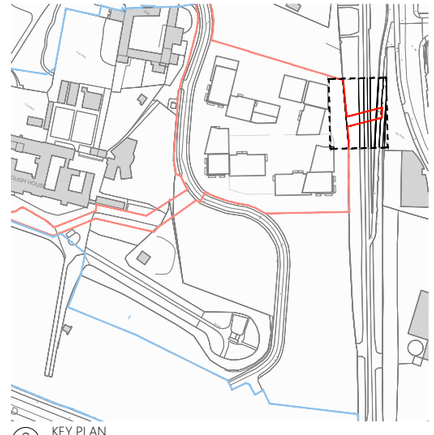


6 SECTION D-D
SCALE 1:100



7 SITE PLAN (bridge deck level)
SCALE 1:200

8 BALUSTRADE DETAIL



9 KEY PLAN
SCALE 1:2500

MATERIAL KEY:

1. TYPE 1 ORNAMENTAL PERFORATED METAL SHEETING BALUSTRADE
2. WALKWAY LIGHTS
3. BRICK BRIDGE PILLARS

NORTH POINT

1:100 & 1:200 A1

C commencing 2021.02.04
B Boundaries 2021.02.01
A Amendments 2021.12.22

FOOTBRIDGE

PROJECT :	THE MEADOWS - BESSBOROUGH	DRAWING DESCRIPTION :	SECTIONS, SITE PLAN	CLIENT :	ESTUARY VIEW ENTERPRISES LTD
SCALE :	1:100 & 1:200 @ A1	DATE :	JANUARY 2022	OVERSEEN BY :	JJ	APPROVED BY :	GB	DRAWING NO.	SB-2020-107-900

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Appendix 5

DUST MITIGATION PLAN

Appendix A
Dust Management Plan

Site management
The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design and effective control strategies. At the construction planning stage, the siting of activities and storage piles will take note of the location of sensitive receptors and prevailing wind directions. As the prevailing wind is predominantly south-westerly, locating construction compounds and storage piles downwind of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors. The Principal Contractor or equivalent must ensure that the proposed mitigation measures are implemented, and that dust impacts and nuisance are minimised.

- It is recommended that community engagement be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses.
- The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary. A complaints register will be kept on site detailing all sources of complaints received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out.
- Regular inspections of the site and boundary should be carried out to monitor dust, records and notes on these inspections should be logged.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook.
- In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed, and satisfactory procedures implemented to rectify the problem.

Preparing and maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site if necessary.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover or fence stockpiles to prevent wind whipping.

Site roads and operating vehicles / machinery

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved site roads.
- Access gates to the site shall be located at least 10m from sensitive receptors where possible.
- Bowsers or suitable watering equipment will be available during periods of dry weather. Watering shall be conducted during sustained dry periods to ensure that unpaved areas are kept moist.
- Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.
- Ensure all vehicles switch off engines when stationary.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.

Site traffic on public roads

- Vehicles delivering material with potential for dust emissions to an off-site location shall be enclosed or covered with tarpaulin at all times.
- At the main construction traffic exit, a wheel wash facility shall be installed. All trucks leaving the site must pass through the wheel wash. The wheel wash will be located sufficiently far from the exit to allow trucks to ‘drip off’ prior to exit. In addition, public roads outside the site shall be regularly inspected for cleanliness and cleaned as necessary.
- Vehicles onsite shall turn off engines when not in use to prevent idling emissions.

Onsite operations

- Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays.

- Ensure an adequate water supply on the site for effective dust / particulate matter suppression.
- Use enclosed chutes and conveyors and covered skips.
- Avoid dry sweeping of large areas.
- Minimise drop heights from conveyors and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event.

Waste management

- Avoid bonfires and burning of waste materials.

Demolition activities

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Ensure effective water suppression is used during demolition operations.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

Earthwork’s activities

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Only remove the cover in small areas during work and not all at once.
- During dry and windy periods, and when there is a likelihood of dust nuisance, a bowser or similar will operate to ensure moisture content is high enough to increase the stability of the soil and thus suppress dust.

Construction activities

- Ensure aggregates are stored in bunded areas and are not allowed to dry out unless this is required for a particular process.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately.
- During periods of very high winds (gales), construction activities likely to generate significant dust emissions should be postponed until the gale has subsided.

- Appendix 2-2 –Construction & Environmental Management Plan – – Phase 2 ‘The Farms’– prepared by JB Barry and Partners Limited, Consultant Engineers

Client:

Estuary View Enterprises 2020 Ltd.

Project:

Bessborough SHD Development

Report:

Construction & Environmental Management Plan (CEMP)

BARRY
& PARTNERS

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Y	N	N	25	4

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Table of Contents

SECTION 1: Introduction

1.1 Introduction

This Construction and Environmental Management Plan (CEMP) has been prepared as part of the planning application for the Phase 2 - The Farm Bessborough Strategic Housing Development (SHD). The site is located in Bessborough, Ballinure, Blackrock, Cork.

The CEMP considers the proposed works associated with the construction of 140 apartments, a creche and shared communal facilities including a resident's gym, workspace, lounge, function room, library, lobby and concierge facilities. The proposed development includes a new pedestrian/cycle bridge over the adjoining Passage West Greenway connecting into the existing down ramp from Mahon providing direct access to the greenway and wider areas. The development also consists of the demolition of 10 no. existing agricultural buildings /sheds and log cabin structure. This CEMP will assist with avoiding, reducing, or mitigating construction and environmental impacts arising from the proposed development.

This document has been prepared based on known assessment issues related to construction works management, traffic and transportation measures, air quality, noise and vibration, water and wastewater, landscape management, archaeology, waste management, emergency planning response and inspection and monitoring, all of which are associated with the construction works. This information will be built on prior to commencement of construction in an updated CEMP.

More detailed site-specific measures will be developed and agreed with Cork City Council prior to the commencement, subject to a successful planning application. The final CEMP will consider any conditions attached to a grant of planning permission.

The Phase 2 – The Farm application represents one of two phases of the development proposed by Estuary View Enterprises 2020 Ltd, for which planning permission is being sought from An Bord Pleanála under the Strategic Housing Development legislation. Zoning differences across the site have necessitated a dual approach being adopted to applying for planning permission, see Fig.1.1 below, including highlighted location of Phases 1 and 2. The area for Phase 2 is zoned under SE4 – Landscape Preservation Zone and ZO4 – Residential, Local Services and Institutional Uses. This CEMP details requirements for Phase 2 'The Farm' and a separate document, 1207-JBB-PH1-XX-RP-C-05001_Construction_&_Environmental_ Plan has been prepared for the proposed Phase 1 development, 'The Meadows'.

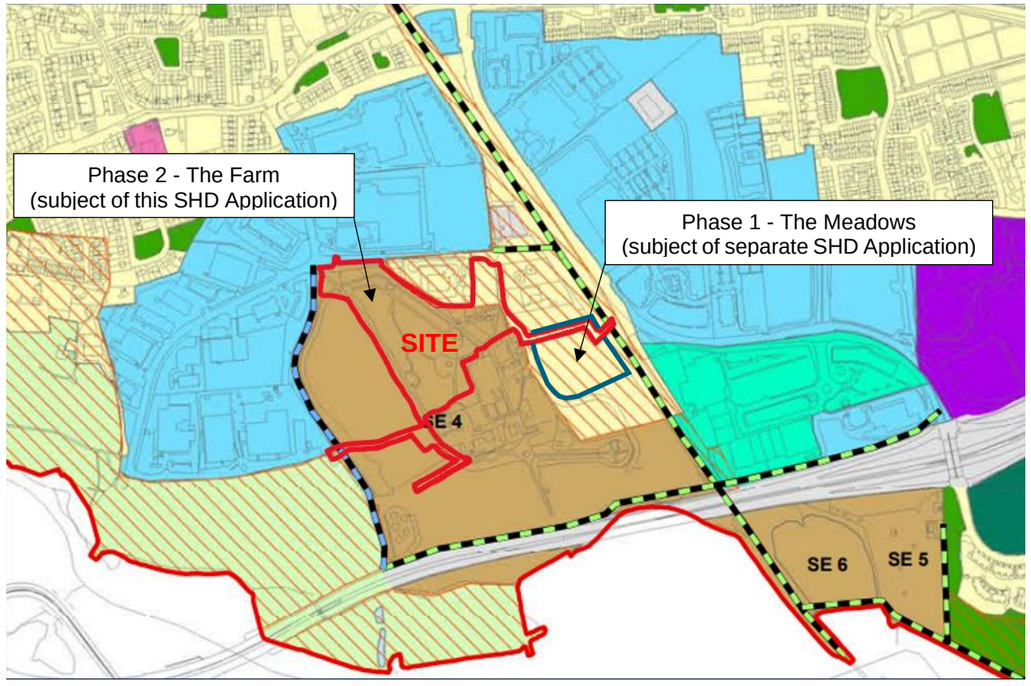

Figure 1-1: Zoning Differences across the proposed site (Cork City Development Plan 2015-2021)

1.2 Proposed Development

1.2.1 Existing Site

The application site is in Bessborough, Ballinure, Blackrock, considered within the south-eastern suburbs of Cork City as defined in the Cork City Development Plan 2015-2021. Access to/from the site is via an existing access road, Bessborough Road. Bessborough Road joins the wider road network at the junction with Skehard Road. Access to the site is by means of the existing access road serving Bessborough Day Care Centre and Bessborough Castle Folly. The existing development lands currently accommodate existing disused farm and outbuildings and treed amenity area and the site is therefore considered predominantly brownfield. Nearby buildings include Bessborough Day Care Centre to the north, Cork Community Mediation Service and the Bessborough Centre immediately to the south.

The surrounding lands are predominantly a mix of residential, parklands and commercial/industrial buildings at Mahon Industrial Estate. There have been several residential developments north of the proposed site, close to the Mahon Industrial Estate, in recent years, one of which is currently at construction stage.

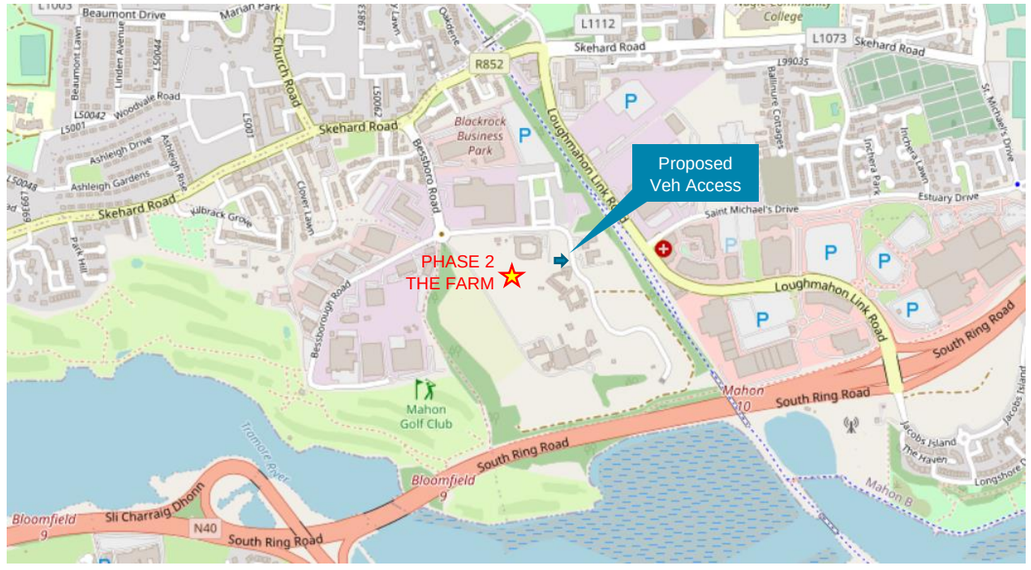

Figure 1-2: Site location and access route

1.2.2 Proposed Development Site Overview

The overall proposed development is ultimately intended to comprise 420 residential units with a creches, café, residence gyms, landscaping, pedestrian/cycleway infrastructure and associated site development works located on lands bounded by the N40, Bessborough Road, the Passage West Greenway and the Ballinure amenity walk.

Permission for the first two phases of the proposed development is being sought under two separate SHD planning applications. These two applications are named as Phase 1-The Meadows and Phase 2 -The Farm. Further development of the site is to include Phase 3 - North Fields, subject to appropriate zoning for this portion of the overall lands, and this Phase 3 area is shown in the masterplan layout. See Appendix 1 for the proposed masterplan layout.

1.2.3 Proposed Development : Phase 2 -The Farm

This CEMP is prepared for the Phase 2 element of the development. A proposed site layout plan is shown in Figure 1.3 below and included in Appendix 2.

The proposed development provides for the demolition of 10 no. existing agricultural buildings /sheds and log cabin residential structure and the construction of a residential development of 140 no. residential apartment units over 2 no. retained and repurposed farmyard buildings (A & B) with single storey extension and 3 no. new blocks of 3-5 storeys in height, with supporting resident amenity facilities, crèche, and all ancillary site development works. The proposed development includes 140 no. apartments to be provided as follows: Block C (9 no. 1-bedroom and 25 no. 2-bedroom over 3 storeys), Block D (34 no. 1-bedroom & 24 no. 2-bedroom over 3-4 storeys), Block E (27 no. 1-bedroom, 20 no. 2-bedroom & 1 no. 3-bedroom over 4-5 storeys). It is proposed to use retained Block A and Block B for resident amenities which include home workspace, library, lounge and function space.

The proposal includes a new pedestrian/cycle bridge over the adjoining Passage West Greenway to the east, connecting into the existing down ramp from Mahon providing direct access to the greenway and wider areas, as well as new pedestrian access to Bessborough Estate to the north including upgrades to an existing pedestrian crossing on Bessboro Road.

The proposed development provides for outdoor amenity areas including publicly accessible parkland, landscaping, surface car parking, bicycle parking, bin stores, substation, public lighting, roof mounted

solar panels, wastewater infrastructure including new inlet sewer to the Bessborough Wastewater Pumping Station to the west, surface water attenuation, water utility services and all ancillary site development works. Vehicular access to the proposed development will be provided via the existing access road off the Bessboro Road.

Figure 1-3: Phase 2 – The Farm Proposed Site Layout

SECTION 2: Roles and Responsibilities

2.1 Client and Contractor

The Applicant will be responsible for ensuring that an appropriate Environmental Management Framework is adhered to, that competent parties are appointed to undertake construction and that sufficient resources are made available to facilitate the appropriate management of risks to the environment.

As part of the Environmental Management Framework, the Building Contractor will need to comply with all relevant environmental legislation, take account of published standards (ISO14001) and relevant documentation including the Environmental Impact Assessment Report (EIAR), any planning conditions from An Bord Pleanala (ABP), this CEMP and the subsequent detailed CEMP. Regarding the subsequent detailed CEMP, the Applicant is responsible for ensuring that this is developed in consultation with the design team and the local authority.

The Building Contractor is also responsible for ensuring that all members of the Project Construction Team, including sub-contractors, comply with the procedures set out in the CEMP, including following any specific requirements set-out in the EIAR. The Contractor appointed will be responsible for the organisation, direction and execution of environmental-related activities during the construction of the proposed development. In addition, they will ensure that all persons allocated specific environmental responsibilities are notified of their appointment and confirm that their responsibilities are clearly understood.

2.2 Site Manager

A Site Manager will be appointed by the Contractor to oversee the day-to-day management of the site and ensure that effective, safe and planned construction activities are delivered on an ongoing basis to the highest standards. The Site Manager will be competent, suitably qualified and an experienced professional that will oversee site logistics, communicate regularly with construction staff, accommodate project-specific inductions for staff on-site and ensure that all work is complaint with the relevant design standards and health and safety legislation.

2.3 Site Environmental Manager (SEM)

A Site Environmental Manager will be appointed by the Contractor to ensure that the CEMP is effectively implemented. The Environmental Manager will be suitably qualified and competent. The responsibilities of the SEM include, but are not limited to:

- Preparing, maintaining and implementing the CEMP
- Completing site inspection and environmental compliance reports
- Providing guidance for the site team in dealing with environmental matters, including legal and statutory requirements affecting the works
- Reviewing environmental management content of method statements where relevant
- Reporting environmental performance to the Site Manager
- Liaising with statutory and non-statutory bodies and third parties with an environmental interest in the proposed development.
- Conducting regular environmental inspections as specified in the contract and checking adherence to the CEMP
- Keeping up-to-date with relevant environmental best practice and legislative changes
- Ensuring all personnel have undertaken adequate environmental inductions, awareness briefings sand training (including sub-contractors)
- Dealing with environmental complaints
- Managing and responding to environmental incidents and ensuring that all incidents are recorded and reported in an appropriate manner.

2.4 Environmental Specialists

Where relevant, and to fulfil obligations under the CEMP, the Contractor will be responsible for engaging suitably qualified specialists including (where necessary):

- Project archaeologist;
- Project ecologist;
- Project arborist;
- Noise and vibration specialist;
- Air Quality and dust specialist;
- Land, soils and contamination specialist; and
- Water specialist.

2.5 Training and Induction

2.5.1 Site Induction

All personnel involved in the proposed Phase 2 – The Farm development will receive environmental awareness training. The environmental training and awareness procedure will ensure that staff are familiar with the principles of the CEMP, the environmental aspects and impacts. associated with their activities, the procedures in place to control these impacts and the consequences of departure from these procedures.

2.5.2 Specific Training and Awareness Raising

A project specific training plan that identifies the competency requirements for all personnel allocated with environmental responsibilities will be produced by the Contractor. Training will be provided by the Contractor to ensure that all persons working on site have a practical understanding of environmental issues and management requirements prior to commencing activities. A register of completed training is to be kept by the SEM. The Site Manager will ensure that environmental emergency plans are drawn up and the SEM will conduct the necessary training/inductions.

SECTION 3: Construction Works Management

3.1 Proposed Construction Sequencing

The development of Phase 2 -The Farm will include the construction and completion of 140 no. residential units and creche comprising 5 apartment blocks and all ancillary works. Prior to any construction works being carried out, the proposed development will initially involve some site clearance, the demolition of existing farm buildings and sheds and earthworks in order to clear and grade the site to accommodate the construction of all associated engineering works and subsequently the building foundations.

This will involve the delivery of machinery, site equipment/plant and materials and the removal of some material off-site. Any material that can be reused later in the construction process will be stockpiled in an appropriate location; this will reduce the number of vehicular movements on the public roads. Once the site access, parking and compound facilities are established, the main haulage of materials to the site will include stone, concrete, blocks, steel and other building materials. Appropriate traffic management measures will be provided to minimise the impact of construction traffic on the local road network as detailed in Section 4 of this report.

An indicative construction sequence is outlined below to illustrate the buildability of the project. The actual construction sequence will be confirmed when any conditions of planning are received, and construction appointments confirmed.

To develop the complete site for Phase 2, the following works will be required to be carried out:

- Provision of a temporary construction access from the existing Bessborough Road into the site (at the location of the proposed permanent entrance), safe and secure site compound including welfare facilities for workers and the erection of temporary boundary fencing.
- Measures to reduce the potential risk of impacts to retained trees.
- Creation of a storage area for surplus plant and materials.
- Creation of a site batch concrete area.
- Creation of silt traps at the low point to the south of the construction site to prevent construction runoff towards natural vegetation and Cork Harbour estuary watercourse.
- Demolition of existing farm buildings and sheds.
- Trenching for underground services including foul sewer, surface water drainage including attenuation, water mains, gas, telecommunications, electricity and lighting.
- Construction of a new pedestrian/cycle bridge over the existing Passage Greenway and linking to the existing down ramp to the greenway.
- Construction and connection of underground services to existing underground services.
- Foul sewer connection will be made across the Ballinure walkway to the west of the site to connect to the existing wastewater pumping station close to the western boundary of the site. The final section of the foul sewer connection to the existing Ballinure wastewater pumping station will be made using directional-drilling methods (and not open-cut trenching) to maintain the integrity of the existing boundary wall to the estate and to allow the walkway to remain in use while these works proceed. A pipe jacking chamber will be constructed on the eastern side of the existing boundary wall to facilitate this installation work.
- Surface water connection will be made to an existing surface water sewer in the south-western area of the site.
- Watermain connections will be made to the existing watermain in Bessborough Road.
- No dwelling unit will be occupied prior to the completion of an approved foul sewer outfall and no hard-standing area will be completed without an approved storm outfall.
- Excavation and concrete works for strip and pad footing foundations.
- Piling to some blocks, likely to be bored piles with in-situ concrete and rebar infilling.
- Construction of the apartment buildings, plant and storage areas, likely to be constructed in reinforced-concrete frames.

- Construction of ancillary site works including the provision of 1 substation, outdoor amenity areas, landscaping, 58 car parking spaces, 5 motorbike spaces, 330 bicycle parking spaces, bin stores, public lighting and all supporting site development works.
- Erection of permanent boundary fencing, landscaping and lighting.

It is estimated that Phase 2 construction will take 24 months to complete.

3.2 Working Hours

It is envisaged that normal working hours will be between 7:00am and 6:00pm, Monday to Friday and 8:00am to 2:00pm on Saturdays, subject to any conditions set down by An Bord Pleanála/Cork City Council. No working will be allowed on Sundays or Bank Holidays. Subject to the agreement of the local authority, out-of-hours working may be required for water main connections, foul drainage connections, tower crane erection and removal etc. Any such arrangements will be agreed at construction stage.

3.3 Cranes and Lifting of Equipment

The proposed build method for the apartment blocks is likely to be as a reinforced concrete (RC) frame. Tower cranes and concrete placing booms will be required to erect the RC frame. A combination of goods hoists and telehandlers will offload and distribute materials for the construction and finishing trades.

Craneage will be required for the installation of the main structure of the pedestrian/cyclist bridge.

All lifting equipment and appliances will carry current test certificates and be inspected prior to use. Trained and competent bankmen will attend the cranes.

Road Closures may be required for a short period to enable the tower crane to be transported to/from site. The appropriate approvals and permits for any road closures will be applied for and agreed with Cork City Council. All relevant stakeholders will be kept informed of any such closures.

3.4 Site Storage

Due to the site restrictions, the storage of materials on site will be kept to the minimum. A construction programme will be developed to ensure that no large materials will be required to be stored on-site until they are needed. Materials such as glazing and cladding systems will be delivered in batches and loaded evenly on the required floors. Throughout the project, storage of materials outside the site boundary will not be permitted.

3.5 Site Safety and Access/Egress

Appropriate management of the transport operations will be applied throughout the construction process. Construction site compounds and staff parking areas will be set up before any construction works start on-site. The site compounds will be located within the site's boundary at appropriate locations as shown in Figure 3.1. Hoarding and boundary fencing will be erected to delineate all site works and separate same from the surrounding public areas located adjacent to the development.

It is not yet confirmed as to where staff parking will be provided. As some of the proposed car park for site staff may located off-site and away from the site compound, there will be appropriate pedestrian facilities between the two which will segregate pedestrians from moving traffic and give priority to pedestrians at any crossing points. A detailed Construction Traffic Management Plan will be prepared by the Contractor and submitted to the Planning Authority prior to the commencement of any construction.

It is proposed to construct the bridge structure which will link the site to the Passage West Greenway as part of the Phase 2 works. This would enable a connection for construction workers to use active travel or

public transport during future phases of development, reducing the requirement for dedicated parking spaces for some workers. See Appendix 3 for details of the proposed bridge.

The construction of the bridge structure over the greenway will require work on both sides of the proposed structure to install abutments/landing areas for what is likely to be a steel structure which is fabricated off-site and delivered and erected on site by crane in a single operation. The construction of a suitable abutment structure/landing area on the eastern side of the greenway will require temporary closure of the access ramp into which the bridge connects and the timing and sequencing of this work will be agreed with Cork City Council. The impacts on the use of the greenway will be limited in extent and significance for this stage of the works.

Figure 3-1: Possible Multiple Site Compound Locations

During the construction of the bridge, a closure of the greenway will be required to construct the bridge supports and lift the bridge into place. When the pre-fabricated bridge structure is being lifted into place there will be a requirement to close the greenway and ramp access to allow this work to proceed safely. This closure is likely to be for a limited period only and again the details of such a closure will be agreed with Cork City Council in advance of construction work commencing on the development. Appropriate diversions will be in place from both the Blackrock and Rochestown side, using the facilities around the Mahon Retail Park. Travelling from Blackrock, users will exit the greenway at the Mater Hospital ramp and use the facilities on the R852 and re-join the greenway prior to the N40 overbridge. From the Rochestown direction, the reverse of the above route will enable users to continue their journey during the bridge construction.

Security of the site is an important issue with respect to restricting site entry to personnel solely involved in the construction process during working hours and preventing unauthorised access out of hours. Site access for all personnel and visitors will be strictly controlled and all visitors will report to the site office prior to entering the construction area.

SECTION 4: Traffic & Transportation Measures

4.1 Introduction

Chapter 5 of the EIAR and the Traffic and Transport Assessment (TTA) and Mobility Management Plan (MMP) prepared by MHL Consulting Engineers has not identified any significant potential impacts in respect of traffic during the construction phase:

- *'In general, the impact of the construction traffic will be temporary in nature and less significant than the final development operational stage'.*
- *'The surrounding road network is suitable to accommodate the construction traffic associated with the proposed development'.*

It is outlined in the TTA that a detailed Construction Traffic Management Plan (CTMP) will be prepared by the successful contractor in consultation with Cork City Council Roads and Transportation Department.

The principal objective of the CTMP is to ensure that the impacts of all building activities generated during the construction phase upon the public (off-site), visitors to the subject site (on-site) and internal (on-site) workers environment are fully considered and proactively managed/programmed, thereby ensuring that safety is maintained at all times, disruption is minimised, and that works are undertaken within a controlled, hazard-minimised environment.

4.2 Access Control

The proposed construction site is located off the access road which serves existing buildings including the Bessboro Day Care Centre and the Cork Community Mediation Service. See Figure 4.1. The proposed development is approximately 700m from the junction of Skehard Road and Bessboro Road. This is the main access point from the wider road network and will form the preferred haulage route to/from the site in agreement with Cork City Council. The geometry of the access route is appropriate for construction traffic and HGVs. A number of nearby residential developments were recently completed or are currently under construction and would have used the same access route, up to a point, for this development.

It is anticipated that heavy goods vehicles, HGVs, will be restricted to off-peak times on the local road network to reduce the impact on the road network during the morning and evening peaks. It is expected that HGV movements and general deliveries will otherwise arrive/leave throughout the day at a steady rate.

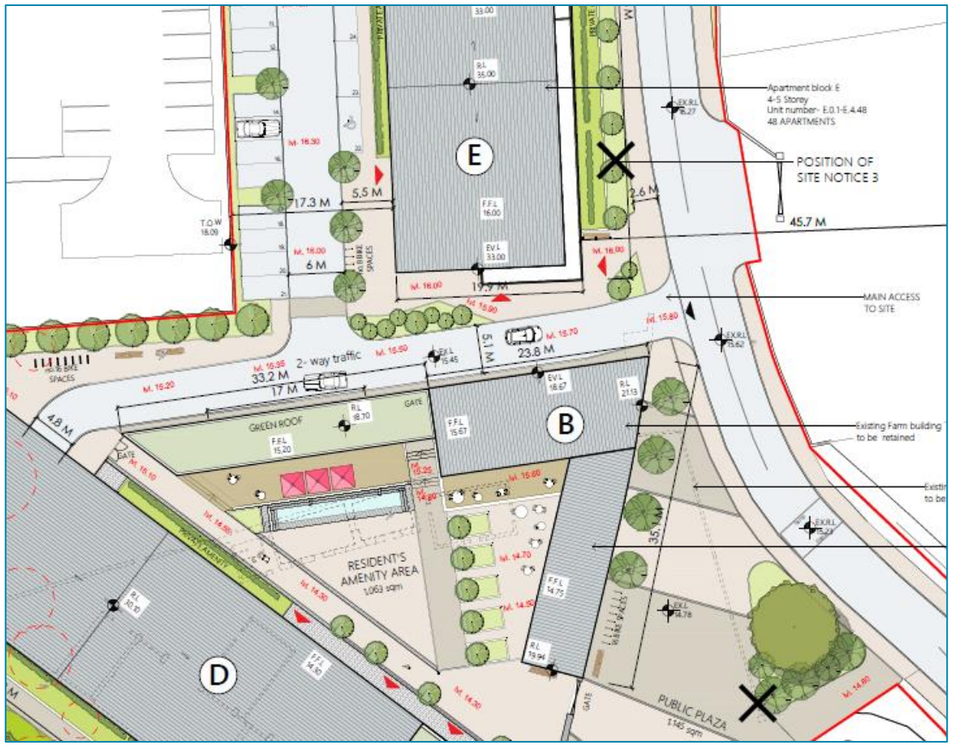

Figure 4-1: Proposed Operational / Construction Site Access

Appropriate signage for the site will be provided on the approach routes to provide clarity for construction vehicles, particularly deliveries who may not be familiar with the site location. This will provide wayfinding for drivers and limit the number of turning manoeuvres outside the site.

The following section includes a range of mitigation measures to minimise the construction traffic generation, ensure the safety of the workforce on the site and accessing the site, and ensuring the safety of the public on the surrounding roads.

4.3 Construction Related Traffic Movements

The demolition, site clearance, piling and general construction activities will generate a level of vehicle movement to and from the site as well as internally within the subject site.

The typical construction trips generated during site clearance and construction comprise:

- Construction employees arriving and leaving work
- Deliveries and removal of machinery; and
- Delivery and removal of materials.

Appropriate measures will be put in place to ensure safe access to/from the site. Measures will also be implemented on-site to ensure safe manoeuvres can be carried out within the construction site. A construction site car park will be located within the Applicant's lands, and possibly on nearby, third-party lands if required, with a dedicated pedestrian route to the site accommodation. There will be designated areas on site for loading/unloading and a specified storage area for materials and machinery. A waste and recycling area will be established within the construction site boundary, close to the construction access, to prevent unnecessary trips through the site for collection. To ensure that the internal site routes and the

public road to the construction site entrance is kept in good condition, a wheel washing facility will be located close to the exit from the construction area to minimize mud and dust.

The level of construction traffic throughout the working day is expected to be low to moderate, the highest volume of vehicles is expected when workers arrive to and leave work. Generally, workers are expected to travel by private vehicle and public transport. It is expected that there will be a typical average of approximately 80 no. construction employees on site during Phase 2 works.

Deliveries and HGV movement numbers are expected to be low to moderate and evenly spread throughout the day. The HGV traffic is expected to be greater during the initial stage of the development as larger machinery and materials will be delivered. This will, however, reduce as the construction of the buildings advance.

Deliveries of materials to site will be planned to avoid high volume periods where possible, particularly the AM peak hour. There may be occasions, however, when it is necessary to have deliveries within these periods. As previously stated, the Contractor will develop, agree and submit a detailed Construction Traffic Management Plan to the local authority for approval prior to commencement of construction works. The following section details some of the mitigation measures to be included in the detailed CTMP.

4.4 Mitigation Measures

A competent traffic co-ordinator and banksmen will be appointed by the contractor to oversee the following control measures which will be implemented as part of the final CTMP to reduce the risks associated with construction traffic. Some of the following measures also tie in with mitigation measures for dust and noise.

- A detailed site plan/layout of the construction site will be developed to identify locations for site offices/storage areas/waste management areas etc.
- Entrances and exits – separate entry and exit gateways will be provided for pedestrians and vehicles with a gate attendant employed to interface with the traffic and public to facilitate safe access and egress of vehicles.
- Where employees will need to cross the carriageway, a clearly signed and lit crossing point will be provided where drivers and pedestrians can see each other clearly.
- Visibility – the site operator will ensure that drivers driving out onto the public road have the appropriate visibility splays.
- All public and private walkways will be maintained free of obstructions
- All operators of construction machinery and vehicles will be trained and competent and have valid CSCS cards.
- All site staff will be made aware that there are residents and employees in the surrounding areas using the access road.
- Approach signage with good sightlines will be provided at the site access route and site entrance.
- Traffic management procedures will be communicated to suppliers and workers.
- Deliveries to site will be planned to arrive during working hours only, save for exceptional loads for which a detailed plan will be agreed with the local authority..
- The access route to the construction site entrance and internal site routes will be kept in good condition and clear of obstructions.
- The contractor will put measures in place to mitigate any excessive noise for nearby properties that may be created during construction activities.
- Internal trafficked areas will be watered twice daily on dry days to reduce dust, if required. Vehicles delivering or collecting material with dust potential will be covered with tarpaulin at all times to restrict the escape of dust.
- A stringent 'clean as you go' policy will be implemented on site to ensure no loose material is left on the ground within the construction access road and the public road.
- Vehicle wheel washing facilities will be in place for vehicles leaving the construction site area.
- A road sweep will be deployed if necessary to ensure the site access route between the site access and the Skehard Road junction will be kept clean at all times.

- Construction materials or equipment will not be stored outside the site boundary.
- Pedestrian/vehicular routes, crossing points, parking, loading and vehicle only areas will be clearly marked, signposted and segregated as appropriate.
- Where required site vehicles will be fitted with appropriate audible and visual devices.
- Loading and unloading will be carried out in a designated area within the construction site boundary and reversing activities will be kept to a minimum.
- Loads will be checked prior to unloading and loads will be adequately secured for travel.
- Visitors to site will be accompanied and a safe area will be provided for visiting drivers during loading and unloading.
- Speed limits signage will be used to control speeds on the access route and within the construction site.
- Construction vehicles and machinery will be maintained in good condition by a competent person as per the manufacturer's instructions. A dedicated area for maintenance work will be provided within the construction site area.
- All operators will wear personal protective equipment on-site and seat belts, where fitted by the manufacturer, will be worn when operating equipment.

SECTION 5: Air Quality

5.1 Introduction

As construction activities are likely to generate some dust emissions, dust management requirements will be developed and implemented as part of the detailed Dust Mitigation Plan during the construction phase of the project. The potential for dust to be emitted depends on the type of construction activity being carried out, the dust controls in place and also the weather conditions, such as the level of rainfall, wind speed and direction.

A preliminary Dust Management Plan has been prepared by the DK Partnership as part of the Environmental Impact Assessment Report (EIAR) for the project and this plan is attached as Appendix 4 of this document for information purposes.

5.2 Dust Sources

The potential impact for dust depends on the distance to potentially sensitive locations, such as neighbouring residential and commercial properties in this case. The main activities that give rise to dust emissions during construction include the following:

- Excavations and Piling
- Materials handling and storage
- Temporary stockpiling of any earthworks material for re-use
- Movement of vehicles, particularly HGVs.

The mitigation measures set out below will be put in place during the construction phase. The level of dust control to be implemented will depend on the weather conditions, the specific construction activities (e.g. earthworks activities, construction activities and site vehicle movements) and the potential for dust nuisance as a result of those activities.

5.3 Mitigation Measures

Mitigation measures for dust control will include:

- The contractor shall prepare a dust minimisation plan which shall be communicated to all staff.
- Internal trafficked areas will be watered twice daily on dry days to reduce dust if required. Vehicles delivering or collecting material with dust potential will be covered with tarpaulin at all times to restrict the escape of dust.
- A stringent 'clean as you go' policy will be implemented on site to ensure no loose material is left on the ground within the construction access road and the public road.
- Vehicle wheel washing facilities will be in place for vehicles leaving the construction site area.
- Bessborough public road will be inspected daily for cleanliness and a road sweep will be deployed if necessary to ensure the site access route between the site access and the Bessborough Road/Skehard Road junction will be kept clean at all times.
- Topsoil stockpiles will be located in a location so as not to necessitate double handling and topsoil stockpiles will be seeded to promote grass growth and reduce dust.
- Material handling systems and site stockpiling of materials will be laid out to minimise exposure to wind.
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.

Further mitigation measures are outlined in the preliminary Dust Management Plan prepared by the DK Partnership, see Appendix 4.

SECTION 6: Noise and Vibration Control Measures

6.1 Introduction

In order to minimise the noise impact on the adjoining community, creche and residential properties it is proposed that heavy equipment and machinery including piling drills (if required), construction vehicles and generators only work between the hours detailed above. In addition, no deliveries and/or removal of materials will occur outside of these hours, save for exceptional situations when permissions will be sought from the Local Authority.

Normal working hours are outlined in Section 3.2 above, however these will be subject to detailed agreement with Cork City Council prior to commencement.

On occasions it may prove necessary to carry out construction activities outside of normal working hours. In such instances prior consultation will be carried out with Cork City Council, local residents, and businesses outlining the nature and reason for the works and their likely duration.

6.2 Noise and Vibration Regulations

During the works the contractor shall comply with the requirements of BS 5228-1:2009+ A1:2014 and BS 5228-2:2009 +A1:2014 (Code of Practice for Noise and Vibration Control on Construction and Open Sites) as well as Safety, Health and Welfare at Work (General Applications) Regulations 2007 Noise and Vibration.

Noise Limits

Noise limits to be applied for the duration of the construction works are as set out in BS 5528. This applies a noise limit of 70dBA between 07:00 and 19:00 outside the nearest window of the occupied room closest to the site boundary in suburban areas away from main road traffic and industrial noise.

For the duration of the construction works, a daytime noise limit (07:00 to 19:00) of 70 dBA shall apply (in accordance with BS 5228).

Vibration Limits

Vibration limits to be applied for the duration of construction works are as set out in BS 5228 (Code of Practice for Vibration Control on Construction and Open Sites) and BS 7385:1993 (Evaluation and measurement for vibration in buildings Part 2: Guide to daameg levels from ground borne vibration). Allowable vibration during the construction phase is summarised below in Figure 5.1.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 4Hz	15 to 40Hz	40Hz (and above)
12 mm/sa	12.5 mm/sa	50 mm/sa

Figure 6-1: Guidelines for Allowable Vibration

6.3 Mitigation Measures

In particular, the following practices are to be implemented during the construction phase:

- Limiting the hours during which site activities that are likely to create high levels of noise and vibration are permitted
- Erection of a barrier along the site boundary (e.g. standard 2.4m high construction hoarding and additional, higher hoarding at boundaries with adjacent existing buildings) to remove direct line of sight between noise sources and receiver when construction works are being carried out in proximity to noise sensitive receivers
- Establish channels of communication between the contractor, local authority and local businesses and residents
- Appoint a site representative (SEM) responsible for matters relating to noise
- Selection of plant with low inherent potential for generation of noise
- Siting of noisy plant as far away from sensitive properties as permitted by site constraints and implementation of noise reduction measures such as acoustic enclosures when required
- Avoidance of unnecessary revving of engines and switching off of plant when idle
- All plant and equipment will be maintained in good working order in accordance with BS.5228 in order to minimise air and noise emissions.
- All ancillary pneumatic percussive tools shall be fitted with mufflers or silencers of the type recommended by the manufacturers, and where commercially available, dampening tools and accessories shall be used.
- Noise monitors will be erected and data collected to assess sound levels.
- Ear protection zones will be established and all personnel will be trained on ear protection.

SECTION 7: Water and Wastewater Controls

7.1 Introduction

All works carried out as part of these works will comply with all Statutory Legislation including the Local Government (Water Pollution) Act, 1977 and 1990 (as amended) and the contractor will cooperate in-full with Irish Water and the Environmental Department of Cork City Council. There is no immediate watercourse in the vicinity of the site. The Douglas Estuary is located approximately 250m south of the site on the southern side of the N40.

The following description outlines the proposed water/wastewater works to be carried out during Phase 2:

- Surface Water - The proposed surface water network will include a drainage pipe network, attenuation storage and SuDS features. The restricted discharge from the site will be conveyed in a new surface water pipe laid from the western boundary of the site in a westerly direction across the Bessborough site to connect to an existing 750mm diameter surface water sewer upstream of its connection to the 1350mm diameter surface water pipe which discharges to the Douglas Estuary south of the N40.
- Foul Drainage - Wastewater collection within the proposed development will be via a network of 150mm and 225mm diameter gravity sewers, which will direct the flows to the southwest corner of the site. A new gravity sewer will then convey the flows in a westerly direction and will connect directly to the Bessborough wastewater pumping station.
- Potable Water - A 300mm diameter ductile iron watermain is located in Bessborough Road to the north of the site. Irish Water have advised that the connection to serve the development is to be made to this existing main.

The mitigation measures outlined below provide the water management controls required to be implemented by potential Contractors and Sub-contractors and set out the proposed procedures and operations to be utilised on the proposed development to mitigate against any water related environmental impacts. The mitigation and control measures outlined herein will be employed on site during the construction phase of the development.

The main areas of water related concerns covered by this section are:

- Pre-Construction (Inc Site Clearance/Tree felling)
- Construction Phase drainage controls
- Earthworks (i.e. infrastructure & drainage) and surface water quality protection
- Temporary stockpiles water management and controls; and
- Fuel usage, storage and management.

7.2 Mitigation Measures

Surface water runoff during site clearance and construction stage can be potentially contaminated. The most likely forms of contamination are ‘siltation’ and spillage. Siltation occurs when soil and particulate matter are washed away in rainfall events by rainwater. Siltation will be mitigated on the project using stilling basins and strainers within the site to prevent silt being lost to the drainage network.

Excavation, Erosion and Sediment Control

- Measures will be implemented to capture and treat sediment laden water run off (e.g. silt traps; siltbuster)
- The area of exposed ground will be minimised and as much vegetation as possible will be retained for as long as is practical
- Delay clearing and topsoil stripping of each area until work is ready to proceed.
- Close and backfill trenches as soon as practically possible
- Any earthworks temporary stockpile areas will require silt fencing to be installed.

- Any on-site settlement areas are to include geotextile liners and riprapped inlets and outlets to prevent scour and erosion
- Surface water runoff from areas stripped of topsoil and surface water collected in excavations will be directed to on-site settlement areas, at the lower, south west end of the site, where measures will be implemented to capture and treat sediment laden runoff prior to discharge of surface water at a controlled rate.
- Surface water discharge points during the construction phase are to be agreed Cork City Council’s Environment Section prior to commencing works on site.

As fuels and oils are required during construction stage, it is necessary to mitigate the possibility of there being an accidental leakage of these liquids. All fuels stored on site will be bunded and all chemicals will be stored in an appropriate tank. Should any spillage occur on site during construction, it is likely that there will be a localised moderate impact in the short term on the environment.

Accidental Spills and Leaks

- All oils, fuels, paints and other chemicals will be stored in a secure bunded hardstand (impervious) area
- Refuelling and servicing of construction machinery will take place in a designated hard stand area which is also remote from any surface water inlets.
- A response procedure will be put in place to deal with any accidental pollution events and spillage kits will be available and construction staff will be familiar with the emergency procedures and use of equipment.

Concrete

- Concrete batching will take place on-site and offsite. Wash down and wash out of concrete trucks will take place off site and any excess concrete will not be disposed of on site
- Pumped concrete will be monitored to ensure there is no accidental discharge
- Mixer washings are not to be discharged into surface water drains and will be directed to settlement areas.

Wheel Wash Areas

- Discharge from any vehicle wheel wash areas is to be directed to onsite settlement areas, debris and sediment captured by vehicle wheel washes are to be disposed off-site at a licensed facility.

Through consultation with the Site Manager (SM) /Site Environmental Manager (SEM), a schedule for surface water quality monitoring will be drawn up. This will be finalised prior to the start of construction. Where monitoring parameters are found to exceed the standards laid down, the SM/SEM will initiate and report corrective actions. This may necessitate the alteration of the environmental control measures and in turn the relevant construction method statement.

It is proposed to implement a programme for monitoring water quality at the outfall tie-in as part of the construction of this development, in agreement with the Planning Authority. This programme and sampling requirements will be agreed with Cork City Council.

SECTION 8: Landscape Management

During Phase 2 construction, site security fencing and solid hoarding will be used where appropriate to restrict visibility, minimise noise pollution and restrict visibility into the site, minimising the temporary landscape and visual impacts. There is a significant area of existing vegetation/trees to the south and west of the site and along the routes of foul and surface-water outfall/connections. These areas will require protection measures to be employed during construction works, particularly during the construction of the bridge and foul and storm drainage outfalls. It is expected that fifty-four trees will be required to be removed as part of the development of this phase.

The mitigation measures set out below will be implemented to minimise the impact on any trees/vegetation.

Although the removal of some trees will be required for the construction of the pedestrian/cycle bridge and the trenching and construction of watermains, foul and surface-water drainage, such tree removal will be restricted to that identified for removal in the application.

- All mitigation measures to be put in place to protect such trees and vegetation shall be prepared in consultation with a qualified Arborist, who shall supervise works for which an Arboriculture Method Statement is required.
- The specific Arboriculture Method Statement shall be prepared for any works within the root protection area of any tree to be retained and the measures outlined shall be strictly enforced on site.
- Trees will be protected in accordance with BS: 5837:2012 *Trees in relation to design, demolition and construction. Recommendations* and any further agreed procedures.
- The construction works for the new ped/cycle bridge shall be fenced off with solid hoarding and protected from the public. The contractor will liaise and co-ordinate these works with the Cork City Council.
- Reinstatement of trees and vegetation will be undertaken by a suitably qualified landscape contractor.

SECTION 9: Archaeology & Heritage

9.1 Pre-Construction

Given the historic and sensitive nature of the site, prior to any construction commencing, an archaeological and heritage assessment and surveys should be carried to include advance archaeological testing across the footprint of the development where machine or hand excavated test trenches allow for the early indication of relevant material. This allows for informed decisions to be made as to how best to progress with construction works and deal with any discovered archaeological finds should they arise.

Based on the results of the above assessments/surveys, detailed monitoring of all groundworks associated with the development may be recommended, with the provision for full excavation of any archaeologically significant material uncovered.

9.2 During Construction

Following the archaeological and heritage assessment, during the construction process, if deemed necessary, archaeological monitoring will be carried out where the construction works are suspected to be in the proximity to an archaeological site. This may involve a forensic archaeologist or human osteoarchaeologist maintaining a watching brief while groundworks are taking place in order to identify and record any archaeological remains that may be present. In the event of archaeological features or material being uncovered during construction monitoring, it is important that all machine work in the immediate area ceases to allow the archaeologist to assess, excavate and record any findings.

Should archaeological features or material be uncovered, adequate funds to cover excavation, fencing, post-excavation analysis and reporting will be made available. This work should be done under license in accordance with Section 26 of the National Monuments Act 1930-2014 and with a method statement agreed in advance with the National Monuments Service (Dept. of Culture, Heritage and the Gaeltacht) and the National Museum of Ireland.

9.3 Mitigation Measures

A programme of archaeological supervision/monitoring of all ground works will be undertaken by a suitably-qualified archaeologist. Given the developed nature of the portions of the site (especially within ‘The Farm’) and previous programmes of archaeological investigations (within the ‘The Meadows’), the archaeological risk is considered to be low. In the unlikely event of an archaeological discovery, the National Monuments Service and Cork City Council will be consulted to agree how the encountered archaeological remains are recorded and resolved.

Site development works (especially ground reduction work) will be monitored by a forensic specialist and osteoarchaeologist to allow for the identification any previously-unrecorded burials or human remains. In the event of such a discovery, An Garda Síochána will be immediately notified and the localised works in the affected area will be suspended subject to the direction of An Garda Síochána.

In relation to works to historic boundary walls, it is recommended that interventions to historic masonry boundary walls have intentionally been kept to a minimum. Where repair or rebuilding works to historic masonry walls are required (including the creation of a new pedestrian entrance in the boundary wall adjacent to the historic entrance to Bessborough Estate), such works will be undertaken by suitably-experienced conservation contractors with proven experience in the use of traditional lime mortars and rubble masonry.

SECTION 10: Waste Management

10.1 Introduction

A detailed Construction Waste Management Plan will be agreed with Cork City Council and put in place in order to control waste management on site, ensure segregation of waste streams and minimise construction waste costs. Waste arising from the site will be considered in relation to the waste management hierarchy of prevention, reduce, reuse, recycle, energy recovery and disposal.

Construction and demolition waste is the largest "municipal" waste stream contributing to the current pressure on landfill facilities in the region. Unsustainable management and inappropriate disposal of this waste stream can result in impact on natural resources and lead to environmental pollution. The main source of waste material at the site will be construction waste.

Waste is defined as any substances or object belonging to a category of waste specified in the First Schedule (of the Waste Management Act 1996) or included in the European Waste Catalogue, which the holder discards or intends or is required to discard and anything which is discarded or otherwise dealt with as if it were waste shall be presumed to be waste until the contrary is proved.

There are two main types of construction waste – Hazardous and Non-hazardous as detailed below:

Non-hazardous

- Timber Waste
- Scrap Metal
- Plastic
- Paper / Cardboard
- Canteen Waste
- Litter

Hazardous

Hazardous Wastes are defined as wastes which can have a harmful effect on the environment and on human health as they exhibit ignitability, reactivity, corrosivity and/or toxicity and/or are listed as hazardous by the European Waste Catalogue and/or may be identified as hazardous by application of the EPA Waste Characterisation Tool compiled by The Clean Technology Centre.

The hazardous wastes that may be experienced at a development of this nature are as follows:

- Adhesives and Sealants
- Aerosols
- Batteries
- Chemicals
- Cleaning Products
- Oil (Contaminated absorbent Material or debris)
- Paints and Thinner
- Fuels (hydrocarbons such as diesel)
- Concrete waste

The Farm (Phase 2) development will result in the generation of waste material from the following sources:

- Removal of existing boundaries
- Demolition of existing buildings and sheds
- Excavation of soil for site access, to foundations, ductwork and sewers/watermains
- Excavation of stone / made ground at infrastructure tie-ins to existing water mains, sewers, gas etc.
- Surplus material (off-cuts, damaged materials, packaging etc.) generated during the construction of the new development.

Soil will be excavated to facilitate construction of foundations, access roads, the installation of site services and general landscaping. Where possible, excavated topsoil will be reused on site for landscaping. It is anticipated that any additional soil will be removed from the site for reuse, recovery and/or disposal as there are limited suitable onsite re-use options.

The Waste Management Hierarchy states that the most preferred option for waste management is prevention and minimisation of waste, followed by reuse and recycling/recovery, energy recovery (i.e. incineration) and, least favoured of all, disposal. The excavations are required to facilitate construction so the preferred option (prevention and minimisation) cannot be accommodated for the bulk excavation phase.

The next option (beneficial reuse) may be possible for some and potentially all of the inert natural material (Category A1). This material could be used as fill material in other construction projects or engineering fill for waste licensed sites. Beneficial reuse of surplus excavation material as engineering fill may be subject to further testing to determine if materials meet the specific engineering standards for their proposed end-use.

Any nearby sites requiring clean fill/capping material will be contacted to investigate reuse opportunities for clean and inert material. If any of the material is to be reused on another site European Communities (Waste Directive) Regulations 2011, Article 27 requires that certain conditions are met and that by-product decisions are made to the EPA, via their online notification form.

If the material is deemed to be a waste, removal and reuse/recycling/ recovery/disposal of the material will be carried out in accordance with the Waste Management Acts 1996-2008, the Waste Management (Collection Permit) Regulations 2007 (as amended) the Waste Management (Facility Permit & Registration) Regulations 2007 (as amended). The volume of waste removed will dictate whether a Certificate of Registration (COR), Waste Facility Permit or Waste Licence is required by the receiving facility.

Once all available beneficial reuse options have been exhausted, the options of recycling and recovery at waste permitted and licensed sites will be considered. The option of disposal of inert natural material to landfill will only be considered once all available reuse options have been explored and where capacity cannot be secured at appropriately permitted/licensed facilities for recycling or recovery purposes.

Any soil/subsoil that is deemed to be contaminated will be stored separately to the clean and inert soil/subsoil. The material will be appropriately tested and classified as either non-hazardous or hazardous in accordance with the EPA publication 'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous' using the HazWasteOnline application (or similar approved classification method). The material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the EC Council Decision 2003/33/EC.

The highest volume of materials generated will be topsoil and subsoil/stones from site clearance to accommodate access routes, bridge construction, footpaths, services, and foundation excavation to enable construction of the apartment blocks. Some of the material will be re-used on site, however, some will be removed off-site. Given that the proposed developable area is 4.28 hectares, the following estimations of excavated material have been calculated:

- An average depth of 100 - 200mm for topsoil strip will generate approx. 2,950m3.
- Subsoil excavation for access route and footpath construction, piling and excavation for foundations will generate approx.1,200m3 of material.
- Excavation for watermains, foul and surface water sewer will generate approx. 5,650m3 of material.
- Subsoil excavation to provide SUDS attenuation area amounts to approx. 1,050m3.
- The total subsoil excavation is therefore approximately 7,900m3.

Approx. 1,500m3 of topsoil and 3,170m3 of subsoil will be required for backfilling the SUDS attenuation and trench excavations. As such, it is estimated that approximately 6,180m3 will need to be transported off-site for reuse/recycling. (See Table 9.1).

Also, the demolition of the buildings will generate quantities of rubble/stone, structural steel and corrugated metal roof sheeting. It is unlikely that any of this material will be re-usable on site so this material will have to be taken off-site to approved recycling/recovery facilities. Surveys to date have established that there is no asbestos materials in these existing buildings and this will be confirmed at pre-demolition stage.

An estimated 320m3 of rubble/stone will be generated, with approximately 6.5 tonnes of structural steel and 5.0 tonnes of corrugated roof sheeting.

A standard 4-axle rigid construction tipper capacity weight is 20 tonnes which is equivalent to approximately 11 cubic metres of soil. Therefore, approximately 560 HGV loads will be required to export the excess soil off-site, while a further 35 HGV loads will be required to export the demolition waste generated.

Table 10-1: Cut and Fill Calculation

Item	Excavate	Reuse	Export
Topsoil Strip	2,950m3		
Topsoil Reuse		1,500m3	
Topsoil for Export			1,450m3
Subsoil from Excavation	7,900m3		
Fill Required		3,170m3	
Subsoil Excess for Export			4,730m3
Total Surplus for Export off-site			6,180m3

SECTION 11: Emergency Planning and Response

A set of standardised emergency response procedures will govern the management of emergency incidents. The contractor will be required to outline emergency incident response procedures in the detailed CEMP and to develop an Emergency Incident Response Plan. These procedures will be as follows:

- Emergency preparedness and response procedure (incl. emergency phone numbers)
- Incident investigation procedure
- Nonconformity, corrective action and preventative action
- Spillage containment procedure
- Pollution prevention programme and corrective action reporting

In the event of spillages or other incidents, steps will be taken to prevent environmental pollution, for example through protection of drains by use of drain covers or booms, use of absorbent granules following a fuel or oil / chemical spill and turning off equipment or other sources of noise or dust.

Once the situation has been rectified, full details the incident and remedial actions undertaken will be provided to the City Council and relevant authorities and recorded appropriately.

Appropriate measures to prevent a recurrence of such incidents will be developed in consultation with these authorities.

SECTION 12: Inspections and Monitoring

The environmental performance of the contractor will be monitored through site inspections. Monitoring will be carried out in accordance with the requirements of the EIAR so that construction activities are undertaken in a manner that does not give rise to significant negative effects. Suitable monitoring programmes will need to be developed, implemented, documented, and assessed in accordance with the measures outlined in the detailed CEMP and EIAR.

The results of all environmental monitoring activities will be reviewed by the Site Environmental Manager on an ongoing basis to enable trends to be identified and corrective actions to be implemented as necessary.

Routine inspections of construction activities will be carried out by the Site Environmental Manager on a daily basis to ensure all necessary environmental measures relevant to the construction activities are being effectively implemented by construction staff. Detailed inspections should be carried out weekly which would be appropriately documented by the Environmental Manager. The inspection routine should include:

- Summary of compliance/non-compliance with the detailed CEMP
- Results and interpretation of monitoring programmes
- Key issues noted during inspections
- Summary record of non-conformities, incidents and corrective actions
- Summary of environmental complaints and queries received in relation to environmental matters; and
- Summary record of environmental training undertaken by staff.

Appendix 1

PROPOSED MASTERPLAN LAYOUT

PHASE 2
FARM
140 UNITS

PHASE 1
THE MEADOWS
280 UNITS

PHASE 3
NORTH FIELDS
200 UNITS

NATIONAL MEMORIAL AND RECORDS CENTRE

SAINT MICHAEL'S DRIVE

CITY GATE

CITY GATE

CITY GATE

CITY GATE

SOUTH RING ROAD

SOUTH RING ROAD

ORDNANCE SURVEY MAP

Ordnance Survey Ireland

1:1,000 | 6428-05
1:1,000 | 6383-25
1:1,000 | 6429-01

NORTH POINT

Data Extraction Date:
==========
Date= 18-Mar-2021

Source Data Release:
==========
DCLMS Release V1.138.111

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

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Arna thiomsú agus arna fhoilsiú ag Suirbhéireacht Ordanáis Éireann, Páirc an Fhionnuisce, Baile Átha Cliath 8, Éire.

Sáraíonn ataírgeadh neamhúdaraithe cóipcheart
Shuirbhéireacht Ordanáis Éireann agus Rialtas
na hÉireann.

Gach cead ar cosnamh. Ní ceadmhach aon chuid den fhoilseachán seo a chóipeáil, a ataírgeadh nó a tharchur in aon fhoirm ná ar aon
bhealach gan cead i scríbhinn roimh ré ó úinéirí
an chóipchirt.

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 PROPOSED SITE MASTER PLAN
1:1000 @ A1

A FOR PLANNING 16.03.2022

SITE MASTER PLAN

SHiPSEYBARRY place makers

PROJECT :	BESSBOROUGH			DRAWING DESCRIPTION:	SITE MASTER PLAN	CLIENT :	ESTUARY VIEW ENT. 2020 LTD.
SCALE :	1:1000 @ A1	DATE :	03.2022	OVERSEEN BY :	JJ	APPROVED BY :	GB	DRAWING NO. :	SB-2020-107-805

28,Richmond Hill , Ballyfoteli , Cork, Ireland t : + 353 (0)21 23988 55 f : + 353 (0)21 23988 22 e: info@shipseybarry.com www.shipseybarry.com

Appendix 2

PROPOSED SITE PLAN

FARM SCHEME BUILDINGS:A,B,C,D,E		
140 APARTMENTS	NO.	%
1 BEDROOM AP.	70	50 %
2 BEDROOMS AP. 3P	12	8.6 %
2 BEDROOM AP. 4P	57	40.7%
3 BEDROOMS AP.	1	0.7 %
TOTAL NO.	140	100 %
DUAL ASPECT	57	40.7%
NO. OF UNITS WITH AREA 10% GREATER THAN REQUIRED	78	55.0%
TOTAL RESIDENT'S PRIVATE AMENITY AREA	2,563 sqm	
PUBLIC OPEN SPACE	27,136 sqm	63.3 %
STREETS AND SQUARES	1,072 sqm	
PUBLIC PARK	24,520 sqm	
PUBLIC LINK TO GREENWAY	1,544 sqm	
PARKING SPACES	54	38.0%
CRECHE DROP OFF	4	
MOTORBIKE SPACES	5	
RESIDENT'S BIKE SPACES	230	
VISITOR'S BIKE SPACES	100	

LEGEND

- SITE BOUNDARY — SITE AREA: 51.250 sqm — DEVELOPABLE AREA: 42 842 sqm
- OTHER LANDS UNDER APPLICANT'S CONTROL
- RESIDENT'S AMENITY AREA
- EXISTING STRUCTURE TO BE DEMOLISHED
- PROPOSED TREES
- EXISTING TREES TO BE RETAINED
- ROOT PROTECTION ZONE
- EXISTING TREES TO BE REMOVED

1 PROPOSED SITE LAYOUT PLAN
1:500 @ A0

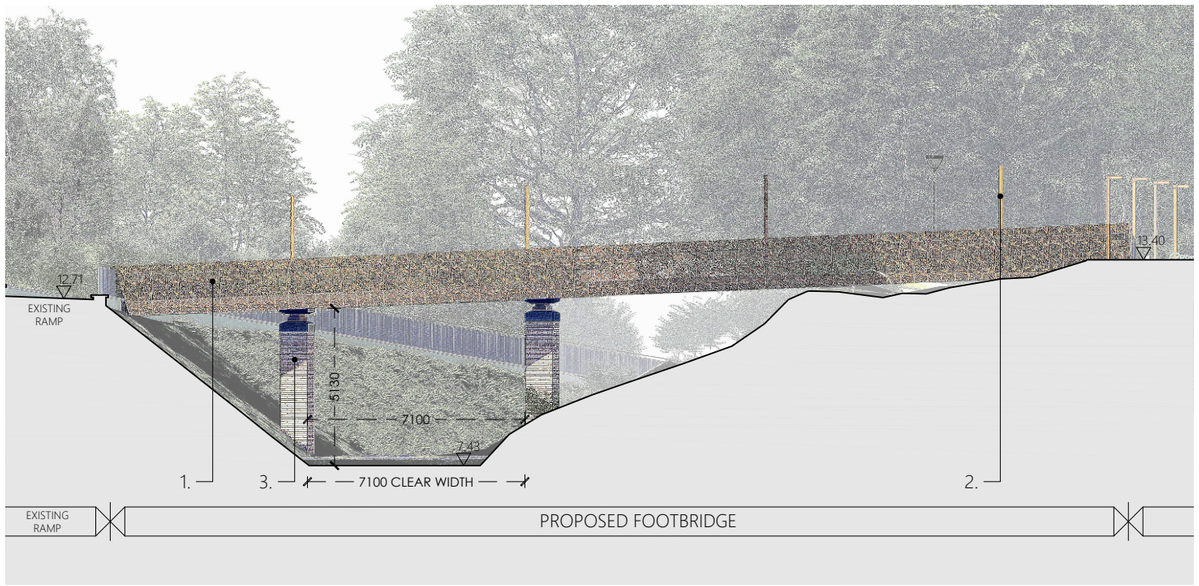
SITE LAYOUT PLAN
1:500@A0

SHiPSEYBARRY
Chartered Architects

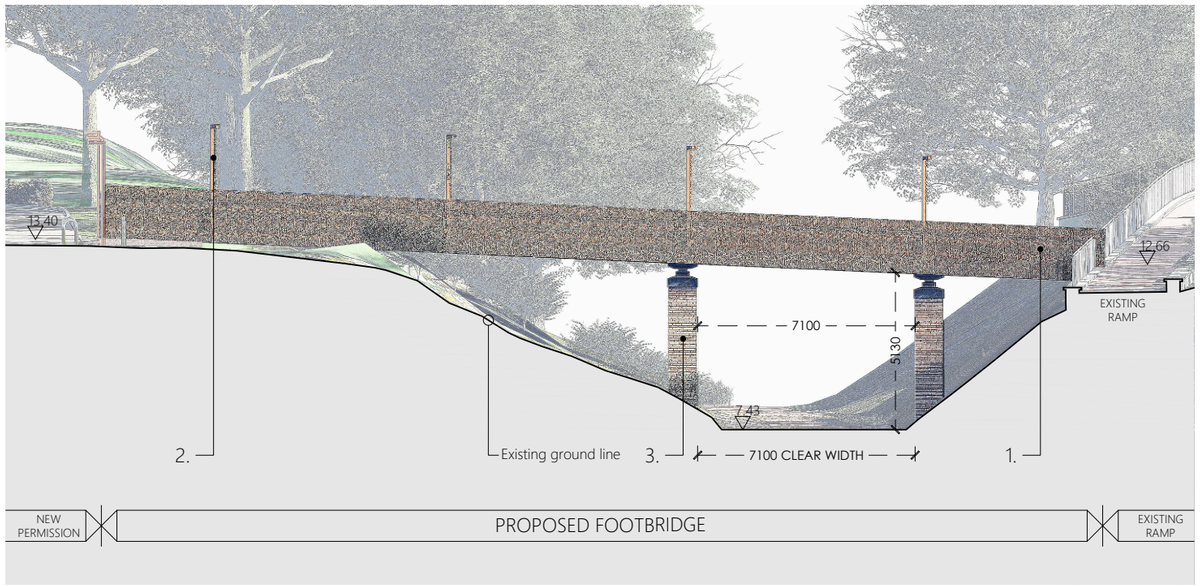
PROJECT:	PHASE 2- THE FARM-BESSBOROUGH
SCALE:	1:500 @ A0
DATE:	04.2021
DRAWING DESCRIPTION:	SITE LAYOUT PLAN
OVERSEEN BY:	AH
APPROVED BY:	GB
CLIENT:	ESTUARY VIEW ENT. 2020 LTD.
DRAWING NO.:	SB-2020-107-200

Appendix 3

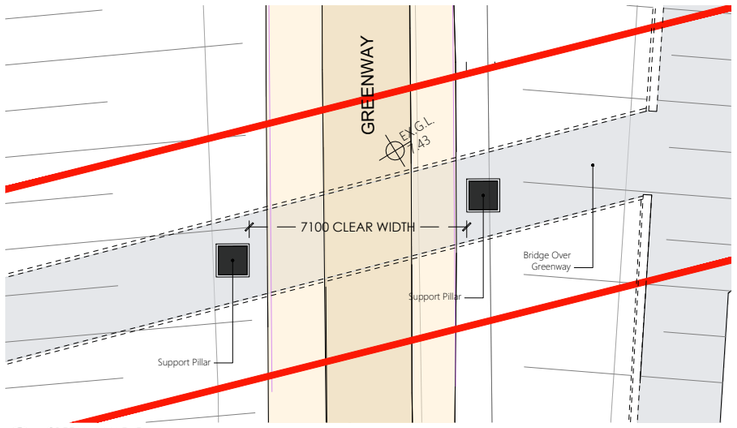
PROPOSED PEDESTRIAN/CYCLE BRIDGE



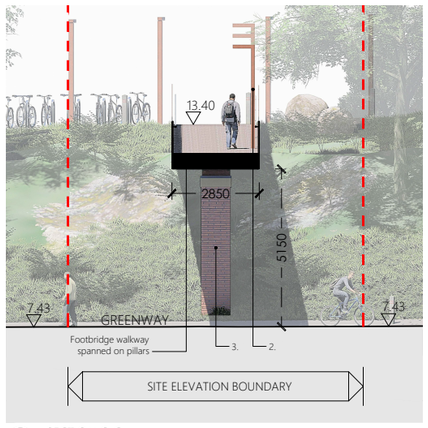
1 SECTION A-A
SCALE 1:100



2 SECTION B-B
SCALE 1:100

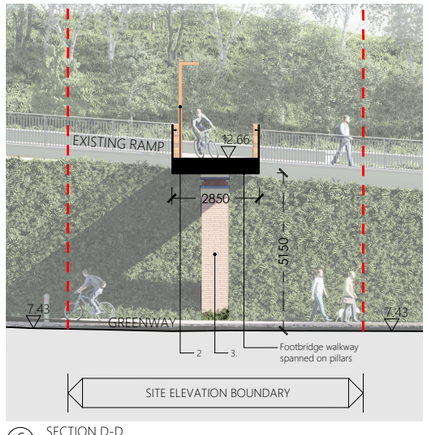


3 GREENWAY LEVEL
SCALE 1:100

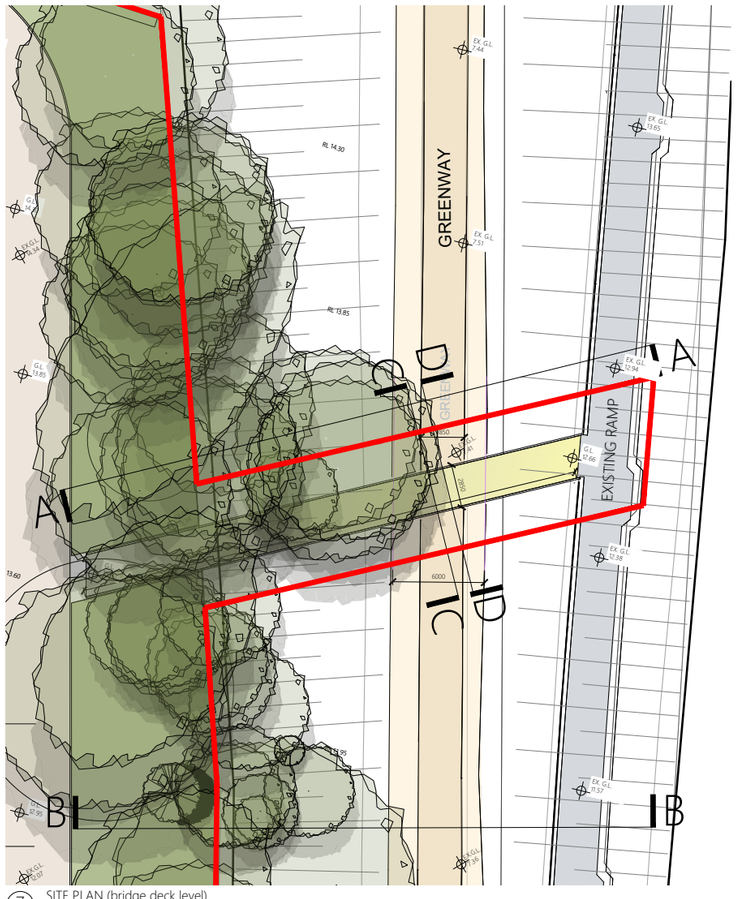


4 SECTION C-C
SCALE 1:100

5 PEDESTRIAN VIEW

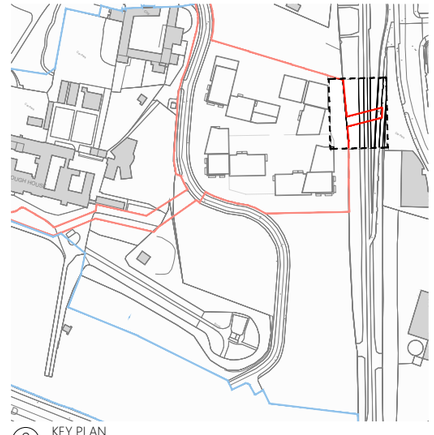


6 SECTION D-D
SCALE 1:100



7 SITE PLAN (bridge deck level)
SCALE 1:200

8 BALUSTRADE DETAIL



9 KEY PLAN
SCALE 1:2500

MATERIAL KEY:

1. TYPE 1 ORNAMENTAL PERFORATED METAL SHEETING BALUSTRADE
2. WALKWAY LIGHTS
3. BRICK BRIDGE PILLARS

NORTH POINT

1:100 & 1:200 A1

C commencing 2021.02.04
B Boundaries 2021.02.01
A Amendments 2021.12.22

FOOTBRIDGE

PROJECT :	THE MEADOWS - BESSBOROUGH	DRAWING DESCRIPTION :	SECTIONS, SITE PLAN	CLIENT :	ESTUARY VIEW ENTERPRISES LTD
SCALE :	1:100 & 1:200 @ A1	DATE :	JANUARY 2022	OVERSEEN BY :	JJ	APPROVED BY :	GB	DRAWING NO.	SB-2020-107-900

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Appendix 4

DUST MITIGATION PLAN

Appendix A
Dust Management Plan

Site management
The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design and effective control strategies. At the construction planning stage, the siting of activities and storage piles will take note of the location of sensitive receptors and prevailing wind directions. As the prevailing wind is predominantly south-westerly, locating construction compounds and storage piles downwind of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors. The Principal Contractor or equivalent must ensure that the proposed mitigation measures are implemented, and that dust impacts and nuisance are minimised.

- It is recommended that community engagement be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses.
- The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary. A complaints register will be kept on site detailing all sources of complaints received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out.
- Regular inspections of the site and boundary should be carried out to monitor dust, records and notes on these inspections should be logged.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook.
- In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed, and satisfactory procedures implemented to rectify the problem.

Preparing and maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site if necessary.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover or fence stockpiles to prevent wind whipping.

Site roads and operating vehicles / machinery

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved site roads.
- Access gates to the site shall be located at least 10m from sensitive receptors where possible.
- Bowsers or suitable watering equipment will be available during periods of dry weather. Watering shall be conducted during sustained dry periods to ensure that unpaved areas are kept moist.
- Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.
- Ensure all vehicles switch off engines when stationary.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.

Site traffic on public roads

- Vehicles delivering material with potential for dust emissions to an off-site location shall be enclosed or covered with tarpaulin at all times.
- At the main construction traffic exit, a wheel wash facility shall be installed. All trucks leaving the site must pass through the wheel wash. The wheel wash will be located sufficiently far from the exit to allow trucks to ‘drip off’ prior to exit. In addition, public roads outside the site shall be regularly inspected for cleanliness and cleaned as necessary.
- Vehicles onsite shall turn off engines when not in use to prevent idling emissions.

Onsite operations

- Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays.

- Ensure an adequate water supply on the site for effective dust / particulate matter suppression.
- Use enclosed chutes and conveyors and covered skips.
- Avoid dry sweeping of large areas.
- Minimise drop heights from conveyors and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event.

Waste management

- Avoid bonfires and burning of waste materials.

Demolition activities

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Ensure effective water suppression is used during demolition operations.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

Earthwork’s activities

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Only remove the cover in small areas during work and not all at once.
- During dry and windy periods, and when there is a likelihood of dust nuisance, a bowser or similar will operate to ensure moisture content is high enough to increase the stability of the soil and thus suppress dust.

Construction activities

- Ensure aggregates are stored in bunded areas and are not allowed to dry out unless this is required for a particular process.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately.
- During periods of very high winds (gales), construction activities likely to generate significant dust emissions should be postponed until the gale has subsided.

- Appendix 2-3 – Phase 1 ‘The Meadows’ Proposed Site Layout – prepared by Shipsey Barry Architects

1 SITE PLAN
SCALE 1:500

THE MEADOWS BUILDINGS: A,B,C,D

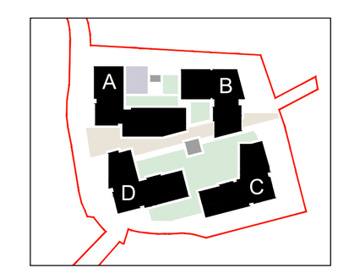
280 APARTMENTS	NO.	%
STUDIO AP.	6	2.1 %
1 BEDROOM AP.	112	40.0 %
2 BEDROOM AP. 4P	150	53.6%
3 BEDROOM AP.	12	4.3 %
TOTAL NO.	280	100 %
DUAL ASPECT	121	43.2%
NO. OF UNITS WITH AREA 10% GREATER THAN REQUIRED	162	57.8%
TOTAL RESIDENT'S PRIVATE AMENITY AREA	2,172 sqm	
PUBLIC OPEN SPACE	3,958 sqm	63,5 %
PARKING SPACES	98	35.0%
CRECHE DROP OFF	4	
MOTORBIKE SPACES	10	
RESIDENT'S BIKE SPACES	464	
VISITOR'S BIKE SPACES	140	

LEGEND

POND
VEGETATIONS
PATHS
GREEN ROOF
EXISTING TREES ROOT PROTECTION ZONE
PROPOSED TREES
TREE TO BE REMOVED

SITE BOUNDARY AREA: 22,905sqm (2.29 ha)
Site Centre Point Coordinates:
X,Y = 571940.0,570405.0

SITE BOUNDARY
OTHER LANDS UNDER APPLICANT'S OWNERSHIP



KEY PLAN

280 UNITS 1:500 A0

C FOR APPLICATION 03.2022
B FOR TRI-PARTY 08.2021
A FOR DISCUSSION 03.2021

SITE PLAN

SHiPSEYBARRY place makers

PROJECT :	THE MEADOWS- BESSBOROUGH	DRAWING DESCRIPTION:	SITE PLAN	-	CLIENT :	ESTUARY VIEW ENT. LTD
SCALE :	1:500 @ A0	DATE : 03.2021	OVERSEEN BY : MD	APPROVED BY : GB	DRAWING NO. :	SB-2020-107-200

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- Appendix 2-4 – Phase 2 ‘The Farm’ Proposed Site Layout – prepared by Shipsey Barry Architects

FARM SCHEME BUILDINGS:A,B,C,D,E

140 APARTMENTS	NO.	%
1 BEDROOM AP.	70	50 %
2 BEDROOMS AP. 3P	12	8.6 %
2 BEDROOM AP. 4P	57	40.7%
3 BEDROOMS AP.	1	0.7 %
TOTAL NO.	140	100 %
DUAL ASPECT	57	40.7%
NO. OF UNITS WITH AREA 10% GREATER THAN REQUIRED	78	55.0%
TOTAL COMMUNAL AMENITY AREA	2,563 sqm	
PUBLIC OPEN SPACE	27,136 sqm	63,3 %
STREETS AND SQUARES	1,072 sqm	
PUBLIC PARK	24,520 sqm	
PUBLIC LINK TO GREENWAY	1,544 sqm	
PARKING SPACES	54	38.0%
CRECHE DROP OFF	4	
MOTORBIKE SPACES	5	
RESIDENT'S BIKE SPACES	230	
VISITOR'S BIKE SPACES	100	

LEGEND

- SITE BOUNDARY SITE AREA: 51,250 sqm DEVELOPABLE AREA: 42 842 sqm
- OTHER LANDS UNDER APPLICANT'S CONTROL
- LOCATION OF SITE NOTICES
- LOCATION OF WAYLEAVE
- PRIVATE WAYLEAVE IN FAVOUR OF APPLICANT
- (A) (B) EXISTING FARM BUILDINGS TO BE PRESERVED AND REFURBISHED
- (C) APARTMENT BLOCK C -34 APARTMENTS
- (D) APARTMENT BLOCK D -58 APARTMENTS
- (E) APARTMENT BLOCK E -48 APARTMENTS
- COMMUNAL AMENITY AREA
- EXISTING STRUCTURE TO BE DEMOLISHED
- PROPOSED TREES
- EXISTING TREES TO BE RETAINED
- ROOT PROTECTION ZONE
- EXISTING TREES TO BE REMOVED

1 PROPOSED SITE LAYOUT PLAN
1:500 @ A0

SITE LAYOUT PLAN

SHiPSEYBARRY
CHARTERED ARCHITECTS

PROJECT	PHASE 2- THE FARM- BESSBOROUGH
SCALE	1:500 @ A0
DATE	04.2021
DRAWING DESCRIPTION	SITE LAYOUT PLAN
OVERSEEN BY	AH
APPROVED BY	GB
CLIENT	ESTUARY VIEW ENT. 2020 LTD.
DRAWING NO.	SB-2020-107-200

1:500@A0

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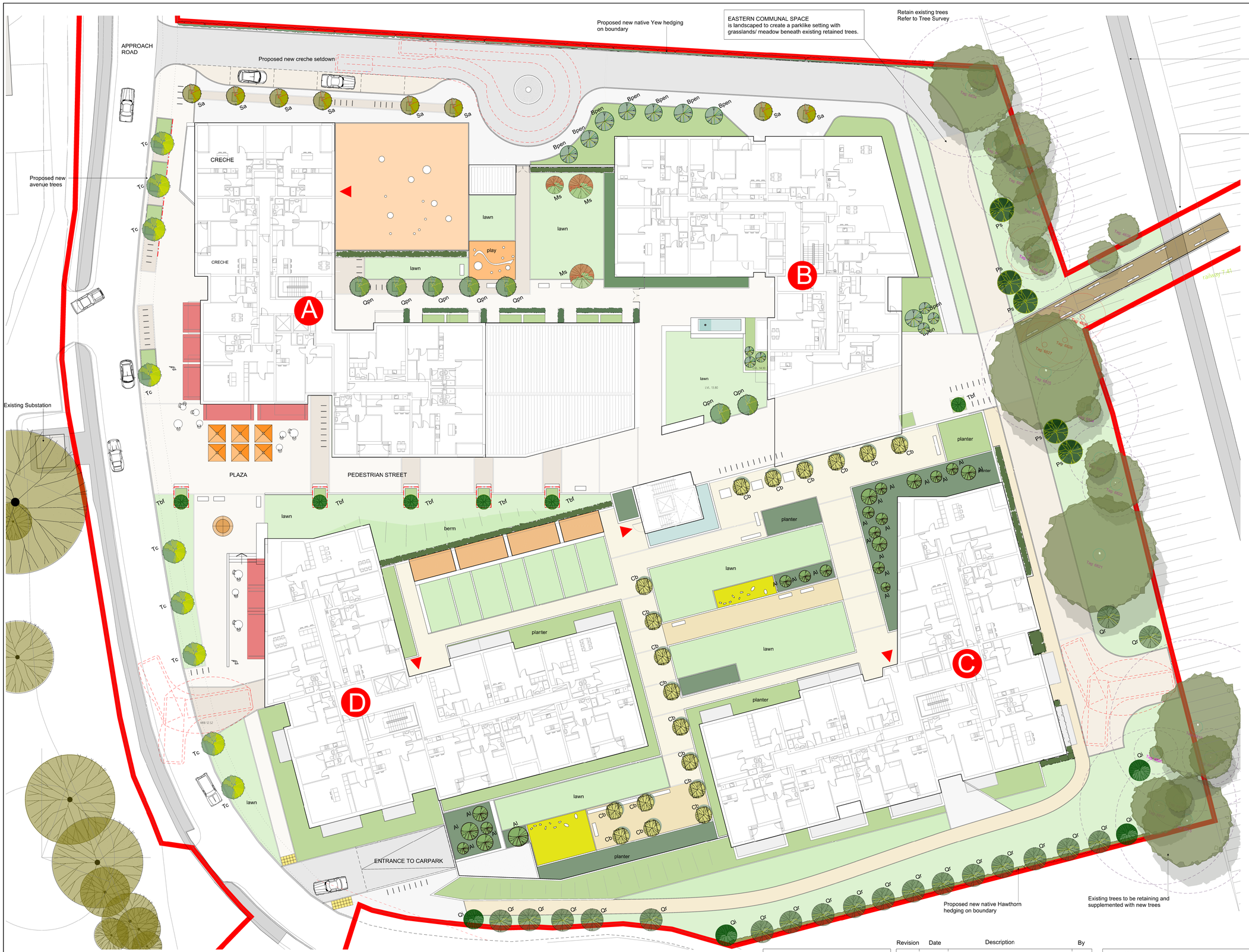
- Appendix 2-5 - Phase 1 ‘The Meadows’ Primary Planting Plan prepared by Ilsa Rutgers Landscape Architecture



TREE AND HEDGING LEGEND

Symbol	Species and size
	Existing Trees to be protected during construction if within the hoarded site. Refer to Arboriculturist's Report NOTE: Retained trees to be protected in strict accordance with BS 5837 (2012)
	Existing Tree to be removed as part of proposed works associated with this development. Refer to Aboriculturist's Report.
	Rough grass
	EVERGREEN HEDGING Taxus baccata (Native Yew) for medium height Buxus semprevirons for low height
	NATIVE DECIDUOUS HEDGING Crataegus monogyna (Hawthorn)
	ROOT PROTECTION BARRIER

Symbol	Species and size	quantity
Qr	*Quercus robur* Dair ghallda / Common Oak 20-22 cm girth, 2m clear stem, 4-5m tall, rootball	19
Ps	*Pinus sylvestris* Péine albanach / Scot's Pine 16-18 cm girth, 2m clear stem, 3-4m tall, rootball	5
Bpen	*Betula pendula* Beith gheal / Silver Birch 16-18 cm girth, 2m clear stem, 4-5 m tall, rootball	7
Tc	*Tilia cordata 'Greenspire'* Lime tree 20-24 cm girth, 2m clear stem, 4-5m tall, rootball	9
Qi	*Quercus ilex* Holm Oak (evergreen) 18 -22 cm girth, 2m clear stem, 4-5m tall, rootball	4
Tbf	*Taxus baccata 'fastigiata'* Irish Yew (evergreen) 16 -18 cm girth, 3-4m tall, container	6
Sa	*Sorbus aucuparia* Mountain Ash 18-20 cm girth, 2m clear stem, 3.5 - 4.5m tall, rootball	8
Qpn	*Quercus palustris* Pin Oak 18-20 cm girth, 2m clear stem, 4-5m tall, rootball	7
Cb	*Carpinus betulus* Hornbeam 16-18 cm girth, 2m clear stem, 4 tall, grown in planter containers	19
Ms	*Magnolia x soulangeana 'Alba Superba'* Evergreen Magnolia 20-24 cm girth, 2m clear stem, 4-5m tall, container	3
Al	*Amelanchier lamarckii* Snowy Mespilus 14-16 cm girth, multistemmed, 4 tall, grown in planter containers	21

1
2500

LANDSCAPE DESIGN - PRIMARY PLANTING PLAN

SCALE 1:250 @ A1 or 1:500 @ A3

NOTES / LEGEND

* DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
* THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS AND DRAWINGS.
* ALL DIMENSIONS TO BE CHECKED ON SITE
* IN THE EVENT OF ANY DISCREPANCIES BETWEEN DRAWINGS THE CONTRACTOR IS TO INFORM THE ARCHITECT IMMEDIATELY.

Revision	Date	Description	By
P.0	25.03.22	Issued for Planning Application	IR

Drawing Status: **planning application**

ilsa rutgers landscape architecture

ARCHITECTURAL DESIGN ■ LANDSCAPE DESIGN

Telephone: +353 85 7378900
e-mail: ilsa@ilsarutgers.com

Project:	BESSBOROUGH RESIDENTIAL PHASE 1 'The Meadows'		
Drawing:	LANDSCAPE DESIGN - PRIMARY PLANTING		
Date: April 2021	Drawn by: IR	Scale: 1:250@A1 / 1:500@A3	
Client: Estuary View Enterprises 2020 Ltd.	Job No. 210221	Drg No. 2500	Rev. P.0

- Appendix 2-6 - Phase 2 ‘The Farm’ Primary Planting Plan prepared by Ilsa Rutgers Landscape Architecture

ORIGINAL ESTATE ENTRANCE

ENTRANCE GATE

REINSTATE HISTORICAL PATH ALONG THE NORTHERN BOUNDARY

NEW NATIVE TREES TO REPLACE TREES PROPOSED FOR REMOVAL

EPOXY BOUND GRAVEL PATH

RETAIN EXISTING STONE BOUNDARY WALL

RETAIN EXISTING TREES

SACRED HEART CONVENT

Hostel (SHB)

NEW LANDSCAPED CAR PARK

NEW STREET TREES

NEW VEHICULAR ENTRANCE

EXISTING PARK
Remove existing paths dotted in red

REMOVE ALL EXISTING PATHS /STRUCTURES IN THE PARK AND CREATE MORE AREAS OF ROUGH GRASS / MEADOW

CRECHE OUTDOOR PLAY

CRECHE

RED DASHED CIRCLES INDICATE EXISTING TREES TO BE REMOVED. REFER TO ARBORICULTURAL REPORT.

GATE

LOUNGE

WORKSPACE

EXISTING HISTORIC FARM BUILDINGS TO BE PRESERVED AND REFURBISHED

RESIDENTIAL AMENITY

RETAIN EXISTING TREE IN NEW PLANTER

GATE

GATE

LANDSCAPED PUBLIC SPACE (provides right of way to Bessborough Historic Farmyard)

RETAIN EXISTING TREES

RETAIN EXISTING TREES

ORIGINAL ESTATE ENTRANCE ROAD (private)

NEW TREES

GATE

GATE

BESSBOROUGH HISTORIC FARMYARD

REPLACE EXISTING FENCE WITH NEW 1.8m PAINTED STEEL RAILINGS

PROPOSED MEMORIAL BENCH CENTRED ON EVERGREEN MAGNOLIA TREE

EXISTING ENTRANCE

RESIDENTIAL AMENITY

RED DASHED CIRCLES INDICATE EXISTING TREES TO BE REMOVED. REFER TO ARBORICULTURAL REPORT.

REMOVE EXISTING PLAYGROUND

RESIDENTIAL AMENITY

NEW LANDSCAPED CAR PARK

SUBSTATION

NEW TREES

RED DASHED CIRCLES INDICATE EXISTING TREES TO BE REMOVED. REFER TO ARBORICULTURAL REPORT.

NEW TREES

EXISTING ENTRANCE

NEW TREES

TREE LEGEND

Symbol	Species and size	within park	urban context
Qr	*Quercus robur* Dair ghallda / Common Oak 20-22 cm girth, 2m clear stem, 4-5m tall, rootball	19	
Qp	*Quercus petraea* Dair ghaelach/ Sessile Oak 20-22 cm girth, 2m clear stem, 4-5m tall, rootball	9	
Ps	*Pinus sylvestris* Péine albanach / Scot's Pine 16-18 cm girth, 2m clear stem, 3-4m tall, rootball	15	
Betpen	*Betula pendula* Beith gheal / Silver Birch 16-18 cm girth, 2m clear stem, 4-5 m tall, rootball		4
Betpub	*Betula pubescens* Beith chlúmhach / Downy Birch 16-18 cm girth, 2m clear stem, 4-5 m tall, rootball		4
Au	*Arbutus unedo* Caithne / Strawberry tree 12-14 cm girth, multistemmed, rootball, 2.5-3m tall	2	
Fs	*Fagus sylvatica* Beech 18-20 cm girth, 2m clear stem, 4-5m tall, rootball	6	
Qi	*Quercus ilex* Holm Oak (evergreen) 18 -22 cm girth, 2m clear stem, 4-5m tall, rootball	3	
Tbf	*Taxus baccata 'fastigiata'* Irish Yew (evergreen) 16 -18 cm girth, 3-4m tall, container	8	
Qpa	*Quercus palustris* Pin Oak 18-20 cm girth, 2m clear stem, 4-5m tall, rootball		13
Cb	*Carpinus betulus* Eurocean Hornbeam 18-20 cm girth, 2m clear stem, 4-5m tall, rootball		4
Sa	*Sorbus aucuparia* Mountain Ash 18-20 cm girth, 2m clear stem, 4-5m tall, rootball		13
Pa	*Pyrus avium* Native wild cherry 16-18 cm girth, 2m clear stem, 3-4m tall, container		15
Ms	*Magnolia x soulangeana 'Alba Superba'* Evergreen Magnolia 20-24 cm girth, 2m clear stem, 4-5m tall, container	1	

Symbol	Species and size
Tag No.	Existing Trees to be protected during construction if within the hoarded site. Refer to Arboriculturist's Report NOTE: Retained trees to be protected in strict accordance with BS 5837 (2012)
	Existing Tree to be removed as part of proposed works associated with this development. Refer to Aboriculturist's Report to the number and species of trees to be removed.
	Rough grass
	EVERGREEN HEDGING Taxus baccata (Yew) for medium height Buxus sempreviron for low height

north

ilsa rutgers landscape architecture

ARCHITECTURAL DESIGN ■ LANDSCAPE DESIGN

Revision	Date	Description	By
P.0	25.03.22	Issued for Planning Application	IR

Drawing Status: **planning application**

Telephone: +353 85 7378900
e-mail: ilsa@ilsarutgers.com

Project: BESSBOROUGH RESIDENTIAL - PHASE 2 'The Farm'

Drawing: LANDSCAPE DEIGN - Primary Planting

Date: April 2021 | Drawn by: IR | Scale: 1:500@A1 / 1:1000@A3

Client: Estuary View Enterprises 2020 Ltd. | Job No. 210604 | Drg No. 2500 | Rev. P.0

- Appendix 2-7 - Phase 1 'The Meadows' Services Infrastructure Report prepared JB Barry and Partners Limited, Consultant Engineers

Client:

Estuary View Enterprises 2020 Ltd.

Project:

Bessborough SHD Development

Report:

Services Infrastructure Report

BARRY
& PARTNERS

Document Control Sheet

Client:	Estuary View Enterprises 2020 Ltd.
Project Title:	Bessborough SHD Development
Document Title:	Services Infrastructure Report
File Name:	21207-JBB-PH1-XX-RP-C-01003

Table of Contents *(incl. Y/N)*	**List of Tables** *(incl. Y/N)*	**List of Figures** *(incl. Y/N)*	**Pages of Text** *(No.)*	**Appendices** *(No.)*
Y	Y	Y	17	12

Document Revision				**Document Verification**			
Issue Date *(DD/MM/YY)*	**Revision Code**	**Suitability Code**	**Author** *(Initials)*	**Checker** *(Initials)*	Reviewer *As Per PMP (Initials)*	**Approver** *As Per PMP (Initials)*	**Peer Review** *(Initials or N/A)*
06/08/2021	P01	S3	DOB	RS	TF	TF	N/A
21/02/2022	P02	S3	DOB	RS	TF	TF	N/A
21/03/2022	P03	S3	DOB	RS	TF	TF	N/A

Table of Contents

Appendices

List of Figures

Estuary View Enterprises 2020 Ltd.
Bessborough SHD Development
Services Infrastructure Report

List of Tables

SECTION 1: INTRODUCTION

1.1 Scope of the Report

This Services Infrastructure Report outlines the proposed means of servicing the development with wastewater collection and disposal, stormwater management and disposal and water supply infrastructure. A Flood Risk Assessment is provided with this submission under a separate cover. Roads and traffic issues are dealt with separately by MHL Consulting Engineers on behalf of the Applicant and their submission should be consulted for such details.

The following should be read in conjunction with the engineering drawings which illustrate the servicing proposals and with the submissions by other members of the Applicant's design team.

1.2 Site Location

The proposed development is located at Phase 1- 'The Meadows', Bessborough, Ballinure, Blackrock, Cork, on a circa 2.29-hectare site, with a developable area of 1.53-hectares, see Figure 1.1. This proposed development will form Phase 1 of a larger development on a circa 16.59-hectare site, see Figure 1.2 for outline phasing proposals.

The Passage West Greenway forms the eastern boundary of the proposed development site, and the South Ring Road (N40) is located approximately 200m from the southern boundary of the proposed development. The western and northern boundaries of the Phase 1 site are formed by the buildings, outbuildings, roads and open spaces of the overall Bessborough complex. The site slopes gently from north to south, with ground levels falling from approximately 14.50 m OD to 11.25 m OD across the site.

1.3 Proposed Development Brief

This report is prepared in support of a Strategic Housing Development (SHD) planning application by Estuary View Enterprises 2020 Ltd.

The development will consist of the construction of a residential development of 280 no. residential apartment units with supporting tenant amenity facilities, café, crèche, and all ancillary site development works. The proposed development includes 280 no. apartments to be provided as follows: Block A (6 no. studio apartments, 14 no. 1-bedroom, 34 no. 2-bedroom & 1 no. 3-bedroom over 1-6 storeys), Block B (37 no. 1-bedroom & 49 no. 2-bedroom over 6-10 storeys), Block C (31 no. 1-bedroom, 36 no. 2-bedroom & 6 no. 3-bedroom over 5-9 storeys) and Block D (30 no. 1-bedroom, 31 no. 2-bedroom & 5 no. 3-bedroom over 6-7 storeys).

The proposal includes a new pedestrian/cycle bridge over the adjoining Passage West Greenway to the east, connecting into the existing down ramp from Mahon providing direct access to the greenway and wider areas.

The proposed development provides for outdoor amenity areas, landscaping, under-podium and street car parking, bicycle parking, bin stores, 2 no. substations one of which is single storey free standing, a single storey carpark access building, public lighting, roof mounted solar panels, wastewater infrastructure including new inlet sewer to the Bessborough Wastewater Pumping Station to the west, surface water attenuation, water utility services and all ancillary site development works. Vehicular access to the proposed development will be provided via the existing access road off the Bessboro Road.

Figure 1-1: Location of Proposed Development

Figure 1-2: Phasing of Proposed Development

SECTION 2: WASTEWATER COLLECTION & DISPOSAL

2.1 Existing Wastewater Network

Cork City Council / Irish Water drainage records show an existing 375/450mmØ foul sewer located to the west of the Phase 3 lands which runs north to south before discharging to the Bessborough Wastewater Pumping Station (WWPS). From the WWPS a 350mmØ rising main heads east crossing through the greenfield area in the ownership of the applicant before turning north along the Passage West Greenway, see Appendix 2.

A feasibility study of the local area has revealed that there is an existing a 150mmØ foul sewer in the road adjacent to the western boundary of the Phase 1 site which runs north to south before turning in a westerly direction and connecting to the WWPS described above, see as-built drawing in Appendix 3. This sewer was constructed under planning reference 03/27028.

2.2 Pre-Connection Enquiry Stage

Following a Pre-Connection Enquiry, Irish Water (IW) issued a Confirmation of Feasibility (COF) stating that the site can be serviced by its wastewater infrastructure network. This COF is included in Appendix 4.

IW have advised that the proposed connection should be made directly to the WWPS, via a new inlet sewer. The WWPS is almost at design loading capacity. However, Irish Water has a project underway to replace the existing pumps which will increase the pump rate and provide sufficient capacity to accommodate this development and subsequent phases of this development. This upgrade project is scheduled to be completed by Q4 2022 and the proposed connection could be completed as soon as possibly practicable after this date.

2.3 Design Acceptance Stage

The proposed designs were progressed in accordance with Irish Water's Code of Practice for Wastewater Infrastructure and were submitted to Irish Water for review and consideration for design acceptance as per the requirement of the SHD process. A Statement of Design Acceptance was issued by Irish Water and is included in Appendix 4.

The wastewater collection within the development will be via a network of gravity sewers. The wastewater flows will be collected and will be conveyed in in a westerly direction, from the south-western boundary of the proposed development site and will connect directly to the WWPS. A legal wayleave is in place across the Bessborough lands immediately to the west of the proposed development site to facilitate this connection.

The final connection from the western edge of the lands to the existing WWPS will be undertaken using directional-drilling techniques to ensure that the existing western boundary wall to the lands will remain undisturbed during construction.

The wastewater collection system is designed and will be constructed in accordance with Irish Water's Code of Practice for Wastewater Infrastructure to ensure self-cleansing velocities will be achieved on all pipe runs. The pipes proposed as part of this design have been sized in accordance with Table 2.1 below, an extract from IW-CDS-5030-03 (Revision 2 2020).

Manholes will be constructed on all pipe-runs at changes in sewer direction, changes in gradients, at significant sewer connections and at a maximum spacing of 90m on all straight sections of pipework. The gravity wastewater sewers have been designed using MicroDrainage design software and the outputs are included in Appendix 5 of this report. The foul sewer layout plans are attached on Drawing No's. 21207-JBB-PH1-XX-DR-C-04000 & 04001.

No. of Dwellings	Pipe Diameter	Minimum Gradient
2 to 9	150mm (or 225mm)	1:60
10 to 20		1:150
21 to 210	225mm	1:200
211 to 250		1:150
250 to 330		1:100
331 to 450	300mm	1:300
451 to 565		1:200
566 to 655		1:150
656 to 830		1:100

Table 2-1: Foul Sewer Size/Gradient Criteria

2.4 Loading Calculations

The design flows are calculated using the Irish Water Code of Practice for Wastewater Infrastructure Appendix B which is summarised in tables 2.2 and 2.3 below.

Use	No. of Units	Occupancy Rate	Population (P)	Loading (G) (l/day/person)	Daily Loading (PxG) (l/day)	Daily Loading (l/s)
Residential	280	2.7/ Unit	756	150	113,400	
				Infiltration (I) 10% (COP Appendix B – Table 2.4)	11,340	
				Dry Weather Flow (PG +I)	124,740	
				Residential Peaking Factor (Pf_{Dom}) (COP Appendix B – Table 2.5)	6	
				Design Foul Flow [(Pf_{Dom} x PG + I]	691,740	8.006
				Misconnection Allowance (SW) 3% (COP Appendix B - Section 2.2.10)		0.350
				Design Flow		8.356

Table 2-2: Foul Flow Calculations for Residential Development

Use	Floor Area (m^2)		Occupancy Rate	Population (P)	Loading (G) (l/day/person)	Daily Loading (PxG) (l/day)	Daily Loading (l/s)
Creche	320		4	42	50	2,100	
Café	89		1 per 20m^2	4	50	200	
			1 per 5m^2	18	12	216	
Communal Workspace	166		14	14	100	1,400	
Lounge	180		31	31	15	465	
Gym	191		1 per 5m^2	38	50	1,900	
	Total					6,281	
	Total (Based on 12 Hour Day)					3,141	
	Infiltration (I) 10% (COP Appendix B – Table 2.4)					314	
	Dry Weather Flow (l/s) PG +I					3,455	
	Commercial Peaking Factor ($Pf_{Dom, Ind}$) (COP Appendix B – Table 2.7)					4.5	
	Design Foul Flow ($Pf_{Dom, Ind}$ x PG) + I (l/s)					14,449	0.168
	Misconnection Allowance (SW) 2% (COP Appendix B – Table 2.10)						0.233
	Design Flow (l/s)						0.401

Table 2-3: Foul Flow Calculations for Commercial Development

The combined residential and commercial design flow is 8.8l/s. This figure has been proportionally applied as a base flow to the heads of the wastewater sewer runs within the MicroDrainage design model, see Appendix 5 for the results.

SECTION 3: STORMWATER COLLECTION & DISPOSAL

3.1 Existing Hydrology

The proposed development site does not contain any mapped watercourse. The nearest watercourse to the proposed development site is the Douglas Estuary which is located approximately 260m to the south of the site. The Douglas Estuary flows in an easterly direction and discharges to transitional water body Lough Mahon to the south of the site. The main hydrological features associated with the site are presented in Figure 3.1 below.

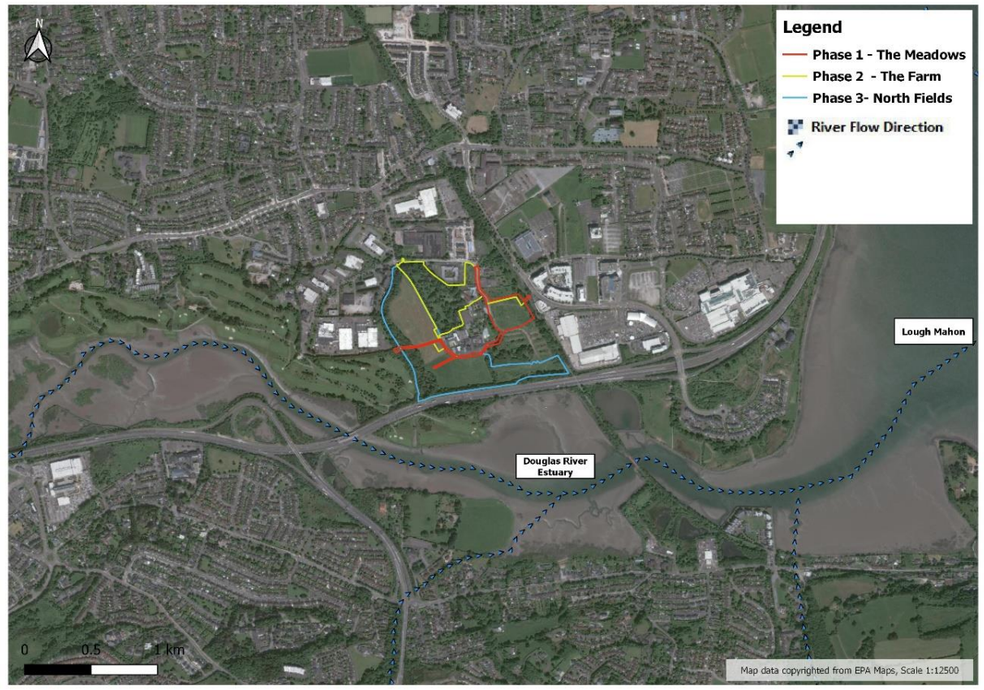


Figure 3-1: Hydrological Features of the Area

A geological desk study was conducted to gain an initial understanding of the existing ground conditions. The below Figure 3.2 is an extract from the Geological Survey of Ireland (GSI), where the soil permeability at the site is categorised as 'Moderate'. Further to this the groundwater vulnerability is categorised as 'High', see Figure 3.3. Groundwater vulnerability of an area is determined by the permeability and thickness of the subsoils overlying the groundwater, and the type of recharge sources (diffuse or point source). Therefore, areas where the infiltrating water and contaminants move faster from land to groundwater with high permeability are more vulnerable. Both sources of information would suggest that the site should have reasonable rates of permeability.

A ground investigation was undertaken by Priority Geotechnical Ltd. in January 2022 to establish subsurface conditions at the proposed project site. An infiltration test was conducted in one of the boreholes (BH05), see Appendix 6. The results were inconclusive as there was no drop in water level after 60 minutes and it is thought this result is unlikely to be an accurate representation of the existing ground conditions considering the GIS data above. Infiltration testing in accordance with BRE 365 will be conducted in due course as part of later detailed design. For now, conservative assumptions have been made, to ensure a robust design, and there will be no reduction in runoff volumes applied for the various SuDS measures.

However, it has been assumed that the first flush, 5mm, of rainfall can be infiltrated to ground in specific areas designated for interception purposes, which is explained in greater detail below.

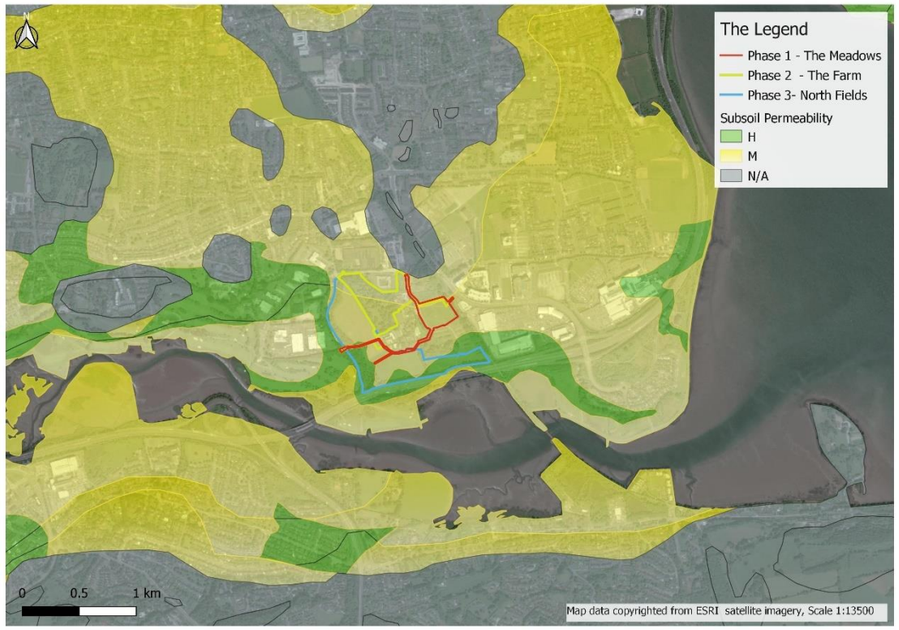


Figure 3-2: Soil Permeability

Figure 3-3: Groundwater Vulnerability

3.2 Existing Stormwater Network

Cork City Council drainage records indicate there is an existing 1350mmØ trunk storm sewer located approximately 400m to the west of the Phase 1 site, outside the boundary of the lands, which runs in a north-south direction before crossing under the South Ring Road (N40) and discharging to the Douglas Estuary, see Appendix 7.

A feasibility study of the local area has revealed that there is an existing 450mmØ storm sewer in the road adjacent to the western boundary of the Phase 1 site (increasing downstream to a 750mmØ), which runs north to south before turning in a westerly direction and connecting to the 1350mmØ storm sewer described above, see as-built drawing in Appendix 3. This sewer was constructed under planning reference 03/27028.

Pending further investigation and confirmation of the capacity of the 450mmØ pipe the proposal is to connect to the larger 750mmØ further downstream.

3.3 Greenfield Runoff Rate

The total site area for Phase 1 is 1.53ha. The greenfield runoff rate has been estimated using the HR Wallingford Greenfield runoff estimation online tool (report attached in Appendix 8). The online tool calculated a Qbar figure of 12.61 l/s (equivalent to 8.24 l/sec/ha). A summary of the design values output by the HR Wallingford Greenfield runoff estimation online tool is shown below:

Design Criteria	Value
Site Area (ha)	1.53
Soil Type	4
SPR	0.47
SAAR (mm)	1106
1 year factor	0.85
30-year factor	1.65
100-year factor	1.95

Table 3-1: HR Wallingford Design Value Outputs

Given the proximity of the site to the final outfall to the Douglas Estuary, the controlled outflow from the development has been set to the Q100 figure (the flow from the site in its greenfield condition in a 100-year storm event). This approach was proposed to Cork City Council Drainage Department and they were satisfied with the approach. See correspondence from Cork City Council in Appendix 9.

The growth factor to be applied when calculating Q100 from QBAR is 1.95 giving an upper limit to the discharge from the site at 24.6 l/sec. This is the value that will be used in later detailed design as the upper limit of surface water discharge from the development.

3.4 Proposed Development Surface Water Management System

The proposed surface water management system will, as far as is feasible, be designed in accordance with the principles of Sustainable Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS).

The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimise the impact of urbanisation by replicating the runoff characteristics of a greenfield site. The criteria provide a consistent approach to addressing both rate and volume of runoff as well as ensuring the environment is protected from pollution that is washed off roads and buildings. These drainage design criteria are as follows:

- Criterion 1 - River Water Quality Protection
- Criterion 2 - River Regime Protection
- Criterion 3 - Flood Risk Assessment
- Criterion 4 - River Flood Protection

The requirements of SuDS are typically addressed by provision of the following:

- Interception storage
- Treatment storage (not required if interception storage is provided)
- Attenuation storage
- Long term storage (In discussion with Cork City Council there is no requirement for long term storage)

3.4.1 Layout of the Proposed Network

The proposed surface water network will include a storm drainage pipe network, attenuation storage structures and several SuDS features which will aid the reduction of runoff volumes by slowing surface water flows, providing the opportunity for evapotranspiration, and providing the opportunity for infiltration to ground. Both the interception and attenuation storage requirements of GDSDS will be sufficiently met.

An assessment of the potential SuDS measures that could be incorporated within the site was conducted using the SuDS Manual, CIRIA 753 as guidance. The following SuDS features have been identified as applicable and will be provided within the proposed scheme:

- Green Roofs: will be provided throughout the site, on flat roofs, where possible. The green roof will be an extensive type with sedum planting at the surface with a drainage layer beneath. The drainage layer will convey flows to discharge locations. It is not proposed to restrict the discharges from the roofs. Where possible discharges from roofs will be tied into planters or permeable paving substrata via diffusers.

- Permeable Paving: will be provided for all paved areas, excluding the access road, the car park ramp and the pedestrian link corridor. Permeable paving will be a Type B as per SuDS Manual, CIRIA 753, a combination of infiltration and piped drainage.

- Tree Pits/Bioretention Planters: will be provided in every feasible location where there is a proposed tree or planter. The tree pits will contain engineered soil-filled tree boxes with drainage pipes beneath to link trees together and tie in with the proposed surface water sewer. The bioretention planters will consist of a shallow landscaped depression at the surface with a drainage layer beneath.

- StormTech Attenuation Tank: will be provided at the natural low point, at the south of the site for final storage of runoff volumes before discharging to the existing surface water network at a controlled rate.

- Permavoid Geocellular Units: will be provided at the base of the raised podium build up, which will provide storage and conveyance of surface water volumes. The raised podium will consist of impermeable surfaces and permeable surface (i.e., tree pits/bioretention planters).

The SuDS features will be designed to work in sequence thereby creating a treatment train. The proposed SuDS layout is shown on see Drawing No. 21207-JBB-PH1-XX-DR-C-04003 and the overall drainage arrangement is shown on Drawing No. 21207-JBB-PH1-XX-DR-C-04001, both included with this submission.

Manholes will be constructed on all pipe-runs at changes in sewer direction, changes in gradients, at significant sewer connections and at a maximum spacing of 90m on all straight sections of pipework The gravity surface water sewers have been designed using MicroDrainage design software and the outputs are included in Appendix 10 of this report.

The contributing surface areas of the development have been split up and tabulated below:

Area Type	Units (ha)
Total Site Area	1.53
Roof Area (Blocks A, B, C & D) (Partially Green)	0.50 (0.34 Green)
Raised Carpark Podium (Partially Green)	0.23 (0.11 Green)
Permeable Paving	0.17
Tree Pits/Bioretention Planters	0.25
Impermeable Area	0.54
Open Space Without Formal Drainage	0.12
Total Drained Area	1.41

Table 3-2: Surface Areas

3.4.2 Interception Storage

In accordance with the requirements of GDSGS, at least 5mm, and preferably 10mm, of interception storage should be provided on site, where runoff to the receiving water can be prevented. Despite the infiltration test results we are confident that the existing ground will be able to disperse some runoff via infiltration. Further infiltration testing will be conducted in due course to confirm this assumption.

In the case of this development the total drained area is 1.41ha (14,100m²) as per Table 3.2 above. This results in a required interception storage volume of 70.50m³ (14,100 X 0.005) The proposed interception storage will be provided by green roofs, permeable paving, tree pits and bioretention areas.

Green roofs are proposed for each of residential blocks. These areas cover a total area of 3,400m². The build-up in the green roof system will provide a minimum of 5mm of interception storage per 1m², allowing for a total interception storage volume of 17.00m³.

Permeable surfaces including permeable paving, tree pits and bioretention planters are proposed throughout the development, for a total area of 4,200m². The drainage pipe within the gravel bed for these areas will be set at 50mm above the bed formation giving (assumed 30% voids) interception stage equivalent to 15mm storage depth. Total interception volume provided in the permeable paving equals 63.00m³.

The proposed StormTech attenuation tank has a surface area of 299m². Interception storage will be provided within the base of the tanks for a depth of 260mm depth of stone below the StormTech Chambers. Assuming the tanks have a void ratio of 43% (which is conservative), the total interception storage volume provided is 33.43m³

The overall interception storage volume provided is therefore 113.43m³ which represents approximately 8mm of interception storage which is above the required minimum provision as detailed above.

3.4.3 Attenuation Storage

The proposed rate of surface water discharge from the development will be limited to that of the greenfield runoff for a 100-year storm event, as described in Section 4.2. Attenuation will be provided by StormTech attenuation chambers which will cater for the 100-year storm event with a 10% climate change allowance added. The proposed surface water network has been split into two catchments, A and B, see Figure 3.4.

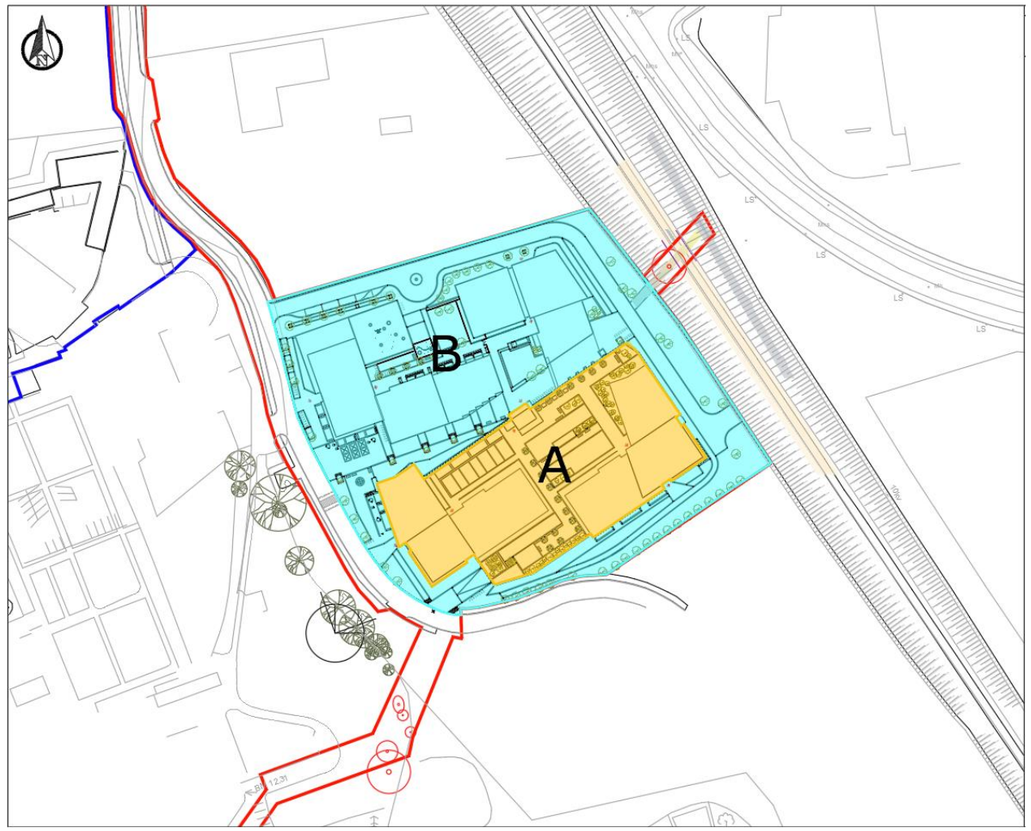


Figure 3-4: Surface Water Catchment Areas

It is proposed to use a geocellular attenuation system such as Polypipe's Permavoid Modular Cell 85 system (or similar approved), in the base of the podium for Catchment A. The Permavoid system provides at least 92% voids, which allow for conveyance and storage across the system. Based on a surface area of 2152m², Permavoid Modular Cell 85 system can provide 168m³ storage volume, in the geocellular units alone. Storage will also be available in the drainage stone above the geocellular units. There will be flow control devices installed at the invert level of the drainage system on the podium.

StormTech attenuation chambers are proposed for Catchment B. The restricted flows from the podium (Catchment A) will tie in upstream of the StormTech attenuation chambers.

The various SuDS components being proposed as part of the development will provide some attenuation, reduce flow rates and will disperse surface water via evapotranspiration and infiltration. However, at this stage of the design process, and to ensure a robust design, we are designing for the worst case and have not assumed a reduction in runoff volume from the various SuDS features and permeable surfaces in the required attenuation storage calculations. This will be revisited closer to construction stage, subject to a granted planning permission, to reduce the required attenuation storage volume if possible.

Preliminary attenuation volume calculations, based on the above criteria, are summarised in Table 3.3. (See Appendix 11 for detailed calculations)

Ref.	Catchment Area (ha)	Q100 (l/s)	Max. Discharge Rate (l/s)	Required Storage Volume 100yr +10% C.C. (m³)	Provided Attenuation Volume (m³)	Attenuation Storage Type
A	0.48	7.72	7.72	162	168	Permavoid Modular Cell 85
B	1.05	16.88	24.60	355	360	StormTech Chambers

Table 3-3: Summary of Attenuation Requirements and Proposals

3.4.4 Water Quality

The proposed development is residential and therefore is considered a low-level pollution hazard. Surface water runoff will be directed to the SuDS features as mentioned above and will therefore benefit from their pollutant removal qualities. However, to ensure water quality standards are met, we are proposing a hydrocarbon interceptor upstream of the StormTech attenuation tank (Catchment B). This catchment includes the drainage of the access road which has the potential to contaminate surface water runoff via oil spills etc. from vehicles.

Simple Index Approach

The effectiveness of the chosen SuDS components to achieve water quality can be assessed using the 'simple index approach' as described in CIRIA C753.

The simple index approach designates risk indices to the various areas of development to determine their possible pollutant contribution. Similarly, the SuDS features are designated mitigation indices and if the mitigation indices are larger than the risk indices the water quality objectives are considered satisfied.

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Driveways, car parks, low traffic roads	Low	0.5	0.4	0.4

Table 3-4: Pollution Hazard Indices for Different Land Uses (Source: CIRIA C753)

As can be seen in Table 3.5 below the total mitigation potential of the SuDS features far outweigh the contamination risks. Secondary (or further) stages in the treatment train are assigned 50% of the stated treatment indices value.

SuDS Component	TSS	Metals	Hydrocarbons
Permeable paving	0.7	0.6	0.6
Bioretention/Tree pits	0.8	0.8	0.8
Petrol Interceptor	0.4	0.4	0.4

Table 3-5: Indicative SuDS Mitigation Indices for Discharges to Surface Waters (Source: CIRIA C753)

3.4.5 Amenity and Biodiversity

Meeting amenity and biodiversity standards is all about creating attractive, pleasant, and liveable urban areas for both people and for nature.

The proposed SuDS features within this development will not only be aesthetically pleasing, but they will also assist the creation of liveable habitats for nature by retaining rainfall at the source. The final details of these features will be drawn-up in consultation with the landscape design and ecological consultants on the design team.

3.5 Conveyance of Surface Water Outflow to Final Discharge Location

A new 225mmØ surface water outfall pipe will convey the restricted flows from the site in a westerly direction across the overall Bessborough site connecting to the existing 750mmØ surface water sewer upstream of its connection to the existing 1350mmØ surface water pipe which in turn discharges to the Douglas Estuary further to the south.

A legal wayleave is in place across the Bessborough lands immediately to the west of the Phase 1 development to facilitate this connection.

The controlled discharge from the proposed development (a maximum of 24.8 l/sec) will be minimal in the context of the capacity of the existing 750mm and 1350mm pipes and given that this controlled outflow matches existing greenfield runoff from the site in a 100-year storm event these flows will not create a significant increase in the flow to the estuary.

The proposed route of this sewer is shown on Drawing No. 21207-JBB-PH1-XX-DR-C-04007.

SECTION 4: WATER SUPPLY

4.1 Existing Watermain Network

Cork City Council watermain records show there is an existing 150mmØ watermain in the roadway adjacent to the western boundary of the Phase 1 site. There is also an existing 1200mmØ trunk watermain running through the greenfield area in the ownership of the Applicant to the south of development site, see Appendix 12.

4.2 Pre-Connection Enquiry Stage

Following a Pre-Connection Enquiry, Irish Water (IW) have issued a Confirmation of Feasibility (COF) that the site can be serviced by its water infrastructure network. This COF is included in Appendix 4.

IW have advised that the connection is to be made to the existing 150mmØ ductile iron watermain in the roadway adjacent to the western boundary of the Phase 1 site.

4.3 Design Acceptance Stage

The proposed designs for water supply infrastructure within the development were progressed in accordance with Irish Water's Code of Practice for Water Infrastructure and were submitted to Irish Water for review and consideration for design acceptance as per the requirement of the SHD process. A Statement of Design Acceptance was issued by Irish Water and is included in Appendix 4.

To serve the development a 40mmØ watermain will be connected to the existing 150mmØ ductile iron watermain in the roadway adjacent to the western boundary of the site. This new connection will feed a cold-water storage tank that will supply boosted potable water to each apartment and commercial unit and supply a sprinkler system. A bulk water meter will be provided at the connection to the site. The supply arrangements will be carried out to the requirements of Irish Water.

A second and separate connection will be made to the existing 150mmØ ductile iron watermain for the purposes of fire-fighting water supply. A fire-main and fire hydrants will be provided such that each building will be within 46m of a hydrant and these hydrants will be fully accessible to the fire service. Apartment buildings will be subject to Fire Safety Certificate applications and the provision of appropriate water supply for firefighting will be addressed in these applications.

Preliminary water supply layout plans are shown on Drawing No. 21207-JBB-PH1-XX-DR-C-03001.

The water supply system is designed and will be constructed in accordance with Irish Water's Code of Practice for Water Infrastructure

4.4 Loading Calculations

Water demand for the development is determined in accordance with Irish Water Code of Practice for Water Infrastructure.

Per-capita consumption = 150 litres/person/day

Average day / peak week demand (ADPWD) = 1.25 x ADDD

Peak Water Demand = 5.00 x ADPWD

Use	Floor Area (m^2)	Occupancy Rate	Population (P)	Average Daily Demand (l/day)	Average Daily Demand (l/s)	Average Day/Peak Week Demand (l/s)	Peak Hour Water Demand (l/s)
Residential	280	2.7	756	113,400	1.31	1.64	8.2
						Total	**8.2**

Table 4-1: Water Demand for Residential Development

Use	Floor Area (m^2)	Occupancy Rate	Population (P)	Average Daily Demand (l/day)	Average Daily Demand (l/s)	Average Day/Peak Week Demand (l/s)	Peak Hour Water Demand (l/s)
Creche	320	42	42	6,300	0.073	0.091	0.455
Café	89	1 per $20m^2$	4	600	0.038	0.048	0.240
		1 per $5m^2$	18	2,700			
Communal Workspace	166	14	14	2,100	0.024	0.030	0.150
Lounge	180	31	31	4,650	0.054	0.068	0.340
Gym	191	1 per $5m^2$	38	5,700	0.066	0.083	0.415
						Total	1.6
						Total (Based on 12 Hour Day)	**0.8**

Table 4-2: Water Demand for Commercial development

Appendix 1

PROPOSED SITE LAYOUT PLAN

THE MEADOWS BUILDINGS: A,B,C,D

280 APARTMENTS	NO.	%
STUDIO AP.	6	2.1 %
1 BEDROOM AP.	112	40.0 %
2 BEDROOM AP. 4P	150	53.6%
3 BEDROOM AP.	12	4.3 %
TOTAL NO.	280	100 %
DUAL ASPECT	121	43.2%
NO. OF UNITS WITH AREA 10% GREATER THAN REQUIRED	162	57.8%
TOTAL RESIDENT'S PRIVATE AMENITY AREA	2,172 sqm	
PUBLIC OPEN SPACE	3,958 sqm	63,5 %
PARKING SPACES	98	35.0%
CRECHE DROP OFF	4	
MOTORBIKE SPACES	10	
RESIDENT'S BIKE SPACES	464	
VISITOR'S BIKE SPACES	140	

LEGEND

- POND
- VEGETATIONS
- PATHS
- GREEN ROOF
- EXISTING TREES
- ROOT PROTECTION ZONE
- PROPOSED TREES
- TREE TO BE REMOVED

SITE BOUNDARY AREA: 2.3 ha

Site Centre Point Coordinates:
X,Y = 571940.0,570405.0

- SITE BOUNDARY
- OTHER LANDS UNDER APPLICANT'S OWNERSHIP

1 SITE PLAN
SCALE 1:500

280 UNITS 1:500 A1

C Client Meeting 03.2022
B For Planning 08.2021
A For Client Review 03.2021

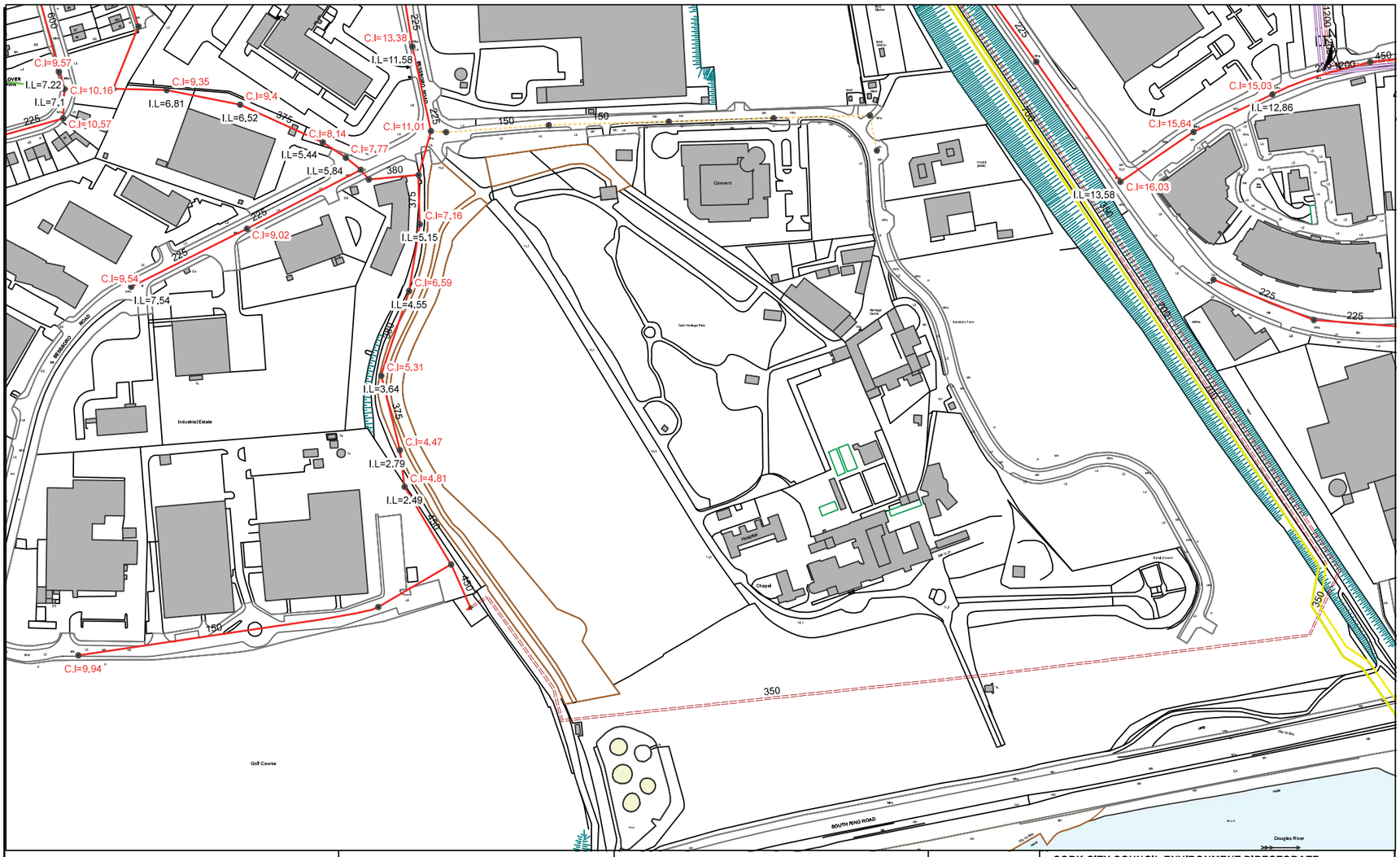
SITE PLAN

SHiPSEYBARRY place makers

PROJECT:	THE MEADOWS- BESSBOROUGH	DRAWING DESCRIPTION:	SITE PLAN
SCALE:	1:500 @ A1	DATE:	03.2021
OVERSEEN BY:	MD	APPROVED BY:	GB
CLIENT:	ESTUARY VIEW ENT. LTD		
DRAWING NO.:	SB-2020-107-200		

Appendix 2

CORK CITY COUNCIL - EXISTING WASTEWATER NETWORK



Drainage Records

Legend

IW_FoulNetwork
PIPE_FUNCT
- LOCAL COMBINED
- LOCAL FOUL
- RISING MAIN
- County Co
- CoCo Rising Main
- PRIVATE FOUL
- PRESSURE PIPE
- PUMP OVERFLOW
- UNPROCESSED

IW_FoulManholes
MANHOLE_
- Manhole
- Pumphouse

THE SEWERS SHOWN ON THIS MAP ARE FOR REFERENCE ONLY. THE LOCATION AND PROPERTIES OF ALL SEWERS, LEVELS, PIPESIZES, etc. MUST BE CONFIRMED ON SITE.

1:2,500

N

CORK CITY COUNCIL ENVIRONMENT DIRECTORATE
(As agents of Irish Water)

Drawn By: A. Homan

Checked by: G.R.

Date: 25/07/2018

Appendix 3

AS-BUILT LOCAL DRAINAGE NETWORK

NOTES.

1.	To be read in conjunction with all relevant drawings and specification.
2.	Do not scale if in doubt ask.
3.	All dimensions to be checked on site.

Legend

Foul & Storm
150mm Ø Site Connections

Existing Services Connected

MAHON GOLF COURSE

CONVENT

Tank

Tank

1.	AS CONSTRUCTED	A.T.	0.0'D	06.09.'06
0.	ISSUED FOR CONSTRUCTION	M.M.	0.0'D	11.04.'06
REV.	DETAILS	REV.	CHKD.	DATE

CORK CITY COUNCIL
Scanned
PLANNING DIRECTORATE

John O'Donovan & Associates
Civil, Structural, Mechanical & Electrical Engineers
Model Farm Road, Cork 4, Ireland.
telephone: 021 454 4244 facsimile: 021 454 4277
e-mail: firstnames.surname@joda.ie web: www.joda.ie

jodo ENGINEERING CONSULTANTS

Bessborough Site Development Works
Bessborough, Blackrock, Cork

3699–103

DWG TITLE: As Built Site Services – Foul & Storm Water Drainage
DN: A.T.
CHKD: 0'D.D
STATUS: CONSTRUCTION
SCALE: Not To Scale
DATE: APRIL 2006

Appendix 4

IRISH WATER – CONFIRMATION OF FEASIBILITY

IRISH WATER – STATEMENT OF DESIGN ACCEPTANCE

Tim Finn

JB Barry & Partners
3 Eastgate, Eastgate Business Park
Little Island
Co. Cork
T45KH74

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

9 February 2022

Re: CDS21001326 pre-connection enquiry - Subject to contract | Contract denied

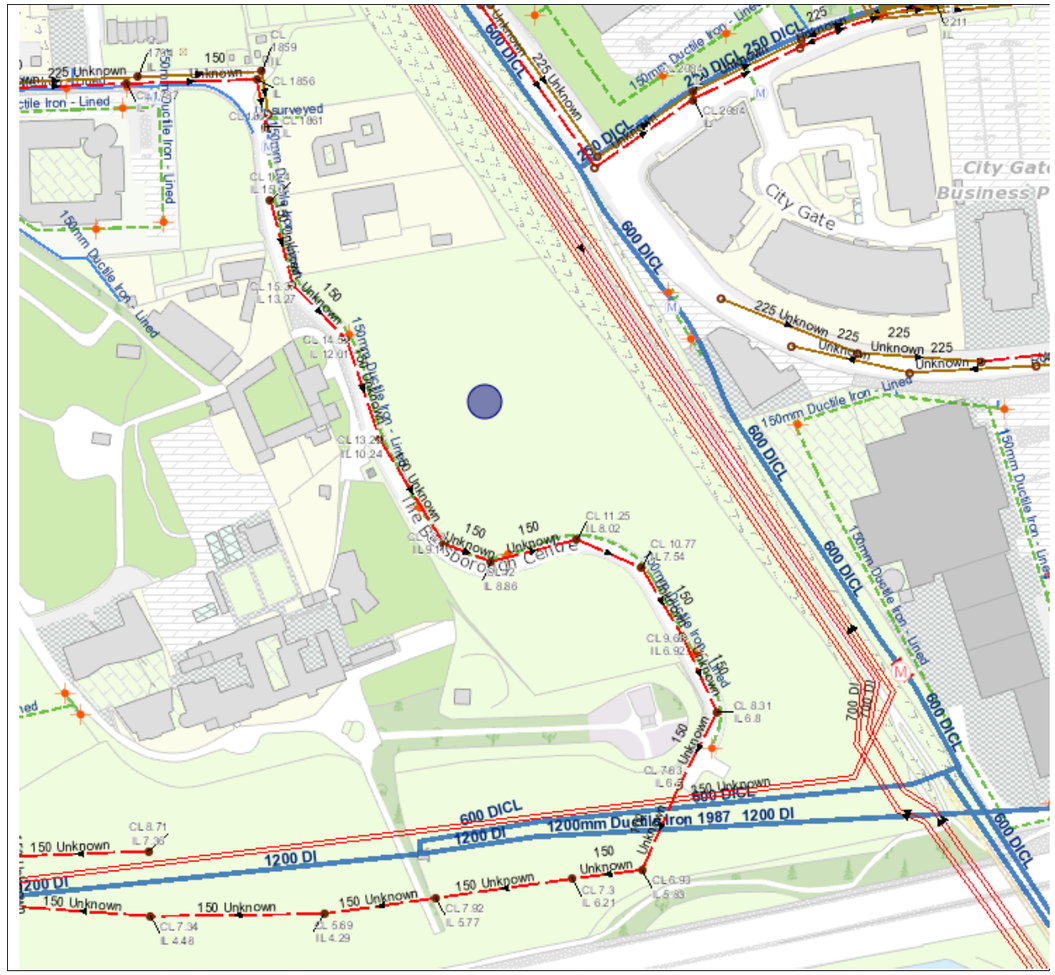
Connection for Multi/Mixed Use Development of 280 unit(s) and creche at Bessboro, Blackrock, Co. Cork

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Bessboro, Blackrock, Co. Cork (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	Connection to be made to the existing 150mm DI adjacent to site. No works to interfere with existing 1200mm trunkmain. No diversions of this main shall be permitted.
Wastewater Connection	Bessborough WWPS is almost at design loading capacity. Irish Water has a project underway to replace the existing pumps which will increase the pump rate and provide sufficient capacity to accommodate this development. This upgrade project is scheduled to be completed by Q4 2022 (this may be subject to change) and the proposed connection could be completed as soon as possibly practicable after this date.
Strategic Housing Development	Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services.
	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:



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 Marko Komso from the design team on 022 54611 or email mkomso@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Head of Customer Operations

Diarmuid O' Brien
JB Barry & Partners
3 Eastgate, Eastgate Business Park
Little Island, Co. Cork T45KH74

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

28 February 2022

Re: Design Submission for Bessboro, Blackrock, Co. Cork (the "Development") (the "Design Submission") / Connection Reference No: CDS21001326

Dear Diarmuid O'Brien,

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: Kyle Jackson
Email: kyle.jackson@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix 5

FOUL SEWER - MICRODRAINAGE CALCULATIONS

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	150.00	Maximum Backdrop Height (m)	4.000
Persons per House	2.70	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	14.279	0.238	60.0	0.000	0	2.6	1.500	o	225	Pipe/Conduit	
F1.001	20.109	0.134	150.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.002	69.671	0.465	149.8	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F2.000	26.947	0.449	60.0	0.000	0	1.2	1.500	o	225	Pipe/Conduit	
F2.001	26.434	1.088	24.3	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.003	27.027	0.180	150.2	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.004	31.230	0.208	150.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.005	29.246	0.195	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F3.000	10.497	0.175	60.0	0.000	0	0.9	1.500	o	225	Pipe/Conduit	
F3.001	23.302	0.155	150.3	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F3.002	49.153	1.090	45.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.006	27.571	0.184	149.8	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.007	23.108	0.963	24.0	0.000	0	1.2	1.500	o	225	Pipe/Conduit	
F1.008	7.094	0.263	27.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	11.970	0.000	2.6	0	0.0	32	0.74	1.48	59.0	2.6
F1.001	11.732	0.000	2.6	0	0.0	40	0.54	0.94	37.2	2.6
F1.002	11.598	0.000	2.6	0	0.0	40	0.54	0.94	37.2	2.6
F2.000	12.670	0.000	1.2	0	0.0	22	0.58	1.48	59.0	1.2
F2.001	12.221	0.000	1.2	0	0.0	18	0.80	2.33	92.8	1.2
F1.003	11.133	0.000	3.8	0	0.0	49	0.60	0.94	37.2	3.8
F1.004	10.953	0.000	3.8	0	0.0	49	0.60	0.94	37.2	3.8
F1.005	10.745	0.000	3.8	0	0.0	49	0.60	0.94	37.2	3.8
F3.000	11.970	0.000	0.9	0	0.0	20	0.53	1.48	59.0	0.9
F3.001	11.795	0.000	0.9	0	0.0	24	0.39	0.94	37.2	0.9
F3.002	11.640	0.000	0.9	0	0.0	18	0.59	1.71	68.1	0.9
F1.006	10.550	0.000	4.7	0	0.0	54	0.64	0.94	37.2	4.7
F1.007	10.366	0.000	5.9	0	0.0	38	1.31	2.35	93.4	5.9
F1.008	9.403	0.000	5.9	0	0.0	40	1.25	2.22	88.1	5.9

Network Design Table for Foul - Main

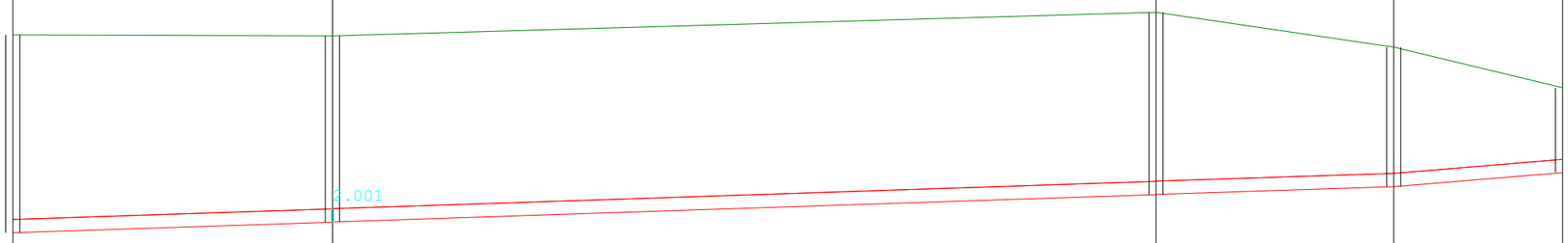
PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F4.000	18.382	0.306	60.1	0.000	0	1.0	1.500	o	225	Pipe/Conduit	
F4.001	30.621	0.204	150.1	0.000	0	1.0	1.500	o	225	Pipe/Conduit	
F5.000	10.220	0.465	22.0	0.000	0	0.9	1.500	o	225	Pipe/Conduit	
F4.002	10.047	0.067	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F4.003	52.923	0.353	149.9	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.009	57.818	0.578	100.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.010	37.535	0.375	100.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.011	36.298	0.363	100.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.012	64.690	0.647	100.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.013	27.697	0.277	100.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.014	24.176	0.242	99.9	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.015	27.035	0.270	100.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.016	33.938	0.339	100.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.017	45.563	1.478	30.8	0.000	0	8.8	1.500	o	225	Pipe/Conduit	
F1.018	45.563	0.456	99.9	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.019	78.650	2.044	38.5	0.000	0	6.1	1.500	o	225	Pipe/Conduit	
F1.020	10.451	0.475	22.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

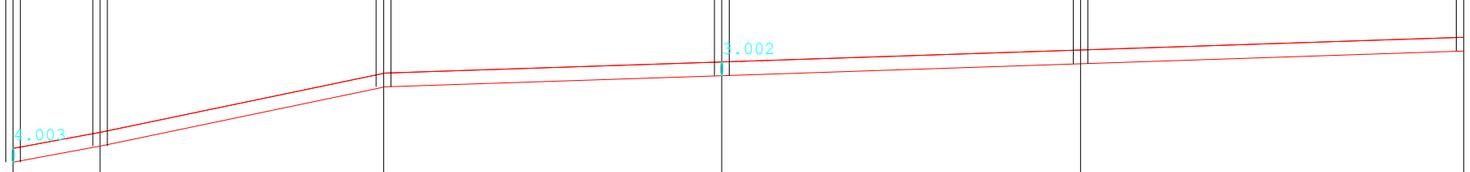
PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F4.000	10.070	0.000	1.0	0	0.0	21	0.55	1.48	58.9	1.0
F4.001	9.764	0.000	2.0	0	0.0	36	0.49	0.94	37.2	2.0
F5.000	10.070	0.000	0.9	0	0.0	16	0.75	2.45	97.6	0.9
F4.002	9.560	0.000	2.9	0	0.0	43	0.55	0.94	37.2	2.9
F4.003	9.493	0.000	2.9	0	0.0	43	0.55	0.94	37.2	2.9
F1.009	9.140	0.000	8.8	0	0.0	67	0.89	1.15	45.6	8.8
F1.010	8.562	0.000	8.8	0	0.0	67	0.89	1.15	45.6	8.8
F1.011	8.187	0.000	8.8	0	0.0	67	0.89	1.15	45.6	8.8
F1.012	7.824	0.000	8.8	0	0.0	67	0.89	1.15	45.6	8.8
F1.013	7.177	0.000	8.8	0	0.0	67	0.89	1.15	45.6	8.8
F1.014	6.900	0.000	8.8	0	0.0	67	0.89	1.15	45.7	8.8
F1.015	6.658	0.000	8.8	0	0.0	67	0.89	1.15	45.6	8.8
F1.016	6.388	0.000	8.8	0	0.0	67	0.89	1.15	45.6	8.8
F1.017	6.049	0.000	17.6	0	0.0	71	1.65	2.07	82.4	17.6
F1.018	4.571	0.000	17.6	0	0.0	97	1.07	1.15	45.7	17.6
F1.019	4.115	0.000	23.7	0	0.0	88	1.65	1.85	73.7	23.7
F1.020	2.071	0.000	23.7	0	0.0	76	2.02	2.45	97.5	23.7

Free Flowing Outfall Details for Foul - Main

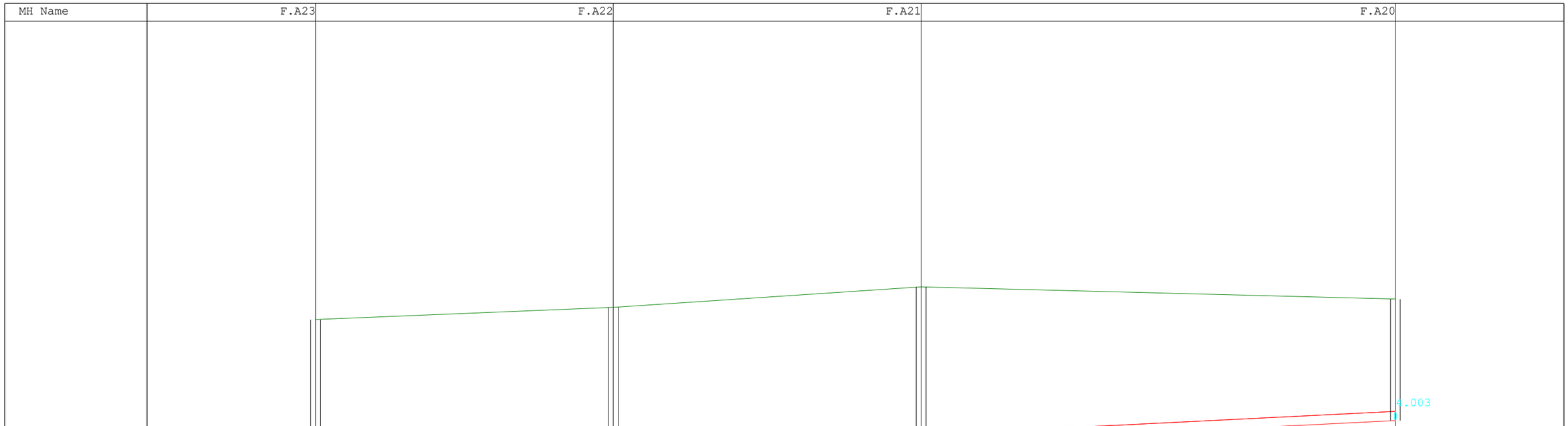
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.020	F.A32	3.800	1.596	0.000	0	0



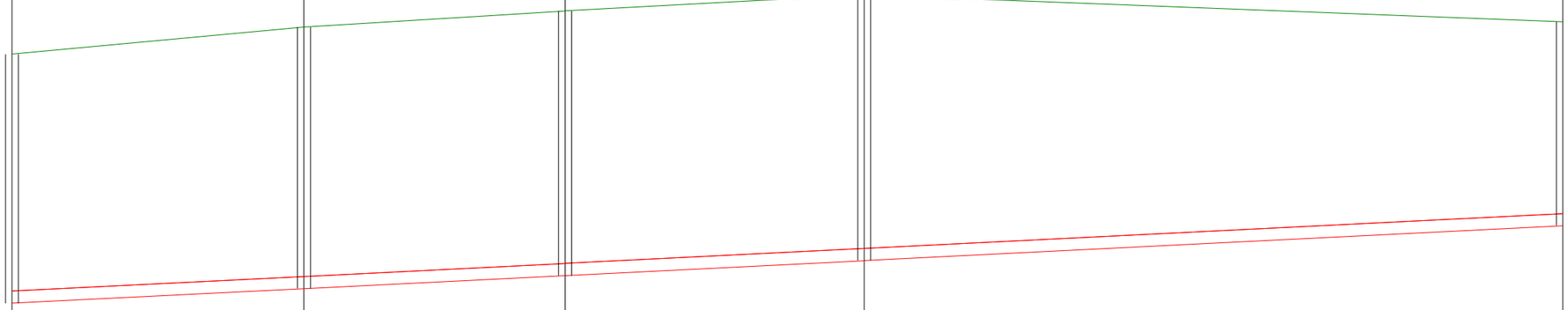
MH Name		F.A7	F.A6	F.A3	F.A2	F.A1	
Hor Scale 500 Ver Scale 100 Datum (m) 4.000							
PN		F1.003	F1.002	F1.001	F1.000		
Dia (mm)		225	225	225	225		
Slope (1:X)		150.2	149.8	150.1	60.0		
Cover Level (m)	14.300	14.280	14.680	14.090	13.400		
Invert Level (m)	10.953	11.133	11.133	11.598	11.598	11.732	11.732	11.970	
Length (m)		27.027	69.671	20.109	14.279		



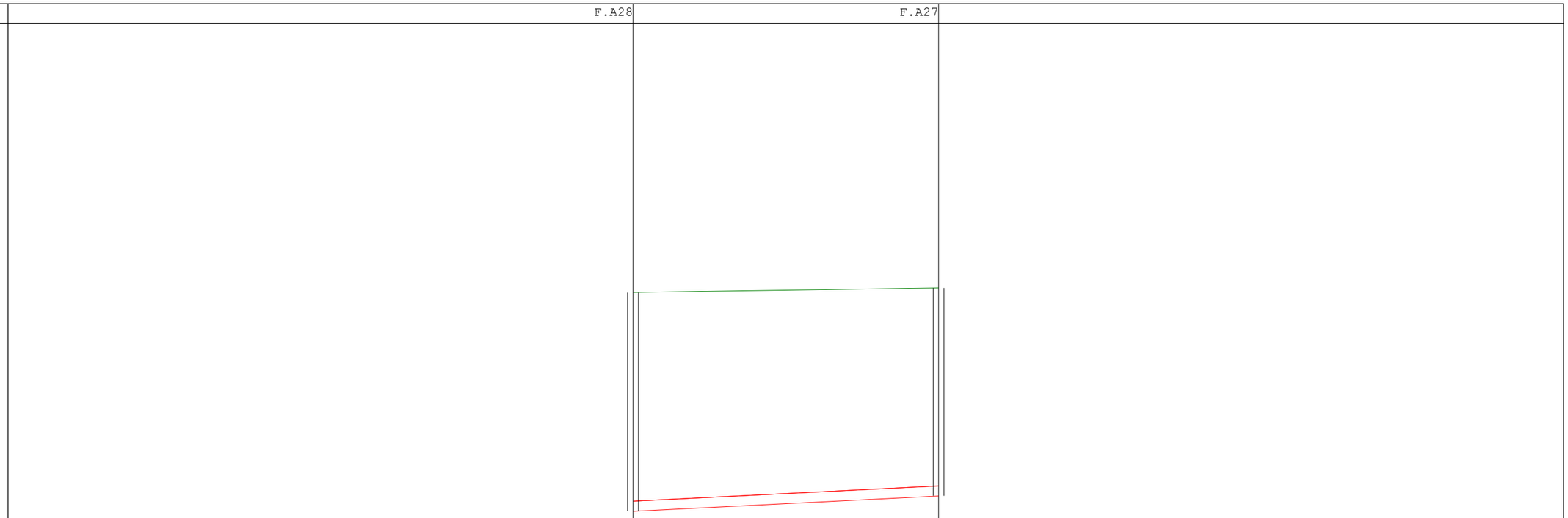
MH Name		F.A20	F.A14	F.A13	F.A12	F.A8	F.A7	
Hor Scale 500 Ver Scale 100 Datum (m) 3.000								
PN			F1.008	F1.007	F1.006	F1.005	F1.004	
Dia (mm)			225	225	225	225	225	
Slope (1:X)			27.0	24.0	149.8	150.0	150.1	
Cover Level (m)		12.100	12.300	12.600	13.300	13.800	14.300	
Invert Level (m)			9.140 9.403	9.403 10.366	10.366 10.550	10.550 10.745	10.745 10.953	
Length (m)			7.094	23.108	27.571	29.246	31.230	

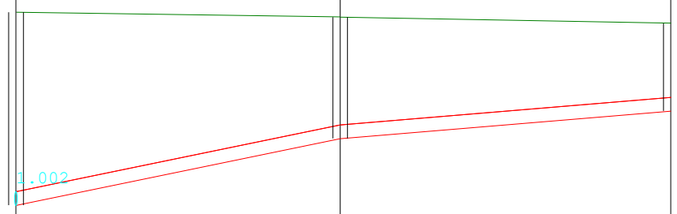


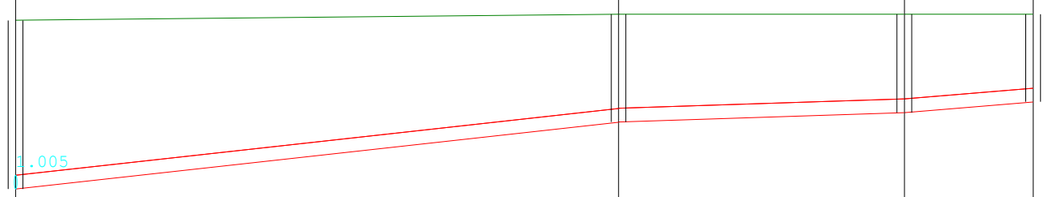
MH Name	F.A23	F.A22	F.A21	F.A20	
Hor Scale 500 Ver Scale 100 Datum (m)2.000					
PN		F1.011	F1.010	F1.009	
Dia (mm)		225	225	225	
Slope (1:X)		100.0	100.1	100.0	
Cover Level (m)	11.600	11.900	12.400	12.100	
Invert Level (m)	7.824	8.187 8.187	8.562 8.562	9.140	
Length (m)		36.298	37.535	57.818	

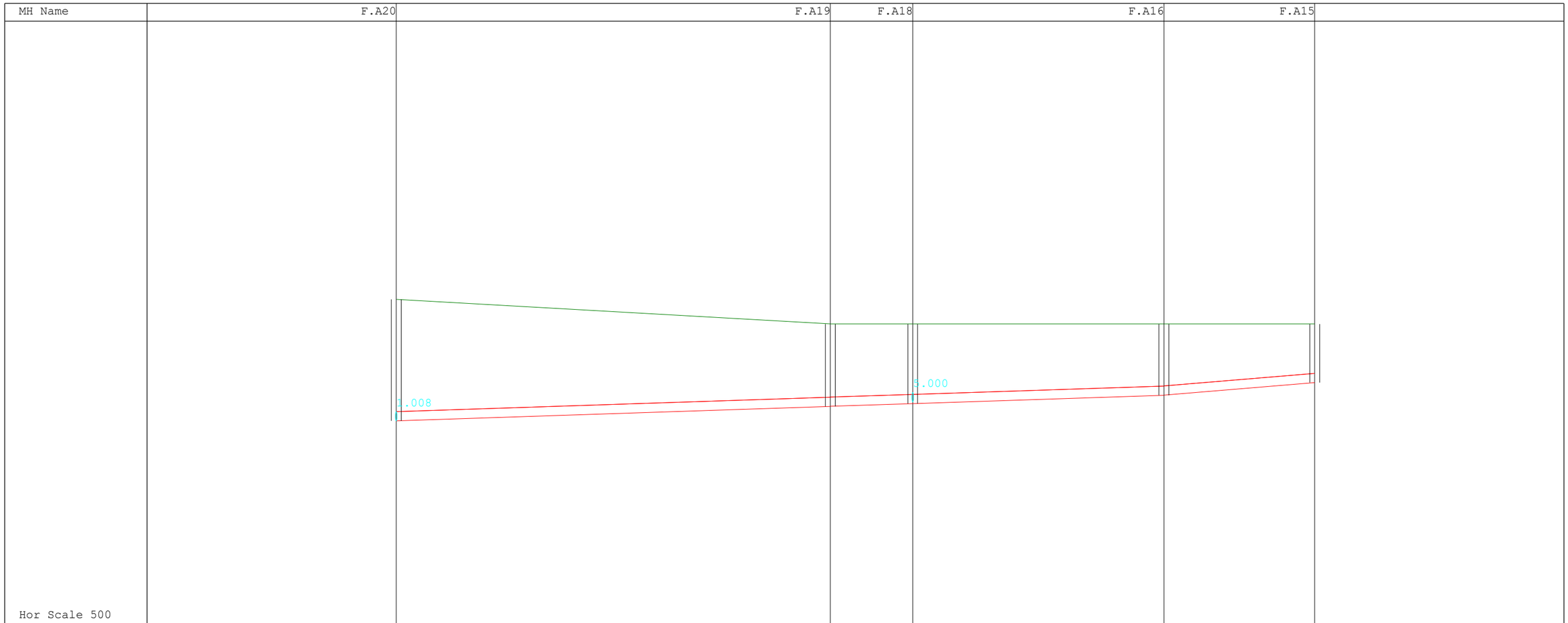


MH Name		F.A27	F.A26	F.A25	F.A24	F.A23	
Hor Scale 500 Ver Scale 100 Datum (m) 1.000							
PN			F1.015	F1.014	F1.013	F1.012	
Dia (mm)			225	225	225	225	
Slope (1:X)			100.1	99.9	100.0	100.0	
Cover Level (m)		11.000	11.500	11.800	12.100	11.600	
Invert Level (m)		6.388	6.658	6.658	6.900	6.900	7.177	7.177	7.824	
Length (m)			27.035	24.176	27.697	64.690	

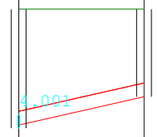
MH Name	F.A28	F.A27	
			
Hor Scale 500 Ver Scale 100 Datum (m) 0.000			
PN		F1.016	
Dia (mm)		225	
Slope (1:X)		100.1	
Cover Level (m)	10.900	11.000	
Invert Level (m)	6.049	6.388	
Length (m)		33.938	

MH Name	F.A6	F.A5	F.A4	
				
Hor Scale 500 Ver Scale 100 Datum (m) 4.000				
PN		F2.001	F2.000	
Dia (mm)		225	225	
Slope (1:X)		24.3	60.0	
Cover Level (m)	14.280	14.200	14.100	
Invert Level (m)	11.133	12.221	12.221 12.670	
Length (m)		26.434	26.947	

MH Name	F.A12	F.A11	F.A10	F.A9	
					
Hor Scale 500 Ver Scale 100 Datum (m) 4.000					
PN		F3.002	F3.001	F3.000	
Dia (mm)		225	225	225	
Slope (1:X)		45.1	150.3	60.0	
Cover Level (m)	13.300	13.400	13.400	13.400	
Invert Level (m)	10.550	11.640 / 11.640	11.795 / 11.795	11.970	
Length (m)		49.153	23.302	10.497	



MH Name		F.A20		F.A19	F.A18	F.A16	F.A15	
Hor Scale 500 Ver Scale 100 Datum (m)2.000								
PN			F4.003		F4.002	F4.001	F4.000	
Dia (mm)			225		225	225	225	
Slope (1:X)			149.9		150.0	150.1	60.1	
Cover Level (m)		12.100		11.500	11.500	11.500	11.500	
Invert Level (m)			9.140	9.493	9.493 9.560	9.560 9.764	9.764 10.070	
Length (m)			52.923		10.047	30.621	18.382	

MH Name	F.A18	F.A17	
			
Hor Scale 500 Ver Scale 100 Datum (m)2.000			
PN		F5.000	
Dia (mm)		225	
Slope (1:X)		22.0	
Cover Level (m)	11.500	11.500	
Invert Level (m)	9.605	10.070	
Length (m)		10.220	

Appendix 6

PRIORITY GEOTECHNICAL LTD - GROUND INVESTIAGTION

Our Ref: JMS/Rp/P21239 + attachments (*.pdf)

16th March, 2022

JB Barry & Partners Limited
3 Eastgate Road,
Eastgate Business Park,
Little Island,
Co. Cork,
T45 KH74.

Re: Bessborough SHD Sites, Site Investigation, Factual report.

Introduction

In November 2021, Priority Geotechnical (PGL) were requested by JB Barry & Partners Limited acting on behalf of their client Estuary View Enterprises to undertake a site investigation as part of the Bessborough SHD Sites project.

Objectives

The objective of the site investigation contract is to determine the ground and groundwater conditions in order to inform the engineering design solutions for the proposed development.

Scope

The original scope of the site investigation, which was specified by JB Barry & Partners, comprised of:

- 06Nr. Cable percussion boreholes;
- Trial pits;
- Surveying of 'as-built' levels and co-ordinates;
- All associated sampling;
- All associated laboratory works;
- Associated reporting;

The final site works as completed is outlined, herein. This geotechnical data report presents the fieldworks records with regard to the site investigation for the Bessborough SHD Sites Project. The report should be read in conjunction with the exploratory records, the photographic records and the laboratory test data accompanying this report.

Site Works

This investigation was carried out in accordance with Eurocode 7- Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9).

The direct intrusive fieldworks were undertaken from the 10th and 17th January, 2022 to under the supervision of PGL, Engineering Geologist(s). Details of the plant and equipment used are detailed on the relevant exploratory records, accompanying this report.

Cable Percussion Boreholes

Six (06) cable percussion boreholes were drilled to depths 4.4m below existing ground level (bgl) to 9.1m bgl using PGL's Dando 2000 Rig and 200mm diameter casing. The logs are accompanying this factual report.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
BH01	4.4	13/01/2022
BH02	9.1	10/01/2022
BH03	8.4	12/01/2022
BH04	7.3	14/01/2022
BH05	7.4	17/01/2022
BH06	7.0	13/01/2022

Chiselling				
Location	**Depth Top (m bgl)**	**Depth Base (m bgl)**	**Duration (hh:mm)**	**Tool**
BH01	1.20	1.30	01:00	Chisel.
	4.30	4.40	01:00	Chisel.
BH02	2.75	2.90	01:00	Chisel.
	8.90	9.10	01:00	Chisel.
BH03	4.90	5.00	01:00	Chisel.
	8.30	8.40	01:00	Chisel.
BH04	3.80	4.00	01:00	Chisel.
	7.20	7.30	01:00	Chisel.
BH05	6.70	6.90	01:00	Chisel.
	7.30	7.40	01:00	Chisel.
BH06	5.75	5.95	01:00	Chisel.
	6.90	7.00	01:00	Chisel.

Trial Pits

Seven (07) trial pits were excavated to depths 0.3m bgl to 4.6m bgl using a 14t tracked excavator. The exploratory logs and photographic records accompany this factual report.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
TP01	3.9	11/01/2022
TP02	3.2	10/01/2022
TP03	4.5	11/01/2022
TP04	4.5	13/01/2022
TP05	4.5	14/01/2022
TP06	0.3	12/01/2022
TP06A	4.6	12/01/2022

Sampling

A total of sixty two (62) bulk disturbed samples (B) and twenty two (22) small disturbed samples (D) were recovered from the exploratory holes in accordance with Geotechnical Investigation and Sampling – Sampling Methods and Groundwater Measurements (EN ISO 22475-1:2006).

***In-Situ* Testing**

Standard Penetration Tests (SPT)

A total of thirty nine (39) standard penetration tests, were carried out in the cable percussion boreholes using the 60^{o} solid cone (CPT) in place of the standard split barrel sampler. The data was presented on the relevant logs accompanying this factual report.

Falling Head Tests

Two (02) *in situ* falling head permeability tests were carried out in boreholes; in accordance with BS5930: 1999, Section 4: Cl. 25.4, within the superficial deposits over duration of one (1) hour. The processed test data was presented on the relevant borehole log presented accompanying this factual report. The shape or intake factor, f was derived from the condition at the base of the borehole at the test depth and test geometry as per Hvorslev (1951).

$$k = \frac{A}{fd} \frac{\log_e (H_0 / H_t)}{t}$$

Generally for all tests the specific depth range of the test was the deposits below the depth of casing. A mean k measured ($k_H = k_V$), permeability in the soil was assumed equal in both horizontal and vertical direction, ($k_H / k_V = 1.$). The test geometry provided a shape factor, f for the test undertaken in the standpipe well.

Dynamic Probing

PGL's Competitor dynamic probing rig was used to undertake dynamic probing (DP(H); 50kg drop weight, 500mm drop height) in general accordance with Geotechnical Investigation and Testing, Part 2, Dynamic probing, BS EN ISO 22476-2:2005. The blows per 100mm ($N_{100\,H}$) were recorded to refusal being 25blows without progress over 100mm. Six (06) number dynamic probes progressed to refusal at depths 2.7m bgl to 8.8m bgl. The exploratory logs accompany this factual report.

Location	Refusal depth, m bgl
DP01	3.7
DP02	8.8
DP03	2.7
DP04	5.0
DP05	3.0
DP06	3.5

Survey and Drawings

The 'as built' exploration locations were surveyed to the Ordinance Survey Irish Transverse Mercator system of co-ordinates (ITM) and elevations to Malin Head datum and shown on the relevant exploratory logs and the Exploratory Location Plans (P21239-SI-A, P21239-SI-01) accompanying this report.

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
BH01	171820.78	70468.88	16.64	4.40	13/01/2022
BH02	171741.94	70395.18	13.07	9.10	10/01/2022
BH03	171738.42	70311.70	11.49	8.40	12/01/2022
BH04	172026.44	70364.45	12.50	7.30	14/01/2022
BH05	172034.00	70300.87	12.21	7.40	17/01/2022
BH06	171946.00	70338.05	13.57	7.00	13/01/2022
DP01	171821.58	70465.48	16.54	3.70	13/01/2022
DP02	171742.31	70392.88	12.93	8.80	13/01/2022
DP03	171735.89	70311.95	11.53	2.70	13/01/2022
DP04	172027.93	70363.86	12.40	5.00	13/01/2022
DP05	172033.97	70304.80	12.21	3.00	14/01/2022
DP06	171944.50	70343.17	13.61	3.50	13/01/2022
TP01	171822.48	70466.73	16.60	3.90	11/01/2022
TP02	171742.96	70394.13	13.04	3.20	10/01/2022
TP03	171736.67	70314.17	11.80	4.50	11/01/2022
TP04	172026.89	70362.36	12.35	4.50	13/01/2022
TP05	172033.99	70303.02	12.21	4.50	14/01/2022
TP06	171940.73	70337.93	13.69	0.30	12/01/2022
TP06A	171944.88	70339.22	13.61	4.60	12/01/2022

Laboratory Testing

Laboratory testing was ongoing at the time of reporting.

Published Geology

A search of the Geological Survey data base and 1:100,000 mapping (Sheet 25) identified two (02) major lithological units defining the area. The majority of the site is underlain by Waulsortian Limestones (WA) described as massive unbedded Lime-Mudstones. The Little Island Formation (LI) is mapped to the north and defined by massive and crinoidal fine Limestone.

Teagasc subsoil mapping indicates that the area is underlain by Made Ground deposits. The National Groundwater Vulnerability mapping indicates the area mostly has a rating of high vulnerability.

Ground and Groundwater Conditions

The full details of the ground conditions encountered are provided for on the exploratory records accompanying this report. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002),– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, *in situ* testing and details of the samples taken, together with any observations made during the ground investigation.

Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc. Low volume groundwater flow may be cut-off by borehole casing as it progresses in stiff glacial deposits. The duration trial pit excavations remain open may not be sufficient to allow for low volume flow to present. The groundwater regime should be assessed from standpipe well installations.

Groundwater was encountered at depths 3.10m bgl to 3.90m bgl during the period of fieldworks within the extent of the borehole and pit excavations, summarised below. The exploratory locations were backfilled with grout, gravel and arisings.

SUMMARY OF GROUNDWATER

Location	Depth Strike (m bgl)	Remarks	Standpipe (Y/N)
BH01	-	None encountered.	N
BH02	-	None encountered.	Y
BH03	-	None encountered.	N
BH04	-	None encountered.	N
BH05	-	None encountered.	N
BH06	-	None encountered.	Y
TP01	-	None encountered.	N
TP02	-	None encountered.	N
TP03	-	None encountered.	N
TP04	3.9	Trickle rate of flow	N
TP05	3.9	Slow rate of flow	N
TP06	-	None encountered.	N
TP06A	3.1	Trickle rate of flow	N

Two (02) number 50mm dia. HDPE standpipe wells were constructed to allow for groundwater monitoring. The construction details are summarised below.

SUMMARY OF STANDPIPE CONSTRUCTION

Location	Depth Top (m bgl)	Depth Base (bgl)	Diameter (mm)	Pipe Type	Pipe Details
BH02	0.00	2.00	50	PLAIN	Plain.
	2.00	8.50	50	SLOTTED	Slotted.
BH06	0.00	3.50	50	PLAIN	Plain.
	3.50	7.00	50	SLOTTED	Slotted.

Exploratory locations were backfilled with their arisings or gravel and bentonite for locations with monitoring wells. Backfill details are displayed graphically on the accompanying logs and summarised below.

SUMMARY OF STANDPIPE DIPS

Location	08/02/2022
	Depth (m bgl)
BH02	Dry
BH06	4.4

SUMMARY OF BACKFILL

GRAVEL Backfill to installation/borehole

ARISINGS Backfill

uPVC slotted pipe

BENTONITE Backfill to installation

Should you have any queries in relation to the data collected and presented herein, please do not hesitate to contact our office.

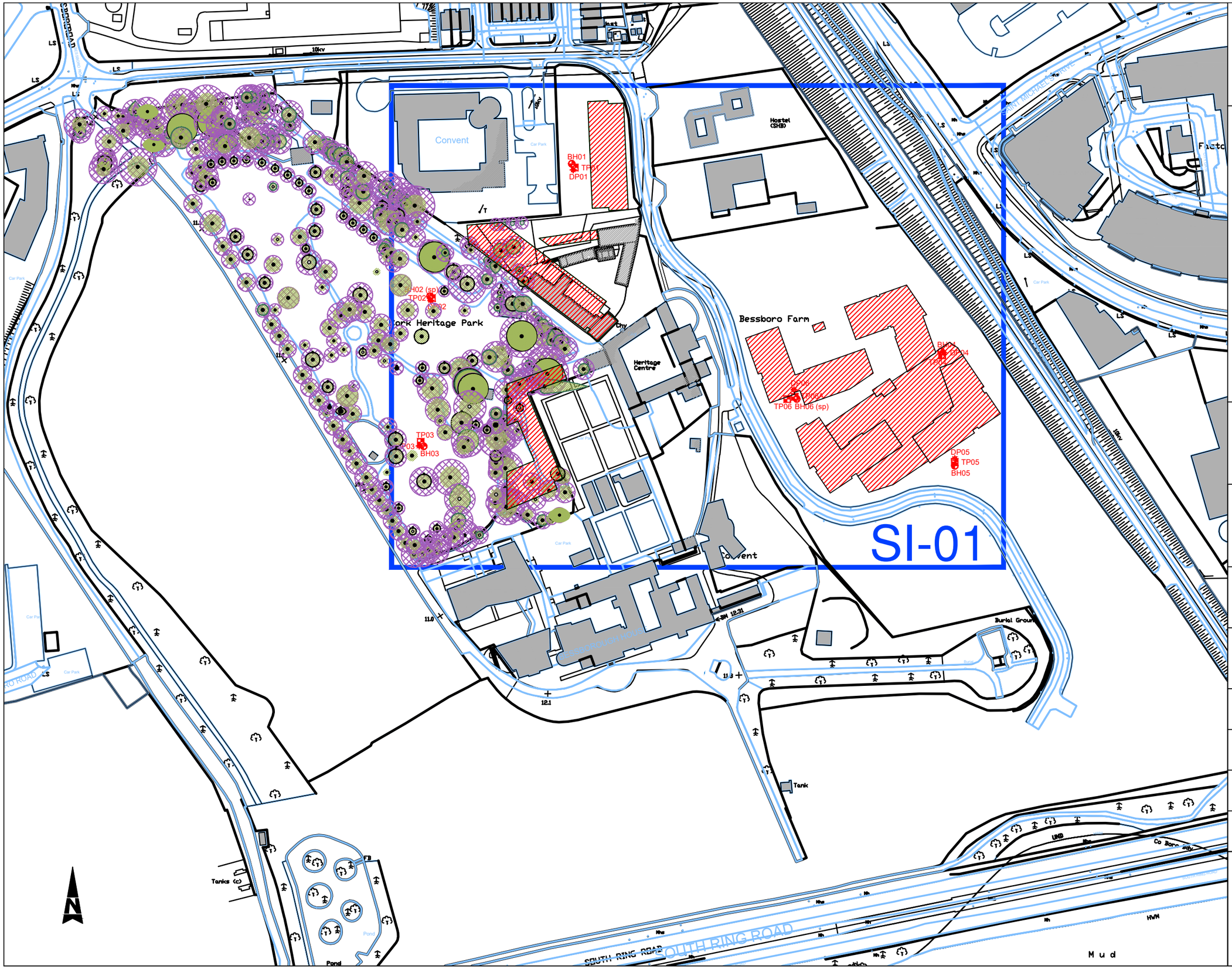
Yours sincerely,
For **Priority Geotechnical,**

James McSweeney BSc
Engineering Geologist

No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations.

No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.

This report has been prepared for Employer and their Representative as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.



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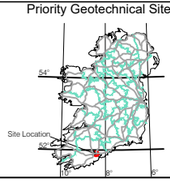

JOB NAME:

Bessborough SHD

Sheet Title:

EXPLORATORY LOCATION LAYOUT

JOB NUMBER:

P21239

DRAWING NUMBER:

P21239-SI-A

DRAWN BY:

Gary Curtin

DATE:

08/12/2021

SCALE:	APPROVED:
1:2000 ON A3	GH

REVISION:

D01

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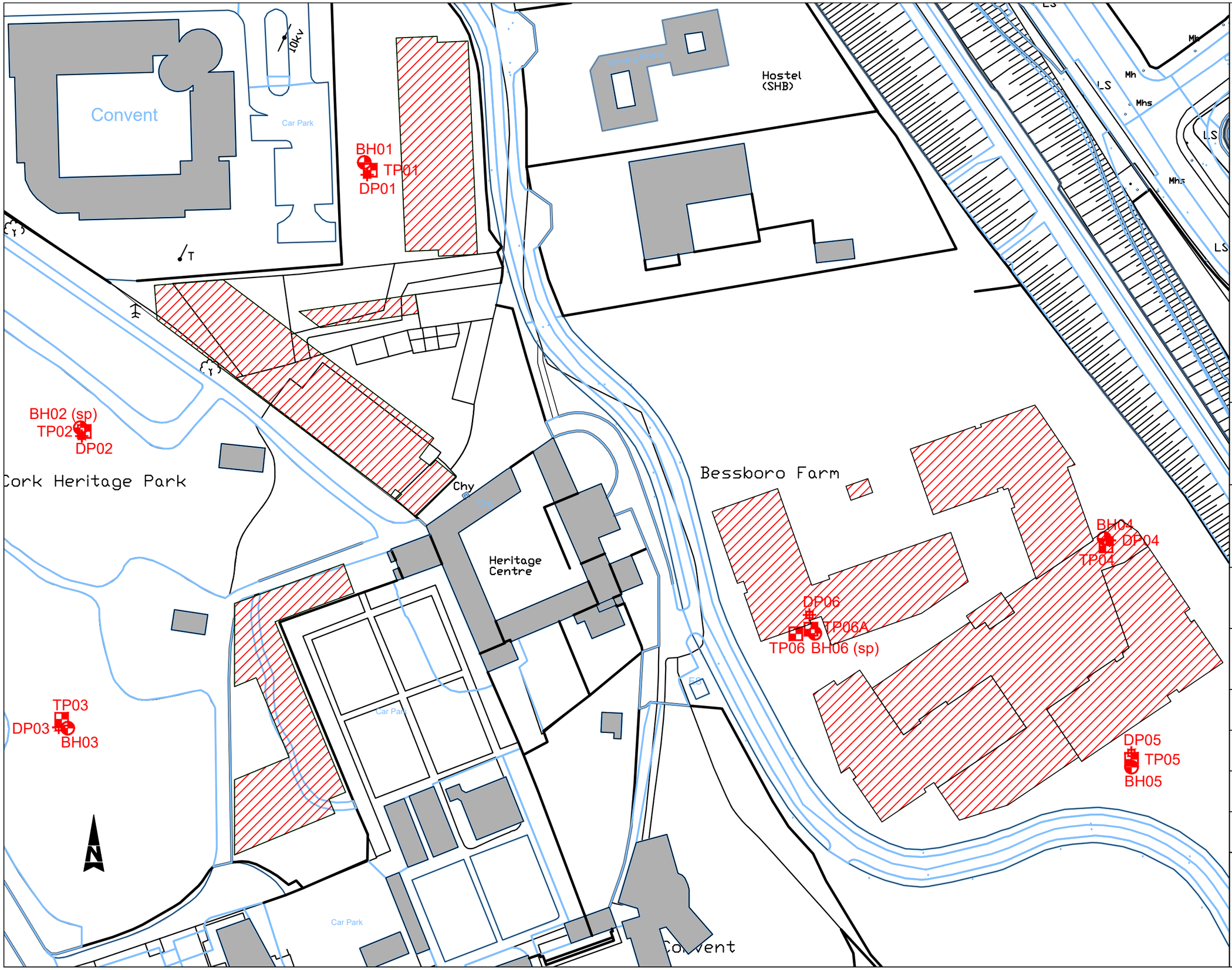

KEY:

- TP00 Denotes Trial Pit location
- BH00 Denotes Borehole location
- DP00 Denotes Dynamic Probe location

Coordinates shown on ING.

TP01	171822.5	70466.7	16.6
TP02	171743	70394.1	13.04
TP03	171736.7	70314.2	11.8
TP04	172026.9	70362.4	12.35
TP05	172034	70303	12.213
TP06	171940.7	70337.9	13.69
TP06A	171944.9	70339.2	13.61
BH01	171820.8	70468.9	16.64
BH02 (sp)	171741.9	70395.2	13.07 stand pipe
BH03	171738.4	70311.7	11.49
BH04	172026.4	70364.5	12.5
BH05	172034	70300.9	12.21
BH06 (sp)	171946	70338.1	13.57 stand pipe
DP01	171821.6	70465.5	16.54
DP02	171742.3	70392.9	12.93
DP03	171735.9	70312	11.53
DP04	172027.9	70363.9	12.4
DP05	172034	70304.8	12.21
DP06	171944.5	70343.2	13.61

JOB NAME:

Bessborough SHD

Sheet Title:

EXPLORATION LOCATION PLAN

JOB NUMBER:

P21239

DRAWING NUMBER:

P21239-SI-01

DRAWN BY:

Gary Curtin

DATE:

05/12/2021

SCALE:

1:1000 ON A3

APPROVED:

GH

REVISION:

D01

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KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

**	Drillers Description
Friable	Easily crumbled

SAMPLES

U( )	Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler
U( )F, U( )P	F- not recovered, P-partially recovered
U38	Undisturbed 38mm diameter sample
P(F), (P)	Piston sample - disturbed
B	Bulk sample - disturbed
D	Jar Sample - disturbed
W	Water Sample
CBR	California Bearing Ratio mould sample
ES	Chemical Sample for Contamination Analysis
SPTLS	Standard Penetration Test S lump sample from split sampler

CORE RECOVERY AND ROCK QUALITY

TCR	Total Core Recovery (% of Core Run)
SCR	Solid Core Recovery (length of core having at least one full diameter as % of core run)
RQD	Rock Quality Designation (length of solid core greater than 100mm as % of core run)
Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column	
If	Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery
AZCL	Assumed Zone of Core Loss
NI	Non intact

GROUNDWATER

▽	Groundwater strike
▼	Groundwater level after standing period
Date/Water	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

INSITU TESTING

S	Standard Penetration Test - split barrel sampler
C	Standard Penetration Test - solid 60° cone
SW	Self Weight Penetration
Ivp, HVp (R)	In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F), (C), (R), (P)	Permeability Test
HP	Hand Penetrometer Test

MEASURED PROPERTIES

N	Standard Penetration Test - blows required to drive 300mm after seating drive
x/y	Denotes x blows for y mm within the Standard Penetration Test
x*/y	Denotes x blows for y mm within the seating drive
c_u	Undrained Shear Strength (kN/m^2)
CBR	California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

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Key Sheet

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Drilled By	Borehole No.
PC	BH01
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171821E - 70469N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	16.64 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	13/01/2022 - 14/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Driller describes: Fill clay with limestone boulders.
		1.00 - 2.00 1.00	B SPT (C)	65 (5,10/65 for 150mm)	1.00	15.64		Firm, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular, limestone with dia 63-80mm. *1.20m - 1.30m: Driller noted: Boulders. Increased SPT blow counts locally.*
		2.00 - 3.00 2.00	B SPT (C)	N=15 (3,3/4,4,3,4)				
		3.00 - 4.00 3.00	B SPT (C)	N=15 (3,3/4,4,3,4)	3.00	13.64		Firm, brown red, slightly sandy slightly gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-rounded, limestone with dia 63-120mm. Driller describes: Hard gravelly clay with boulders.
		4.00	SPT (C)	90 (9,10/90 for 225mm)				
					4.40	12.24		End of Borehole at 4.400m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
4.40	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.20	1.30	01:00	Chisel.
4.30	4.40	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 4.40m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	13/01/2022 08:00	0.00	Start of shift.
Dry	13/01/2022 18:00	2.00	End of shift.
Dry	14/01/2022 08:00	2.00	Start of shift.
Dry	14/01/2022 18:00	4.40	End of borehole.

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Drilled By	Borehole No.
PC	**BH02**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171742E - 70395N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	13.07 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	10/01/2022 - 11/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Driller describes: Gravel clay.
		1.00 - 2.00 1.00	B SPT (C)	N=6 (1,1/1,1,2,2)	1.00	12.07		Soft, brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Driller describes: Gravelly clay.
		2.00 - 3.00 2.00	B SPT (C)	N=7 (1,1/1,2,2,2)				*2.00m - 3.00m: Driller noted: Boulders.*
		3.00 - 4.00 3.00	B SPT (C)	N=12 (3,3/2,3,3,4)	3.00	10.07		Firm to stiff, brown red, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-rounded, Limestone with dia 63-170mm dia.
		4.00 - 5.00 4.00	B SPT (C)	N=21 (4,4/5,5,6,5)				
		5.00 - 6.00 5.00	B SPT (C)	N=24 (5,6/5,6,7,6)	5.00	8.07		Stiff, brown red, slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-rounded, limestone with dia 63-170. Driller describes: boulders.
		6.00 - 7.00 6.00	B SPT (C)	N=29 (6,6/7,7,8,7)				
		7.00 - 8.00 7.00	B SPT (C)	N=33 (7,7/8,8,9,8)				
		8.00	SPT (C)	N=32 (7,8/9,5,9,9)				
					9.10	3.97		End of Borehole at 9.100m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
9.10	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.75	2.90	01:00	Chisel.
8.90	9.10	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 9.10m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	10/01/2022 08:00	0.00	Start of shift.
	10/01/2022 18:00	0.00	End of shift.
	11/01/2022 08:00	0.00	Start of shift.
Dry	11/01/2022 18:00	9.10	End of borehole.

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Drilled By	Borehole No.
PC	**BH03**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171738E - 70312N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	11.49 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	12/01/2022 - 12/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Soft becoming firm, brown red, slightly sandy slightly gravelly CLAY.
		1.00 - 2.00 1.00	B SPT (C)	N=7 (1,1/1,2,2,2)				
		2.00 - 3.00 2.00	B SPT (C)	N=7 (1,1/2,2,1,2)				
		3.00 - 4.00 3.00	B SPT (C)	N=10 (2,3/3,2,3,2)				
		4.00 - 5.00 4.00	B SPT (C)	N=20 (3,4/4,5,5,6)	4.00	7.49		Stiff, brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse.
		5.00 - 6.00 5.00	B SPT (C)	N=26 (6,7/6,6,7,7)	5.00	6.49		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-80mm.
		6.00 - 7.00 6.00	B SPT (C)	N=28 (7,6/6,8,7,7)	6.00	5.49		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-80mm.
		7.00 - 8.00 7.00	B SPT (C)	N=34 (7,8/8,9,8,9)				*6.00m - 8.40m: Driller noted Boulder content.*
		8.00 - 8.40 8.00	B SPT (C)	40 (9,10/40 for 150mm)				
					8.40	3.09		End of Borehole at 8.400m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
8.40	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
4.90	5.00	01:00	Chisel.
8.30	8.40	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 8.40m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	12/01/2022 08:00	0.00	Start of shift.
Dry	12/01/2022 18:00	8.40	End of borehole.

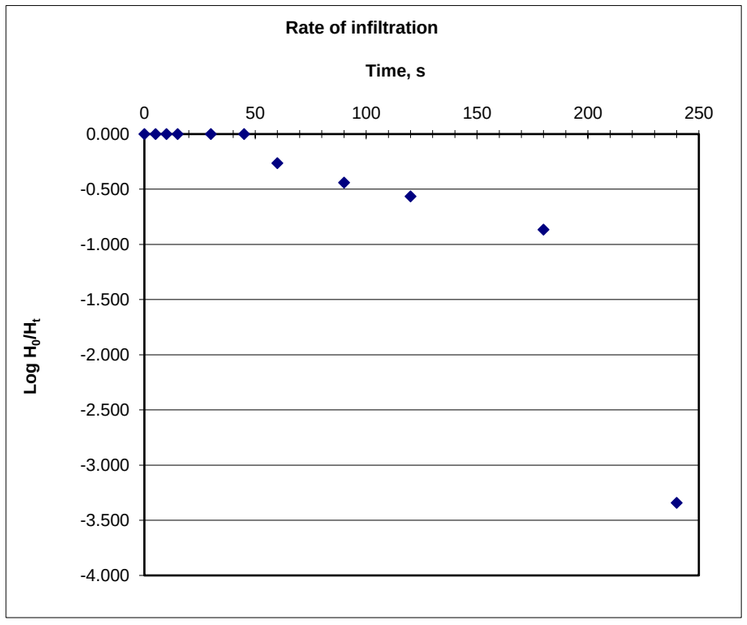
P21239 Falling head permeability test

Location	**Bessborough SHD**		
BH ID	**BH03**	H_w / H_o	**2.20**
Test	**1**		
Casing diameter	**200** mm		
Casing depth	**2.00** m		
Borehole depth	**2.20** m		
GW Influence	**2.20** m bgl		
Date	**12/01/2022**		

Min	Sec	depth, m bgl	vol, cu.m	H_t	log H_0/H_t
0	0	0.000	0.00000	2.200	0.000
0.083	5	0.000	0.00000	2.200	0.000
0.17	10	0.000	0.00000	2.200	0.000
0.25	15	0.000	0.00000	2.200	0.000
0.5	30	0.000	0.00000	2.200	0.000
0.75	45	0.000	0.00000	2.200	0.000
1	60	1.000	0.03140	1.200	-0.263
1.5	90	1.400	0.04396	0.800	-0.439
2	120	1.600	0.05024	0.600	-0.564
3	180	1.900	0.05966	0.300	-0.865
4	240	2.199	0.06905	0.001	-3.342

k_{mean} **1.12E-03 ms^{-1}**

$k_H = k_V$



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Drilled By PC
Logged By CS

Borehole No. **BH04** Sheet 1 of 1

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172026E - 70364N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	12.50 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	14/01/2022 - 14/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
								Dark brown, slightly sandy slightly gravelly SILT with plant material.	
		1.00 - 2.00 1.00	B SPT (C)	N=9 (1,1/2,2,3,2)	1.00	11.50		Firm, dark brown, slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse.	1
		2.00 - 3.00 2.00	B SPT (C)	N=9 (2,2/2,3,2,2)	2.00	10.50		Firm, brown, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-120mm.	2
		3.00 - 4.00 3.00	B SPT (C)	N=14 (2,3/3,4,3,4)	3.00	9.50		Firm to stiff, brown, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-120mm. Driller describes: boulders.	3
		4.00 - 5.00 4.00	B SPT (C)	N=22 (4,4/5,6,5,6)					4
		5.00 - 6.00 5.00	B SPT (C)	N=29 (6,5/7,7,8,7)	5.00	7.50		Stiff, brown, slightly sandy slightly gravelly silty CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-70mm. Boulders are sub-rounded, Limestone with dia 200.	5
		6.00 - 7.00 6.00	B SPT (C)	N=37 (7,8/8,9,9,11)	6.00	6.50		Stiff, brown, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-90mm.	6
		7.00	SPT (C)	75 (10,15/75 for 150mm)					7
					7.30	5.20		End of Borehole at 7.300m	8
									9

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
7.30	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
3.80	4.00	01:00	Chisel.
7.20	7.30	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 7.30m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	14/01/2022 08:00	0.00	Start of shift.
Dry	14/01/2022 18:00	7.30	End of borehole.

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Drilled By	Borehole No.
PC	**BH05**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172034E - 70301N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	12.21 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	17/01/2022 - 17/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Firm becoming stiff, brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		1.00 - 2.00 1.00	B SPT (C)	N=8 (1,1/2,2,2,2)				
		2.00 - 3.00	B					
		3.00	SPT (C)	N=13 (2,3/3,4,3,3)				
		4.00 - 5.00 4.00	B SPT (C)	N=16 (3,4/3,4,4,5)				
		5.00 - 6.00 5.00	B SPT (C)	N=30 (5,6/7,7,8,8)	5.00	7.21		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, 63-120mm dia., Limestone lithology.
		6.00 - 7.00 6.00	B SPT (C)	N=38 (7,8/9,9,10,10)	6.00	6.21		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub--rounded. Cobbles are sub-angular to sub-rounded, 63-120mm dia., Limestone lithology. Boulders are sub-angular, 200-250mm dia., Limestone lithology.
		7.00	SPT (C)	90 (9,10/90 for 225mm)				
					7.40	4.81		End of Borehole at 7.400m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
7.40	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
6.70	6.90	01:00	Chisel.
7.30	7.40	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 7.40m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	17/01/2022 08:00	0.00	Start of shift.
Dry	17/01/2022 18:00	7.40	End of borehole.

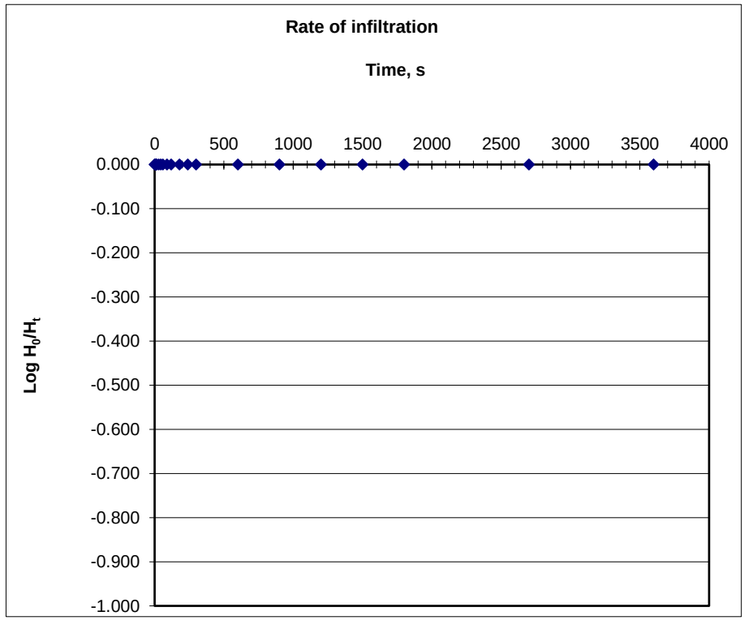
P21239 Falling head permeability test

Location	**Bessborough SHD**		
BH ID	**BH05**	H_w / H_o	**2.00**
Test	**1**		
Casing diameter	**200** mm		
Casing depth	**1.50** m		
Borehole depth	**2.00** m		
GW Influence	**2.00** m bgl		
Date	**17/01/2022**		

Min	Sec	depth, m bgl	vol, cu.m	H_t	log H_0/H_t
0	0	0.000	0.00000	2.000	0.000
0.083	5	0.000	0.00000	2.000	0.000
0.17	10	0.000	0.00000	2.000	0.000
0.25	15	0.000	0.00000	2.000	0.000
0.5	30	0.000	0.00000	2.000	0.000
0.75	45	0.000	0.00000	2.000	0.000
1	60	0.000	0.00000	2.000	0.000
1.5	90	0.000	0.00000	2.000	0.000
2	120	0.000	0.00000	2.000	0.000
3	180	0.000	0.00000	2.000	0.000
4	240	0.000	0.00000	2.000	0.000
5	300	0.000	0.00000	2.000	0.000
10	600	0.000	0.00000	2.000	0.000
15	900	0.000	0.00000	2.000	0.000
20	1200	0.000	0.00000	2.000	0.000
25	1500	0.000	0.00000	2.000	0.000
30	1800	0.000	0.00000	2.000	0.000
45	2700	0.000	0.00000	2.000	0.000
60	3600	0.000	0.00000	2.000	0.000

k_{mean} - ms^{-1}

$k_H = k_V$



Notes:
No Change in groundwater level observed after 60 mins. Infiltration rate mot determined.

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Drilled By	Borehole No.
PC	**BH06**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171946E - 70338N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	13.57 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	13/01/2022 - 13/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown, CLAY.
		1.00 - 2.00 1.00	B SPT (C)	N=6 (1,1/2,2,1,1)	1.00	12.57		Soft becoming stiff, brown red, slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		2.00 - 3.00 2.00	B SPT (C)	N=8 (1,1/2,2,2,2)				
		3.00 - 4.00 3.00	B SPT (C)	N=9 (2,2/3,2,2,2)				
		4.00 - 5.00 4.00	B SPT (C)	N=13 (3,2/3,3,4,3)				*4.00m - 6.00m: Driller described: 'wet' soils.*
		5.00 - 6.00 5.00	B SPT (C)	N=28 (4,6/6,7,7,8)				
		6.00 - 7.00 6.00	B SPT (C)	N=33 (7,7/8,8,9,8)	6.00	7.57		Stiff, brown red, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular, limestone with dia 63-130mm.
					7.00	6.57		End of Borehole at 7.000m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
7.00	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
5.75	5.95	01:00	Chisel.
6.90	7.00	01:00	Chisel.

Remarks:
Cable percussion borehole terminated at 7.0m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	13/01/2022 08:00	0.00	Start of shift.
Dry	13/01/2022 18:00	7.00	End of borehole.

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Trial Pit No **TP01** Sheet 1 of 1

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:** 171822E - 70467N **Level:** 16.60m OD	**Date** 11/01/2022
Location:	Mahon, Cork		**Dimensions (m):** 3.60 x 1.10	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Depth:** 3.90m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20	16.40		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
							(MADE GROUND) Soft to firm, brown, slightly sandy slightly gravelly CLAY with pottery fragments, blocks, timber and plastics. Sand is fine to coarse, Gravel is fine to coarse, sub-rounded to rounded.
	0.70 - 1.50 0.70 - 1.50	B D		0.65	15.95		Soft to firm becoming stiff from 2.80m, brown, slightly sandy slightly gravelly CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded. Boulders sub-rounded to rounded. (Assumed Natural).
	1.50 - 2.50 1.50 - 2.50	B D					
	2.50 - 3.50 2.50 - 3.50	B D					
				3.90	12.70		End of Pit at 3.900m

Stability: Good
Plant: 14T track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 3.90m bgl on rock/ large boulders.

Photographic Record

Number:	**TP01**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

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Trial Pit No **TP02** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171743E - 70394N **Level:** 13.04m OD	**Date** 10/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.20 x 1.00	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 3.20m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	12.74		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
	0.50 - 1.00 0.50 - 1.00	B D					(MADE GROUND) Soft to firm, light brown, slightly sandy slightly gravelly SILT with medium cobble content, medium boulder content and pottery fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded. Cobbles are angular to sub-rounded. Boulders are angular to sub-rounded.
	1.20 - 2.30 1.20 - 2.30	B D		1.20	11.84		Soft, light purple brown, slightly gravelly silty SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded.
	2.30 - 3.20 2.30 - 3.20	B D		2.30	10.74		Soft to firm, purple brown, slightly sandy gravelly CLAY with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded. Boulders are sub-rounded to rounded.
				3.20	9.84		End of Pit at 3.200m

Stability: Poor
Plant: 14T track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 3.20m bgl due to collapsing walls.

Photographic Record

Number:	**TP02**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

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Trial Pit No **TP03** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171737E - 70314N **Level:** 11.80m OD	**Date** 11/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.80 x 1.20	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.50m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.35	11.45		(TOPSOIL) Soft, dark brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded.
	0.50 - 1.50 0.50 - 1.50	B D					(MADE GROUND) Soft to firm, purple brown, slightly sandy gravelly CLAY with medium cobble content and rare pottery and glass fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
				1.10	10.70		(ASSUMED NATURAL) Soft to firm, purple brown, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	1.50 - 2.50 1.50 - 2.50	B D					
	2.50 - 3.50 2.50 - 3.50	B D					
	3.50 - 4.50 3.50 - 4.50	B D					
				4.50	7.30		End of Pit at 4.500m

1 2 3 4 5

Stability: Moderate
Plant: 14T track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated 4.50m bgl, scheduled depth.

Photographic Record

Number:	**TP03**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

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Trial Pit No **TP04** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 172027E - 70362N **Level:** 12.35m OD	**Date** 13/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.60 x 1.10	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.50m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	12.05		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to medium, sub-angular to sub-rounded.
	0.50 - 1.50 0.50 - 1.50	B D					(MADE GROUND): Soft, brown slightly silty slightly gravelly SAND with plastic waste. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
				0.70	11.65		(ASSUMED NATURAL): Soft, brown, slightly silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
	1.50 - 2.50 1.50 - 2.50	B D		1.50	10.85		Soft to firm, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	2.50 - 3.50 2.50 - 3.50	B D					
	3.50 - 4.50 3.50 - 4.50	B D					
				4.50	7.85		End of Pit at 4.500m

1 2 3 4 5

Stability: Moderate
Plant: 14T track machine
Backfill: Arisings.

Groundwater: 3.90m: Trickle rate of flow

Remarks: Trial pit terminated at 4.50m bgl, scheduled depth.

Photographic Record

Number:	**TP04**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

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Trial Pit No **TP05** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 172034E - 70303N **Level:** 12.21m OD	**Date** 14/01/2022
Location: Mahon, Cork		**Dimensions (m):** 4.10 x 1.20	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.50m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	11.91		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to medium, sub-angular to sub-rounded.
							(MADE GROUND) Soft to firm, brown orange, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
	0.70 - 1.50 0.70 - 1.50	B D		0.70	11.51		Firm to stiff, purple brown, slightly sandy slightly gravelly CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded. Boulders are sub-rounded to rounded. (Assumed Natural).
	1.50 - 2.50 1.50 - 2.50	B D					
	2.50 - 3.50 2.50 - 3.50	B D					
	3.50 - 4.50 3.50 - 4.50	B D					
				4.50	7.71		End of Pit at 4.500m

1 2 3 4 5

Stability: Good
Plant: 14T track machine
Backfill: Arisings.

Groundwater: 3.90m: Slow rate of flow

Remarks: Trial pit terminated at 4.50m bgl, scheduled depth.

Photographic Record

Number:	**TP05**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

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Trial Pit No **TP06** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171941E - 70338N **Level:** 13.69m OD	**Date** 12/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.40 x 1.10	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 0.30m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.15	13.54		(TOPSOIL) Soft to firm, slightly sandy slightly gravelly SILT with grass and rootlets.
				0.30	13.39		(MADE GROUND) Firm to stiff, light blue grey, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular.
							Concrete Slab - drain/sewer access cover.
							End of Pit at 0.300m

Stability: Good
Plant: 14T track machine
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 0.30m bgl, due to encountering a concrete slab covering an apparent un-used drain. Pit relocated.

Photographic Record

Number: TP06	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

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Trial Pit No **TP06A** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171945E - 70339N **Level:** 13.61m OD	**Date** 12/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.80 x 1.10	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.60m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.10	13.51		(TOPSOIL) Soft to firm, slightly sandy slightly gravelly SILT with grass and rootlets.
	0.50 - 1.45 0.50 - 1.45	B D					(MADE GROUND) Soft to firm, slightly sandy slightly gravelly CLAY with low cobble content and waste (pottery fragments, glass, plastics). Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	1.50 - 2.50 1.50 - 2.50	B D		1.45	12.16		Soft to firm, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	2.50 - 3.50 2.50 - 3.50	B D					
	3.50 - 4.50 3.50 - 4.50	B D					
				4.60	9.01		End of Pit at 4.600m

1 2 3 4 5

Stability: Good
Plant: 14T track machine
Backfill: Arisings.

Groundwater: 3.10m: Trickle rate of flow

Remarks: Trial pit terminated at 4.60m bgl, scheduled depth.

Photographic Record

Number:	**TP06A**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

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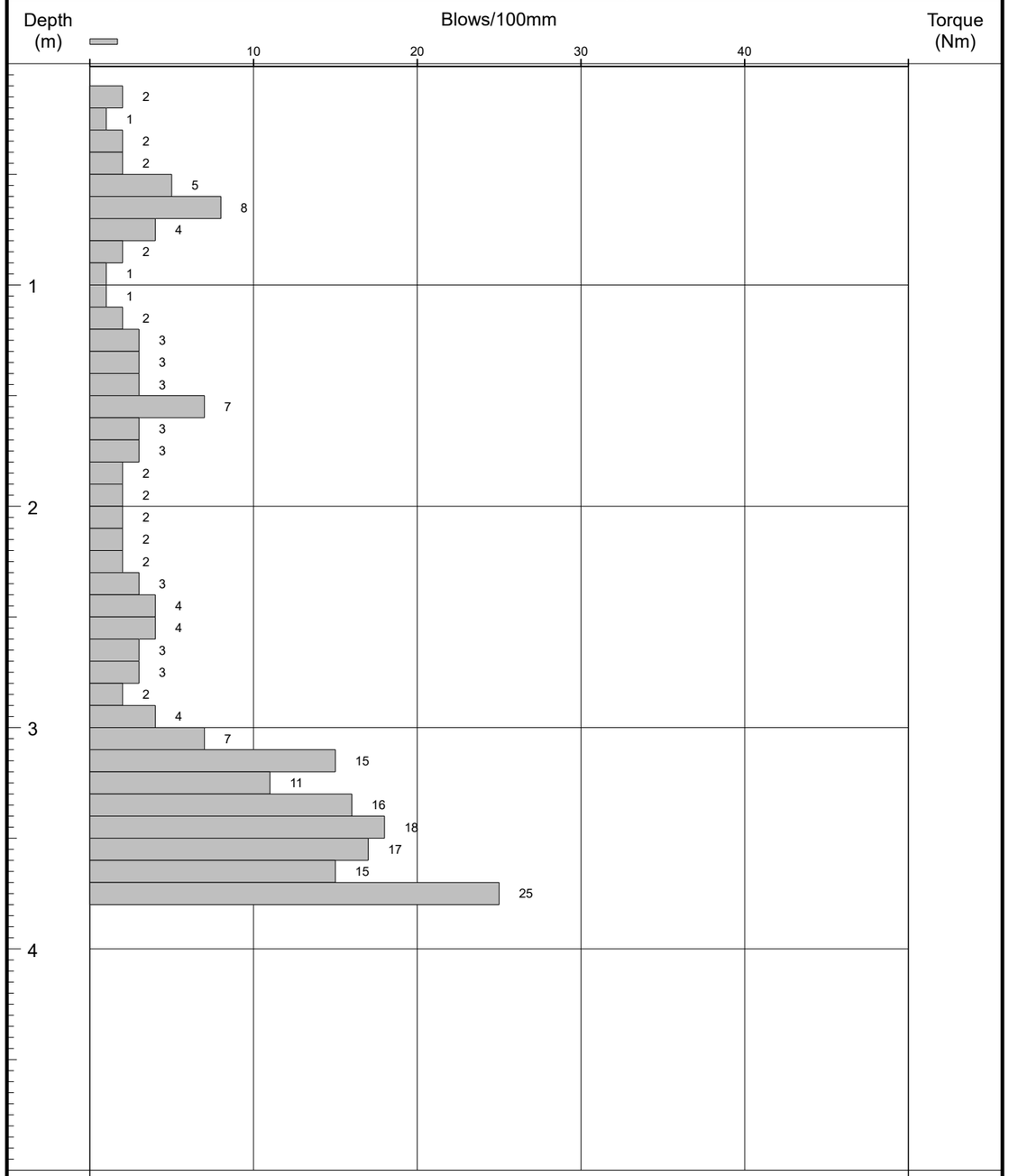
Probe No **DP01**
Sheet 1 of 1

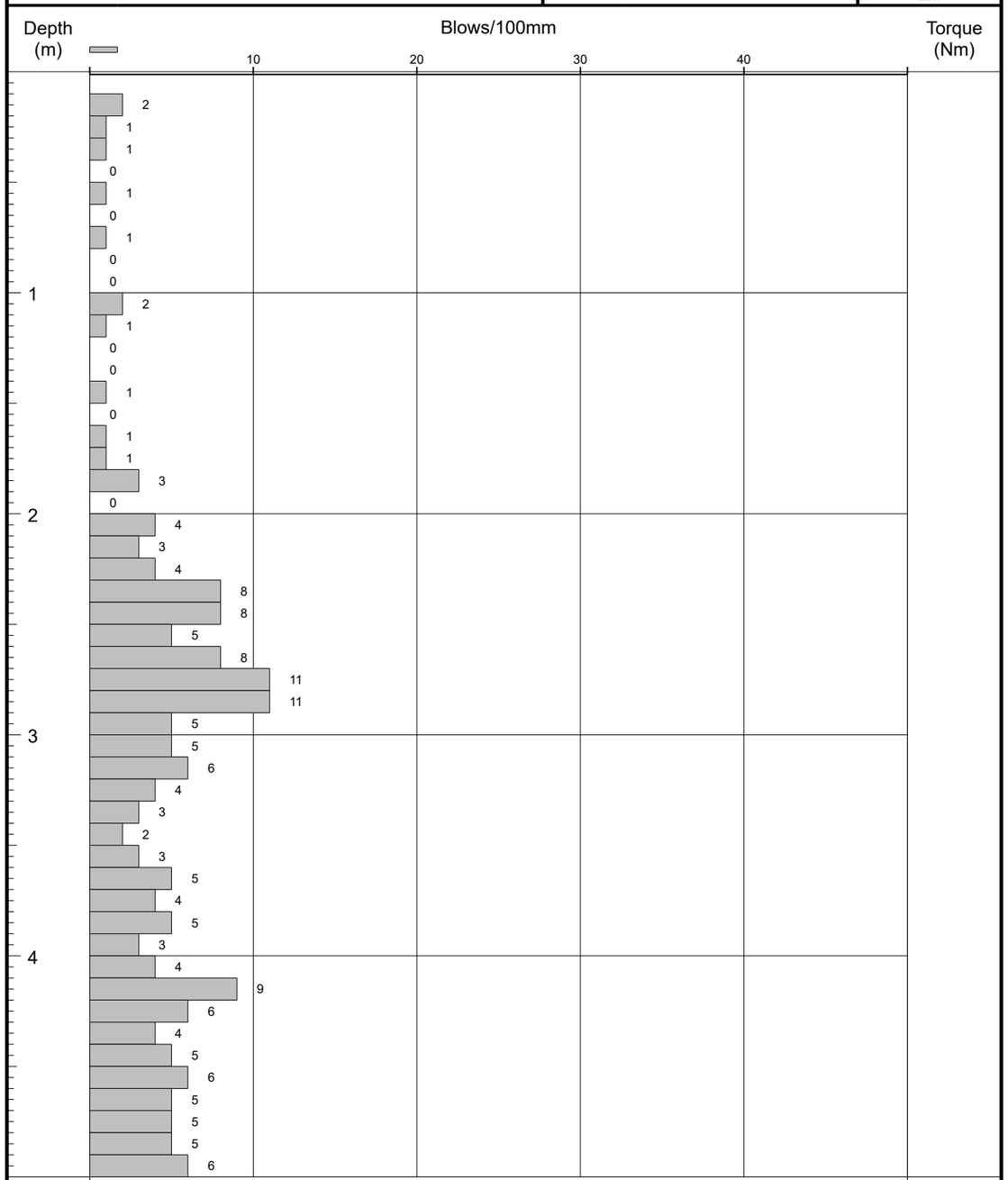
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171822E - 70465N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	16.54m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	13/01/2022	**Logged By** LM



Remarks:
Dynamic probe terminated at 3.70m bgl, refusal.

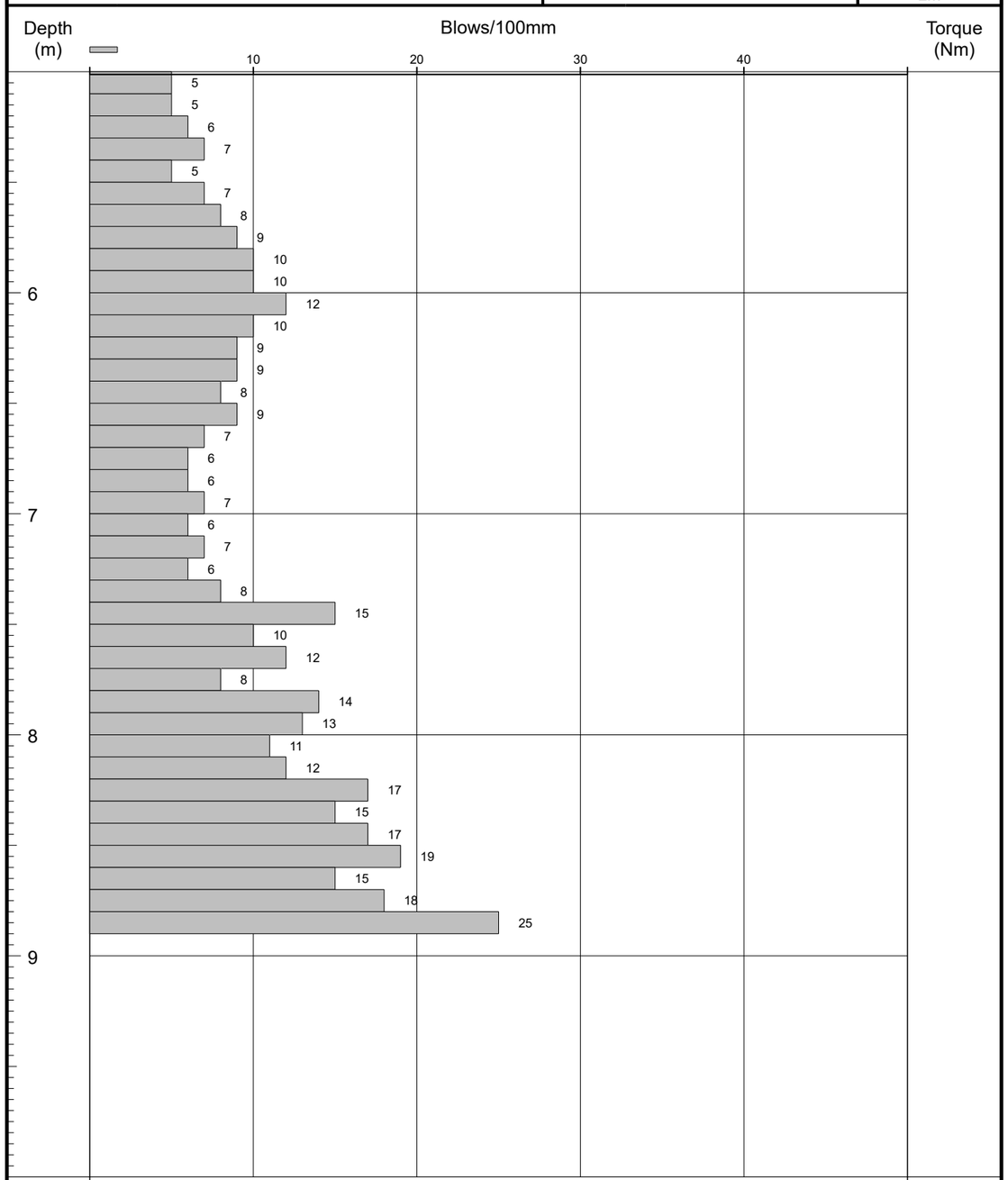
Fall Height (mm):	500	**Cone Base Dia. (mm):**	45
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	3.70

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**		Probe No **DP02** Sheet 1 of 2
Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171742E - 70393N	**Hole Type** DP
Location: Mahon, Cork		**Level:** 12.93m OD	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Dates:** 13/01/2022	**Logged By** LM



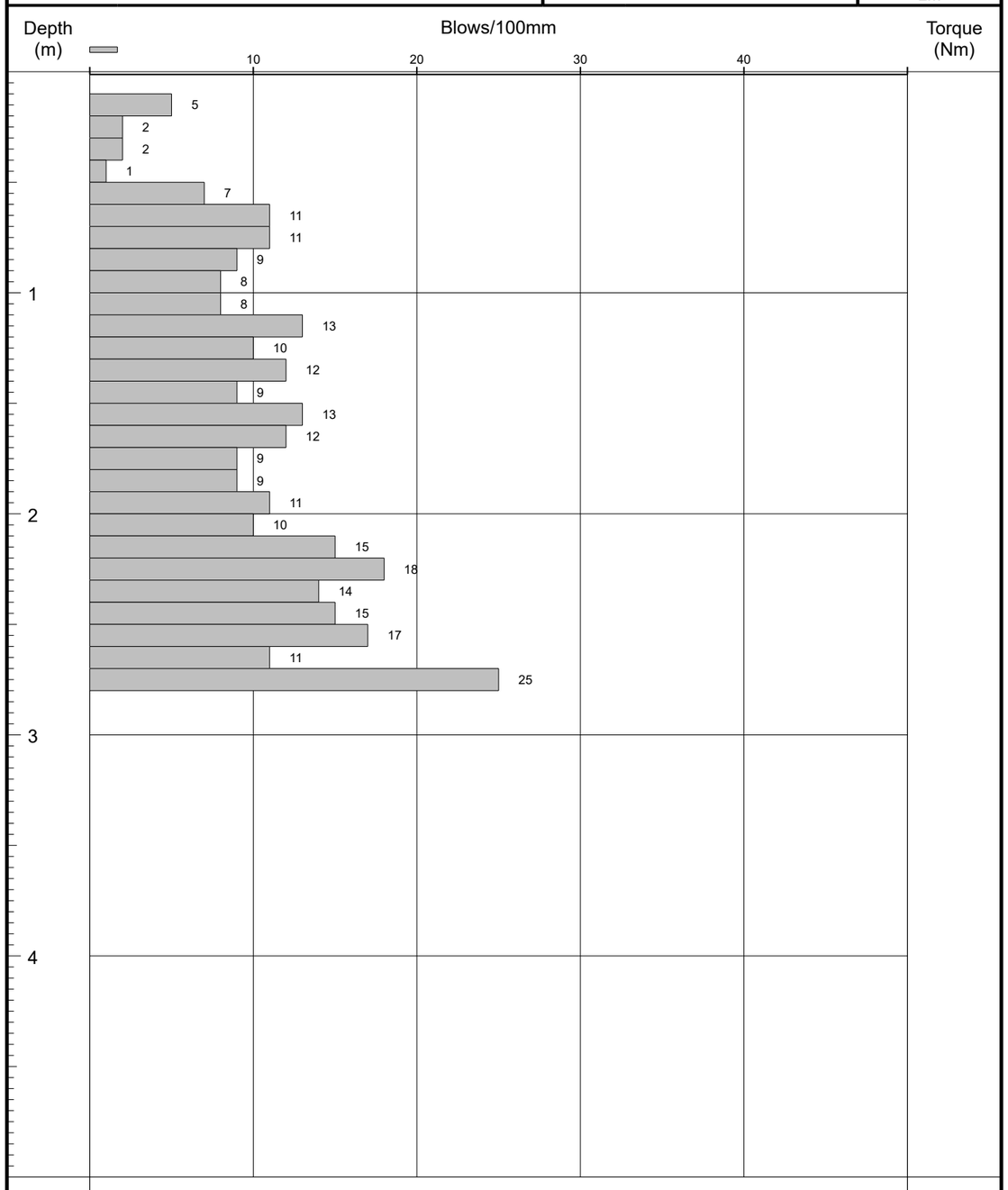
Remarks: Dynamic probe terminated at 8.80m bgl, refusal.	**Fall Height (mm):** 500	**Cone Base Dia. (mm):** 45	
	Hammer Mass (Kg): 50.0	**Cone Angle (Deg):** 90	
	Probe Type: DPH	**Final Depth (m bgl):** 8.80	

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**		Probe No **DP02** Sheet 2 of 2
Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171742E - 70393N	**Hole Type** DP
Location: Mahon, Cork		**Level:** 12.93m OD	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Dates:** 13/01/2022	**Logged By** LM



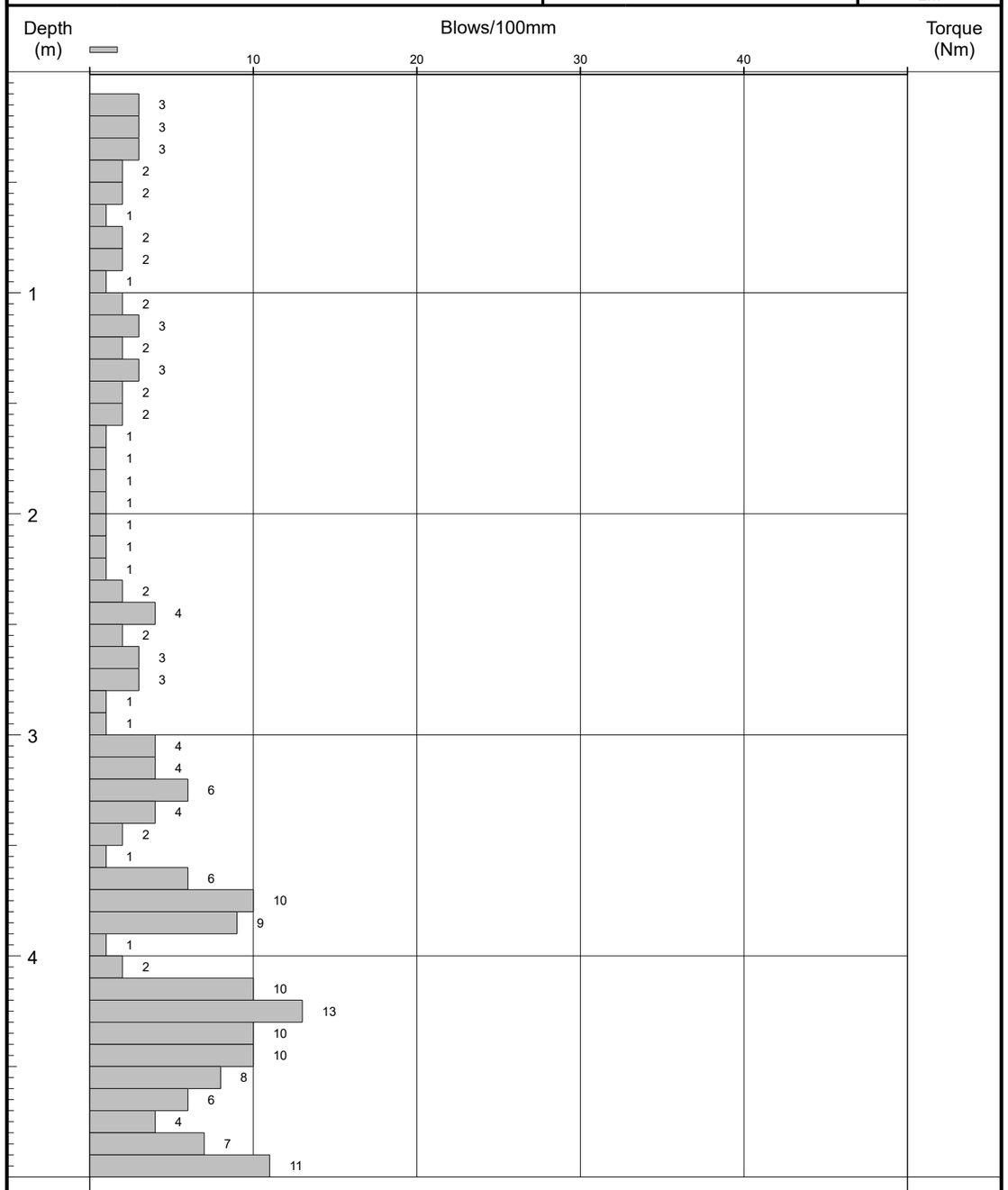
Remarks: Dynamic probe terminated at 8.80m bgl, refusal.	**Fall Height (mm):** 500	**Cone Base Dia. (mm):** 45	
	Hammer Mass (Kg): 50.0	**Cone Angle (Deg):** 90	
	Probe Type: DPH	**Final Depth (m bgl):** 8.80	

Priority Geotechnical Ltd. **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**			Probe No **DP03** Sheet 1 of 1
Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171736E - 70312N	**Hole Type** DP
Location: Mahon, Cork		**Level:** 11.53m OD	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Dates:** 13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 2.70m bgl, refusal.	**Fall Height (mm):** 500	**Cone Base Dia. (mm):** 45	
	Hammer Mass (Kg): 50.0	**Cone Angle (Deg):** 90	
	Probe Type: DPH	**Final Depth (m bgl):** 2.70	

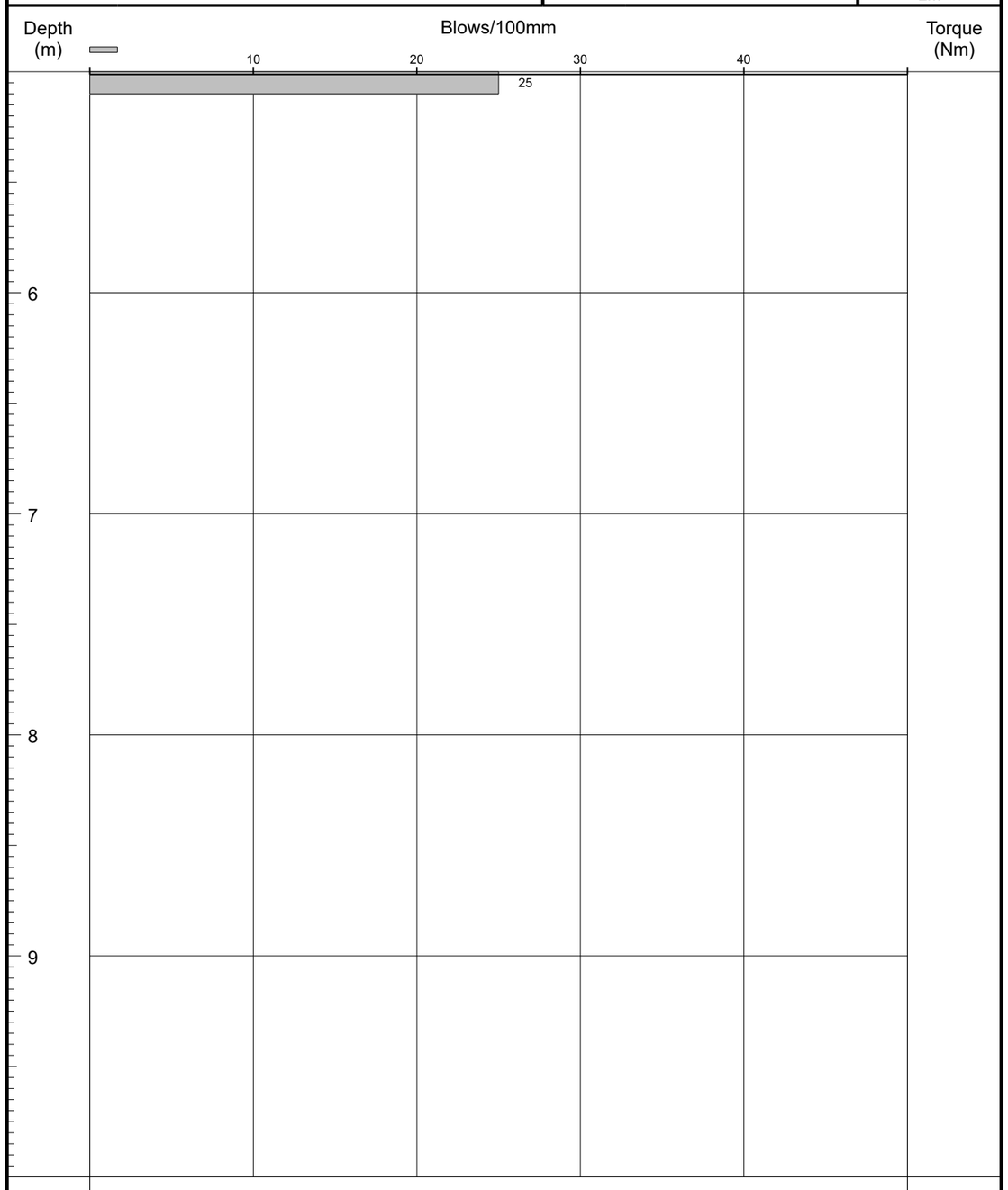
Priority Geotechnical Ltd. **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**			Probe No **DP04** Sheet 1 of 2
Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 172028E - 70364N	**Hole Type** DP
Location: Mahon, Cork		**Level:** 12.40m OD	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Dates:** 13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 5.00m bgl, refusal.	**Fall Height (mm):** 500	**Cone Base Dia. (mm):** 45	
	Hammer Mass (Kg): 50.0	**Cone Angle (Deg):** 90	
	Probe Type: DPH	**Final Depth (m bgl):** 5.00	

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP04** Sheet 2 of 2

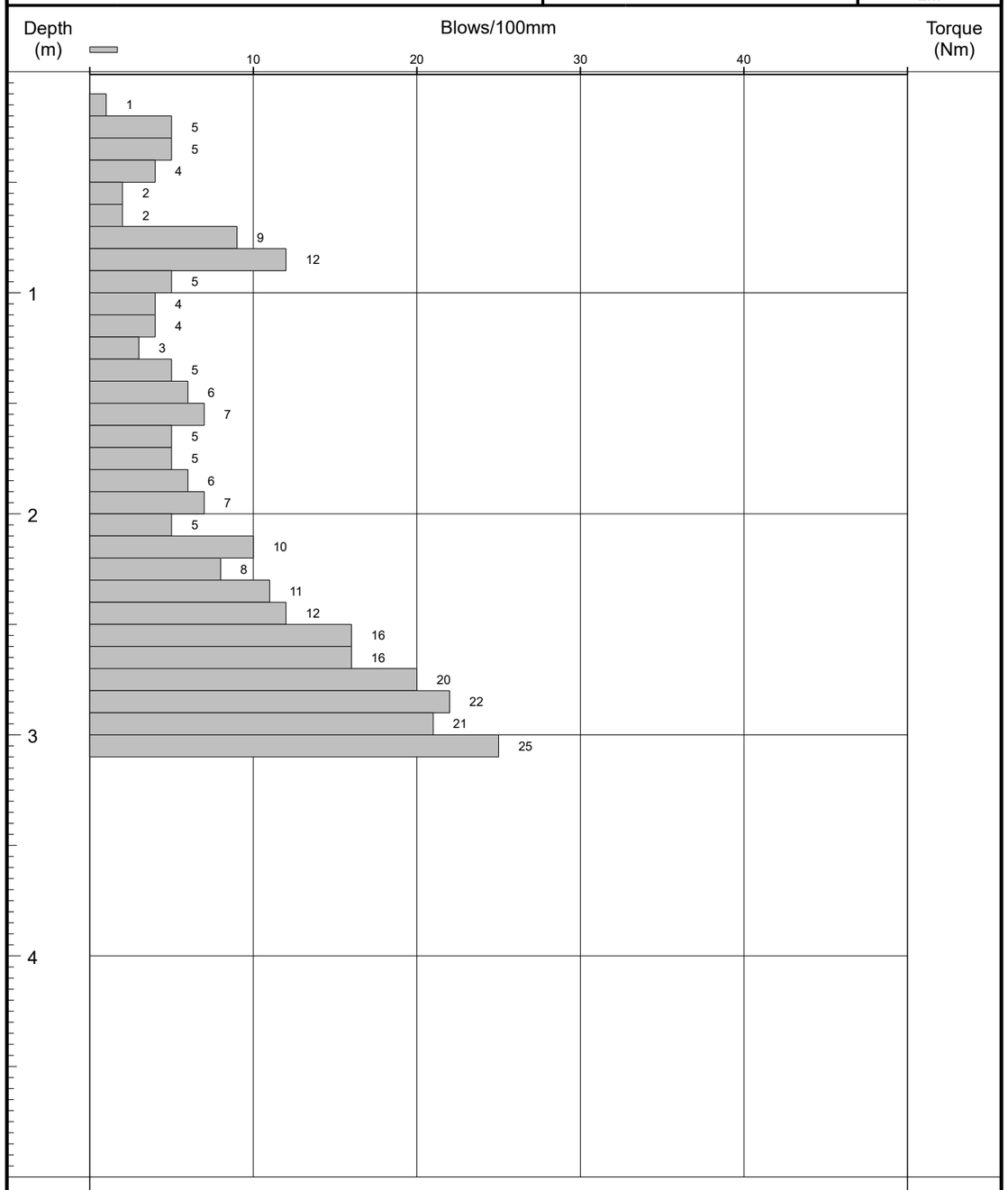
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172028E - 70364N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	12.40m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 5.00m bgl, refusal.	**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45	
	Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90	
	Probe Type:	DPH	**Final Depth (m bgl):**	5.00	

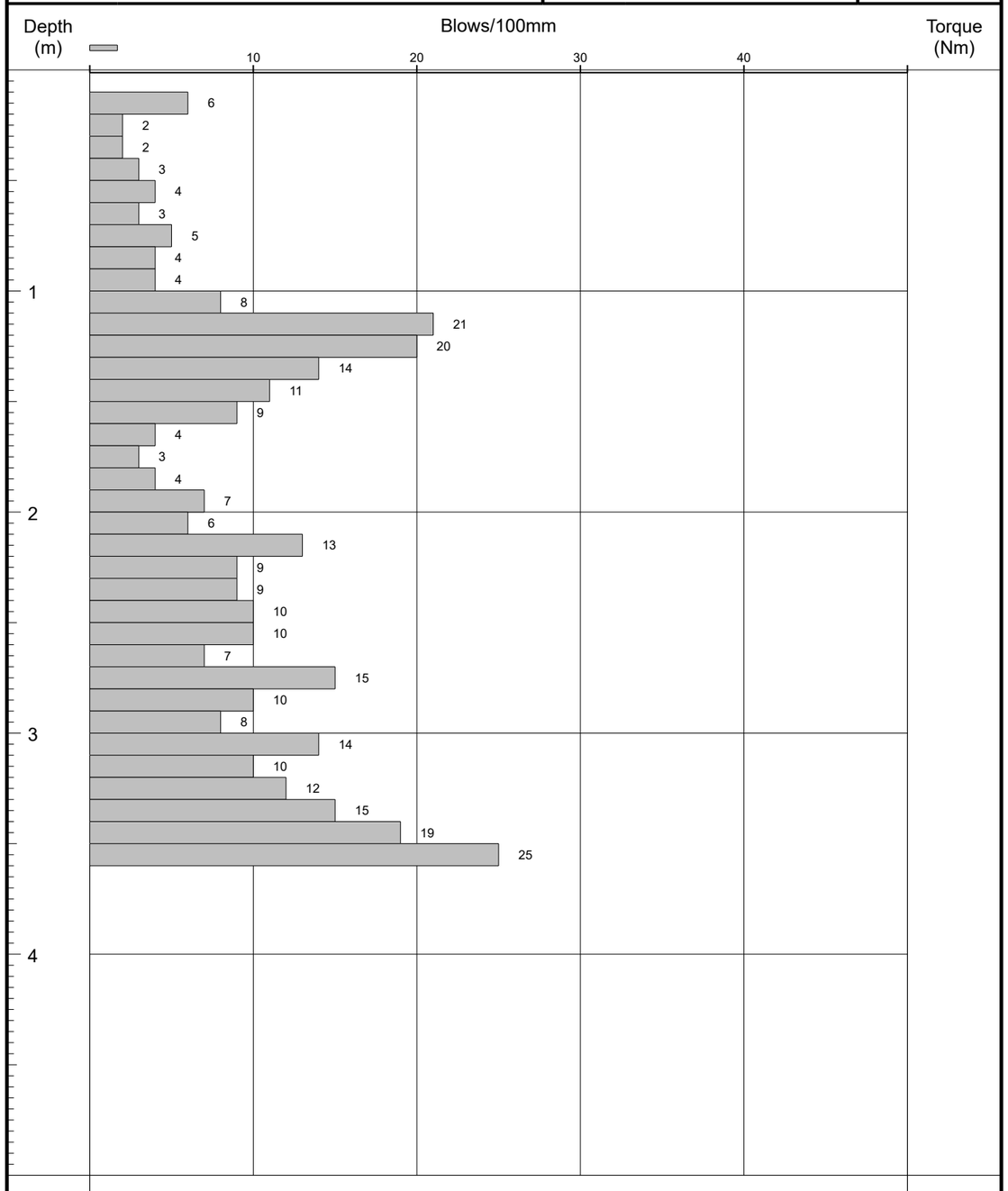
pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP05** Sheet 1 of 1

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172034E - 70305N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	12.21m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	14/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 3.00m bgl, refusal.	**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45	
	Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90	
	Probe Type:	DPH	**Final Depth (m bgl):**	3.00	

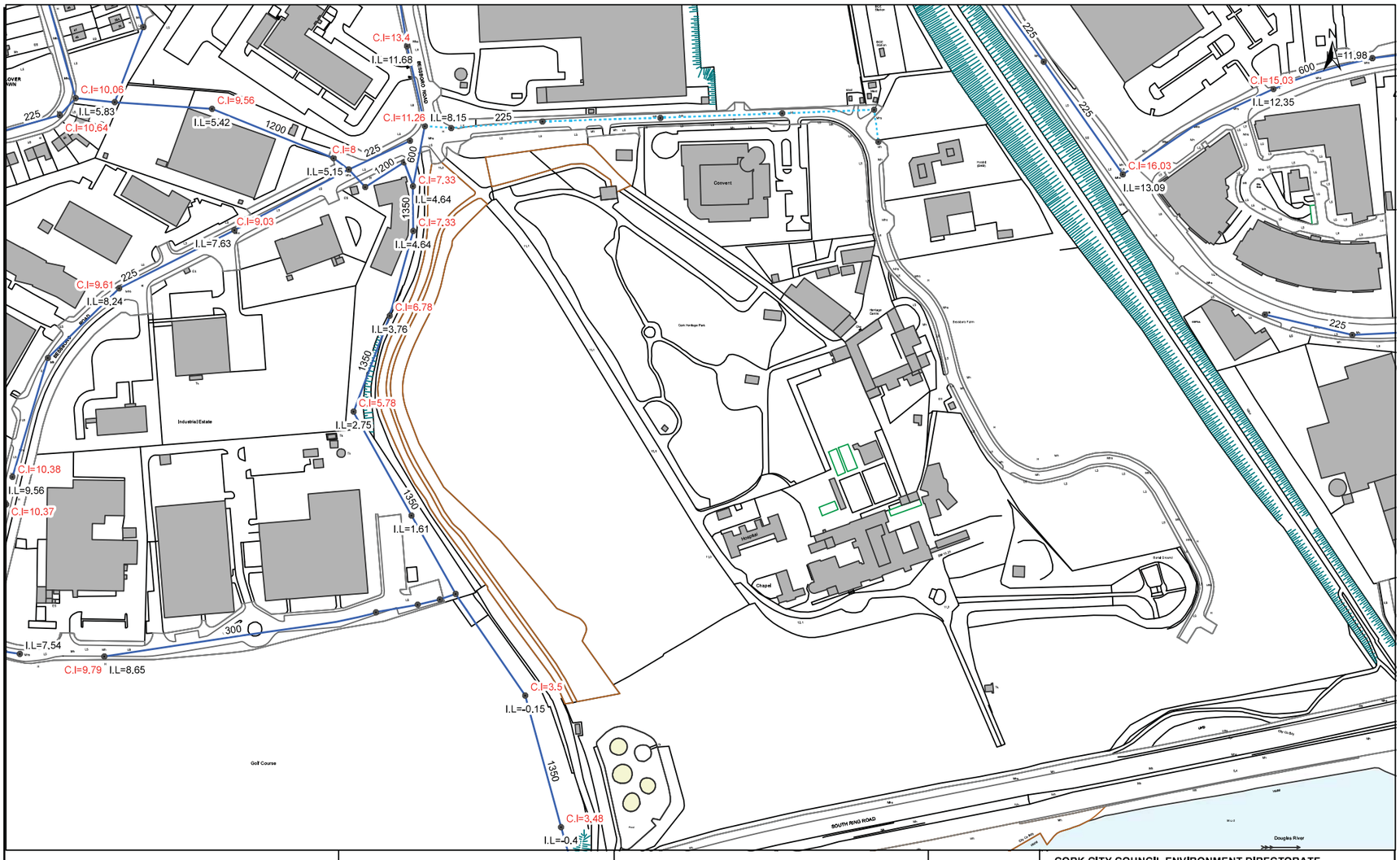
pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**			Probe No **DP06** Sheet 1 of 1
Project Name: Bessboro SHD		**Project No.** P21239	**Co-ords:** 171944E - 70343N	**Hole Type** DP
Location: Mahon, Cork			**Level:** 13.61m OD	**Scale** 1:25
Client: Estuary View Ent. Ltd			**Dates:** 13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 3.50m bgl, refusal.	**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45	
	Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90	
	Probe Type:	DPH	**Final Depth (m bgl):**	3.50	

Appendix 7

CORK CITY COUNCIL - EXISTING STORMWATER NETWORK



Drainage Records

Legend

CCC_StormManholes
MANHOLE_
Manhole
CCC_StormNetwork
PIPE_FUNCT
LOCAL STORM
PRIVATE STORM

THE SEWERS SHOWN ON THIS MAP ARE FOR REFERENCE ONLY. THE LOCATION AND PROPERTIES OF ALL SEWERS, LEVELS, PIPESIZES, etc. MUST BE CONFIRMED ON SITE.

1:2,500

N

CORK CITY COUNCIL ENVIRONMENT DIRECTORATE
Storm Network

Drawn By: A. Homan

Checked by: G.R.

Date: 25/07/2018

Appendix 8

HR WALLINGFORD - GREENFIELD RUNOFF ESTIMATION

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by: Diarmuid O'Brien

Site name: Phase 1 - Bessboro SHD

Site location: Bessboro, Blackrock, Cork.

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude: 51.88489° N

Longitude: 8.40755° W

Reference: 1191625915

Date: Feb 16 2022 16:07

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1.53

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1106	1106
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	12.61	12.61
1 in 1 year (l/s):	10.72	10.72
1 in 30 years (l/s):	20.81	20.81
1 in 100 year (l/s):	24.6	24.6
1 in 200 years (l/s):	27.12	27.12

Appendix 9

CORK CITY COUNCIL CORRESPONDENCE

Figure 3. – Status of Taken in Charge / Not in Charge Roads in the Vicinity of the Bessboro SHD Site.

3.4.14.2 Sustainable Urban Drainage Systems (SuDS) & Stormwater:

The report of the Senior Executive Engineer from the Drainage Section states that:

"*I note the applicant's proposal to use Q100 instead of Qbar as the greenfield run-off rate. This is acceptable, considering the proximity of the development to outfall to the estuary and the size of the existing outfall pipe at 1350mm. This approach is in line with that taken on other previously proposed developments within the Bessboro site. I have checked the Q100 estimate against my own estimate from the uksuds.com website and I am satisfied it is accurate.*

I am pleased to see interception storage being provided for up to 5mm of rainfall…this will have a positive impact on downstream water quality, avoiding the "first flush" which would otherwise be reliant solely on an oil interceptor.

I am pleased to see the number of SuDS measures proposed and would request that design / drawing details are submitted as part of the application for each of the measures proposed. I would request in particular details of how the bio-retention areas are intention to function.

I note from Section 4.3.4 of the Infrastructure Report that it is proposed to discharge surface water from the car park via an interceptor to the storm line (as shown on drawing 21207-JBB-PH1-XX-DR-C-04001). However, based on a review of drawing SB-2020-107-404 it is apparent that this is effectively a "basement carpark", insofar as it is enclosed. As such, in accordance with Section 3.18 of the Greater Dublin Regional Code of Practice for Drainage Works, all drainage from basement areas shall be pumped to ground level prior to discharging by gravity to the public foul sewerage system. Basement car parks must be discharged to the foul system via a petrol/oil interceptor. Access to basement car parks shall be designed such that surface water run-off from the surrounding paved areas cannot flow down the ramp".

3.4.14.3 Flooding:

The report of the Senior Executive Engineer from the Drainage Section states that "*I am satisfied with the Applicant's conclusion that the site is located in Flood Zone 'C' and hence, does not merit further assessment*".

Appendix 10

SURFACE WATER - MICRODRAINAGE CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.250	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	4.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	51.087	0.511	100.0	0.115	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	30.932	0.309	100.1	0.175	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	31.021	0.302	102.7	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	36.395	0.243	149.8	0.120	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	9.219	0.061	151.1	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	34.183	0.567	60.3	0.045	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	31.863	0.570	55.9	0.042	4.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	39.599	0.200	198.0	0.065	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	67.106	0.412	162.9	0.118	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	14.780	0.321	46.0	0.020	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	35.342	0.832	42.5	0.038	0.00	3.9	0.600	o	300	Pipe/Conduit	
S1.006	13.916	0.257	54.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	5.732	0.102	56.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.65	12.830	0.115	0.0	0.0	0.0	1.31	52.0	15.6
S2.000	50.00	4.39	12.670	0.175	0.0	0.0	0.0	1.31	52.0	23.7
S2.001	50.00	4.80	12.361	0.214	0.0	0.0	0.0	1.29	51.3	29.0
S1.001	50.00	5.27	11.984	0.449	0.0	0.0	0.0	1.28	90.6	60.8
S1.002	50.00	5.39	11.741	0.459	0.0	0.0	0.0	1.28	90.2	62.2
S1.003	50.00	5.67	11.680	0.505	0.0	0.0	0.0	2.03	143.4	68.3
S3.000	50.00	4.30	12.370	0.042	0.0	0.0	0.0	1.75	69.7	5.7
S3.001	50.00	5.02	11.800	0.107	0.0	0.0	0.0	0.93	36.8	14.5
S3.002	49.96	6.11	11.600	0.225	0.0	0.0	0.0	1.02	40.6	30.5
S1.004	49.63	6.22	11.113	0.750	0.0	0.0	0.0	2.32	164.2	100.8
S1.005	48.89	6.46	10.792	0.788	3.9	0.0	0.0	2.42	171.0	108.2
S1.006	48.57	6.57	9.960	0.788	3.9	0.0	0.0	2.14	151.4	108.2
S1.007	48.44	6.61	9.703	0.788	3.9	0.0	0.0	2.10	148.6	108.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.008	44.748	0.050	895.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S4.000	16.604	0.166	100.0	0.026	4.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	19.498	0.134	145.5	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.002	10.100	0.300	33.7	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.003	16.086	0.100	160.9	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.004	33.680	1.020	33.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.005	2.186	0.124	17.6	0.000	0.00	3.8	0.600	o	225	Pipe/Conduit	
S1.009	34.516	0.181	190.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.010	17.091	0.087	196.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.011	57.377	0.284	202.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	41.156	0.206	199.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.013	36.345	0.182	199.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.014	63.431	1.321	48.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.015	29.911	0.602	49.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.016	94.491	3.780	25.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.008	45.72	7.62	9.376	0.788	3.9	0.0	0.0	0.74	160.3	108.2
S4.000	50.00	4.21	11.170	0.026	0.0	0.0	0.0	1.31	52.0	3.6
S4.001	50.00	4.51	11.004	0.043	0.0	0.0	0.0	1.08	43.0	5.9
S4.002	50.00	4.59	10.870	0.058	0.0	0.0	0.0	2.26	90.0	7.8
S4.003	50.00	4.85	10.570	0.068	0.0	0.0	0.0	1.03	40.9	9.2
S4.004	50.00	5.09	10.470	0.068	0.0	0.0	0.0	2.28	90.8	9.2
S4.005	50.00	5.10	9.450	0.068	3.8	0.0	0.0	3.13	124.5	13.0
S1.009	50.00	4.61	9.326	0.000	24.6	0.0	0.0	0.94	37.5	24.6
S1.010	50.00	4.92	9.145	0.000	24.6	0.0	0.0	0.93	36.9	24.6
S1.011	50.00	5.96	9.058	0.000	24.6	0.0	0.0	0.92	36.4	24.6
S1.012	48.18	6.70	8.774	0.000	24.6	0.0	0.0	0.92	36.6	24.6
S1.013	46.38	7.36	8.568	0.000	24.6	0.0	0.0	0.92	36.6	24.6
S1.014	44.99	7.92	8.386	0.000	24.6	0.0	0.0	1.89	75.3	24.6
S1.015	44.35	8.19	7.065	0.000	24.6	0.0	0.0	1.86	74.0	24.6
S1.016	43.02	8.79	6.463	0.000	24.6	0.0	0.0	2.63	104.5	24.6

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.016	S.A29	4.390	2.683	0.000	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S.A21, DS/PN: S1.009, Volume (m³): 14.1

Unit Reference	MD-SHE-0208-2460-1680-2460
Design Head (m)	1.680
Design Flow (l/s)	24.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	208
Invert Level (m)	9.326
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.680	24.6	Kick-Flo®	1.086	20.0
Flush-Flo™	0.497	24.6	Mean Flow over Head Range	-	21.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.1	0.800	23.6	2.000	26.7	4.000	37.3	7.000	48.9
0.200	20.0	1.000	21.7	2.200	28.0	4.500	39.5	7.500	50.5
0.300	23.5	1.200	20.9	2.400	29.2	5.000	41.5	8.000	52.1
0.400	24.4	1.400	22.5	2.600	30.3	5.500	43.5	8.500	53.7
0.500	24.6	1.600	24.0	3.000	32.5	6.000	45.4	9.000	55.2
0.600	24.4	1.800	25.4	3.500	35.0	6.500	47.2	9.500	56.7

Storage Structures for Storm

Cellular Storage Manhole: S.A21, DS/PN: S1.009

Invert Level (m) 9.326 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	284.0	0.0	0.900	284.0	0.0	1.681	0.0	0.0
0.100	284.0	0.0	1.000	284.0	0.0	1.900	0.0	0.0
0.200	284.0	0.0	1.100	284.0	0.0	2.000	0.0	0.0
0.300	284.0	0.0	1.200	284.0	0.0	2.100	0.0	0.0
0.400	284.0	0.0	1.300	284.0	0.0	2.200	0.0	0.0
0.500	284.0	0.0	1.400	284.0	0.0	2.300	0.0	0.0
0.600	284.0	0.0	1.500	284.0	0.0	2.400	0.0	0.0
0.700	284.0	0.0	1.600	284.0	0.0	2.500	0.0	0.0
0.800	284.0	0.0	1.680	284.0	0.0			

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.800 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.250 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S.A1	15 Winter	1	+10%	100/15 Summer				12.920	-0.135
S2.000	S.A2	15 Winter	1	+10%	30/15 Summer				12.786	-0.109
S2.001	S.A3	15 Winter	1	+10%	30/15 Summer				12.491	-0.095
S1.001	S.A4	15 Winter	1	+10%	30/15 Summer				12.174	-0.110
S1.002	S.A5	15 Winter	1	+10%	30/15 Summer				11.978	-0.063
S1.003	S.A6	15 Winter	1	+10%	30/15 Summer				11.829	-0.151
S3.000	S.A7	15 Winter	1	+10%	100/15 Summer				12.416	-0.179
S3.001	S.A8	15 Winter	1	+10%	30/15 Summer				11.898	-0.127
S3.002	S.A9	15 Winter	1	+10%	30/15 Summer				11.736	-0.089
S1.004	S.A10	15 Winter	1	+10%	30/15 Summer				11.294	-0.119
S1.005	S.A11	15 Winter	1	+10%	30/15 Summer				10.967	-0.125
S1.006	S.A12	15 Winter	1	+10%	30/15 Summer				10.206	-0.054
S1.007	S.A13	15 Winter	1	+10%	1/15 Summer				10.042	0.039
S1.008	S.A14	15 Winter	1	+10%	30/60 Summer				9.702	-0.199
S4.000	S.A15	15 Summer	1	+10%					11.214	-0.181
S4.001	S.A16	15 Winter	1	+10%					11.062	-0.167
S4.002	S.A17	15 Winter	1	+10%					10.918	-0.177
S4.003	S.A18	15 Winter	1	+10%					10.644	-0.151
S4.004	S.A19	15 Winter	1	+10%					10.518	-0.177
S4.005	S.A20	180 Winter	1	+10%	30/15 Summer				9.675	0.000
S1.009	S.A21	180 Winter	1	+10%	1/30 Winter				9.673	0.122
S1.010	S.A22	180 Winter	1	+10%					9.286	-0.084
S1.011	S.A23	180 Winter	1	+10%					9.193	-0.090
S1.012	S.A24	180 Winter	1	+10%					8.909	-0.090
S1.013	S.A25	180 Winter	1	+10%					8.704	-0.089
S1.014	S.A26	180 Winter	1	+10%					8.473	-0.138
S1.015	S.A27	180 Winter	1	+10%					7.155	-0.135
S1.016	S.A28	180 Winter	1	+10%					6.535	-0.152

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S.A1	0.000	0.34			16.9	OK	
S2.000	S.A2	0.000	0.52			25.5	OK	
S2.001	S.A3	0.000	0.62			29.6	OK	
S1.001	S.A4	0.000	0.71			59.6	OK	
S1.002	S.A5	0.000	0.97			60.1	OK	
S1.003	S.A6	0.000	0.49			65.0	OK	
S3.000	S.A7	0.000	0.09			6.2	OK	
S3.001	S.A8	0.000	0.38			13.4	OK	
S3.002	S.A9	0.000	0.65			25.6	OK	
S1.004	S.A10	0.000	0.67			92.3	OK	
S1.005	S.A11	0.000	0.63			99.5	OK	
S1.006	S.A12	0.000	0.79			99.5	OK	
S1.007	S.A13	0.000	1.24			99.3	SURCHARGED	
S1.008	S.A14	0.000	0.69			97.0	OK	
S4.000	S.A15	0.000	0.08			3.9	OK	
S4.001	S.A16	0.000	0.15			5.8	OK	
S4.002	S.A17	0.000	0.10			7.5	OK	
S4.003	S.A18	0.000	0.24			8.6	OK	
S4.004	S.A19	0.000	0.10			8.6	OK	
S4.005	S.A20	0.000	0.13			6.6	OK	
S1.009	S.A21	0.000	0.66		96	23.4	SURCHARGED	
S1.010	S.A22	0.000	0.71			23.4	OK	
S1.011	S.A23	0.000	0.67			23.4	OK	
S1.012	S.A24	0.000	0.67			23.4	OK	
S1.013	S.A25	0.000	0.68			23.4	OK	
S1.014	S.A26	0.000	0.32			23.4	OK	
S1.015	S.A27	0.000	0.34			23.4	OK	
S1.016	S.A28	0.000	0.23			23.4	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.800 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.250 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S.A1	15 Winter	30	+10%	100/15 Summer				12.977	-0.078
S2.000	S.A2	15 Winter	30	+10%	30/15 Summer				13.300	0.405
S2.001	S.A3	15 Winter	30	+10%	30/15 Summer				13.052	0.466
S1.001	S.A4	15 Winter	30	+10%	30/15 Summer				12.735	0.451
S1.002	S.A5	15 Winter	30	+10%	30/15 Summer				12.415	0.374
S1.003	S.A6	15 Winter	30	+10%	30/15 Summer				12.274	0.294
S3.000	S.A7	15 Winter	30	+10%	100/15 Summer				12.448	-0.147
S3.001	S.A8	15 Winter	30	+10%	30/15 Summer				12.425	0.400
S3.002	S.A9	15 Winter	30	+10%	30/15 Summer				12.358	0.533
S1.004	S.A10	15 Winter	30	+10%	30/15 Summer				11.930	0.517
S1.005	S.A11	15 Winter	30	+10%	30/15 Summer				11.550	0.458
S1.006	S.A12	15 Winter	30	+10%	30/15 Summer				10.699	0.439
S1.007	S.A13	15 Winter	30	+10%	1/15 Summer				10.296	0.293
S1.008	S.A14	240 Winter	30	+10%	30/60 Summer				10.126	0.225
S4.000	S.A15	15 Winter	30	+10%					11.235	-0.160
S4.001	S.A16	15 Summer	30	+10%					11.098	-0.131
S4.002	S.A17	15 Winter	30	+10%					10.946	-0.149
S4.003	S.A18	15 Winter	30	+10%					10.697	-0.098
S4.004	S.A19	15 Winter	30	+10%					10.547	-0.148
S4.005	S.A20	240 Winter	30	+10%	30/15 Summer				10.122	0.447
S1.009	S.A21	240 Winter	30	+10%	1/30 Winter				10.120	0.569
S1.010	S.A22	480 Summer	30	+10%					9.290	-0.080
S1.011	S.A23	600 Winter	30	+10%					9.197	-0.086
S1.012	S.A24	480 Winter	30	+10%					8.914	-0.085
S1.013	S.A25	480 Winter	30	+10%					8.708	-0.085
S1.014	S.A26	360 Winter	30	+10%					8.476	-0.135
S1.015	S.A27	720 Summer	30	+10%					7.157	-0.133
S1.016	S.A28	720 Summer	30	+10%					6.537	-0.151

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S.A1	0.000	0.74			36.9	OK	
S2.000	S.A2	0.000	0.92			44.9	SURCHARGED	
S2.001	S.A3	0.000	1.08			51.8	SURCHARGED	
S1.001	S.A4	0.000	1.34			112.1	SURCHARGED	
S1.002	S.A5	0.000	1.74			107.9	SURCHARGED	
S1.003	S.A6	0.000	0.86			113.8	SURCHARGED	
S3.000	S.A7	0.000	0.21			13.7	OK	
S3.001	S.A8	0.000	0.68			23.9	SURCHARGED	
S3.002	S.A9	0.000	1.25			49.1	SURCHARGED	
S1.004	S.A10	0.000	1.11			152.3	SURCHARGED	
S1.005	S.A11	0.000	1.01			158.9	SURCHARGED	
S1.006	S.A12	0.000	1.26			157.4	SURCHARGED	
S1.007	S.A13	0.000	1.96			157.0	SURCHARGED	
S1.008	S.A14	0.000	0.44			62.3	SURCHARGED	
S4.000	S.A15	0.000	0.19			8.7	OK	
S4.001	S.A16	0.000	0.36			14.1	OK	
S4.002	S.A17	0.000	0.25			18.8	OK	
S4.003	S.A18	0.000	0.59			21.5	OK	
S4.004	S.A19	0.000	0.25			21.7	OK	
S4.005	S.A20	0.000	0.17			8.5	SURCHARGED	
S1.009	S.A21	0.000	0.69		160	24.5	SURCHARGED	
S1.010	S.A22	0.000	0.74			24.5	OK	
S1.011	S.A23	0.000	0.70			24.5	OK	
S1.012	S.A24	0.000	0.70			24.5	OK	
S1.013	S.A25	0.000	0.71			24.5	OK	
S1.014	S.A26	0.000	0.34			24.5	OK	
S1.015	S.A27	0.000	0.35			24.5	OK	
S1.016	S.A28	0.000	0.24			24.5	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.800 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.250 Cv (Winter) 0.840

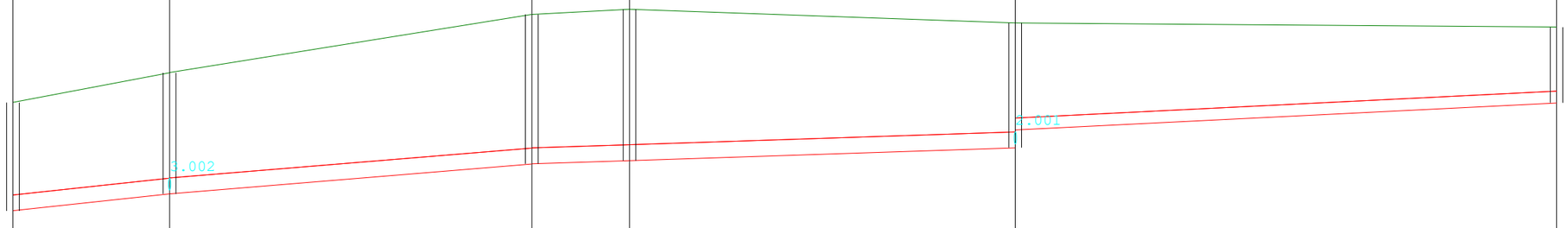
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

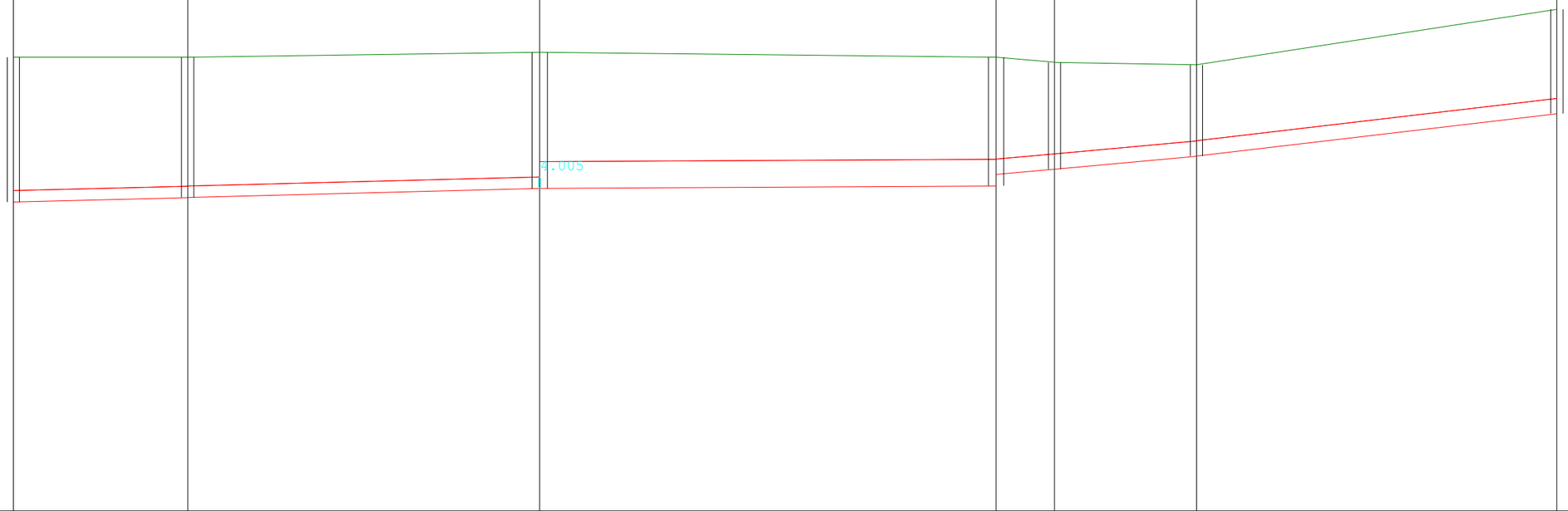
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S.A1	15 Winter	100	+10%	100/15 Summer				13.660	0.605
S2.000	S.A2	15 Winter	100	+10%	30/15 Summer				14.089	1.194
S2.001	S.A3	15 Winter	100	+10%	30/15 Summer				13.863	1.277
S1.001	S.A4	15 Winter	100	+10%	30/15 Summer				13.532	1.248
S1.002	S.A5	15 Winter	100	+10%	30/15 Summer				13.151	1.110
S1.003	S.A6	15 Winter	100	+10%	30/15 Summer				12.968	0.988
S3.000	S.A7	15 Winter	100	+10%	100/15 Summer				13.183	0.588
S3.001	S.A8	15 Winter	100	+10%	30/15 Summer				13.163	1.138
S3.002	S.A9	15 Winter	100	+10%	30/15 Summer				13.093	1.268
S1.004	S.A10	15 Winter	100	+10%	30/15 Summer				12.514	1.101
S1.005	S.A11	15 Winter	100	+10%	30/15 Summer				12.024	0.932
S1.006	S.A12	15 Winter	100	+10%	30/15 Summer				10.946	0.686
S1.007	S.A13	240 Winter	100	+10%	1/15 Summer				10.461	0.458
S1.008	S.A14	240 Winter	100	+10%	30/60 Summer				10.455	0.554
S4.000	S.A15	15 Winter	100	+10%					11.245	-0.150
S4.001	S.A16	15 Summer	100	+10%					11.113	-0.116
S4.002	S.A17	15 Winter	100	+10%					10.958	-0.137
S4.003	S.A18	15 Winter	100	+10%					10.722	-0.073
S4.004	S.A19	15 Winter	100	+10%					10.560	-0.135
S4.005	S.A20	240 Winter	100	+10%	30/15 Summer				10.451	0.776
S1.009	S.A21	240 Winter	100	+10%	1/30 Winter				10.449	0.898
S1.010	S.A22	360 Summer	100	+10%					9.290	-0.080
S1.011	S.A23	720 Summer	100	+10%					9.197	-0.086
S1.012	S.A24	480 Winter	100	+10%					8.914	-0.085
S1.013	S.A25	600 Summer	100	+10%					8.708	-0.085
S1.014	S.A26	1440 Summer	100	+10%					8.476	-0.135
S1.015	S.A27	1440 Summer	100	+10%					7.157	-0.133
S1.016	S.A28	1440 Summer	100	+10%					6.537	-0.151

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

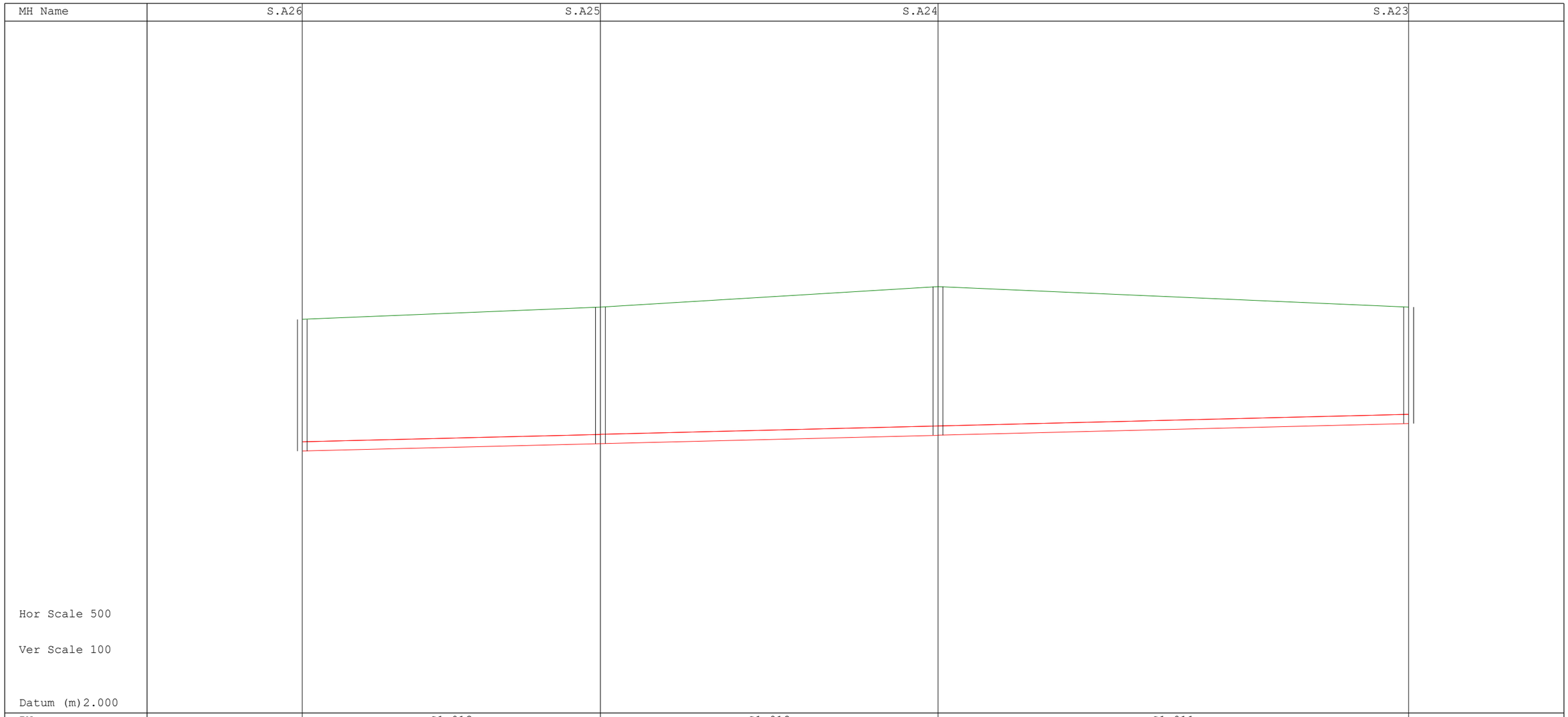
PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S.A1	0.000	0.84			41.7	SURCHARGED	
S2.000	S.A2	0.000	1.02			49.4	FLOOD RISK	
S2.001	S.A3	0.000	1.16			55.7	FLOOD RISK	
S1.001	S.A4	0.000	1.43			119.6	SURCHARGED	
S1.002	S.A5	0.000	1.84			114.0	SURCHARGED	
S1.003	S.A6	0.000	0.91			120.4	SURCHARGED	
S3.000	S.A7	0.000	0.25			16.3	SURCHARGED	
S3.001	S.A8	0.000	0.69			23.9	FLOOD RISK	
S3.002	S.A9	0.000	1.39			54.8	FLOOD RISK	
S1.004	S.A10	0.000	1.25			171.3	SURCHARGED	
S1.005	S.A11	0.000	1.15			180.7	SURCHARGED	
S1.006	S.A12	0.000	1.43			178.9	SURCHARGED	
S1.007	S.A13	0.000	0.97			77.4	SURCHARGED	
S1.008	S.A14	0.000	0.54			76.8	SURCHARGED	
S4.000	S.A15	0.000	0.24			11.2	OK	
S4.001	S.A16	0.000	0.47			18.3	OK	
S4.002	S.A17	0.000	0.33			24.4	OK	
S4.003	S.A18	0.000	0.77			27.8	OK	
S4.004	S.A19	0.000	0.33			28.2	OK	
S4.005	S.A20	0.000	0.20			9.7	SURCHARGED	
S1.009	S.A21	0.000	0.69		188	24.5	SURCHARGED	
S1.010	S.A22	0.000	0.74			24.5	OK	
S1.011	S.A23	0.000	0.70			24.5	OK	
S1.012	S.A24	0.000	0.70			24.5	OK	
S1.013	S.A25	0.000	0.71			24.5	OK	
S1.014	S.A26	0.000	0.34			24.5	OK	
S1.015	S.A27	0.000	0.35			24.5	OK	
S1.016	S.A28	0.000	0.24			24.5	OK	



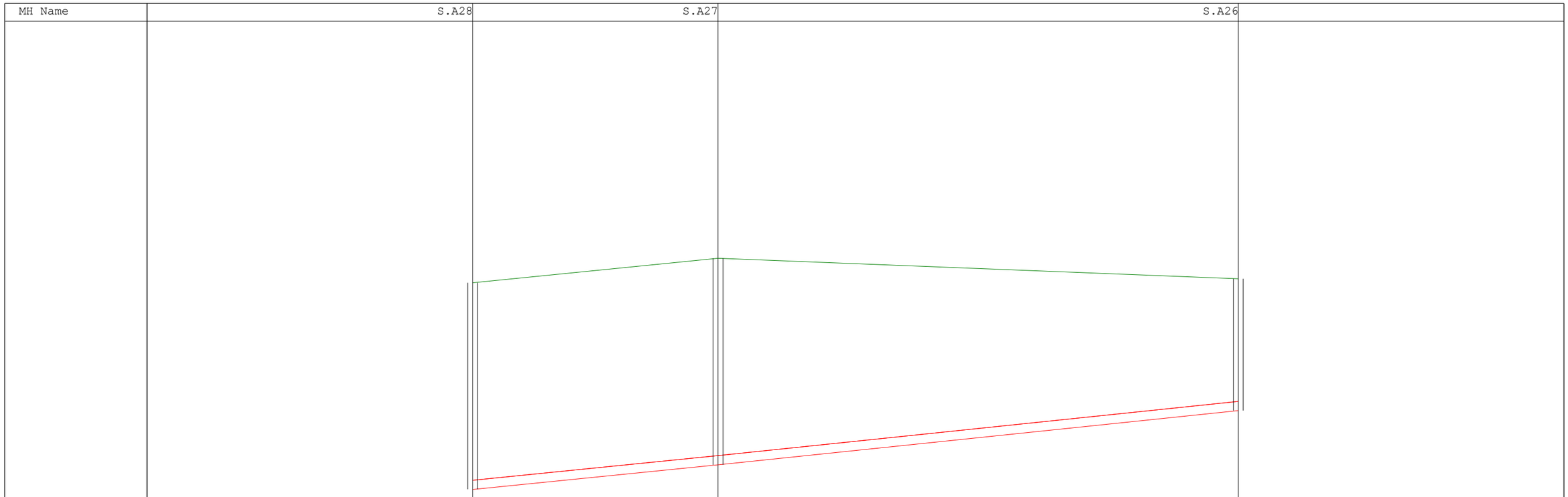
MH Name		S.A11	S.A10	S.A6	S.A5	S.A4	S.A1	
Hor Scale 500 Ver Scale 100 Datum (m) 4.000								
PN			S1.004	S1.003	S1.002	S1.001	S1.000	
Dia (mm)			300	300	300	300	225	
Slope (1:X)			46.0	60.3	151.1	149.8	100.0	
Cover Level (m)		12.840	13.400	14.500	14.600	14.340	14.260	
Invert Level (m)			10.792	11.113 11.113	11.680 11.680	11.741 11.741	11.984 12.319	12.830	
Length (m)			14.780	34.183	9.219	36.395	51.087	



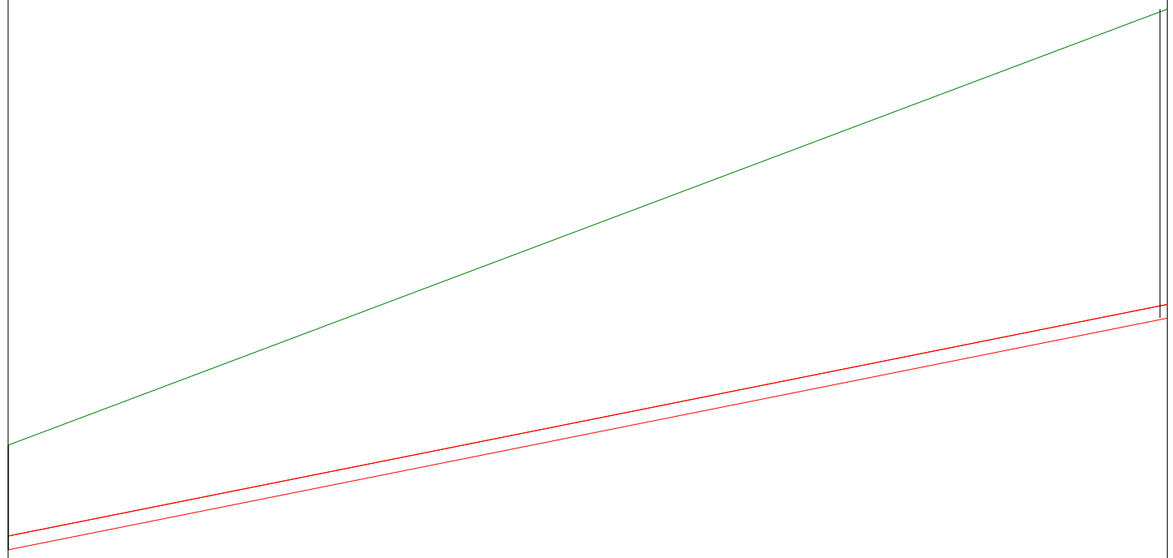
MH Name		S.A23	S.A22	S.A21	S.A14	S.A13	S.A12	S.A11	
Hor Scale 500 Ver Scale 100 Datum (m) 3.000									
PN			S1.010	S1.009	S1.008	S1.007	S1.006	S1.005	
Dia (mm)			225	225	525	300	300	300	
Slope (1:X)			196.4	190.7	895.0	56.2	54.1	42.5	
Cover Level (m)		11.900	11.900	12.000	11.900	11.800	11.750	12.840	
Invert Level (m)		9.058	9.145	9.145 9.326	9.326 9.376	9.601 9.703	9.703 9.960	9.960 10.792	
Length (m)			17.091	34.516	44.748	5.732	13.916	35.342	

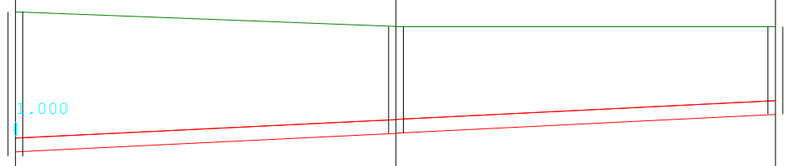


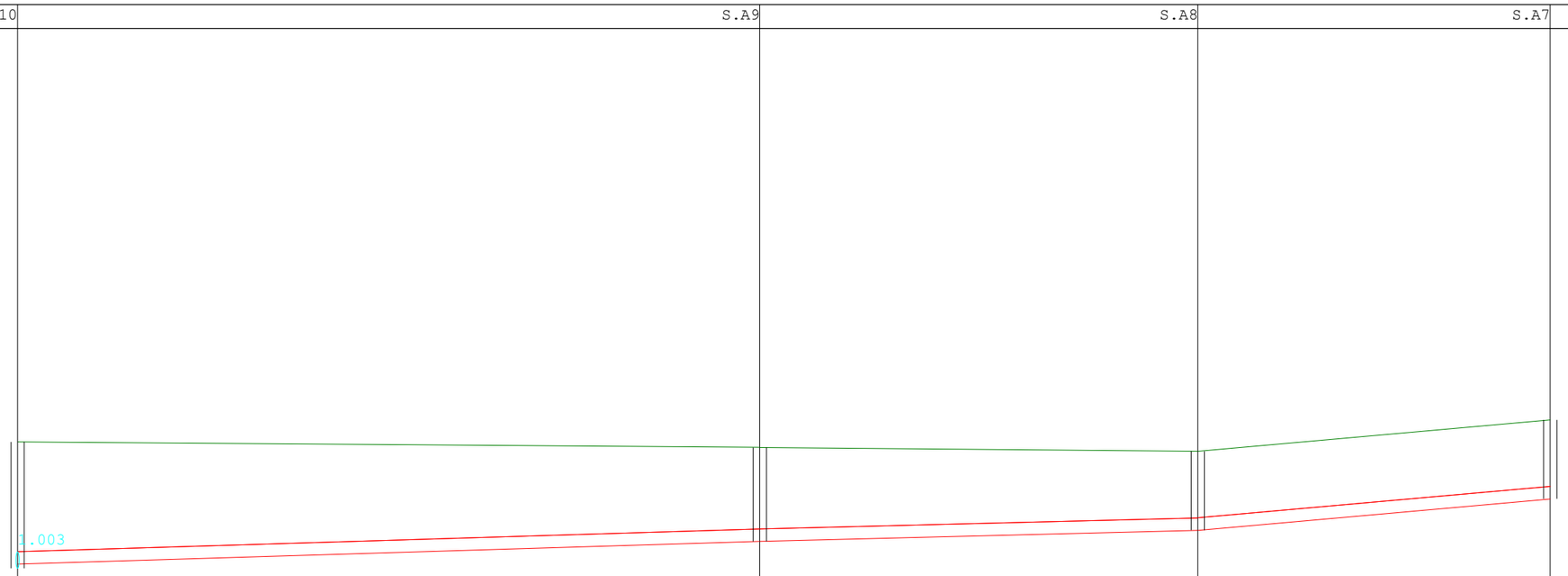
MH Name		S.A26	S.A25	S.A24	S.A23	
Hor Scale 500 Ver Scale 100 Datum (m) 2.000						
PN			S1.013	S1.012	S1.011	
Dia (mm)			225	225	225	
Slope (1:X)			199.7	199.8	202.0	
Cover Level (m)		11.600	11.900	12.400	11.900	
Invert Level (m)		8.386	8.568	8.568	8.774	8.774	9.058	
Length (m)			36.345	41.156	57.377	

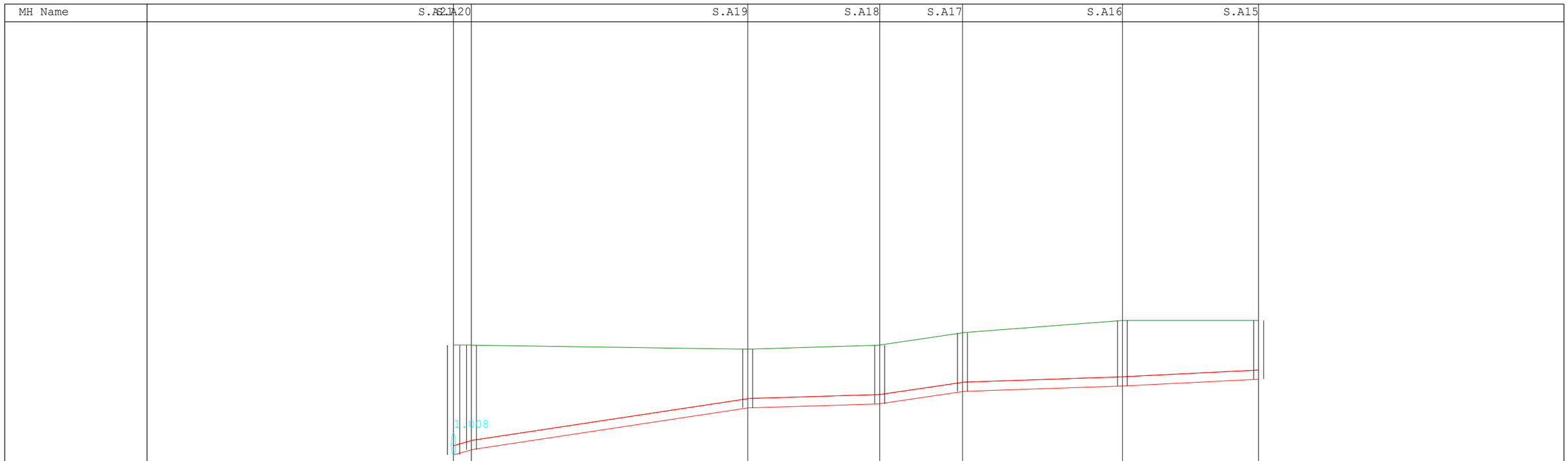


MH Name	S.A28	S.A27	S.A26	
Hor Scale 500 Ver Scale 100 Datum (m) 1.000				
PN		S1.015	S1.014	
Dia (mm)		225	225	
Slope (1:X)		49.7	48.0	
Cover Level (m)	11.500	12.100	11.600	
Invert Level (m)	6.463	7.065	7.065 / 8.386	
Length (m)		29.911	63.431	

MH Name	S.A29		S.A28	
Hor Scale 500 Ver Scale 100 Datum (m)-1.000				
PN		S1.016		
Dia (mm)		225		
Slope (1:X)		25.0		
Cover Level (m)	4.390		11.500	
Invert Level (m)	2.683		6.463	
Length (m)		94.491		

MH Name	S.A4	S.A3	S.A2	
				
Hor Scale 500 Ver Scale 100 Datum (m) 5.000				
PN		S2.001	S2.000	
Dia (mm)		225	225	
Slope (1:X)		102.7	100.1	
Cover Level (m)	14.340	14.100	14.100	
Invert Level (m)		12.059 12.361	12.361 12.670	
Length (m)		31.021	30.932	

MH Name	S.A10	S.A9	S.A8	S.A7	
					
Hor Scale 500 Ver Scale 100 Datum (m) 4.000					
PN		S3.002	S3.001	S3.000	
Dia (mm)		225	225	225	
Slope (1:X)		162.9	198.0	55.9	
Cover Level (m)	13.400	13.300	13.230	13.800	
Invert Level (m)		11.188	11.600 / 11.600	11.800 / 11.800	12.370	
Length (m)		67.106	39.599	31.863	



PN	S4.005	S4.004	S4.003	S4.002	S4.001	S4.000	
Dia (mm)	225	225	225	225	225	225	
Slope (1:X)	17.6	33.0	160.9	33.7	145.5	100.0	
Cover Level (m)	12.000 / 12.000	11.900	12.000	12.300	12.600	12.600	
Invert Level (m)	9.236 / 9.450	10.470 / 10.470	10.570 / 10.570	10.870 / 10.870	11.004 / 11.004	11.170	
Length (m)	2.186	33.680	16.086	10.100	19.498	16.604	

Appendix 11

ATTENUATION ESTIMATES, STORAGE TANK SIZING

CATCHMENT A

PROJECT: **Bessborough SHD Development**

DESCRIPTION: **21207-JBB-PH1-XX-CA-C-04401_Attenuation_Assessment_A_(Phase_1)**

DATE: 17/02/2022 **SHEET** 100 Year +10%

Sheet 1

Catchment Characteristics

Site Area			0.480 ha
SAAR			1106 mm
Soil Category	4	SOIL =	**0.47**
M5-60			16.3 mm
M5-2D			76.6 mm
r = M5-60 / M5-2d =			0.21

Permissible flow (Q100) = **7.72** l/s

Developent Area = 0.480 ha
Impervious Area = 0.480 ha

Rainfall duration hrs	Rainfall depth (R100) mm	Including CCF (R100)*1.1 mm	Total volume of runoff m3	Average flow m3/s	Permsble Flow m3/s	Flow to be stored m3/s	Storage Volume m3
0.25	16.1	17.7	85.01	0.094	0.0077	0.087	78
0.5	21.6	23.8	114.05	0.063	0.0077	0.056	100
1	28.9	31.8	152.59	0.042	0.0077	0.035	125
2	38.7	42.6	204.34	0.028	0.0077	0.021	149
4	51.8	57.0	273.50	0.019	0.0077	0.011	162
6	61.5	67.7	324.72	0.015	0.0077	0.007	158
12	82.3	90.5	434.54	0.010	0.0077	0.002	101
24	110.3	121.3	582.38	0.007	0.0077	-0.001	-84
48	128.3	141.1	677.42	0.004	0.0077	-0.004	-656
Required Volume = Maxum of storage volume, V100 =							**162** m3

Total attenuation storage required (m3) = **162** m3

CATCHMENT B

PROJECT: **Bessborough SHD Development**

DESCRIPTION: **21207-JBB-PH1-XX-CA-C-04403_Attenuation_Assessment_B_(Phase_1)**

DATE: 17/02/2022 **SHEET** 100 Year +10%

BARRY & PARTNERS consulting engineers

Sheet 1

Catchment Characteristics

Site Area			1.050 ha
SAAR			1106 mm
Soil Category	4	SOIL =	**0.47**
M5-60			16.3 mm
M5-2D			76.6 mm
r = M5-60 / M5-2d =			0.21

Permissible flow (Q100) = **16.88** l/s

Developent Area = 1.050 ha
Impervious Area = 1.050 ha

Rainfall duration hrs	Rainfall depth (R100) mm	Including CCF (R100)*1.1 mm	Total volume of runoff m3	Average flow m3/s	Permsble Flow m3/s	Flow to be stored m3/s	Storage Volume m3
0.25	16.1	17.7	185.96	0.207	0.0169	0.190	171
0.5	21.6	23.8	249.48	0.139	0.0169	0.122	219
1	28.9	31.8	333.80	0.093	0.0169	0.076	273
2	38.7	42.6	446.99	0.062	0.0169	0.045	325
4	51.8	57.0	598.29	0.042	0.0169	0.025	355
6	61.5	67.7	710.33	0.033	0.0169	0.016	346
12	82.3	90.5	950.57	0.022	0.0169	0.005	221
24	110.3	121.3	1273.97	0.015	0.0169	-0.002	-185
48	128.3	141.1	1481.87	0.009	0.0169	-0.008	-1435
Required Volume = Maxum of storage volume, V100 =							**355** m3

Total attenuation storage required (m3) = **355** m3

STORMTECH Stormwater Management System Design Tool

ver: Aug15

PROJECT REF:	Bessborough SHD Development
LOCATION:	Bessborough, Blackrock, Cork
DATE:	17-Feb-22
CREATED BY:	DOB

SYSTEM PARAMETERS

Required Total Storage	355	m^3
Stormtech chamber model	MC3500	
Filtration Permeable Geo or Impermeable Geo	Filter geo	
Number of Isolator Rows (IR)	1	

SITE PARAMETERS

Stone Porosity	43%		
Excavation Batter Angle (degrees)	60	°	*Minimum Requirement*
Stone Above Chambers	0.3	m	*0.30*
Stone Below Chambers	0.26	m	*0.23*
In-between Row Spacing	0.23	m	*0.23*
Additional Storage outside Excavation. E.g manholes, Header Pipe	0	m^3	

HEADER PIPE

Is Header pipe required within excavation	No	
Orientation of Header Pipe	Parrallel to IR	
Diameter of Header Pipe	0.6	m
Length of Header Pipe	0	m

CHAMBER SYSTEM DIMENSIONS

	Calculated	Adopted	
Number of Rows		3	ea
Number of units per Row		19	ea
System Installed Storage Depth (effective storage depth)	1.705		m
Tank overall installed Width at base	6.93	6.93	m
Tank overall installed Length at Base	43.16	43.16	m
Total Effective System Storage	**359.7**	**359.7**	m^3

STORMTECH SYSTEM DETAIL

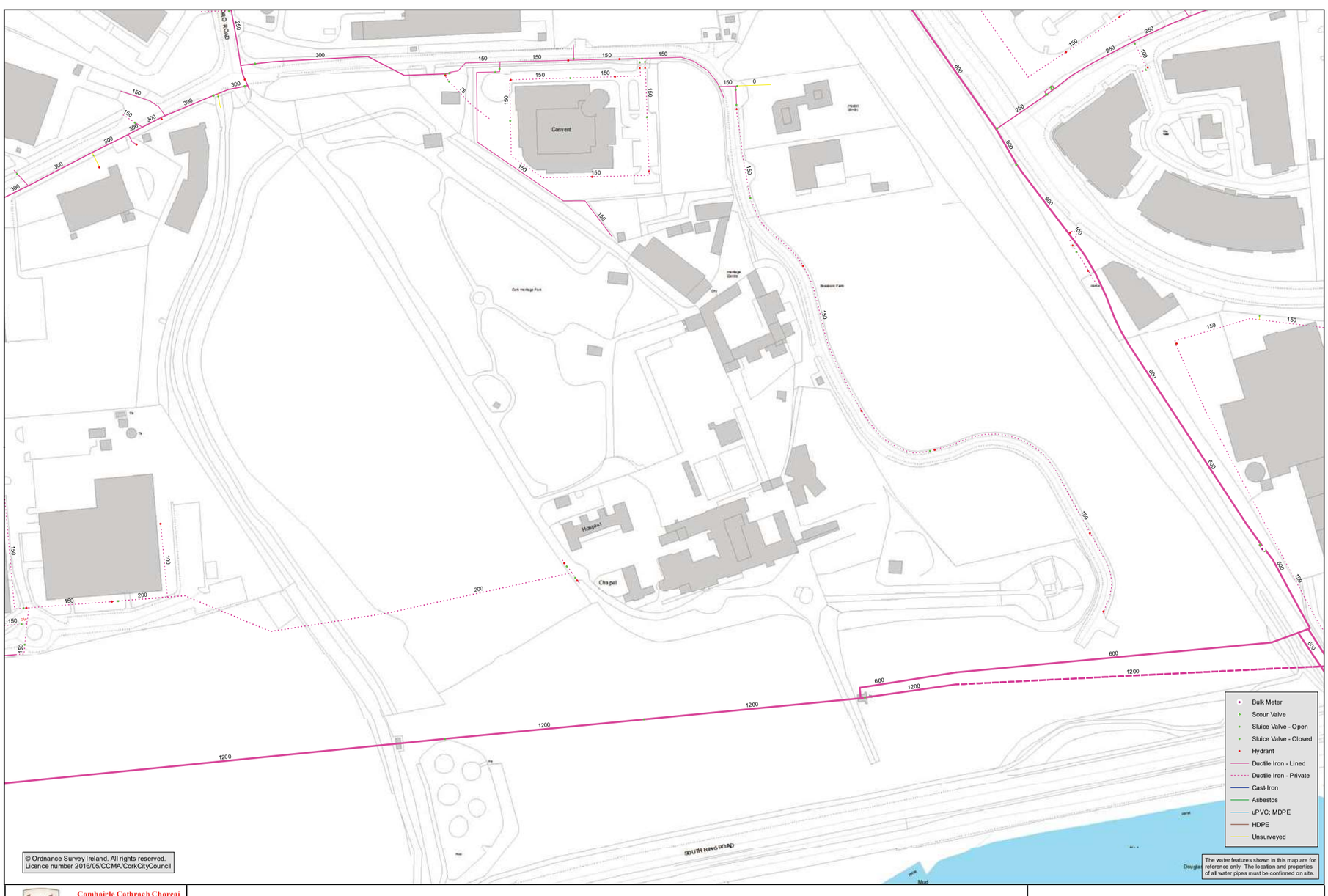
StormTech Chamber Model	MC3500	
Unit Width	1.955	m
Unit Length	2.18	m
Unit Height	1.145	m
Min Cover Over System	0.3	m
Max Cover Over Chamber	2.4	m
Chamber Internal Storage Vol.	3.11	m^3
Header Pipe Internal Storage Vol in Excavation	0.0	m^3

STONE AND EXCAVATION DETAIL

Volume of Dig for System	597	m^3
Width at base	6.93	m
Width at top	8.89	m
Length at base	43.16	m
Length at top	45.13	m
Depth Of System	1.71	m
Area of Dig at Base of System	299	m^2
Area of Dig at Top of System	401	m^2
Void Ratio	60%	
Stone Requirement - m3	415	m^3
Stone Requirement - tonne	681	tonne

Appendix 12

CORK CITY COUNCIL - EXISTING WATERMAIN RECORDS



Comhairle Cathrach Chorcaí
Cork City Council
Environment Directorate
Water Services (Distribution) Section
Tel: 021-4924026
Fax: 021-4924015
Web: www.corkcity.ie

Bessboro, Mahon
Public Watermain Records

Scale: 1:1000 Date: Jul 2018 DrgNo.
Drawn: LG Checked:

- Appendix 2-8 - Phase 2 'The Farm' Services Infrastructure Report prepared JB Barry and Partners Limited, Consultant Engineers

Client:

Estuary View Enterprises 2020 Ltd.

Project:

Bessborough SHD Development

Report:

Services Infrastructure Report

BARRY
& PARTNERS

Document Control Sheet

Client:	Estuary View Enterprises 2020 Ltd.
Project Title:	Bessborough SHD Development
Document Title:	Services Infrastructure Report
File Name:	21207-JBB-PH2-XX-RP-C-01006

Table of Contents *(incl. Y/N)*	**List of Tables** *(incl. Y/N)*	**List of Figures** *(incl. Y/N)*	**Pages of Text** *(No.)*	**Appendices** *(No.)*
Y	N	Y	15	12

Document Revision				**Document Verification**			
Issue Date *(DD/MM/YY)*	**Revision Code**	**Suitability Code**	**Author** *(Initials)*	**Checker** *(Initials)*	Reviewer As Per PMP *(Initials)*	**Approver** *As Per PMP (Initials)*	**Peer Review** *(Initials or N/A)*
30/07/2021	P01	S3	DOB	RS	TF	TF	N/A
21/02/2022	P02	S3	DOB	RS	TF	TF	N/A
21/03/2022	P03	S3	DOB	RS	TF	TF	N/A

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SECTION 1: INTRODUCTION

1.1 Scope of the Report

This Services Infrastructure Report outlines the proposed means of servicing the development with wastewater collection and disposal, stormwater management and disposal and water supply infrastructure. A Flood Risk Assessment is provided with this submission under a separate cover. Roads and traffic issues are dealt with separately by MHL Consulting Engineers on behalf of the Applicant and their submission should be consulted for such details.

The following should be read in conjunction with the engineering drawings which illustrate the servicing proposals and with the submissions by other members of the Applicant's design team

1.2 Site Location

The proposed development is located at Phase 2 'The Farm', Bessborough, Ballinure, Blackrock, Cork, on a circa 5.13-hectare site, with a developable area of 4.28-hectares, see Figure 1.1. This proposed development will form Phase 2 of a larger development on a circa 16.59-hectare site, see Figure 1.2 for outline phasing proposals.

The South Ring Road (N40) is located approximately 250m from the southern boundary of the proposed development. The boundaries of the site are formed by the buildings, outbuildings, roads and open spaces of the overall Bessborough complex. The site slopes gently from north to south, with ground levels falling from approximately 18.00 m OD in the north-east of the site to 10.50 m OD in the south-west of the site.

1.3 Proposed Development Brief

This report is prepared in support of a Strategic Housing Development (SHD) planning application by Estuary View Enterprises 2020 Ltd.

The proposed development provides for the demolition of 10 no. existing agricultural buildings /sheds and log cabin residential structure and the construction of a residential development of 140 no. residential apartment units over 2 no. retained and repurposed farmyard buildings (A & B) with single storey extension and 3 no. new blocks of 3-5 storeys in height, with supporting resident amenity facilities, crèche, and all ancillary site development works. The proposed development includes 140 no. apartments to be provided as follows: Block C (9 no. 1-bedroom and 25 no. 2-bedroom over 3 storeys), Block D (34 no. 1-bedroom & 24 no. 2-bedroom over 3-4 storeys), Block E (27 no. 1-bedroom, 20 no. 2-bedroom & 1 no. 3-bedroom over 4-5 storeys). It is proposed to use retained Block A and Block B for resident amenities which include home workspace, library, lounge and function space.

The proposal includes a new pedestrian/cycle bridge over the adjoining Passage West Greenway to the east, connecting into the existing down ramp from Mahon providing direct access to the greenway and wider areas, as well as new pedestrian access to Bessborough Estate to the north including upgrades to an existing pedestrian crossing on Bessboro Road.

The proposed development provides for outdoor amenity areas including publicly accessible parkland, landscaping, surface car parking, bicycle parking, bin stores, substation, public lighting, roof mounted solar panels, wastewater infrastructure including new inlet sewer to the Bessborough Wastewater Pumping Station to the west, surface water attenuation, water utility services and all ancillary site development works. Vehicular access to the proposed development will be provided via the existing access road off the Bessboro Road. See Appendix 1 for proposed site layout plan.

Figure 1-1: Location of Proposed Development

Figure 1-2: Phasing of Proposed Development

SECTION 2: WASTEWATER COLLECTION & DISPOSAL

2.1 Existing Wastewater Network

Cork City Council / Irish Water drainage records show that there is an existing 375/450mmØ foul sewer located to the west of the Phase 3 lands, outside of the boundary of the Applicant's lands, which runs north to south and discharges to the Bessborough Wastewater Pumping Station (WWPS). From the WWPS a 350mmØ rising main heads east crossing through the greenfield area in the ownership of the Applicant before turning north along the Passage West Greenway, see Appendix 2.

A feasibility study of the local area has revealed that there is an existing a 150mmØ foul sewer in the road adjacent to the eastern boundary of the Phase 2 site which runs north to south before turning in a westerly direction and connecting to the WWPS described above, see as-built drawing in Appendix 3. This sewer was constructed under planning reference 03/27028.

2.2 Pre-Connection Enquiry Stage

Following a Pre-Connection Enquiry, Irish Water (IW) issued a Confirmation of Feasibility (COF) stating that the site can be serviced by its wastewater infrastructure network. This COF is included in Appendix 4.

IW have advised that the proposed connection should be made directly to the WWPS, via a new inlet sewer. The WWPS is almost at design loading capacity. However, Irish Water has a project underway to replace the existing pumps which will increase the pump rate and provide sufficient capacity to accommodate this development and subsequent phases of this development. This upgrade project is scheduled to be completed by Q4 2022 and the proposed connection could be completed as soon as possibly practicable after this date.

2.3 Design Acceptance Stage

The proposed designs were progressed in accordance with Irish Water's Code of Practice for Wastewater Infrastructure and were submitted to Irish Water for review and consideration for design acceptance as per the requirement of the SHD process. A Statement of Design Acceptance was issued by Irish Water and is included in Appendix 4.

The wastewater collection within the development will be via a network of gravity sewers. The wastewater flows will be collected and conveyed in in a westerly direction, from the western boundary of the proposed development site and will connect directly to the WWPS.

The final connection from the western edge of the lands to the existing WWPS will be undertaken using directional-drilling techniques to ensure that the existing western boundary wall to the lands will remain undisturbed during construction.

The wastewater collection system is designed and will be constructed in accordance with Irish Water's Code of Practice for Wastewater Infrastructure to ensure self-cleansing velocities will be achieved on all pipe runs. The pipes proposed as part of this design have been sized in accordance with Table 2.1, an extract from IW-CDS-5030-03 (Revision 2 2020).

Manholes will be constructed on all pipe-runs at changes in sewer direction, changes in gradients, at significant sewer connections and at a maximum spacing of 90m on all straight sections of pipework. The gravity wastewater sewers have been designed using MicroDrainage design software and the outputs are included in Appendix 5 of this report. The foul sewer layout plans are attached on Drawing No's. 21207-JBB-PH1-XX-DR-C-04000 & 04001.

No. of Dwellings	Pipe Diameter	Minimum Gradient
2 to 9	150mm (or 225mm)	1:60
10 to 20		1:150
21 to 210	225mm	1:200
211 to 250		1:150
250 to 330		1:100
331 to 450	300mm	1:300
451 to 565		1:200
566 to 655		1:150
656 to 830		1:100

Table 2-1: Foul Sewer Size/Gradient Criteria

2.4 Loading Calculations

The design flows are calculated using the Irish Water Code of Practice for Wastewater Infrastructure Appendix B which is summarised in tables 2.2 and 2.3 below.

Use	No. of Units	Occupancy Rate	Population (P)	Loading (G) (l/day/person)	Daily Loading (PxG) (l/day)	Daily Loading (l/s)
Residential	140	2.7/ Unit	378	150	56,700	
Infiltration (I) 10% (COP Appendix B – Table 2.4)					5,670	
Dry Weather Flow (PG +I)					62,370	
Residential Peaking Factor (Pf_{Dom}) (COP Appendix B – Table 2.5)					6	
Design Foul Flow [(Pf_{Dom} x PG + I]					345,870	4.003
Misconnection Allowance (SW) 3% (COP Appendix B - Section 2.2.10)						0.338
Design Flow						4.341

Table 2-2: Foul Flow Calculations for Residential Development

Use	Floor Area (m^2)	Occupancy Rate	Population (P)	Loading (G) (l/day/person)	Daily Loading (PxG) (l/day)	Daily Loading (l/s)
Creche	242	31*	31	90	2,790	
Café	65	1 per 20m^2	3	50	150	
		1 per 5m^2	13	12	156	
Communal Workspace	180	24**	24	100	2,400	
Gym	108	1 per 5m^2	22	50	1,100	
Lounge	85	30**	30	15	450	
Function Room	70	30**	30	60	1,800	
				Total	8,846	
				Total (Based on 12 Hour Day)	4,423	
				Infiltration (I) 10% (COP Appendix B – Table 2.4)	442	
				Dry Weather Flow (l/s) PG +I	4,865	
				Commercial Peaking Factor ($Pf_{Dom, Ind}$) (COP Appendix B – Table 2.7)	4.5	
				Design Foul Flow ($Pf_{Dom, Ind}$ x PG) + I (l/s)	20,346	0.235
				Misconnection Allowance (SW) 2% (COP Appendix B – Table 2.10)		0.233
				Design Flow (l/s)		0.468

Table 2-3: Foul Flow Calculations for Commercial Development

The combined residential and commercial design flow is 4.8l/s. This figure has been proportionally applied as a base flow to the heads of the wastewater sewer runs within the MicroDrainage design model, see Appendix 5 for the results.

SECTION 3: STORMWATER COLLECTION & DISPOSAL

3.1 Existing Hydrology

The proposed development site does not contain any mapped watercourse. The nearest watercourse to the proposed Phase 2 development site is the Douglas Estuary which is located approximately 250m to the south of the site. The Douglas Estuary flows in an easterly direction and discharges to transitional water body Lough Mahon to the south of the site. The main hydrological features associated with the site are presented in Figure 3.1 below.

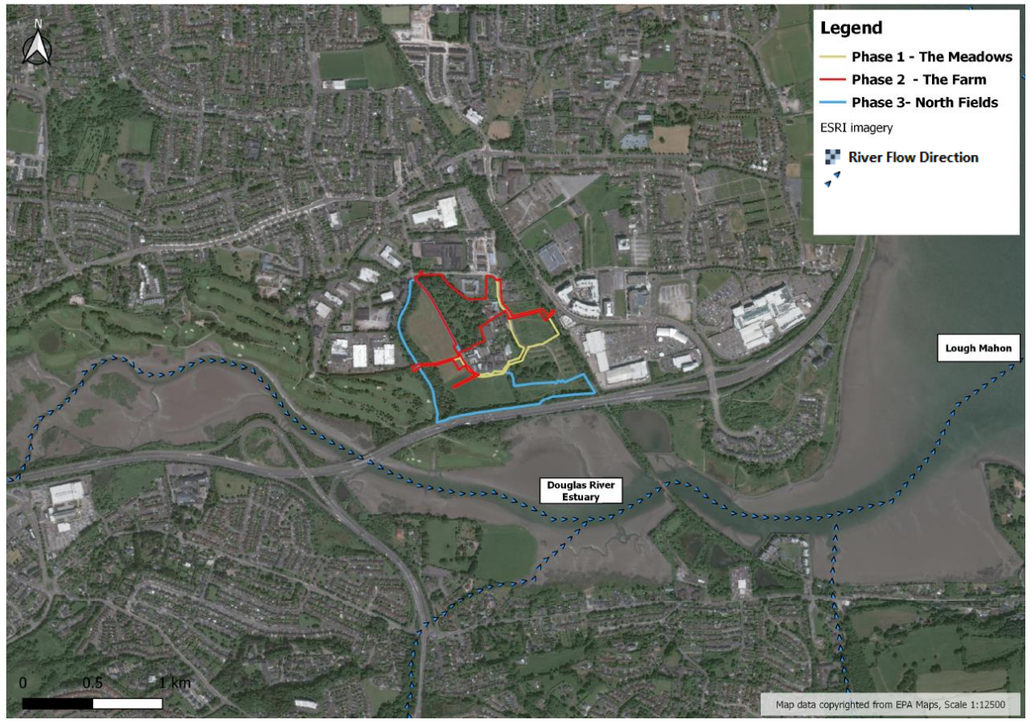


Figure 3-1: Hydrological Features of the Area

A geological desk study was conducted to gain an initial understanding of the existing ground conditions. Figure 3.2 is an extract from the Geological Survey of Ireland (GSI), where the soil permeability at the site is categorised as 'Moderate'. Further to this the groundwater vulnerability is categorised as 'High', see Figure 3.3. Groundwater vulnerability of an area is determined by the permeability and thickness of the subsoils overlying the groundwater, and the type of recharge sources (diffuse or point source). Therefore, areas where the infiltrating water and contaminants move faster from land to groundwater with high permeability are more vulnerable. Both sources of information would suggest that the site should have reasonable rates of permeability.

A ground investigation was undertaken by Priority Geotechnical Ltd. in January 2022 to establish subsurface conditions at the proposed project site. An infiltration test was conducted in one of the boreholes (BH03), see Appendix 6, which resulted in an infiltration rate of $1.12x10^{-3}$ m/s. An infiltration test was also conducted in one of the boreholes (BH05), on the Phase 1 site which saw no drop in water level after 60 minutes. Due to the inconsistency of results, we have conservatively assumed there will be no reduction in runoff volumes applied for the various SuDS measures. However, it has been assumed that the first flush, 5mm of rainfall

can be infiltrated to ground in specific areas designated for interception purpose, which is explained in greater detail below. Further infiltration testing in accordance with BRE 365 will be conducted in due course to determine accurate results.

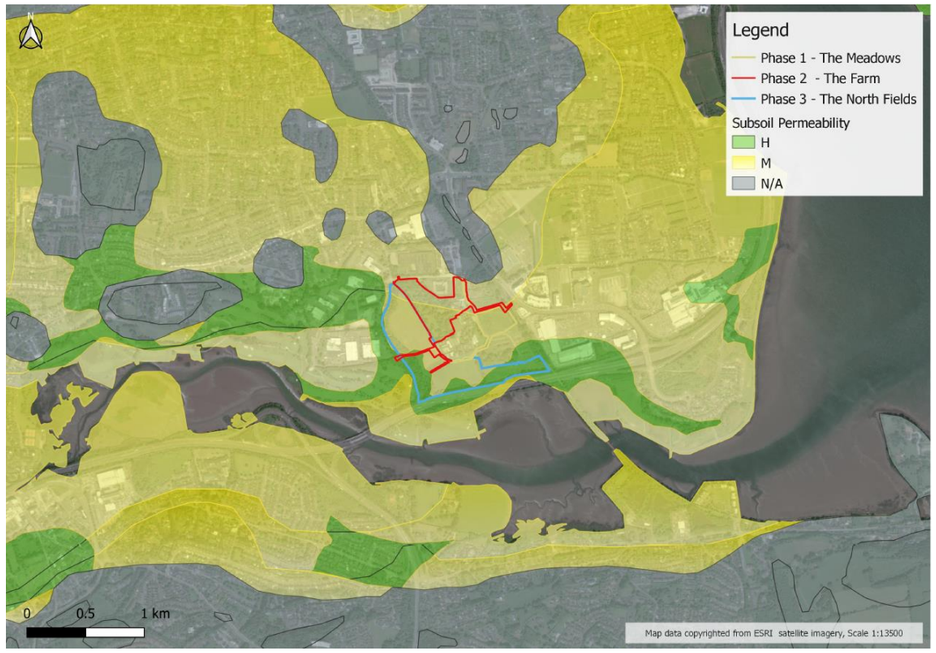


Figure 3-2: Soil Permeability

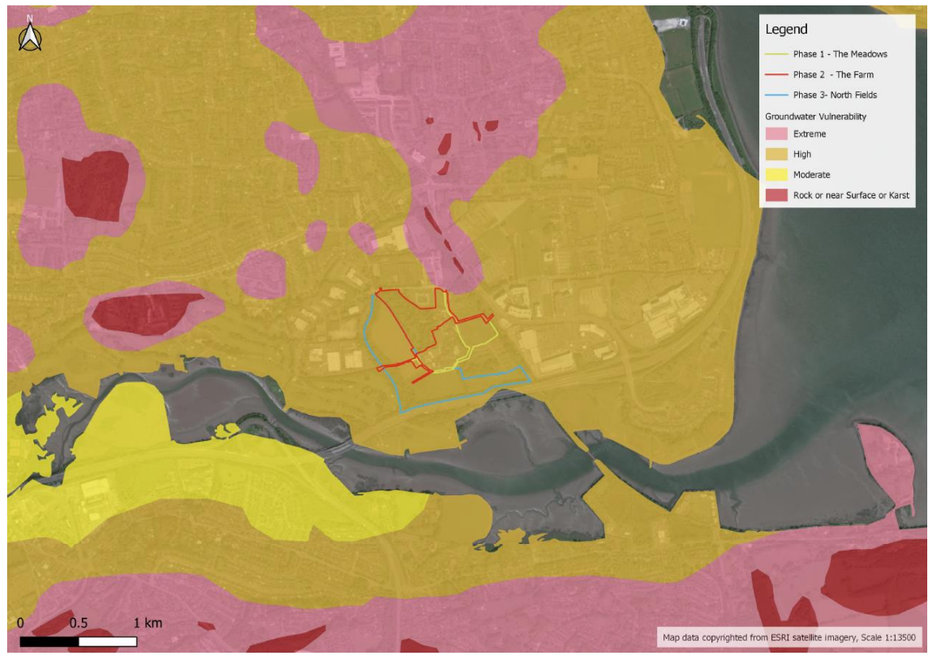


Figure 3-3: Groundwater Vulnerability

3.2 Existing Stormwater Network

Cork City Council drainage records indicate there is an existing 1350mmØ trunk storm sewer located approximately 200m to the west of the Phase 2 site, outside the boundary of the Applicant's lands, which runs in a north-south direction before crossing under the South Ring Road (N40) and discharging to the Douglas Estuary, see Appendix 7.

A feasibility study of the local area has revealed that there is an existing 225mmØ storm sewer in the road adjacent to the eastern boundary of the site (increasing downstream to a 450mm/750mmØ), which runs north to south before turning in a westerly direction and connecting to the 1350mmØ storm sewer described above, see as-built drawing in Appendix 3. This sewer was constructed under planning reference 03/27028.

3.3 Greenfield Runoff

The total developable site area is 4.28-hectares however this includes large open space and treed areas along the western and northern boundaries which will remain undeveloped and therefore will not be positively drained to the development surface water drainage system, and these areas are excluded from the surface water calculations of Qbar. In this context a figure of 1.48ha is used for the site area.

The greenfield runoff rate has been estimated using the HR Wallingford Greenfield runoff estimation online tool (report attached in Appendix 8). The online tool calculated a Qbar figure of 12.2 l/s (equivalent to 8.24 l/sec/ha). A summary of the design values output by the HR Wallingford Greenfield runoff estimation online tool is shown below:

Design Criteria	Value
Site Area (ha)	1.48
Soil Type	4
SPR	0.47
SAAR (mm)	1106
1 year factor	0.85
30-year factor	1.65
100-year factor	1.95

Table 3-1: HR Wallingford Design Value Outputs

Given the proximity of the site to the Douglas Estuary the controlled outflow from the development has been set to the Q100 figure (the flow from the site in its greenfield condition in a 100-year storm event). This approach was proposed to Cork City Council Drainage Department and they were satisfied with the approach. See correspondence from Cork City Council in Appendix 9.

The growth factor to be applied when calculating Q100 from Qbar is 1.95 giving an upper limit to the discharge from the site at 23.79 l/sec. This is the value that will be used in later detailed design as the upper limit of surface water discharge from the development.

3.4 Proposed Development Surface Water Management System

The proposed surface water management system will, as far as is feasible, be designed in accordance with the principles of Sustainable Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS).

The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimise the impact of urbanisation by replicating the runoff characteristics of a greenfield site. The criteria provide a consistent approach to addressing both rate and volume of runoff as well as ensuring the environment is protected from pollution that is washed off roads and buildings. These drainage design criteria are as follows:

- Criterion 1 - River Water Quality Protection
- Criterion 2 - River Regime Protection
- Criterion 3 - Flood Risk Assessment
- Criterion 4 - River Flood Protection

The requirements of SuDS are typically addressed by provision of the following:

- Interception storage
- Treatment storage (not required if interception storage is provided)
- Attenuation storage
- Long term storage (In discussion with Cork City Council there is no requirement for long term storage)

3.4.1 Layout of the Proposed Network

The proposed surface water network will include a storm drainage pipe network, attenuation storage structures and several SuDS features which will aid the reduction of runoff volumes by slowing surface water flows, providing the opportunity for evapotranspiration and providing the opportunity for infiltration to ground. Both the interception and attenuation storage requirements of GDSDS will be sufficiently met.

An assessment of the potential SuDS measures that could be incorporated within the site was conducted using the SuDS Manual, CIRIA 753 as guidance. The following SuDS features have been identified as applicable and will be provided within the proposed scheme:

- Green Roofs: will be provided throughout the site on flat roofs, where possible. The green roof will be an extensive type with sedum planting at the surface with a drainage layer beneath. The drainage layer will convey flows to discharge locations. It is not proposed to restrict the discharges from the roofs. Where possible discharges from roofs will be tied into planters or permeable paving substrata via diffusers.

- Permeable Paving: will be provided for all parking spaces and the creche play area. Permeable paving will be a Type B as per SuDS Manual, CIRIA 753, a combination of infiltration and piped drainage.

- Tree Pits/Bioretention Planters: will be provided in every feasible location where there is a proposed tree or planter. The tree pits will contain engineered soil filled tree boxes with drainage pipes beneath to link trees together and tie in with the proposed surface water sewer. The bioretention planters will consist of a shallow landscaped depression at the surface with a drainage layer beneath.

- StormTech Attenuation Tank: will be provided at the natural low point, at the southwest of the site for final storage of runoff volumes before discharging to the existing surface water network at a controlled rate.

The SuDS features will be designed to work in sequence thereby creating a treatment train. The proposed SuDS layout is shown on see Drawing No. 21207-JBB-PH2-XX-DR-C-04005 and the overall drainage arrangement is shown on Drawing No. 21207-JBB-PH2-XX-DR-C-04002, both included with this submission.

Manholes will be constructed on all pipe-runs at changes in sewer direction, changes in gradients, at significant sewer connections and at a maximum spacing of 90m on all straight sections of pipework The gravity surface water sewers have been designed using MicroDrainage design software and the outputs are included in Appendix 10 of this report.

The contributing surface areas of the development has been split up and tabulated below:

Area Type	Units (ha)
Total Site Area	4.28
Catchment Area	1.48
Green Roof	0.13
Permeable Paving	0.01
Tree Pits/Bioretention Planters	0.05
Impermeable Area	1.17
Open Space Without Formal Drainage	0.12
Total Drained Area	1.36

Table 3-2: Surface Areas

3.4.2 Interception Storage

In accordance with the requirements of GDSGS, at least 5mm, and preferably 10mm, of interception storage should be provided on site, where runoff to the receiving water can be prevented.

In the case of this Phase 2 development the total drained area is 1.36ha (13,600m²) as per Table 3.2 above. This results in a required interception storage volume of 68.0m³ (13,600 X 0.005) The proposed interception storage will be provided by permeable paving, swales, tree pits and bioretention areas.

Green roofs are proposed throughout the development. These areas cover a total area of 1,300m². The build-up in the green roof system will provide a minimum of 5mm of interception storage per 1m², allowing for a total interception storage volume of 6.50m³.

Permeable surfaces including permeable paving, tree pits and bioretention planters are proposed throughout the development, for a total area is 600m². The drainage pipe within the gravel bed for these areas will be set at 50mm above the bed formation giving (assumed 30% voids) interception stage equivalent to 15mm storage depth. Total interception volume provided in the permeable paving equals 9m³.

The proposed StormTech attenuation tank has a surface area of 420m². Interception storage will be provided within the base of the tanks for a depth of 300mm depth of stone below the StormTech Chambers. Assuming the tanks have a void ratio of 43% (which is conservative), the total interception storage volume provided is 54.18m³.

The overall interception storage volume provided is therefore 69.68m³ which represents approximately 5.1mm of interception storage which is above the required minimum provision as detailed above.

3.4.3 Attenuation Storage

The proposed rate of surface water discharge from the development will be limited to that of the greenfield runoff for a 100-year storm event, as described in Section 4.2. Attenuation will be provided by StormTech attenuation chambers which will cater for the 100-year storm event with 10% climate change allowance added. The proposed surface water network will be contained in a single catchment, see Figure 3.4.

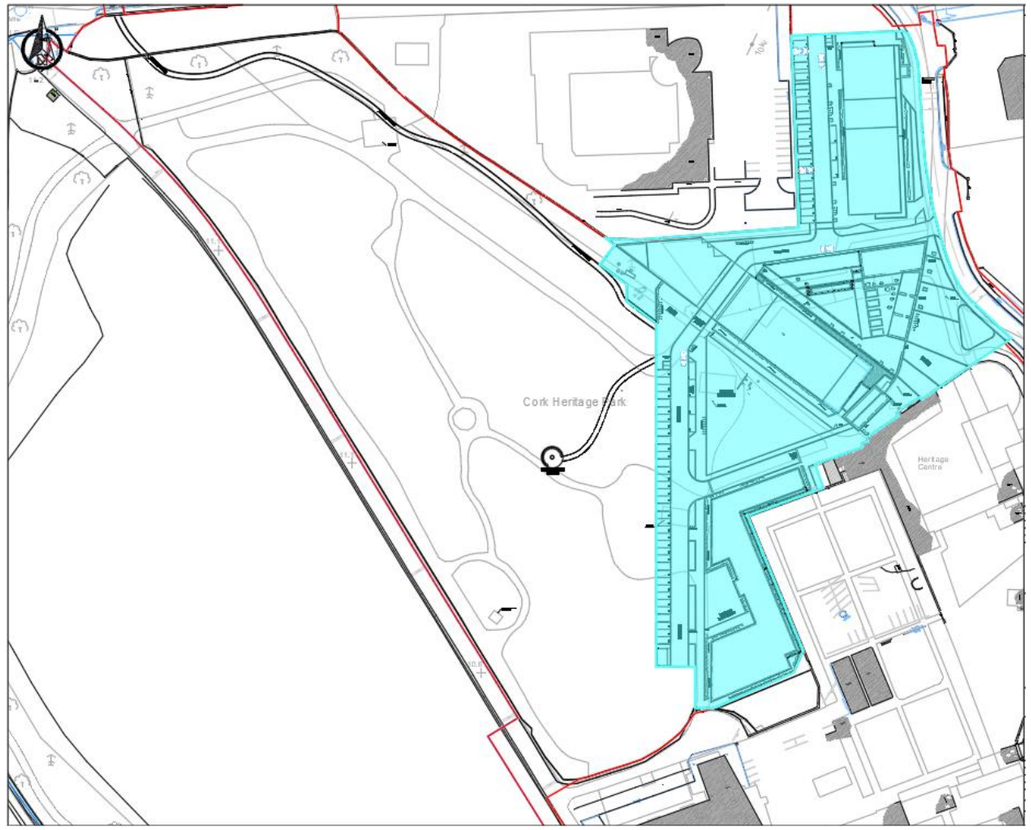


Figure 3-4: Surface Water Catchment Areas

The various SuDS components being proposed as part of the development will provide some attenuation, reduce flow rates and will disperse surface water via evapotranspiration and infiltration. However, at this stage of the design process, and to ensure a robust design, we are designing for the worst case and have not assumed a reduction in runoff volume from the various SuDS features and permeable surfaces in the attenuation storage calculations. This will be revisited closer to construction stage, subject to a granted planning permission.

Preliminary attenuation volume calculations, based on the above criteria, are summarised in Table 3.3. (See Appendix 11 for detailed calculations)

Ref.	Catchment Area (ha)	Q100 (l/s)	Required Storage Volume 100yr +10% C.C. (m³)	Provided Attenuation Volume (m³)	Attenuation Storage Type
A	1.48	23.79	501	501	StormTech Chambers

Table 3-3: Summary of Attenuation Requirements and Proposals

3.4.4 Water Quality

The proposed development is residential and therefore is considered a low-level pollution hazard. Surface water runoff will be directed to the SuDS features as mentioned above and will therefore benefit from their pollutant removal qualities. However, to ensure water quality standards are met, we are proposing a hydrocarbon interceptor upstream of the StormTech attenuation tank.

Simple Index Approach

The effectiveness of the chosen SuDS components to achieve water quality can be assessed using the 'simple index approach' as described in CIRIA C753.

The simple index approach designates risk indices to the various areas of development to determine their possible pollutant contribution. Similarly, the SuDS features are designated mitigation indices and if the mitigation indices are larger than the risk indices the water quality objectives are considered satisfied.

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Driveways, car parks, low traffic roads	Low	0.5	0.4	0.4

Table 3-4: Pollution Hazard Indices for Different Land Uses

As can be seen in Table 3.5 below the total mitigation potential of the SuDS features far outweigh the contamination risks. Secondary (or further) stages in the treatment train are assigned 50% of the stated treatment indices value.

SuDS Component	TSS	Metals	Hydrocarbons
Permeable paving	0.7	0.6	0.6
Bioretention/Tree pits	0.8	0.8	0.8
Petrol Interceptor	0.4	0.4	0.4

Table 3-5: Indicative SuDS Mitigation Indices for Discharges to Surface Waters

3.4.5 Amenity and Biodiversity

Meeting amenity and biodiversity standards is all about creating attractive, pleasant, and liveable urban areas for both people and for nature.

The proposed SuDS features within this development will not only be aesthetically pleasing, but they will also assist the creation of liveable habitats for nature by retaining rainfall at the source. The final details of these features will be drawn-up in consultation with the landscape design and ecological consultants on the design team.

3.5 Conveyance of Surface Water Outflow to Final Discharge Location

A new 225mmØ surface water outfall pipe will convey the restricted flows from the site in a south-westerly direction connecting to the existing 750mmØ surface water sewer upstream of its connection to the existing 1350mmØ surface water pipe which in turn discharges to the Douglas Estuary further to the south.

The controlled discharge from the proposed development (a maximum of 23.79 l/sec) will be minimal relative of the capacity of the existing 750mmØ and 1350mmØ pipes and given that this controlled outflow matches existing greenfield runoff from the site in a 100-year storm event these flows will not create a significant increase in the flow to the Douglas Estuary.

The proposed route of this sewer is shown on Drawing No. 21207-JBB-PH2-XX-DR-C-04006.

SECTION 4: WATER SUPPLY

4.1 Existing Watermain Network

Cork City Council watermain records show there is an existing 150mmØ watermain in the roadway adjacent to the eastern boundary of the site, an existing 300mmØ watermain in the roadway to the north of the site and a 200mmØ watermain to the south. There is also an existing 1200mmØ trunk watermain running through the greenfield area in the ownership of the Applicant to the south of development site, see Appendix 12.

4.2 Pre-Connection Enquiry Stage

Following a Pre-Connection Enquiry, Irish Water (IW) have issued a Confirmation of Feasibility (COF) that the site can be serviced by its water infrastructure network. This COF is included in Appendix 4.

IW have advised that the connection is to be made to the existing 300mmØ ductile iron watermain in the roadway to the north of the site.

4.3 Design Acceptance Stage

The proposed design for water supply infrastructure within the development was progressed in accordance with Irish Water's Code of Practice for Water Infrastructure and was submitted to Irish Water for review and consideration for design acceptance as per the requirement of the SHD process. A Statement of Design Acceptance was issued by Irish Water and is included in Appendix 4.

To serve the development a 150mmØ watermain will be connected to the existing 300mmØ ductile iron watermain in the roadway to the north of the site. 40mmØ spurs will be taken off the proposed 150mmØ watermain and will feed a local cold water storage tank / booster station within the plant room of each apartment block. A bulk flow meter will be provided on each of the apartment block supply lines. From the plant rooms each of the residential and commercial units will be fed and metered individually.

Fire hydrants will be provided such that each building will be within 46m of a hydrant and these hydrants will be fully accessible to the fire service. Apartment buildings will be subject to Fire Safety Certificate applications and the provision of appropriate water supply for firefighting will be addressed in these applications.

The proposed water supply layout plans are shown on Drawing No. 21207-JBB-PH2-XX-DR-C-03002.

4.4 Loading Calculations

Water demand for the development is determined in accordance with Irish Water Code of Practice for Water Infrastructure.

Per-capita consumption = 150 litres/person/day

Average day / peak week demand (ADPWD) = 1.25 x ADDD

Peak Water Demand = 5.00 x ADPWD

Use	Floor Area (m^2)	Occupancy Rate	Population (P)	Average Daily Demand (l/day)	Average Daily Demand (l/s)	Average Day/Peak Week Demand (l/s)	Peak Hour Water Demand (l/s)
Residential	140	2.7	378	56,700	0.656	0.82	4.1
						Total	4.1

Table 4-1: Water Demand for Residential Development

Use	Floor Area (m^2)	Occupancy Rate	Population (P)	Average Daily Demand (l/day)	Average Daily Demand (l/s)	Average Day/Peak Week Demand (l/s)	Peak Hour Water Demand (l/s)
Creche	242	31	31	4,650	0.054	0.068	0.340
Café	65	1 per 20m^2	3	450	0.027	0.035	0.175
		1 per 5m^2	13	1,950			
Communal Workspace	180	24	24	3,600	0.042	0.053	0.265
Gym	108	1 per 5m2	22	3,300	0.038	0.048	0.240
Lounge	85	30	30	4,500	0.052	0.065	0.325
Function Room	70	30	30	4,500	0.052	0.065	0.325
						Total	1.67
						Total (Based on 12 Hour Day)	0.835

Table 4-2: Water Demand for Commercial development

Appendix 1

PROPOSED SITE LAYOUT PLAN

FARM SCHEME BUILDINGS:A,B,C,D,E		
140 APARTMENTS	NO.	%
1 BEDROOM AP.	70	50 %
2 BEDROOMS AP. 3P	12	8.6 %
2 BEDROOM AP. 4P	57	40.7%
3 BEDROOMS AP.	1	0.7 %
TOTAL NO.	140	100 %
DUAL ASPECT	57	40.7%
NO. OF UNITS WITH AREA 10% GREATER THAN REQUIRED	78	55.0%
TOTAL RESIDENT'S PRIVATE AMENITY AREA	2,563 sqm	
PUBLIC OPEN SPACE	27,136 sqm	63.3 %
STREETS AND SQUARES	1,072 sqm	
PUBLIC PARK	24,520 sqm	
PUBLIC LINK TO GREENWAY	1,544 sqm	
PARKING SPACES	54	38.0%
CRECHE DROP OFF	4	
MOTORBIKE SPACES	5	
RESIDENT'S BIKE SPACES	230	
VISITOR'S BIKE SPACES	100	

LEGEND

- SITE BOUNDARY — SITE AREA: 51.250 sqm — DEVELOPABLE AREA: 42 842 sqm
- OTHER LANDS UNDER APPLICANT'S CONTROL
- RESIDENT'S AMENITY AREA
- EXISTING STRUCTURE TO BE DEMOLISHED
- PROPOSED TREES
- EXISTING TREES TO BE RETAINED
- ROOT PROTECTION ZONE
- EXISTING TREES TO BE REMOVED

1 PROPOSED SITE LAYOUT PLAN
1:500 @ A0

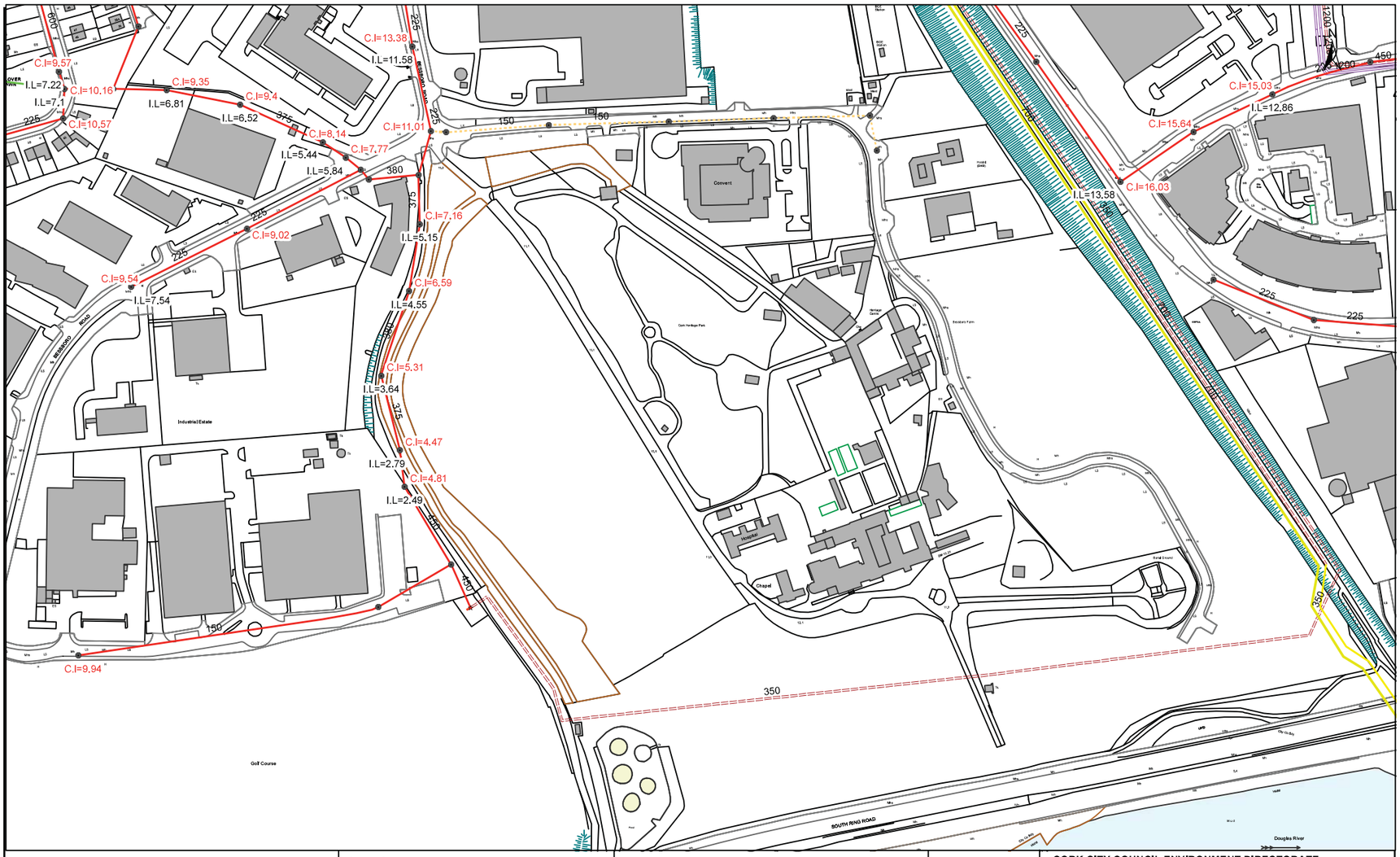
SITE LAYOUT PLAN
1:500@A0

SHiPSEYBARRY
Chartered Architects

PROJECT:	PHASE 2- THE FARM-BESSBOROUGH
SCALE:	1:500 @ A0
DATE:	04.2021
DRAWING DESCRIPTION:	SITE LAYOUT PLAN
OVERSEEN BY:	AH
APPROVED BY:	GB
CLIENT:	ESTUARY VIEW ENT. 2020 LTD.
DRAWING NO.:	SB-2020-107-200

Appendix 2

CORK CITY COUNCIL - EXISTING WASTEWATER NETWORK



Drainage Records

Legend

IW_FoulNetwork
PIPE_FUNCT
- LOCAL COMBINED
- LOCAL FOUL
- RISING MAIN
- County Co
- CoCo Rising Main
- PRIVATE FOUL
- PRESSURE PIPE
- PUMP OVERFLOW
- UNPROCESSED

IW_FoulManholes
MANHOLE_
- Manhole
- Pumphouse

THE SEWERS SHOWN ON THIS MAP ARE FOR REFERENCE ONLY. THE LOCATION AND PROPERTIES OF ALL SEWERS, LEVELS, PIPESIZES, etc. MUST BE CONFIRMED ON SITE.

1:2,500

N

CORK CITY COUNCIL ENVIRONMENT DIRECTORATE
(As agents of Irish Water)

Drawn By: A. Homan

Checked by: G.R.

Date: 25/07/2018

Appendix 3

AS-BUILT LOCAL DRAINAGE NETWORK

NOTES.

1.	To be read in conjunction with all relevant drawings and specification.
2.	Do not scale if in doubt ask.
3.	All dimensions to be checked on site.

Legend

Foul & Storm
150mm Ø Site Connections

Existing Services Connected

MAHON GOLF COURSE

CONVENT

Tank

Tank

1.	AS CONSTRUCTED	A.T.	0.0'D	06.09.'06
0.	ISSUED FOR CONSTRUCTION	M.M.	0.0'D	11.04.'06
REV.	DETAILS	REV.	CHKD.	DATE

CORK CITY COUNCIL
Scanned
PLANNING DIRECTORATE

John O'Donovan & Associates
Civil, Structural, Mechanical & Electrical Engineers
Model Farm Road, Cork 4, Ireland.
telephone: 021 454 4244 facsimile: 021 454 4277
e-mail: firstnames.surname@joda.ie web: www.joda.ie

jodo ENGINEERING CONSULTANTS

Bessborough Site Development Works
Bessborough, Blackrock, Cork

3699–103

DWG TITLE: As Built Site Services – Foul & Storm Water Drainage
DN: A.T.
CHKD: 0'D.D
STATUS: CONSTRUCTION
SCALE: Not To Scale
DATE: APRIL 2006

Appendix 4

IRISH WATER – CONFIRMATION OF FEASIBILITY

IRISH WATER – STATEMENT OF DESIGN ACCEPTANCE

Tim Finn

JB Barry & Partners
3 Eastgate, Eastgate Business Park
Little Island
Co. Cork
T45KH74

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

9 February 2022

Re: CDS21001326 pre-connection enquiry - Subject to contract | Contract denied

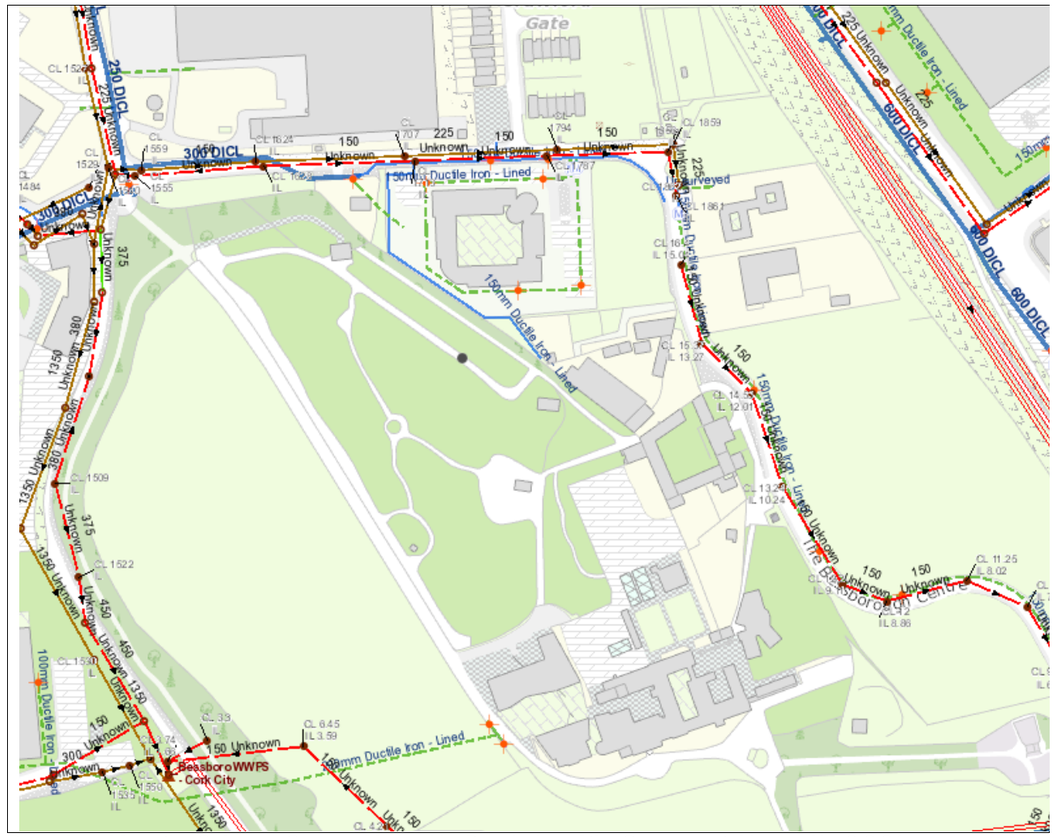
Connection for Multi/Mixed Use Development of 140 unit(s) and creche at Bessboro, Blackrock, Co. Cork

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Bessboro, Blackrock, Co. Cork (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	Connection to be made to the existing 300mm DI adjacent to site on Bessboro Rd. No works to interfere with existing 1200mm trunk main. No diversions of this main shall be permitted.
Wastewater Connection	Bessborough WWPS is almost at design loading capacity. Irish Water has a project underway to replace the existing pumps which will increase the pump rate and provide sufficient capacity to accommodate this development. This upgrade project is scheduled to be completed by Q4 2022 (this may be subject to change) and the proposed connection could be completed as soon as possibly practicable after this date.
	New development to discharge directly to Bessborough WWPS via a new inlet sewer.
Strategic Housing Development	Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services.
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 Marko Komso from the design team on 022 54611 or email mkomso@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Head of Customer Operations

Diarmuid O' Brien
JB Barry & Partners
3 Eastgate, Eastgate Business Park
Little Island, Co. Cork T45KH74

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

25 February 2022

Re: Design Submission for Bessboro, Blackrock, Co. Cork (the "Development") (the "Design Submission") / Connection Reference No: CDS21001328

Dear Diarmuid O' Brien,

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: Kyle Jackson
Email: Kyle.jackson@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix 5

FOUL SEWER - MICRODRAINAGE CALCULATIONS

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	150.00	Maximum Backdrop Height (m)	4.000
Persons per House	2.70	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	67.499	2.120	31.8	0.000	0	1.6	1.500	o	225	Pipe/Conduit	
F2.000	25.192	0.420	60.0	0.000	0	0.1	1.500	o	225	Pipe/Conduit	
F1.001	27.040	0.588	46.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.002	28.445	0.603	47.2	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F3.000	30.656	0.511	60.0	0.000	0	0.1	1.500	o	255	Pipe/Conduit	
F1.003	64.774	0.432	149.9	0.000	0	2.0	1.500	o	255	Pipe/Conduit	
F1.004	59.191	0.423	139.9	0.000	0	0.0	1.500	o	255	Pipe/Conduit	
F1.005	24.505	0.164	149.4	0.000	0	1.0	1.500	o	255	Pipe/Conduit	
F1.006	23.563	0.195	120.8	0.000	0	0.0	1.500	o	255	Pipe/Conduit	
F4.000	17.403	0.290	60.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F4.001	12.128	0.243	50.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F4.002	9.495	0.462	20.5	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	15.500	0.000	1.6	0	0.0	22	0.79	2.04	81.0	1.6
F2.000	13.800	0.000	0.1	0	0.0	7	0.26	1.48	59.0	0.1
F1.001	13.380	0.000	1.7	0	0.0	25	0.71	1.69	67.4	1.7
F1.002	12.792	0.000	1.7	0	0.0	25	0.71	1.67	66.5	1.7
F3.000	12.700	0.000	0.1	0	0.0	7	0.25	1.61	82.3	0.1
F1.003	12.159	0.000	3.8	0	0.0	47	0.59	1.02	51.9	3.8
F1.004	11.727	0.000	3.8	0	0.0	46	0.61	1.05	53.8	3.8
F1.005	11.304	0.000	4.8	0	0.0	52	0.64	1.02	52.0	4.8
F1.006	11.140	0.000	4.8	0	0.0	50	0.69	1.13	57.9	4.8
F4.000	11.970	0.000	0.0	0	0.0	0	0.00	1.48	59.0	0.0
F4.001	11.680	0.000	0.0	0	0.0	0	0.00	1.63	64.6	0.0
F4.002	11.437	0.000	0.0	0	0.0	0	0.00	2.54	101.0	0.0

Network Design Table for Foul - Main

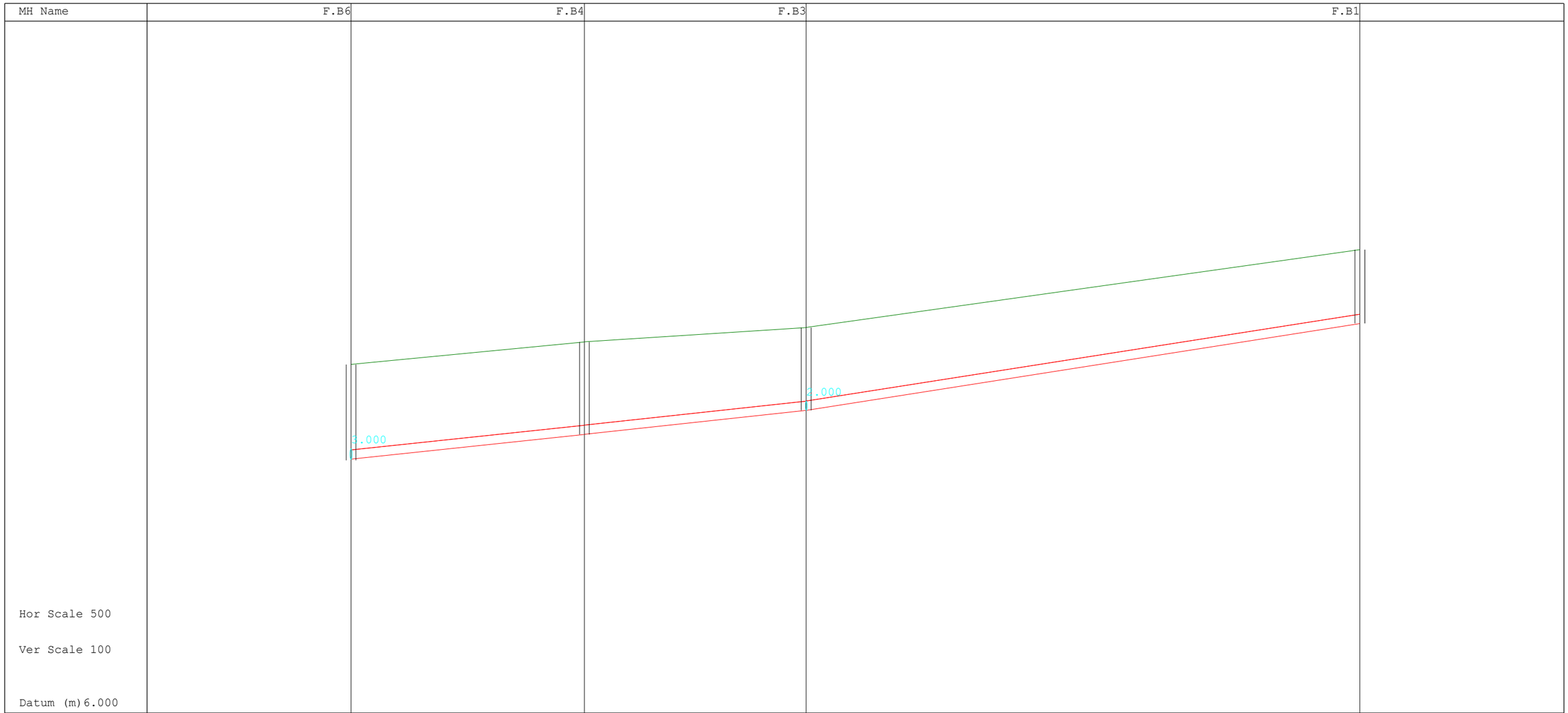
PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.007	7.397	0.200	37.0	0.000	0	0.0	1.500	o	255	Pipe/Conduit	
F1.008	12.727	0.350	36.4	0.000	0	0.0	1.500	o	255	Pipe/Conduit	
F1.009	26.235	1.251	21.0	0.000	0	0.0	1.500	o	255	Pipe/Conduit	
F1.010	36.829	1.632	22.6	0.000	0	0.0	1.500	o	255	Pipe/Conduit	
F1.011	38.614	1.464	26.4	0.000	0	0.0	1.500	o	255	Pipe/Conduit	
F1.012	43.328	1.478	29.3	0.000	0	8.8	1.500	o	255	Pipe/Conduit	
F1.013	45.563	0.455	100.1	0.000	0	0.0	1.500	o	255	Pipe/Conduit	
F1.014	62.433	2.044	30.5	0.000	0	6.1	1.500	o	255	Pipe/Conduit	
F1.015	19.092	0.475	40.2	0.000	0	0.0	1.500	o	255	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.007	10.945	0.000	4.8	0	0.0	37	1.04	2.05	104.9	4.8
F1.008	10.745	0.000	4.8	0	0.0	37	1.04	2.07	105.8	4.8
F1.009	10.395	0.000	4.8	0	0.0	32	1.27	2.73	139.4	4.8
F1.010	9.144	0.000	4.8	0	0.0	33	1.23	2.63	134.3	4.8
F1.011	7.512	0.000	4.8	0	0.0	34	1.17	2.43	124.2	4.8
F1.012	6.048	0.000	13.6	0	0.0	58	1.54	2.31	117.8	13.6
F1.013	4.570	0.000	13.6	0	0.0	80	0.99	1.25	63.6	13.6
F1.014	4.115	0.000	19.7	0	0.0	71	1.69	2.26	115.4	19.7
F1.015	2.071	0.000	19.7	0	0.0	77	1.53	1.97	100.6	19.7

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.015	F.A33	3.800	1.596	0.000	0	0

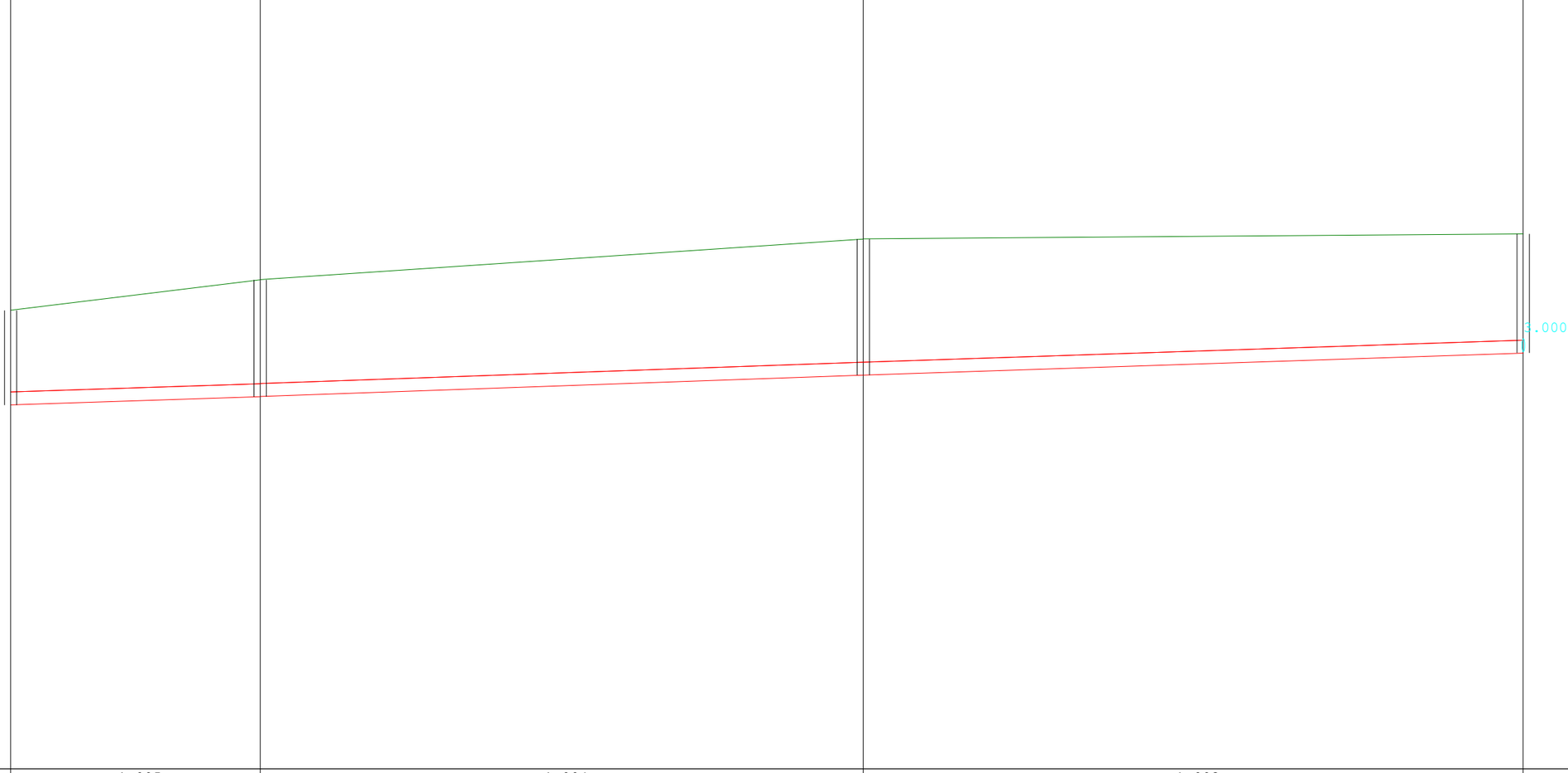


Hor Scale 500

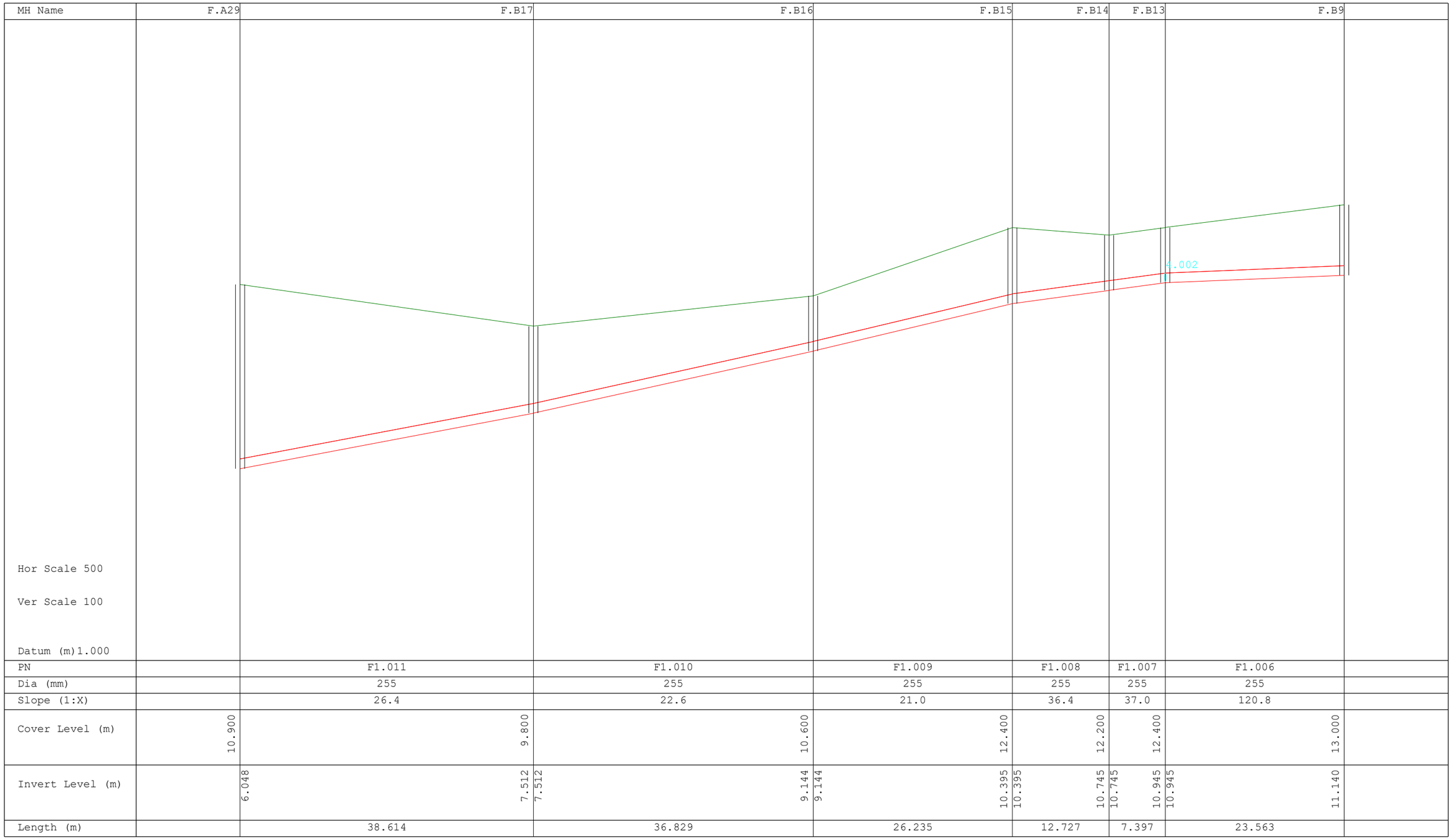
Ver Scale 100

Datum (m) 6.000

PN		F1.002	F1.001	F1.000	
Dia (mm)		225	225	225	
Slope (1:X)		47.2	46.0	31.8	
Cover Level (m)	14.500	15.050	15.400	17.300	
Invert Level (m)	12.189	12.792 12.792	13.380 13.380	15.500	
Length (m)		28.445	27.040	67.499	



MH Name		F.B9	F.B8	F.B7	F.B6	
Hor Scale 500 Ver Scale 100 Datum (m) 4.000						
PN		F1.005	F1.004	F1.003		
Dia (mm)		255	255	255		
Slope (1:X)		149.4	139.9	149.9		
Cover Level (m)	13.000	13.600	14.400	14.500		
Invert Level (m)		11.140	11.304	11.304	11.727	11.727	12.159	
Length (m)		24.505	59.191	64.774		

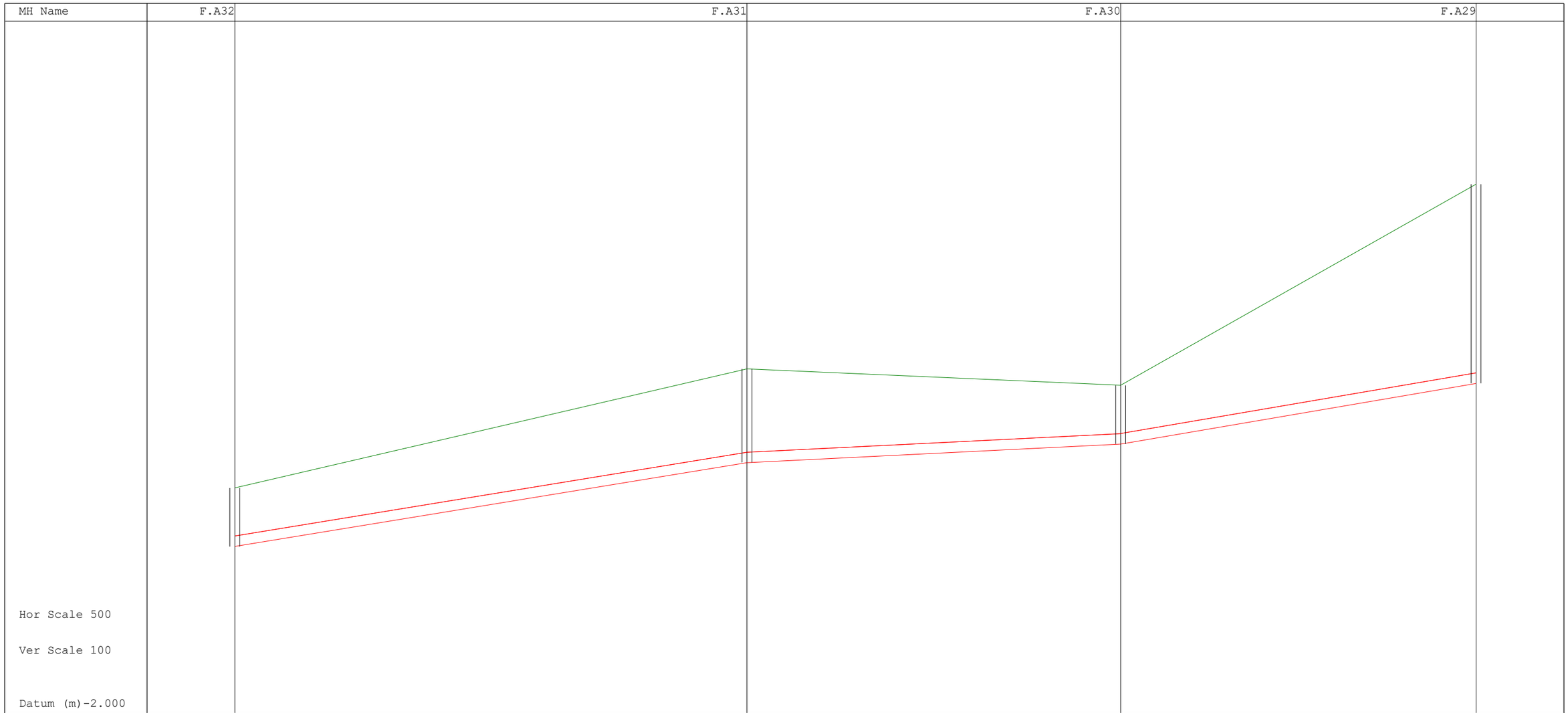


Hor Scale 500

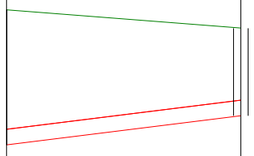
Ver Scale 100

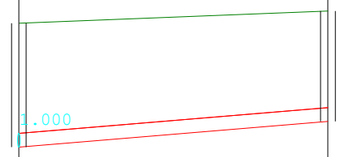
Datum (m) 1.000

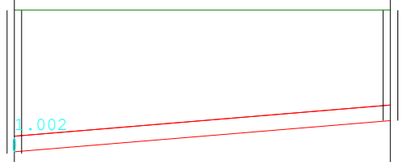
MH Name		F.A29	F.B17	F.B16	F.B15	F.B14	F.B13	F.B9	
PN			F1.011	F1.010	F1.009	F1.008	F1.007	F1.006	
Dia (mm)			255	255	255	255	255	255	
Slope (1:X)			26.4	22.6	21.0	36.4	37.0	120.8	
Cover Level (m)	10.900	9.800	10.600	12.400	12.200	12.400	13.000		
Invert Level (m)		6.048	7.512	7.512	9.144	9.144	10.395	10.395	10.745	10.745	10.945	10.945	11.140	
Length (m)			38.614	36.829	26.235	12.727	7.397	23.563	

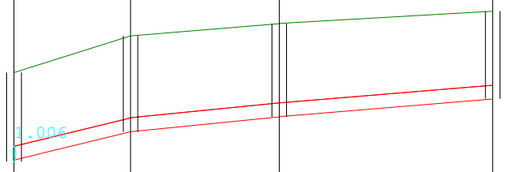


PN		F1.014	F1.013	F1.012	
Dia (mm)		255	255	255	
Slope (1:X)		30.5	100.1	29.3	
Cover Level (m)	3.500	6.400	6.000	10.900	
Invert Level (m)	2.071	4.115	4.115 4.570	4.570 6.048	
Length (m)		62.433	45.563	43.328	

MH Name	F.A33	F.A32	
Hor Scale 500 Ver Scale 100 Datum (m)-6.000			
PN		F1.015	
Dia (mm)		255	
Slope (1:X)		40.2	
Cover Level (m)	3.800	3.500	
Invert Level (m)	1.596	2.071	
Length (m)		19.092	

MH Name	F.B3	F.B2	
			
Hor Scale 500 Ver Scale 100 Datum (m) 6.000			
PN		F2.000	
Dia (mm)		225	
Slope (1:X)		60.0	
Cover Level (m)	15.400	15.600	
Invert Level (m)	13.380	13.800	
Length (m)		25.192	

MH Name	F.B6	F.B5	
			
Hor Scale 500 Ver Scale 100 Datum (m) 5.000			
PN		F3.000	
Dia (mm)		255	
Slope (1:X)		60.0	
Cover Level (m)	14.500	14.500	
Invert Level (m)	12.189	12.700	
Length (m)		30.656	

MH Name		F.B13	F.B12	F.B11	F.B10	
						
Hor Scale 500 Ver Scale 100 Datum (m) 4.000						
PN			F4.002	F4.001	F4.000	
Dia (mm)			225	225	225	
Slope (1:X)			20.5	50.0	60.0	
Cover Level (m)		12.400	13.000	13.200	13.400	
Invert Level (m)			10.975 11.437	11.437 11.680	11.680 11.970	
Length (m)			9.495	12.128	17.403	

Appendix 6

PRIORITY GEOTECHNICAL LTD - GROUND INVESTIAGTION

Our Ref: JMS/Rp/P21239 + attachments (*.pdf)

16th March, 2022

JB Barry & Partners Limited
3 Eastgate Road,
Eastgate Business Park,
Little Island,
Co. Cork,
T45 KH74.

Re: Bessborough SHD Sites, Site Investigation, Factual report.

Introduction

In November 2021, Priority Geotechnical (PGL) were requested by JB Barry & Partners Limited acting on behalf of their client Estuary View Enterprises to undertake a site investigation as part of the Bessborough SHD Sites project.

Objectives

The objective of the site investigation contract is to determine the ground and groundwater conditions in order to inform the engineering design solutions for the proposed development.

Scope

The original scope of the site investigation, which was specified by JB Barry & Partners, comprised of:

- 06Nr. Cable percussion boreholes;
- Trial pits;
- Surveying of 'as-built' levels and co-ordinates;
- All associated sampling;
- All associated laboratory works;
- Associated reporting;

The final site works as completed is outlined, herein. This geotechnical data report presents the fieldworks records with regard to the site investigation for the Bessborough SHD Sites Project. The report should be read in conjunction with the exploratory records, the photographic records and the laboratory test data accompanying this report.

Site Works

This investigation was carried out in accordance with Eurocode 7- Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9).

The direct intrusive fieldworks were undertaken from the 10th and 17th January, 2022 to under the supervision of PGL, Engineering Geologist(s). Details of the plant and equipment used are detailed on the relevant exploratory records, accompanying this report.

Cable Percussion Boreholes

Six (06) cable percussion boreholes were drilled to depths 4.4m below existing ground level (bgl) to 9.1m bgl using PGL's Dando 2000 Rig and 200mm diameter casing. The logs are accompanying this factual report.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
BH01	4.4	13/01/2022
BH02	9.1	10/01/2022
BH03	8.4	12/01/2022
BH04	7.3	14/01/2022
BH05	7.4	17/01/2022
BH06	7.0	13/01/2022

Chiselling				
Location	**Depth Top (m bgl)**	**Depth Base (m bgl)**	**Duration (hh:mm)**	**Tool**
BH01	1.20	1.30	01:00	Chisel.
	4.30	4.40	01:00	Chisel.
BH02	2.75	2.90	01:00	Chisel.
	8.90	9.10	01:00	Chisel.
BH03	4.90	5.00	01:00	Chisel.
	8.30	8.40	01:00	Chisel.
BH04	3.80	4.00	01:00	Chisel.
	7.20	7.30	01:00	Chisel.
BH05	6.70	6.90	01:00	Chisel.
	7.30	7.40	01:00	Chisel.
BH06	5.75	5.95	01:00	Chisel.
	6.90	7.00	01:00	Chisel.

Trial Pits

Seven (07) trial pits were excavated to depths 0.3m bgl to 4.6m bgl using a 14t tracked excavator. The exploratory logs and photographic records accompany this factual report.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
TP01	3.9	11/01/2022
TP02	3.2	10/01/2022
TP03	4.5	11/01/2022
TP04	4.5	13/01/2022
TP05	4.5	14/01/2022
TP06	0.3	12/01/2022
TP06A	4.6	12/01/2022

Sampling

A total of sixty two (62) bulk disturbed samples (B) and twenty two (22) small disturbed samples (D) were recovered from the exploratory holes in accordance with Geotechnical Investigation and Sampling – Sampling Methods and Groundwater Measurements (EN ISO 22475-1:2006).

***In-Situ* Testing**

Standard Penetration Tests (SPT)

A total of thirty nine (39) standard penetration tests, were carried out in the cable percussion boreholes using the 60^{o} solid cone (CPT) in place of the standard split barrel sampler. The data was presented on the relevant logs accompanying this factual report.

Falling Head Tests

Two (02) *in situ* falling head permeability tests were carried out in boreholes; in accordance with BS5930: 1999, Section 4: Cl. 25.4, within the superficial deposits over duration of one (1) hour. The processed test data was presented on the relevant borehole log presented accompanying this factual report. The shape or intake factor, f was derived from the condition at the base of the borehole at the test depth and test geometry as per Hvorslev (1951).

$$k = \frac{A}{fd} \frac{\log_e (H_0 / H_t)}{t}$$

Generally for all tests the specific depth range of the test was the deposits below the depth of casing. A mean k measured ($k_H = k_V$), permeability in the soil was assumed equal in both horizontal and vertical direction, ($k_H / k_V = 1.$). The test geometry provided a shape factor, f for the test undertaken in the standpipe well.

Dynamic Probing

PGL's Competitor dynamic probing rig was used to undertake dynamic probing (DP(H); 50kg drop weight, 500mm drop height) in general accordance with Geotechnical Investigation and Testing, Part 2, Dynamic probing, BS EN ISO 22476-2:2005. The blows per 100mm ($N_{100\,H}$) were recorded to refusal being 25blows without progress over 100mm. Six (06) number dynamic probes progressed to refusal at depths 2.7m bgl to 8.8m bgl. The exploratory logs accompany this factual report.

Location	Refusal depth, m bgl
DP01	3.7
DP02	8.8
DP03	2.7
DP04	5.0
DP05	3.0
DP06	3.5

Survey and Drawings

The 'as built' exploration locations were surveyed to the Ordinance Survey Irish Transverse Mercator system of co-ordinates (ITM) and elevations to Malin Head datum and shown on the relevant exploratory logs and the Exploratory Location Plans (P21239-SI-A, P21239-SI-01) accompanying this report.

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
BH01	171820.78	70468.88	16.64	4.40	13/01/2022
BH02	171741.94	70395.18	13.07	9.10	10/01/2022
BH03	171738.42	70311.70	11.49	8.40	12/01/2022
BH04	172026.44	70364.45	12.50	7.30	14/01/2022
BH05	172034.00	70300.87	12.21	7.40	17/01/2022
BH06	171946.00	70338.05	13.57	7.00	13/01/2022
DP01	171821.58	70465.48	16.54	3.70	13/01/2022
DP02	171742.31	70392.88	12.93	8.80	13/01/2022
DP03	171735.89	70311.95	11.53	2.70	13/01/2022
DP04	172027.93	70363.86	12.40	5.00	13/01/2022
DP05	172033.97	70304.80	12.21	3.00	14/01/2022
DP06	171944.50	70343.17	13.61	3.50	13/01/2022
TP01	171822.48	70466.73	16.60	3.90	11/01/2022
TP02	171742.96	70394.13	13.04	3.20	10/01/2022
TP03	171736.67	70314.17	11.80	4.50	11/01/2022
TP04	172026.89	70362.36	12.35	4.50	13/01/2022
TP05	172033.99	70303.02	12.21	4.50	14/01/2022
TP06	171940.73	70337.93	13.69	0.30	12/01/2022
TP06A	171944.88	70339.22	13.61	4.60	12/01/2022

Laboratory Testing

Laboratory testing was ongoing at the time of reporting.

Published Geology

A search of the Geological Survey data base and 1:100,000 mapping (Sheet 25) identified two (02) major lithological units defining the area. The majority of the site is underlain by Waulsortian Limestones (WA) described as massive unbedded Lime-Mudstones. The Little Island Formation (LI) is mapped to the north and defined by massive and crinoidal fine Limestone.

Teagasc subsoil mapping indicates that the area is underlain by Made Ground deposits. The National Groundwater Vulnerability mapping indicates the area mostly has a rating of high vulnerability.

Ground and Groundwater Conditions

The full details of the ground conditions encountered are provided for on the exploratory records accompanying this report. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002),– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, *in situ* testing and details of the samples taken, together with any observations made during the ground investigation.

Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc. Low volume groundwater flow may be cut-off by borehole casing as it progresses in stiff glacial deposits. The duration trial pit excavations remain open may not be sufficient to allow for low volume flow to present. The groundwater regime should be assessed from standpipe well installations.

Groundwater was encountered at depths 3.10m bgl to 3.90m bgl during the period of fieldworks within the extent of the borehole and pit excavations, summarised below. The exploratory locations were backfilled with grout, gravel and arisings.

SUMMARY OF GROUNDWATER

Location	Depth Strike (m bgl)	Remarks	Standpipe (Y/N)
BH01	-	None encountered.	N
BH02	-	None encountered.	Y
BH03	-	None encountered.	N
BH04	-	None encountered.	N
BH05	-	None encountered.	N
BH06	-	None encountered.	Y
TP01	-	None encountered.	N
TP02	-	None encountered.	N
TP03	-	None encountered.	N
TP04	3.9	Trickle rate of flow	N
TP05	3.9	Slow rate of flow	N
TP06	-	None encountered.	N
TP06A	3.1	Trickle rate of flow	N

Two (02) number 50mm dia. HDPE standpipe wells were constructed to allow for groundwater monitoring. The construction details are summarised below.

SUMMARY OF STANDPIPE CONSTRUCTION

Location	Depth Top (m bgl)	Depth Base (bgl)	Diameter (mm)	Pipe Type	Pipe Details
BH02	0.00	2.00	50	PLAIN	Plain.
	2.00	8.50	50	SLOTTED	Slotted.
BH06	0.00	3.50	50	PLAIN	Plain.
	3.50	7.00	50	SLOTTED	Slotted.

Exploratory locations were backfilled with their arisings or gravel and bentonite for locations with monitoring wells. Backfill details are displayed graphically on the accompanying logs and summarised below.

SUMMARY OF STANDPIPE DIPS

Location	08/02/2022
	Depth (m bgl)
BH02	Dry
BH06	4.4

SUMMARY OF BACKFILL

GRAVEL Backfill to installation/borehole

ARISINGS Backfill

uPVC slotted pipe

BENTONITE Backfill to installation

Should you have any queries in relation to the data collected and presented herein, please do not hesitate to contact our office.

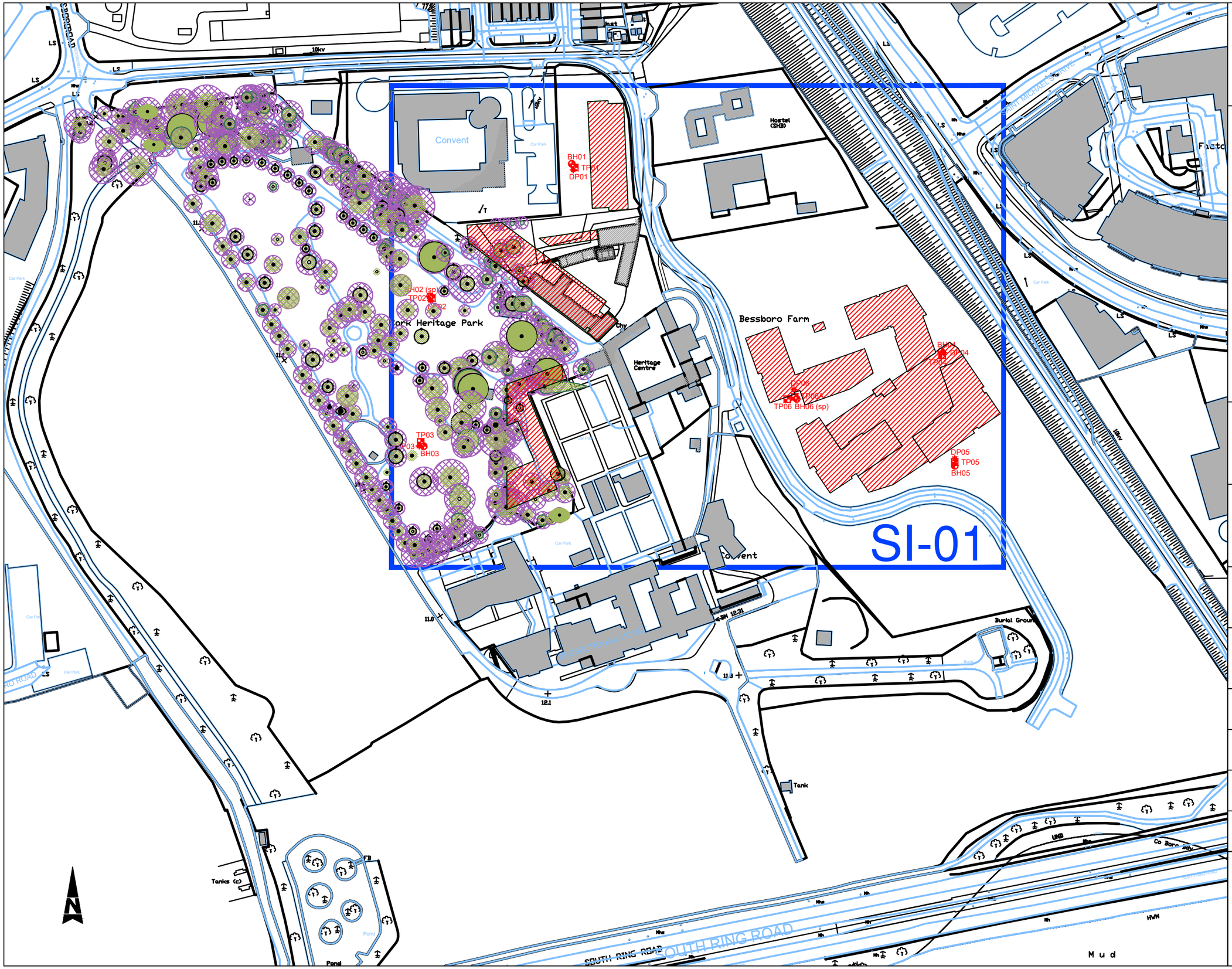
Yours sincerely,
For **Priority Geotechnical,**

James McSweeney BSc
Engineering Geologist

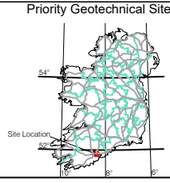
No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations.

No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.

This report has been prepared for Employer and their Representative as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.



Priority Geotechnical Site



JOB NAME:

Bessborough SHD

Sheet Title:

EXPLORATORY LOCATION LAYOUT

JOB NUMBER:

P21239

DRAWING NUMBER:

P21239-SI-A

DRAWN BY:

Gary Curtin

DATE:

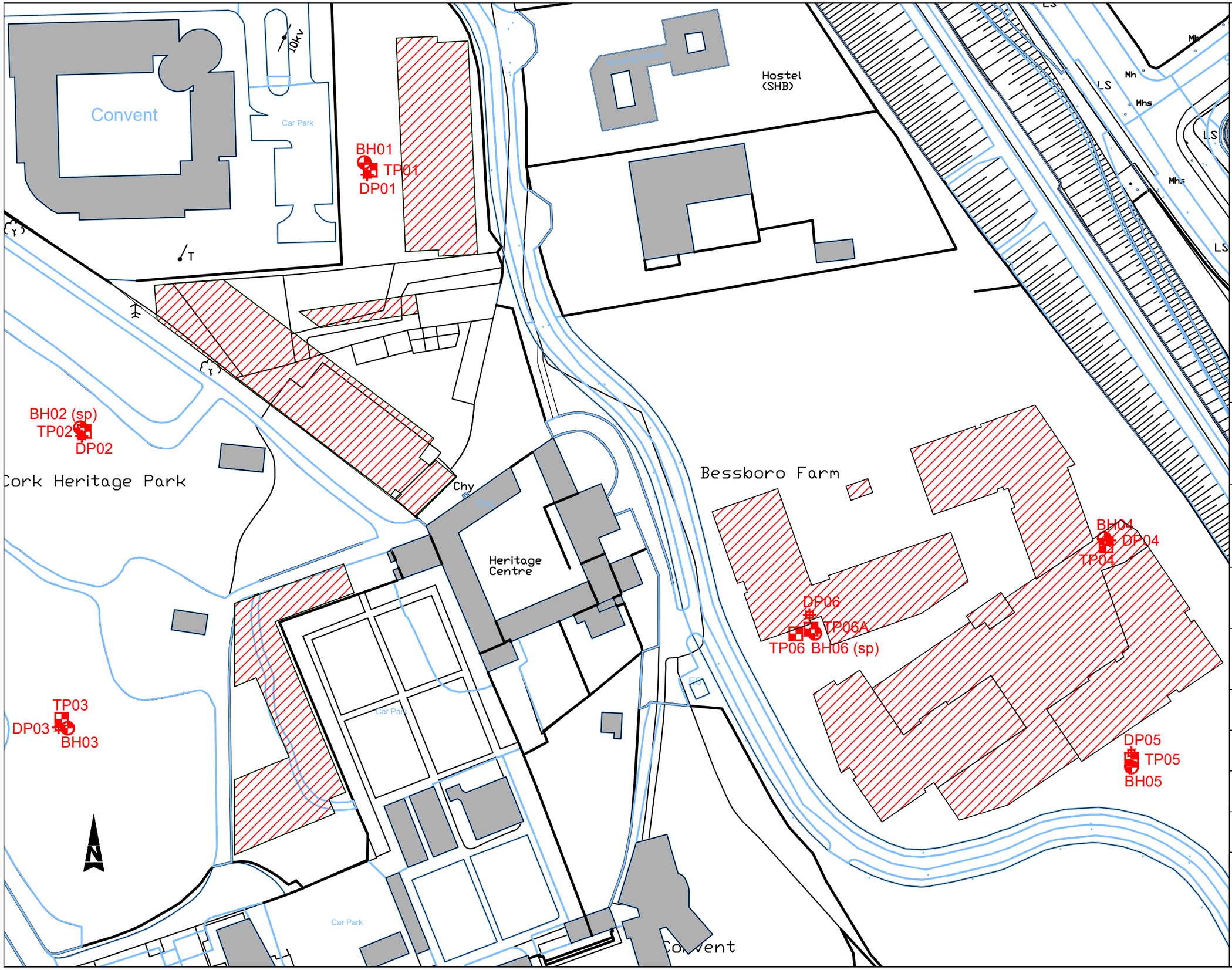
08/12/2021

SCALE:	APPROVED:
1:2000 ON A3	GH

REVISION:

D01

pgl priority geotechnical



KEY:

- TP00 Denotes Trial Pit location
- BH00 Denotes Borehole location
- DP00 Denotes Dynamic Probe location

Coordinates shown on ING.

TP01	171822.5	70466.7	16.6
TP02	171743	70394.1	13.04
TP03	171736.7	70314.2	11.8
TP04	172026.9	70362.4	12.35
TP05	172034	70303	12.213
TP06	171940.7	70337.9	13.69
TP06A	171944.9	70339.2	13.61
BH01	171820.8	70468.9	16.64
BH02 (sp)	171741.9	70395.2	13.07 stand pipe
BH03	171738.4	70311.7	11.49
BH04	172026.4	70364.5	12.5
BH05	172034	70300.9	12.21
BH06 (sp)	171946	70338.1	13.57 stand pipe
DP01	171821.6	70465.5	16.54
DP02	171742.3	70392.9	12.93
DP03	171735.9	70312	11.53
DP04	172027.9	70363.9	12.4
DP05	172034	70304.8	12.21
DP06	171944.5	70343.2	13.61

JOB NAME:

Bessborough SHD

Sheet Title:

EXPLORATION LOCATION PLAN

JOB NUMBER:

P21239

DRAWING NUMBER:

P21239-SI-01

DRAWN BY:

Gary Curtin

DATE:

05/12/2021

SCALE:

1:1000 ON A3

APPROVED:

GH

REVISION:

D01

pgl priority geotechnical

KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

**	Drillers Description
Friable	Easily crumbled

SAMPLES

U( )	Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler
U( )F, U( )P	F- not recovered, P-partially recovered
U38	Undisturbed 38mm diameter sample
P(F), (P)	Piston sample - disturbed
B	Bulk sample - disturbed
D	Jar Sample - disturbed
W	Water Sample
CBR	California Bearing Ratio mould sample
ES	Chemical Sample for Contamination Analysis
SPTLS	Standard Penetration Test S lump sample from split sampler

CORE RECOVERY AND ROCK QUALITY

TCR	Total Core Recovery (% of Core Run)
SCR	Solid Core Recovery (length of core having at least one full diameter as % of core run)
RQD	Rock Quality Designation (length of solid core greater than 100mm as % of core run)
Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column	
If	Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery
AZCL	Assumed Zone of Core Loss
NI	Non intact

GROUNDWATER

▽	Groundwater strike
▼	Groundwater level after standing period
Date/Water	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

INSITU TESTING

S	Standard Penetration Test - split barrel sampler
C	Standard Penetration Test - solid 60° cone
SW	Self Weight Penetration
Ivp, HVp (R)	In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F), (C), (R), (P)	Permeability Test
HP	Hand Penetrometer Test

MEASURED PROPERTIES

N	Standard Penetration Test - blows required to drive 300mm after seating drive
x/y	Denotes x blows for y mm within the Standard Penetration Test
x*/y	Denotes x blows for y mm within the seating drive
c_u	Undrained Shear Strength (kN/m^2)
CBR	California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

pgl priority geotechnical

Key Sheet

pgl priority geotechnical

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Drilled By	Borehole No.
PC	BH01
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171821E - 70469N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	16.64 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	13/01/2022 - 14/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Driller describes: Fill clay with limestone boulders.
		1.00 - 2.00 1.00	B SPT (C)	65 (5,10/65 for 150mm)	1.00	15.64		Firm, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular, limestone with dia 63-80mm. *1.20m - 1.30m: Driller noted: Boulders. Increased SPT blow counts locally.*
		2.00 - 3.00 2.00	B SPT (C)	N=15 (3,3/4,4,3,4)				
		3.00 - 4.00 3.00	B SPT (C)	N=15 (3,3/4,4,3,4)	3.00	13.64		Firm, brown red, slightly sandy slightly gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-rounded, limestone with dia 63-120mm. Driller describes: Hard gravelly clay with boulders.
		4.00	SPT (C)	90 (9,10/90 for 225mm)				
					4.40	12.24		End of Borehole at 4.400m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
4.40	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.20	1.30	01:00	Chisel.
4.30	4.40	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 4.40m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	13/01/2022 08:00	0.00	Start of shift.
Dry	13/01/2022 18:00	2.00	End of shift.
Dry	14/01/2022 08:00	2.00	Start of shift.
Dry	14/01/2022 18:00	4.40	End of borehole.

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Drilled By	Borehole No.
PC	**BH02**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171742E - 70395N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	13.07 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	10/01/2022 - 11/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Driller describes: Gravel clay.
		1.00 - 2.00 1.00	B SPT (C)	N=6 (1,1/1,1,2,2)	1.00	12.07		Soft, brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Driller describes: Gravelly clay.
		2.00 - 3.00 2.00	B SPT (C)	N=7 (1,1/1,2,2,2)				*2.00m - 3.00m: Driller noted: Boulders.*
		3.00 - 4.00 3.00	B SPT (C)	N=12 (3,3/2,3,3,4)	3.00	10.07		Firm to stiff, brown red, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-rounded, Limestone with dia 63-170mm dia.
		4.00 - 5.00 4.00	B SPT (C)	N=21 (4,4/5,5,6,5)				
		5.00 - 6.00 5.00	B SPT (C)	N=24 (5,6/5,6,7,6)	5.00	8.07		Stiff, brown red, slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-rounded, limestone with dia 63-170. Driller describes: boulders.
		6.00 - 7.00 6.00	B SPT (C)	N=29 (6,6/7,7,8,7)				
		7.00 - 8.00 7.00	B SPT (C)	N=33 (7,7/8,8,9,8)				
		8.00	SPT (C)	N=32 (7,8/9,5,9,9)				
					9.10	3.97		End of Borehole at 9.100m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
9.10	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.75	2.90	01:00	Chisel.
8.90	9.10	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 9.10m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	10/01/2022 08:00	0.00	Start of shift.
	10/01/2022 18:00	0.00	End of shift.
	11/01/2022 08:00	0.00	Start of shift.
Dry	11/01/2022 18:00	9.10	End of borehole.

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Drilled By	Borehole No.
PC	**BH03**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171738E - 70312N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	11.49 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	12/01/2022 - 12/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Soft becoming firm, brown red, slightly sandy slightly gravelly CLAY.
		1.00 - 2.00 1.00	B SPT (C)	N=7 (1,1/1,2,2,2)				
		2.00 - 3.00 2.00	B SPT (C)	N=7 (1,1/2,2,1,2)				
		3.00 - 4.00 3.00	B SPT (C)	N=10 (2,3/3,2,3,2)				
		4.00 - 5.00 4.00	B SPT (C)	N=20 (3,4/4,5,5,6)	4.00	7.49		Stiff, brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse.
		5.00 - 6.00 5.00	B SPT (C)	N=26 (6,7/6,6,7,7)	5.00	6.49		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-80mm.
		6.00 - 7.00 6.00	B SPT (C)	N=28 (7,6/6,8,7,7)	6.00	5.49		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-80mm.
		7.00 - 8.00 7.00	B SPT (C)	N=34 (7,8/8,9,8,9)				*6.00m - 8.40m: Driller noted Boulder content.*
		8.00 - 8.40 8.00	B SPT (C)	40 (9,10/40 for 150mm)				
					8.40	3.09		End of Borehole at 8.400m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
8.40	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
4.90	5.00	01:00	Chisel.
8.30	8.40	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 8.40m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	12/01/2022 08:00	0.00	Start of shift.
Dry	12/01/2022 18:00	8.40	End of borehole.

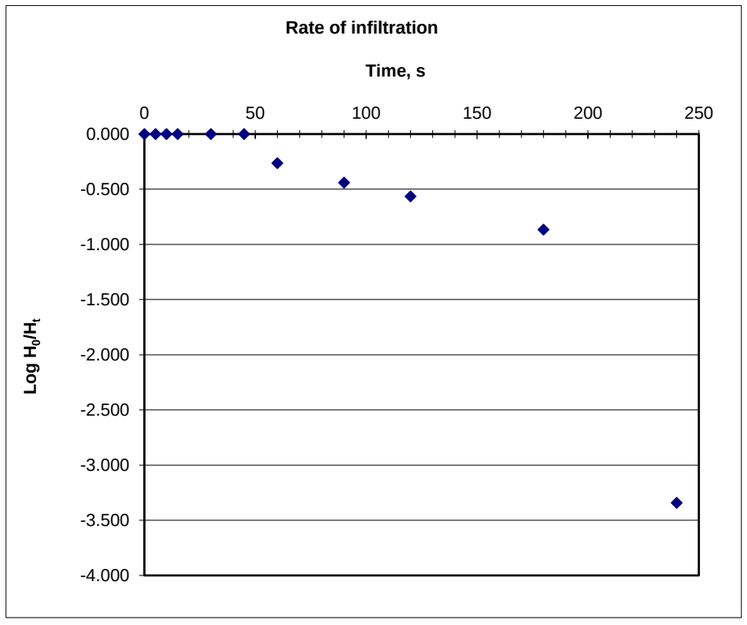
P21239 Falling head permeability test

Location	**Bessborough SHD**		
BH ID	**BH03**	H_w / H_o	**2.20**
Test	**1**		
Casing diameter	**200** mm		
Casing depth	**2.00** m		
Borehole depth	**2.20** m		
GW Influence	**2.20** m bgl		
Date	**12/01/2022**		

Min	Sec	depth, m bgl	vol, cu.m	H_t	log H_0/H_t
0	0	0.000	0.00000	2.200	0.000
0.083	5	0.000	0.00000	2.200	0.000
0.17	10	0.000	0.00000	2.200	0.000
0.25	15	0.000	0.00000	2.200	0.000
0.5	30	0.000	0.00000	2.200	0.000
0.75	45	0.000	0.00000	2.200	0.000
1	60	1.000	0.03140	1.200	-0.263
1.5	90	1.400	0.04396	0.800	-0.439
2	120	1.600	0.05024	0.600	-0.564
3	180	1.900	0.05966	0.300	-0.865
4	240	2.199	0.06905	0.001	-3.342

k_{mean} **1.12E-03 ms^{-1}**

$k_H = k_V$



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Drilled By PC
Logged By CS

Borehole No. **BH04** Sheet 1 of 1

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172026E - 70364N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	12.50 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	14/01/2022 - 14/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description	
								Dark brown, slightly sandy slightly gravelly SILT with plant material.	
		1.00 - 2.00 1.00	B SPT (C)	N=9 (1,1/2,2,3,2)	1.00	11.50		Firm, dark brown, slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse.	1
		2.00 - 3.00 2.00	B SPT (C)	N=9 (2,2/2,3,2,2)	2.00	10.50		Firm, brown, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-120mm.	2
		3.00 - 4.00 3.00	B SPT (C)	N=14 (2,3/3,4,3,4)	3.00	9.50		Firm to stiff, brown, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-120mm. Driller describes: boulders.	3
		4.00 - 5.00 4.00	B SPT (C)	N=22 (4,4/5,6,5,6)					4
		5.00 - 6.00 5.00	B SPT (C)	N=29 (6,5/7,7,8,7)	5.00	7.50		Stiff, brown, slightly sandy slightly gravelly silty CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-70mm. Boulders are sub-rounded, Limestone with dia 200.	5
		6.00 - 7.00 6.00	B SPT (C)	N=37 (7,8/8,9,9,11)	6.00	6.50		Stiff, brown, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-90mm.	6
		7.00	SPT (C)	75 (10,15/75 for 150mm)					7
					7.30	5.20		End of Borehole at 7.300m	8
									9

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
7.30	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
3.80	4.00	01:00	Chisel.
7.20	7.30	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 7.30m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	14/01/2022 08:00	0.00	Start of shift.
Dry	14/01/2022 18:00	7.30	End of borehole.

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Drilled By	Borehole No.
PC	**BH05**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172034E - 70301N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	12.21 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	17/01/2022 - 17/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Firm becoming stiff, brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		1.00 - 2.00 1.00	B SPT (C)	N=8 (1,1/2,2,2,2)				
		2.00 - 3.00	B					
		3.00	SPT (C)	N=13 (2,3/3,4,3,3)				
		4.00 - 5.00 4.00	B SPT (C)	N=16 (3,4/3,4,4,5)				
		5.00 - 6.00 5.00	B SPT (C)	N=30 (5,6/7,7,8,8)	5.00	7.21		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, 63-120mm dia., Limestone lithology.
		6.00 - 7.00 6.00	B SPT (C)	N=38 (7,8/9,9,10,10)	6.00	6.21		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub--rounded. Cobbles are sub-angular to sub-rounded, 63-120mm dia., Limestone lithology. Boulders are sub-angular, 200-250mm dia., Limestone lithology.
		7.00	SPT (C)	90 (9,10/90 for 225mm)				
					7.40	4.81		End of Borehole at 7.400m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
7.40	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
6.70	6.90	01:00	Chisel.
7.30	7.40	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 7.40m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	17/01/2022 08:00	0.00	Start of shift.
Dry	17/01/2022 18:00	7.40	End of borehole.

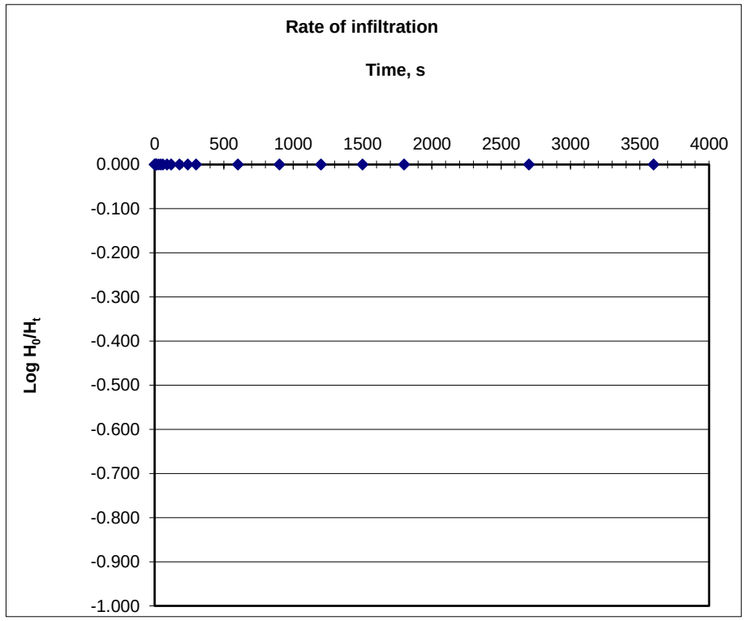
P21239 Falling head permeability test

Location	**Bessborough SHD**		
BH ID	**BH05**	H_w / H_o	**2.00**
Test	**1**		
Casing diameter	**200** mm		
Casing depth	**1.50** m		
Borehole depth	**2.00** m		
GW Influence	**2.00** m bgl		
Date	**17/01/2022**		

Min	Sec	depth, m bgl	vol, cu.m	H_t	log H_0/H_t
0	0	0.000	0.00000	2.000	0.000
0.083	5	0.000	0.00000	2.000	0.000
0.17	10	0.000	0.00000	2.000	0.000
0.25	15	0.000	0.00000	2.000	0.000
0.5	30	0.000	0.00000	2.000	0.000
0.75	45	0.000	0.00000	2.000	0.000
1	60	0.000	0.00000	2.000	0.000
1.5	90	0.000	0.00000	2.000	0.000
2	120	0.000	0.00000	2.000	0.000
3	180	0.000	0.00000	2.000	0.000
4	240	0.000	0.00000	2.000	0.000
5	300	0.000	0.00000	2.000	0.000
10	600	0.000	0.00000	2.000	0.000
15	900	0.000	0.00000	2.000	0.000
20	1200	0.000	0.00000	2.000	0.000
25	1500	0.000	0.00000	2.000	0.000
30	1800	0.000	0.00000	2.000	0.000
45	2700	0.000	0.00000	2.000	0.000
60	3600	0.000	0.00000	2.000	0.000

k_{mean} - ms^{-1}

$k_H = k_V$



Notes:
No Change in groundwater level observed after 60 mins. Infiltration rate mot determined.

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Drilled By	Borehole No.
PC	**BH06**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171946E - 70338N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	13.57 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	13/01/2022 - 13/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown, CLAY.
		1.00 - 2.00 1.00	B SPT (C)	N=6 (1,1/2,2,1,1)	1.00	12.57		Soft becoming stiff, brown red, slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		2.00 - 3.00 2.00	B SPT (C)	N=8 (1,1/2,2,2,2)				
		3.00 - 4.00 3.00	B SPT (C)	N=9 (2,2/3,2,2,2)				
		4.00 - 5.00 4.00	B SPT (C)	N=13 (3,2/3,3,4,3)				*4.00m - 6.00m: Driller described: 'wet' soils.*
		5.00 - 6.00 5.00	B SPT (C)	N=28 (4,6/6,7,7,8)				
		6.00 - 7.00 6.00	B SPT (C)	N=33 (7,7/8,8,9,8)	6.00	7.57		Stiff, brown red, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular, limestone with dia 63-130mm.
					7.00	6.57		End of Borehole at 7.000m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
7.00	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
5.75	5.95	01:00	Chisel.
6.90	7.00	01:00	Chisel.

Remarks:
Cable percussion borehole terminated at 7.0m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	13/01/2022 08:00	0.00	Start of shift.
Dry	13/01/2022 18:00	7.00	End of borehole.

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Trial Pit No **TP01** Sheet 1 of 1

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:** 171822E - 70467N **Level:** 16.60m OD	**Date** 11/01/2022
Location:	Mahon, Cork		**Dimensions (m):** 3.60 x 1.10	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Depth:** 3.90m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20	16.40		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
							(MADE GROUND) Soft to firm, brown, slightly sandy slightly gravelly CLAY with pottery fragments, blocks, timber and plastics. Sand is fine to coarse, Gravel is fine to coarse, sub-rounded to rounded.
	0.70 - 1.50 0.70 - 1.50	B D		0.65	15.95		Soft to firm becoming stiff from 2.80m, brown, slightly sandy slightly gravelly CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded. Boulders sub-rounded to rounded. (Assumed Natural).
	1.50 - 2.50 1.50 - 2.50	B D					
	2.50 - 3.50 2.50 - 3.50	B D					
				3.90	12.70		End of Pit at 3.900m

Stability: Good
Plant: 14T track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 3.90m bgl on rock/ large boulders.

Photographic Record

Number:	**TP01**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

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Trial Pit No **TP02** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171743E - 70394N **Level:** 13.04m OD	**Date** 10/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.20 x 1.00	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 3.20m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	12.74		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
	0.50 - 1.00 0.50 - 1.00	B D					(MADE GROUND) Soft to firm, light brown, slightly sandy slightly gravelly SILT with medium cobble content, medium boulder content and pottery fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded. Cobbles are angular to sub-rounded. Boulders are angular to sub-rounded.
	1.20 - 2.30 1.20 - 2.30	B D		1.20	11.84		Soft, light purple brown, slightly gravelly silty SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded.
	2.30 - 3.20 2.30 - 3.20	B D		2.30	10.74		Soft to firm, purple brown, slightly sandy gravelly CLAY with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded. Boulders are sub-rounded to rounded.
				3.20	9.84		End of Pit at 3.200m

Stability: Poor
Plant: 14T track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 3.20m bgl due to collapsing walls.

Photographic Record

Number:	**TP02**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No **TP03** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171737E - 70314N **Level:** 11.80m OD	**Date** 11/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.80 x 1.20	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.50m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.35	11.45		(TOPSOIL) Soft, dark brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded.
	0.50 - 1.50 0.50 - 1.50	B D					(MADE GROUND) Soft to firm, purple brown, slightly sandy gravelly CLAY with medium cobble content and rare pottery and glass fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
				1.10	10.70		(ASSUMED NATURAL) Soft to firm, purple brown, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	1.50 - 2.50 1.50 - 2.50	B D					
	2.50 - 3.50 2.50 - 3.50	B D					
	3.50 - 4.50 3.50 - 4.50	B D					
				4.50	7.30		End of Pit at 4.500m

1 2 3 4 5

Stability: Moderate
Plant: 14T track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated 4.50m bgl, scheduled depth.

Photographic Record

Number:	**TP03**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No **TP04** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 172027E - 70362N **Level:** 12.35m OD	**Date** 13/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.60 x 1.10	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.50m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	12.05		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to medium, sub-angular to sub-rounded.
	0.50 - 1.50 0.50 - 1.50	B D					(MADE GROUND): Soft, brown slightly silty slightly gravelly SAND with plastic waste. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
				0.70	11.65		(ASSUMED NATURAL): Soft, brown, slightly silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
	1.50 - 2.50 1.50 - 2.50	B D		1.50	10.85		Soft to firm, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	2.50 - 3.50 2.50 - 3.50	B D					
	3.50 - 4.50 3.50 - 4.50	B D					
				4.50	7.85		End of Pit at 4.500m

1 2 3 4 5

Stability: Moderate
Plant: 14T track machine
Backfill: Arisings.

Groundwater: 3.90m: Trickle rate of flow

Remarks: Trial pit terminated at 4.50m bgl, scheduled depth.

Photographic Record

Number:	**TP04**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No **TP05** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 172034E - 70303N **Level:** 12.21m OD	**Date** 14/01/2022
Location: Mahon, Cork		**Dimensions (m):** 4.10 x 1.20	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.50m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	11.91		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to medium, sub-angular to sub-rounded.
							(MADE GROUND) Soft to firm, brown orange, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
	0.70 - 1.50 0.70 - 1.50	B D		0.70	11.51		Firm to stiff, purple brown, slightly sandy slightly gravelly CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded. Boulders are sub-rounded to rounded. (Assumed Natural).
	1.50 - 2.50 1.50 - 2.50	B D					
	2.50 - 3.50 2.50 - 3.50	B D					
	3.50 - 4.50 3.50 - 4.50	B D					
				4.50	7.71		End of Pit at 4.500m

1 2 3 4 5

Stability: Good
Plant: 14T track machine
Backfill: Arisings.

Groundwater: 3.90m: Slow rate of flow

Remarks: Trial pit terminated at 4.50m bgl, scheduled depth.

Photographic Record

Number:	**TP05**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No **TP06** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171941E - 70338N **Level:** 13.69m OD	**Date** 12/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.40 x 1.10	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 0.30m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.15	13.54		(TOPSOIL) Soft to firm, slightly sandy slightly gravelly SILT with grass and rootlets.
				0.30	13.39		(MADE GROUND) Firm to stiff, light blue grey, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular.
							Concrete Slab - drain/sewer access cover.
							End of Pit at 0.300m

Stability: Good
Plant: 14T track machine
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 0.30m bgl, due to encountering a concrete slab covering an apparent un-used drain. Pit relocated.

Photographic Record

Number: TP06	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No **TP06A** Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171945E - 70339N **Level:** 13.61m OD	**Date** 12/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.80 x 1.10	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.60m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.10	13.51		(TOPSOIL) Soft to firm, slightly sandy slightly gravelly SILT with grass and rootlets.
	0.50 - 1.45 0.50 - 1.45	B D					(MADE GROUND) Soft to firm, slightly sandy slightly gravelly CLAY with low cobble content and waste (pottery fragments, glass, plastics). Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	1.50 - 2.50 1.50 - 2.50	B D		1.45	12.16		Soft to firm, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	2.50 - 3.50 2.50 - 3.50	B D					
	3.50 - 4.50 3.50 - 4.50	B D					
				4.60	9.01		End of Pit at 4.600m

1 2 3 4 5

Stability: Good
Plant: 14T track machine
Backfill: Arisings.

Groundwater: 3.10m: Trickle rate of flow

Remarks: Trial pit terminated at 4.60m bgl, scheduled depth.

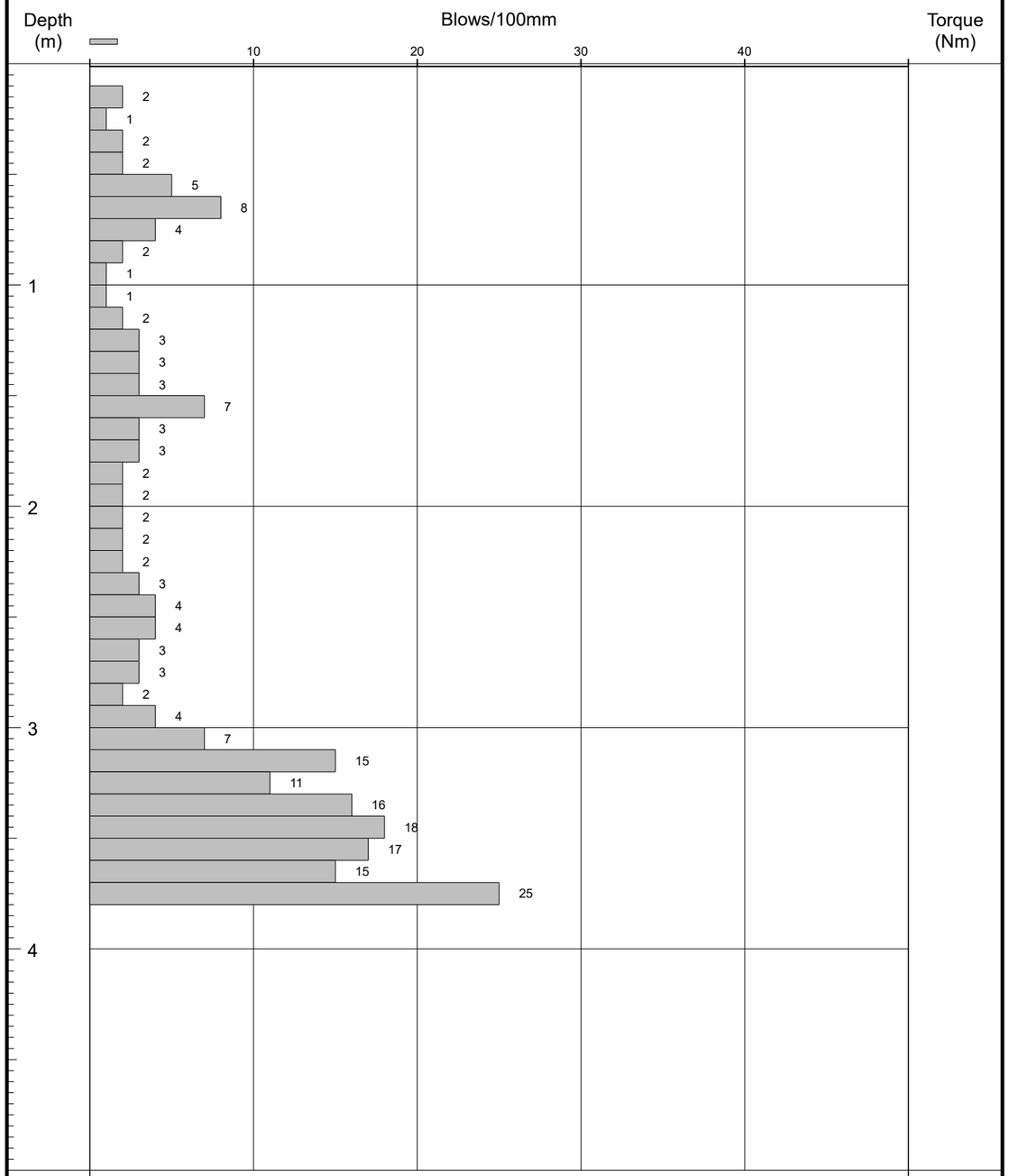
Photographic Record

Number:	**TP06A**	**Project** Bessborough SHD **Project No** P21239 **Engineer** J.B. Barry & Partners	

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Probe No **DP01**
Sheet 1 of 1

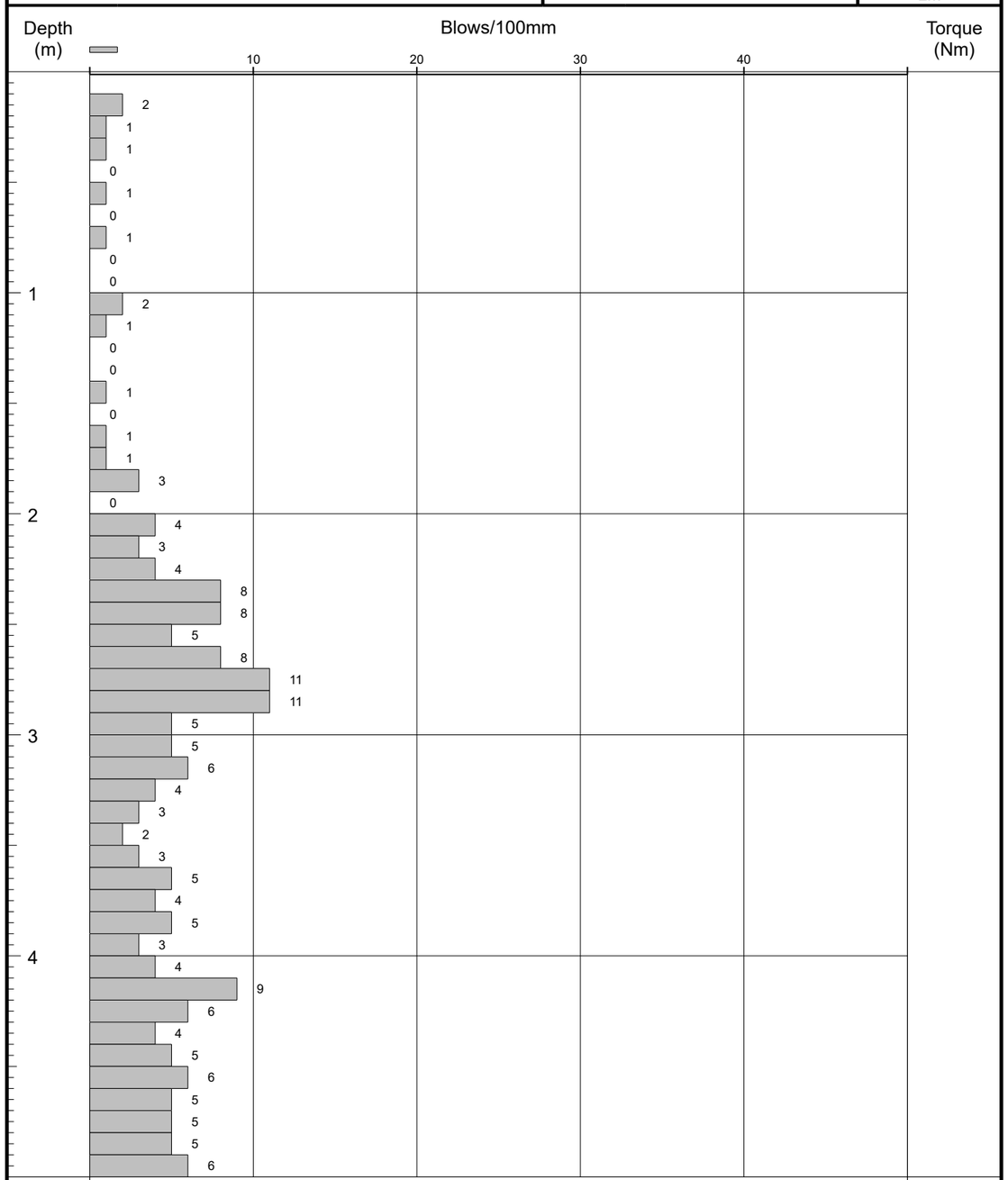
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171822E - 70465N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	16.54m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	13/01/2022	**Logged By** LM



Remarks:
Dynamic probe terminated at 3.70m bgl, refusal.

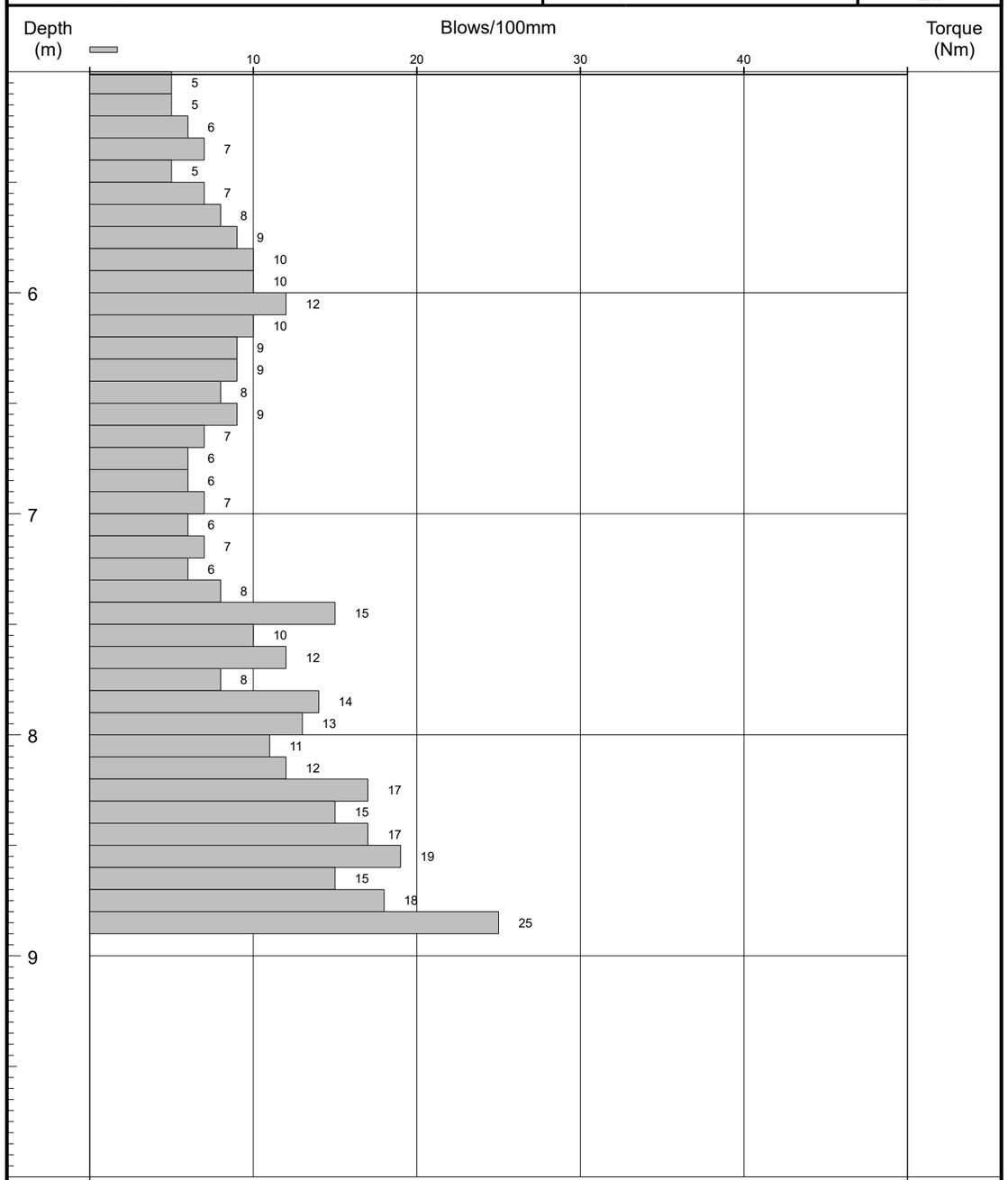
Fall Height (mm):	500	**Cone Base Dia. (mm):**	45
Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
Probe Type:	DPH	**Final Depth (m bgl):**	3.70

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**		Probe No **DP02** Sheet 1 of 2
Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171742E - 70393N	**Hole Type** DP
Location: Mahon, Cork		**Level:** 12.93m OD	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Dates:** 13/01/2022	**Logged By** LM



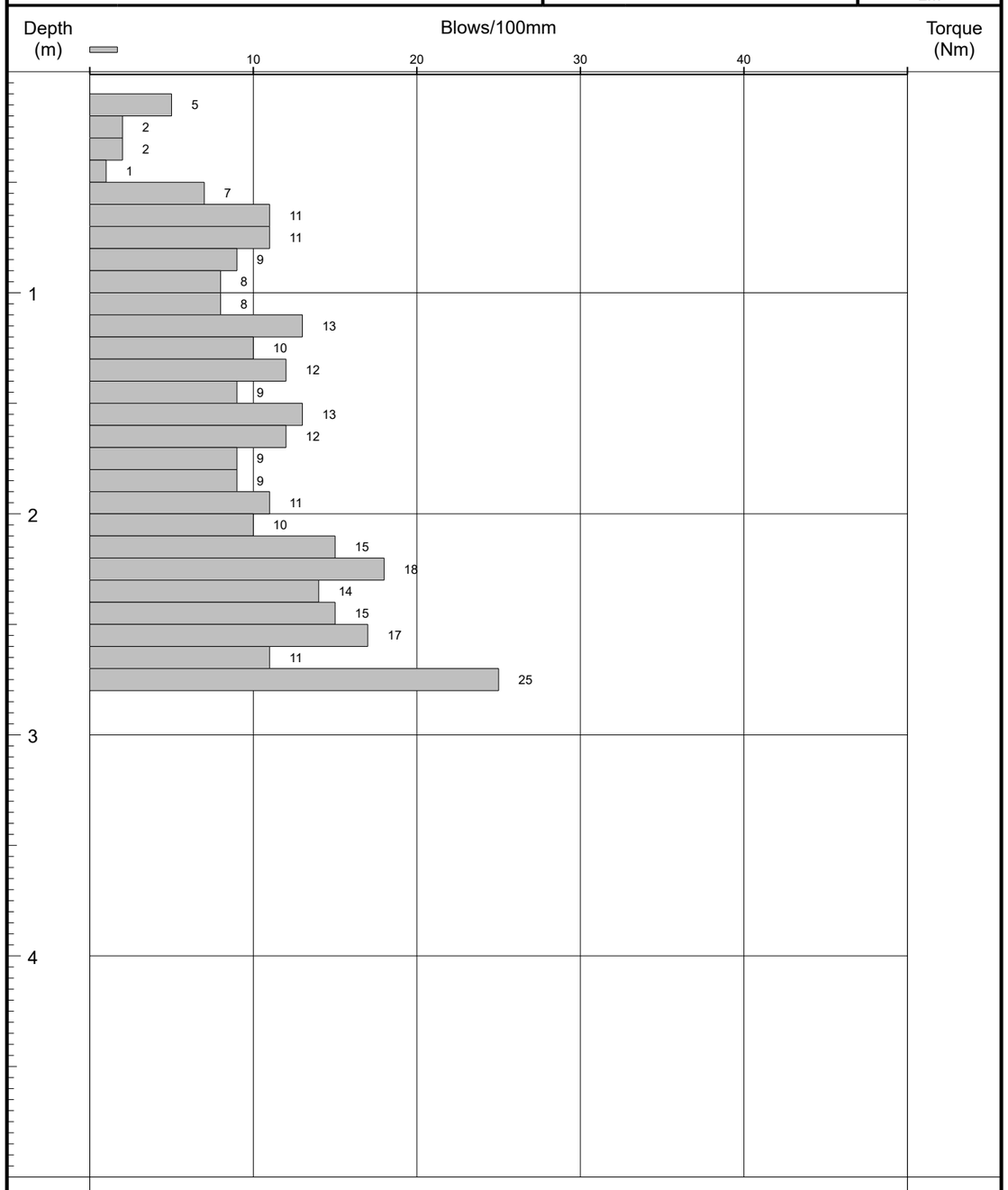
Remarks: Dynamic probe terminated at 8.80m bgl, refusal.	**Fall Height (mm):** 500	**Cone Base Dia. (mm):** 45	
	Hammer Mass (Kg): 50.0	**Cone Angle (Deg):** 90	
	Probe Type: DPH	**Final Depth (m bgl):** 8.80	

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**		Probe No **DP02** Sheet 2 of 2
Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171742E - 70393N	**Hole Type** DP
Location: Mahon, Cork		**Level:** 12.93m OD	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Dates:** 13/01/2022	**Logged By** LM



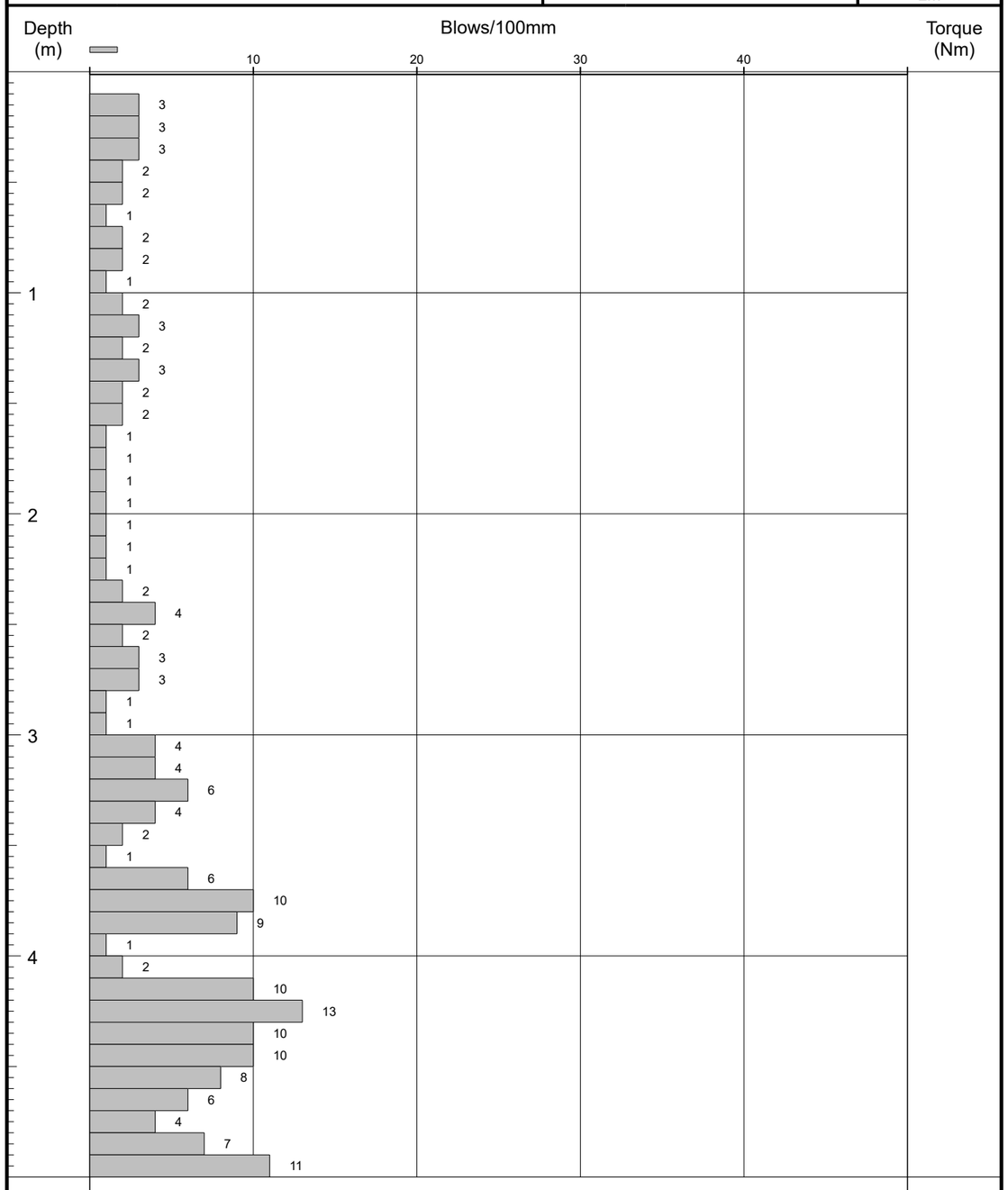
Remarks: Dynamic probe terminated at 8.80m bgl, refusal.	**Fall Height (mm):** 500	**Cone Base Dia. (mm):** 45	
	Hammer Mass (Kg): 50.0	**Cone Angle (Deg):** 90	
	Probe Type: DPH	**Final Depth (m bgl):** 8.80	

Priority Geotechnical Ltd. **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**			Probe No **DP03** Sheet 1 of 1
Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171736E - 70312N	**Hole Type** DP
Location: Mahon, Cork		**Level:** 11.53m OD	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Dates:** 13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 2.70m bgl, refusal.	**Fall Height (mm):** 500	**Cone Base Dia. (mm):** 45	
	Hammer Mass (Kg): 50.0	**Cone Angle (Deg):** 90	
	Probe Type: DPH	**Final Depth (m bgl):** 2.70	

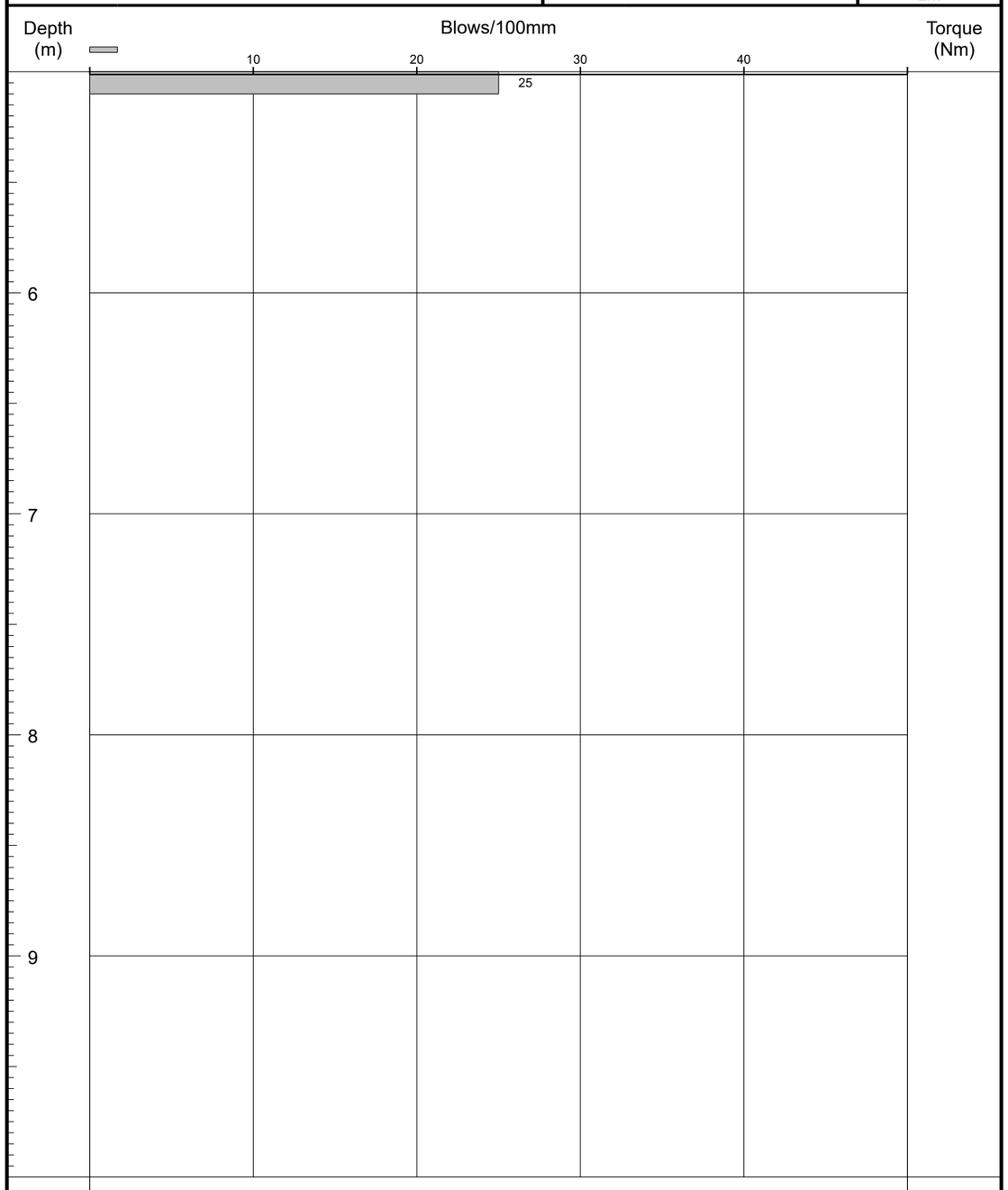
Priority Geotechnical Ltd. **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**			Probe No **DP04** Sheet 1 of 2
Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 172028E - 70364N	**Hole Type** DP
Location: Mahon, Cork		**Level:** 12.40m OD	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Dates:** 13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 5.00m bgl, refusal.	**Fall Height (mm):** 500	**Cone Base Dia. (mm):** 45	
	Hammer Mass (Kg): 50.0	**Cone Angle (Deg):** 90	
	Probe Type: DPH	**Final Depth (m bgl):** 5.00	

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP04** Sheet 2 of 2

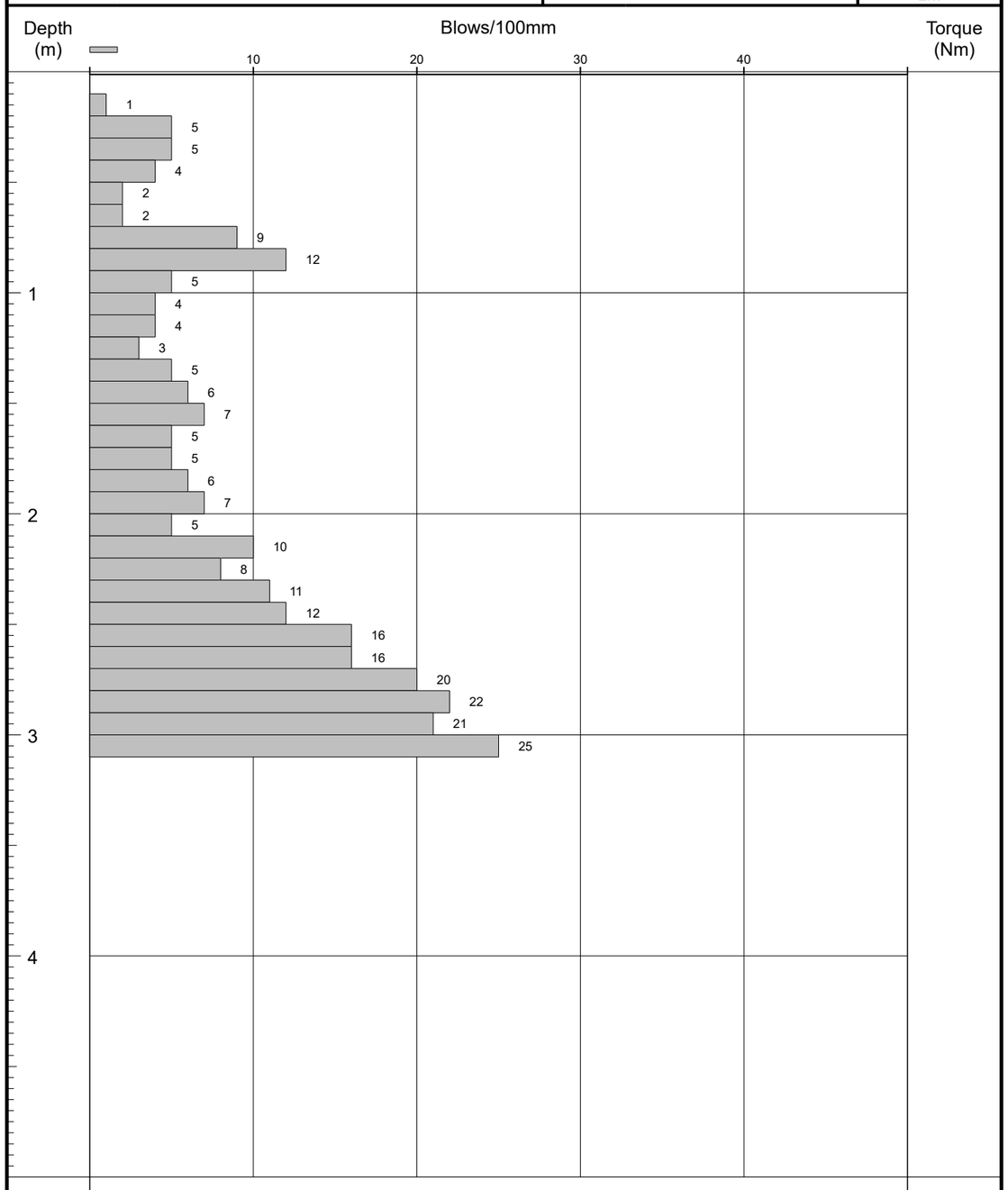
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172028E - 70364N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	12.40m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 5.00m bgl, refusal.	**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45	
	Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90	
	Probe Type:	DPH	**Final Depth (m bgl):**	5.00	

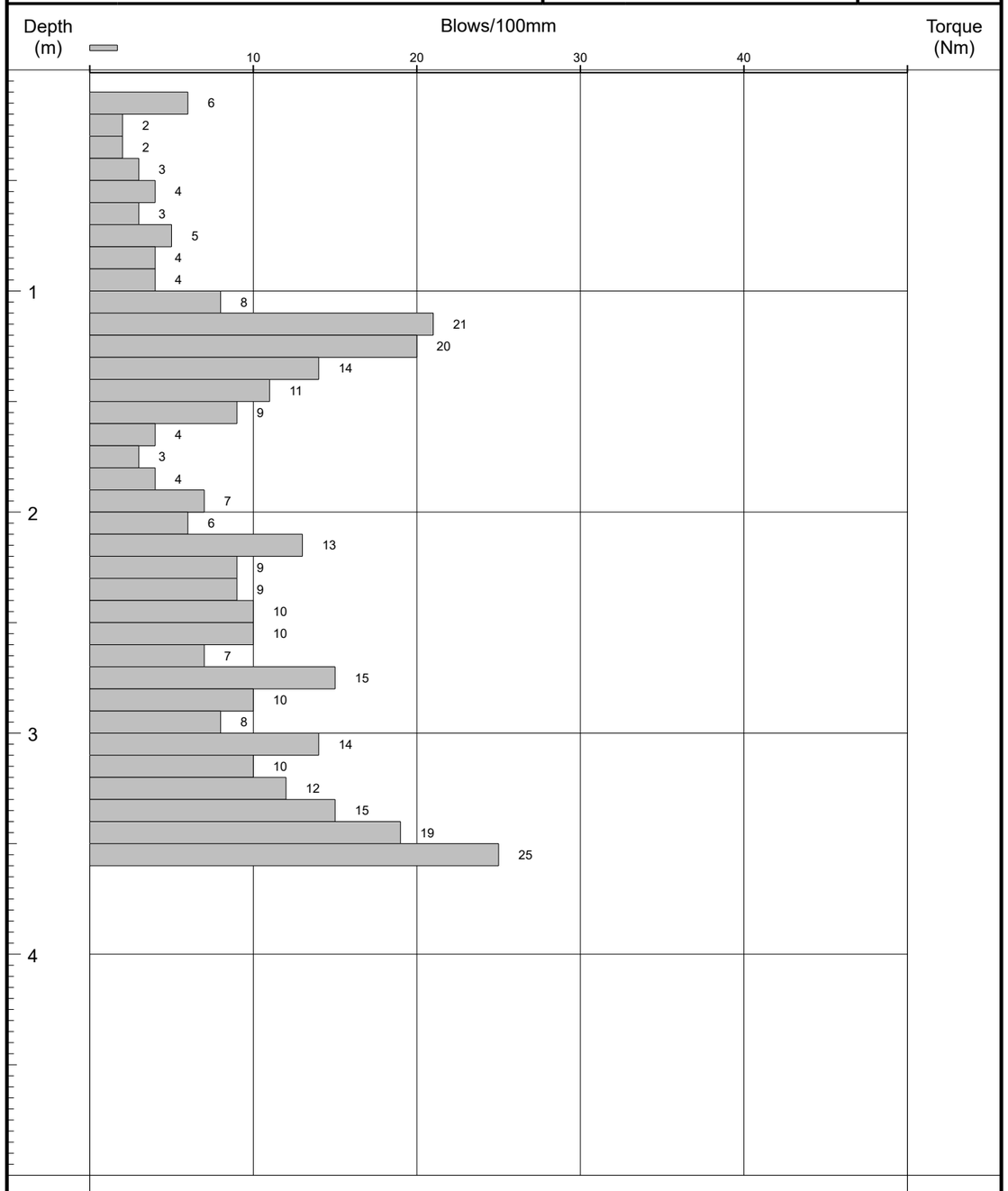
pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP05** Sheet 1 of 1

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172034E - 70305N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	12.21m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	14/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 3.00m bgl, refusal.	**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45	
	Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90	
	Probe Type:	DPH	**Final Depth (m bgl):**	3.00	

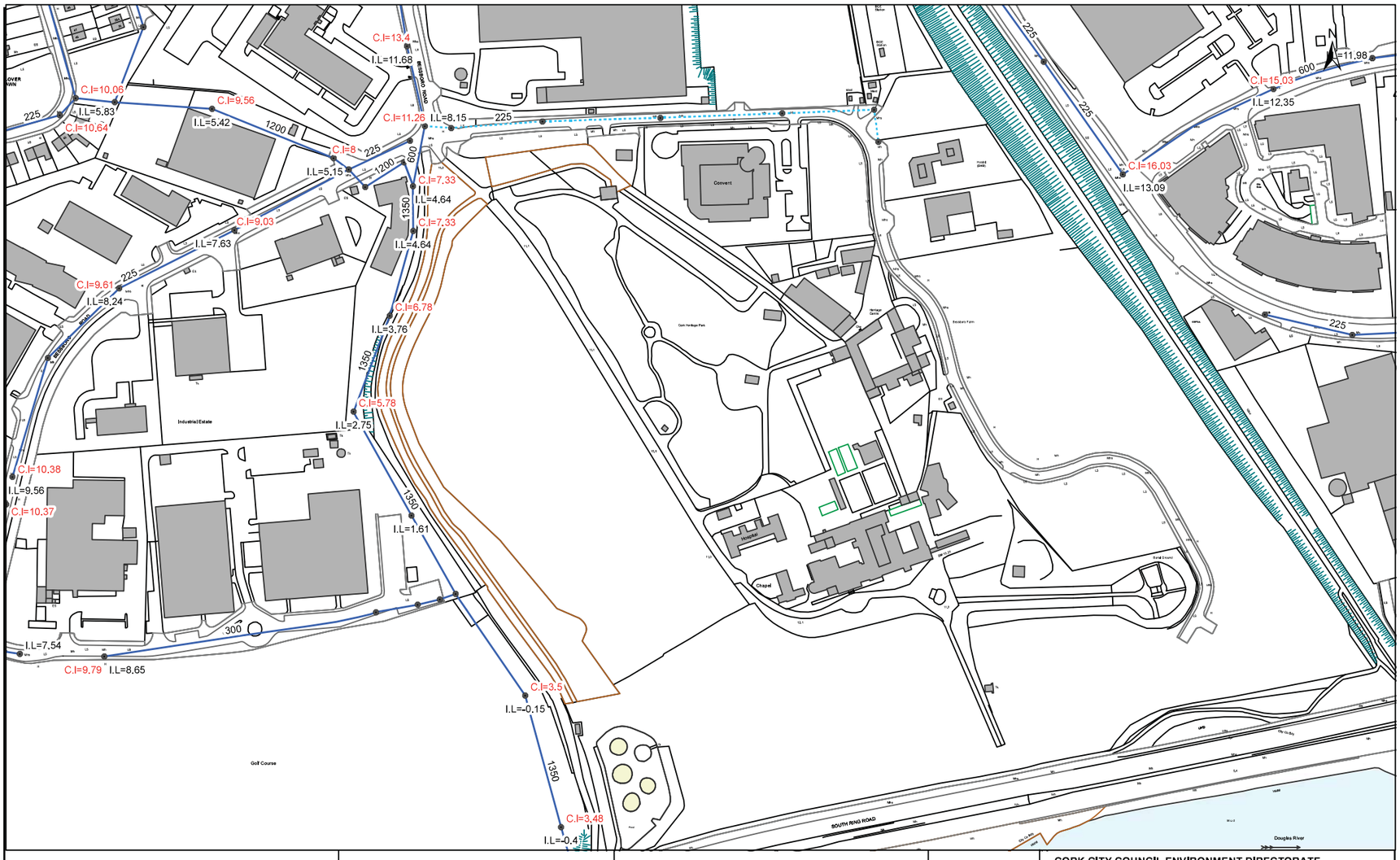
pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**			Probe No **DP06** Sheet 1 of 1
Project Name: Bessboro SHD		**Project No.** P21239	**Co-ords:** 171944E - 70343N	**Hole Type** DP
Location: Mahon, Cork			**Level:** 13.61m OD	**Scale** 1:25
Client: Estuary View Ent. Ltd			**Dates:** 13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 3.50m bgl, refusal.	**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45	
	Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90	
	Probe Type:	DPH	**Final Depth (m bgl):**	3.50	

Appendix 7

CORK CITY COUNCIL - EXISTING STORMWATER NETWORK



Drainage Records

Legend

CCC_StormManholes
MANHOLE_
Manhole
CCC_StormNetwork
PIPE_FUNCT
LOCAL STORM
PRIVATE STORM

THE SEWERS SHOWN ON THIS MAP ARE FOR REFERENCE ONLY. THE LOCATION AND PROPERTIES OF ALL SEWERS, LEVELS, PIPESIZES, etc. MUST BE CONFIRMED ON SITE.

1:2,500

N

CORK CITY COUNCIL ENVIRONMENT DIRECTORATE
Storm Network

Drawn By: A. Homan

Checked by: G.R.

Date: 25/07/2018

Appendix 8:

HR WALLINGFORD - GREENFIELD RUNOFF ESTIMATION

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Diarmuid O'Brien
Site name:	Phase 2 - Bessboro SHD
Site location:	Bessboro, Blackrock, Cork.

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.88555° N
Longitude:	8.41036° W
Reference:	1797377310
Date:	Feb 14 2022 11:01

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1.48

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1106	1106
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	12.2	12.2
1 in 1 year (l/s):	10.37	10.37
1 in 30 years (l/s):	20.13	20.13
1 in 100 year (l/s):	23.79	23.79
1 in 200 years (l/s):	26.24	26.24

Appendix 9

CORK CITY COUNCIL CORRESPONDENCE

Figure 3. – Status of Taken in Charge / Not in Charge Roads in the Vicinity of the Bessboro SHD Site.

3.4.14.2 Sustainable Urban Drainage Systems (SuDS) & Stormwater:

The report of the Senior Executive Engineer from the Drainage Section states that:

"*I note the applicant's proposal to use Q100 instead of Qbar as the greenfield run-off rate. This is acceptable, considering the proximity of the development to outfall to the estuary and the size of the existing outfall pipe at 1350mm. This approach is in line with that taken on other previously proposed developments within the Bessboro site. I have checked the Q100 estimate against my own estimate from the uksuds.com website and I am satisfied it is accurate.*

I am pleased to see interception storage being provided for up to 5mm of rainfall…this will have a positive impact on downstream water quality, avoiding the "first flush" which would otherwise be reliant solely on an oil interceptor.

I am pleased to see the number of SuDS measures proposed and would request that design / drawing details are submitted as part of the application for each of the measures proposed. I would request in particular details of how the bio-retention areas are intention to function.

I note from Section 4.3.4 of the Infrastructure Report that it is proposed to discharge surface water from the car park via an interceptor to the storm line (as shown on drawing 21207-JBB-PH1-XX-DR-C-04001). However, based on a review of drawing SB-2020-107-404 it is apparent that this is effectively a "basement carpark", insofar as it is enclosed. As such, in accordance with Section 3.18 of the Greater Dublin Regional Code of Practice for Drainage Works, all drainage from basement areas shall be pumped to ground level prior to discharging by gravity to the public foul sewerage system. Basement car parks must be discharged to the foul system via a petrol/oil interceptor. Access to basement car parks shall be designed such that surface water run-off from the surrounding paved areas cannot flow down the ramp".

3.4.14.3 Flooding:

The report of the Senior Executive Engineer from the Drainage Section states that "*I am satisfied with the Applicant's conclusion that the site is located in Flood Zone 'C' and hence, does not merit further assessment*".

Appendix 10

SURFACE WATER - MICRODRAINAGE CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.250	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	4.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	67.342	2.245	30.0	0.200	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	25.606	0.512	50.0	0.141	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	28.275	0.690	41.0	0.048	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	25.583	0.627	40.8	0.025	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	33.931	1.131	30.0	0.092	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	65.946	0.824	80.0	0.154	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	33.667	0.168	200.0	0.081	4.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	25.332	0.127	200.0	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.000	26.330	0.132	200.0	0.092	4.00	0.0	0.600	o	225	Pipe/Conduit	
S4.002	35.923	0.180	200.0	0.053	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.47	15.500	0.200	0.0	0.0	0.0	2.40	95.3	27.1
S2.000	50.00	4.23	13.800	0.141	0.0	0.0	0.0	1.85	73.7	19.1
S1.001	50.00	4.66	13.180	0.389	0.0	0.0	0.0	2.46	174.1	52.6
S1.002	50.00	4.83	12.491	0.413	0.0	0.0	0.0	2.47	174.5	56.0
S3.000	50.00	4.24	13.070	0.092	0.0	0.0	0.0	2.40	95.3	12.4
S1.003	50.00	5.46	11.864	0.659	0.0	0.0	0.0	1.76	124.4	89.2
S4.000	50.00	4.61	12.776	0.081	0.0	0.0	0.0	0.92	36.6	11.0
S4.001	50.00	5.07	12.608	0.102	0.0	0.0	0.0	0.92	36.6	13.8
S5.000	50.00	4.48	13.000	0.092	0.0	0.0	0.0	0.92	36.6	12.5
S4.002	50.00	5.72	12.481	0.247	0.0	0.0	0.0	0.92	36.6	33.5

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.004	60.260	0.753	80.0	0.075	0.00	0.0	0.600	o	375	Pipe/Conduit	
S6.000	42.571	0.213	200.0	0.078	4.00	0.0	0.600	o	225	Pipe/Conduit	
S6.001	9.779	0.049	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	22.648	0.283	80.0	0.016	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.006	33.709	0.674	50.0	0.210	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.007	12.673	0.253	50.0	0.048	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.008	26.281	0.526	50.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.009	35.823	0.716	50.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.010	37.725	0.843	44.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.011	6.145	0.079	78.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.012	25.039	0.063	397.4	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.013	35.011	0.026	1356.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.014	27.061	0.135	200.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.015	94.491	3.780	25.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.004	49.64	6.21	10.965	0.981	0.0	0.0	0.0	2.03	223.9	131.9
S6.000	50.00	4.77	12.320	0.078	0.0	0.0	0.0	0.92	36.6	10.6
S6.001	50.00	4.95	12.107	0.078	0.0	0.0	0.0	0.92	36.6	10.6
S1.005	49.07	6.40	10.211	1.075	0.0	0.0	0.0	2.03	223.9	142.9
S1.006	48.43	6.62	9.928	1.285	0.0	0.0	0.0	2.57	283.6	168.5
S1.007	48.19	6.70	9.254	1.332	0.0	0.0	0.0	2.57	283.6	173.9
S1.008	47.71	6.87	9.001	1.332	0.0	0.0	0.0	2.57	283.6	173.9
S1.009	47.07	7.10	8.475	1.332	0.0	0.0	0.0	2.57	283.6	173.9
S1.010	46.34	7.38	7.759	1.332	0.0	0.0	0.0	2.57	283.6	173.9
S1.011	46.11	7.47	6.916	1.332	0.0	0.0	0.0	1.68	185.5	173.9
S1.012	44.92	7.95	6.687	1.332	0.0	0.0	0.0	1.03	222.4	173.9
S1.013	50.00	4.10	6.624	0.000	23.8	0.0	0.0	0.89	35.4	23.8
S1.014	50.00	4.59	6.598	0.000	23.8	0.0	0.0	0.92	36.6	23.8
S1.015	50.00	5.19	6.463	0.000	23.8	0.0	0.0	2.63	104.5	23.8

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.015	S.A28	4.390	2.683	0.000	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S.B22, DS/PN: S1.013, Volume (m³): 10.0

Unit Reference	MD-SHE-0205-2380-1680-2380
Design Head (m)	1.680
Design Flow (l/s)	23.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	205
Invert Level (m)	6.624
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.680	23.8	Kick-Flo®	1.081	19.3
Flush-Flo™	0.498	23.7	Mean Flow over Head Range	-	20.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.0	0.800	22.8	2.000	25.9	4.000	36.1	7.000	47.3
0.200	19.5	1.000	20.9	2.200	27.1	4.500	38.2	7.500	48.9
0.300	22.7	1.200	20.3	2.400	28.2	5.000	40.2	8.000	50.4
0.400	23.5	1.400	21.8	2.600	29.3	5.500	42.1	8.500	51.9
0.500	23.7	1.600	23.2	3.000	31.4	6.000	43.9	9.000	53.4
0.600	23.5	1.800	24.6	3.500	33.8	6.500	45.6	9.500	54.8

Storage Structures for Storm

Cellular Storage Manhole: S.B22, DS/PN: S1.013

Invert Level (m) 6.624 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.67
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	420.0	0.0	0.900	420.0	0.0	1.681	0.0	0.0
0.100	420.0	0.0	1.000	420.0	0.0	1.900	0.0	0.0
0.200	420.0	0.0	1.100	420.0	0.0	2.000	0.0	0.0
0.300	420.0	0.0	1.200	420.0	0.0	2.100	0.0	0.0
0.400	420.0	0.0	1.300	420.0	0.0	2.200	0.0	0.0
0.500	420.0	0.0	1.400	420.0	0.0	2.300	0.0	0.0
0.600	420.0	0.0	1.500	420.0	0.0	2.400	0.0	0.0
0.700	420.0	0.0	1.600	420.0	0.0	2.500	0.0	0.0
0.800	420.0	0.0	1.680	420.0	0.0			

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.800 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.250 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S.B1	15 Winter	1	+10%	100/15 Summer				15.587	-0.138
S2.000	S.B2	15 Winter	1	+10%	100/15 Summer				13.884	-0.141
S1.001	S.B3	15 Winter	1	+10%	30/15 Summer				13.303	-0.177
S1.002	S.B4	15 Winter	1	+10%	30/15 Summer				12.617	-0.173
S3.000	S.B5	15 Winter	1	+10%	100/15 Summer				13.128	-0.167
S1.003	S.B6	15 Winter	1	+10%	30/15 Summer				12.060	-0.104
S4.000	S.B7	15 Winter	1	+10%	30/15 Summer				12.867	-0.134
S4.001	S.B8	15 Winter	1	+10%	30/15 Summer				12.709	-0.124
S5.000	S.B9	15 Winter	1	+10%	100/15 Summer				13.099	-0.126
S4.002	S.B10	15 Winter	1	+10%	30/15 Summer				12.655	-0.051
S1.004	S.B11	15 Winter	1	+10%	30/15 Summer				11.177	-0.163
S6.000	S.B12	15 Winter	1	+10%					12.409	-0.136
S6.001	S.B13	15 Winter	1	+10%					12.202	-0.131
S1.005	S.B14	15 Winter	1	+10%	30/15 Summer				10.451	-0.136
S1.006	S.B15	15 Winter	1	+10%	30/15 Summer				10.147	-0.156
S1.007	S.B16	15 Winter	1	+10%	30/15 Summer				9.519	-0.111
S1.008	S.B17	15 Winter	1	+10%	30/15 Summer				9.226	-0.149
S1.009	S.B18	15 Winter	1	+10%	30/15 Summer				8.696	-0.154
S1.010	S.B19	15 Winter	1	+10%	30/15 Summer				7.972	-0.162
S1.011	S.B20	15 Winter	1	+10%	1/15 Summer				7.372	0.081
S1.012	S.B21	180 Winter	1	+10%	30/15 Summer				7.111	-0.101
S1.013	S.B22	180 Winter	1	+10%	1/15 Summer				7.105	0.256
S1.014	S.B23	180 Winter	1	+10%					6.732	-0.091
S1.015	S.B24	180 Winter	1	+10%					6.534	-0.154

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S.B1	0.000	0.31			29.0	OK	
S2.000	S.B2	0.000	0.30			20.7	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S.B3	0.000	0.35			55.2	OK	
S1.002	S.B4	0.000	0.37			57.8	OK	
S3.000	S.B5	0.000	0.15			13.4	OK	
S1.003	S.B6	0.000	0.74			87.7	OK	
S4.000	S.B7	0.000	0.34			11.6	OK	
S4.001	S.B8	0.000	0.41			13.9	OK	
S5.000	S.B9	0.000	0.40			13.6	OK	
S4.002	S.B10	0.000	0.95			32.7	OK	
S1.004	S.B11	0.000	0.60			126.1	OK	
S6.000	S.B12	0.000	0.32			11.0	OK	
S6.001	S.B13	0.000	0.37			11.1	OK	
S1.005	S.B14	0.000	0.73			139.1	OK	
S1.006	S.B15	0.000	0.64			161.3	OK	
S1.007	S.B16	0.000	0.84			165.9	OK	
S1.008	S.B17	0.000	0.67			164.8	OK	
S1.009	S.B18	0.000	0.65			165.1	OK	
S1.010	S.B19	0.000	0.61			166.0	OK	
S1.011	S.B20	0.000	1.51			165.7	SURCHARGED	
S1.012	S.B21	0.000	0.30			58.4	OK	
S1.013	S.B22	0.000	1.76		99	22.4	SURCHARGED	
S1.014	S.B23	0.000	0.66			22.4	OK	
S1.015	S.B24	0.000	0.22			22.4	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.800 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.250 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S.B1	15 Winter	30	+10%	100/15 Summer				15.640	-0.085
S2.000	S.B2	15 Winter	30	+10%	100/15 Summer				13.936	-0.089
S1.001	S.B3	15 Winter	30	+10%	30/15 Summer				13.794	0.313
S1.002	S.B4	15 Winter	30	+10%	30/15 Summer				13.514	0.723
S3.000	S.B5	15 Winter	30	+10%	100/15 Summer				13.286	-0.009
S1.003	S.B6	15 Winter	30	+10%	30/15 Summer				13.237	1.073
S4.000	S.B7	15 Winter	30	+10%	30/15 Summer				13.256	0.255
S4.001	S.B8	15 Winter	30	+10%	30/15 Summer				13.192	0.360
S5.000	S.B9	15 Winter	30	+10%	100/15 Summer				13.188	-0.037
S4.002	S.B10	15 Winter	30	+10%	30/15 Summer				13.119	0.413
S1.004	S.B11	15 Winter	30	+10%	30/15 Summer				11.944	0.604
S6.000	S.B12	15 Winter	30	+10%					12.464	-0.081
S6.001	S.B13	15 Winter	30	+10%					12.261	-0.071
S1.005	S.B14	15 Winter	30	+10%	30/15 Summer				11.141	0.554
S1.006	S.B15	15 Winter	30	+10%	30/15 Summer				10.724	0.420
S1.007	S.B16	15 Winter	30	+10%	30/15 Summer				10.046	0.417
S1.008	S.B17	15 Winter	30	+10%	30/15 Summer				9.619	0.243
S1.009	S.B18	15 Winter	30	+10%	30/15 Summer				9.069	0.219
S1.010	S.B19	30 Winter	30	+10%	30/15 Summer				8.370	0.236
S1.011	S.B20	240 Winter	30	+10%	1/15 Summer				7.856	0.565
S1.012	S.B21	240 Winter	30	+10%	30/15 Summer				7.849	0.637
S1.013	S.B22	240 Winter	30	+10%	1/15 Summer				7.843	0.994
S1.014	S.B23	360 Summer	30	+10%					6.737	-0.086
S1.015	S.B24	360 Summer	30	+10%					6.536	-0.152

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S.B1	0.000	0.70			64.6	OK	
S2.000	S.B2	0.000	0.68			46.0	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S.B3	0.000	0.73			115.2	SURCHARGED	
S1.002	S.B4	0.000	0.67			104.9	SURCHARGED	
S3.000	S.B5	0.000	0.33			29.8	OK	
S1.003	S.B6	0.000	1.35			160.2	SURCHARGED	
S4.000	S.B7	0.000	0.61			20.9	SURCHARGED	
S4.001	S.B8	0.000	0.75			25.5	SURCHARGED	
S5.000	S.B9	0.000	0.89			30.1	OK	
S4.002	S.B10	0.000	1.82			62.9	SURCHARGED	
S1.004	S.B11	0.000	1.04			218.5	SURCHARGED	
S6.000	S.B12	0.000	0.70			24.5	OK	
S6.001	S.B13	0.000	0.81			24.6	OK	
S1.005	S.B14	0.000	1.22			233.6	SURCHARGED	
S1.006	S.B15	0.000	1.02			259.4	SURCHARGED	
S1.007	S.B16	0.000	1.32			259.8	SURCHARGED	
S1.008	S.B17	0.000	1.04			256.8	SURCHARGED	
S1.009	S.B18	0.000	0.99			253.2	SURCHARGED	
S1.010	S.B19	0.000	0.92			248.9	SURCHARGED	
S1.011	S.B20	0.000	0.89			98.1	SURCHARGED	
S1.012	S.B21	0.000	0.50			97.5	SURCHARGED	
S1.013	S.B22	0.000	1.86		176	23.6	SURCHARGED	
S1.014	S.B23	0.000	0.70			23.6	OK	
S1.015	S.B24	0.000	0.23			23.6	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.800 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.250 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S.B1	15 Winter	100	+10%	100/15 Summer				15.870	0.145
S2.000	S.B2	15 Winter	100	+10%	100/15 Summer				14.999	0.974
S1.001	S.B3	15 Winter	100	+10%	30/15 Summer				14.893	1.412
S1.002	S.B4	15 Winter	100	+10%	30/15 Summer				14.625	1.834
S3.000	S.B5	15 Winter	100	+10%	100/15 Summer				14.396	1.101
S1.003	S.B6	15 Winter	100	+10%	30/15 Summer				14.355	2.191
S4.000	S.B7	15 Winter	100	+10%	30/15 Summer				13.693	0.692
S4.001	S.B8	15 Winter	100	+10%	30/15 Summer				13.643	0.810
S5.000	S.B9	15 Winter	100	+10%	100/15 Summer				13.626	0.401
S4.002	S.B10	15 Winter	100	+10%	30/15 Summer				13.575	0.869
S1.004	S.B11	15 Winter	100	+10%	30/15 Summer				13.026	1.686
S6.000	S.B12	15 Winter	100	+10%					12.494	-0.051
S6.001	S.B13	15 Winter	100	+10%					12.308	-0.024
S1.005	S.B14	15 Winter	100	+10%	30/15 Summer				12.148	1.562
S1.006	S.B15	15 Winter	100	+10%	30/15 Summer				11.658	1.355
S1.007	S.B16	30 Winter	100	+10%	30/15 Summer				10.801	1.172
S1.008	S.B17	15 Winter	100	+10%	30/15 Summer				10.277	0.901
S1.009	S.B18	30 Winter	100	+10%	30/15 Summer				9.582	0.732
S1.010	S.B19	30 Winter	100	+10%	30/15 Summer				8.725	0.592
S1.011	S.B20	360 Winter	100	+10%	1/15 Summer				8.297	1.006
S1.012	S.B21	360 Winter	100	+10%	30/15 Summer				8.290	1.078
S1.013	S.B22	360 Winter	100	+10%	1/15 Summer				8.283	1.434
S1.014	S.B23	1440 Winter	100	+10%					6.737	-0.086
S1.015	S.B24	1440 Winter	100	+10%					6.536	-0.152

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S.B1	0.000	0.86			79.3	SURCHARGED	
S2.000	S.B2	0.000	0.78			53.1	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S.B3	0.000	0.75			117.2	SURCHARGED	
S1.002	S.B4	0.000	0.71			110.9	SURCHARGED	
S3.000	S.B5	0.000	0.36			32.2	FLOOD RISK	
S1.003	S.B6	0.000	1.43			169.7	FLOOD RISK	
S4.000	S.B7	0.000	0.73			25.1	SURCHARGED	
S4.001	S.B8	0.000	0.86			29.1	SURCHARGED	
S5.000	S.B9	0.000	1.01			34.3	SURCHARGED	
S4.002	S.B10	0.000	2.17			75.1	SURCHARGED	
S1.004	S.B11	0.000	1.11			233.8	SURCHARGED	
S6.000	S.B12	0.000	0.92			31.9	OK	
S6.001	S.B13	0.000	1.00			30.4	OK	
S1.005	S.B14	0.000	1.36			259.4	SURCHARGED	
S1.006	S.B15	0.000	1.16			294.5	SURCHARGED	
S1.007	S.B16	0.000	1.48			292.0	SURCHARGED	
S1.008	S.B17	0.000	1.18			291.5	SURCHARGED	
S1.009	S.B18	0.000	1.12			285.2	SURCHARGED	
S1.010	S.B19	0.000	1.04			281.4	SURCHARGED	
S1.011	S.B20	0.000	0.86			94.4	SURCHARGED	
S1.012	S.B21	0.000	0.48			93.9	SURCHARGED	
S1.013	S.B22	0.000	1.86		252	23.6	SURCHARGED	
S1.014	S.B23	0.000	0.70			23.6	OK	
S1.015	S.B24	0.000	0.23			23.6	OK	

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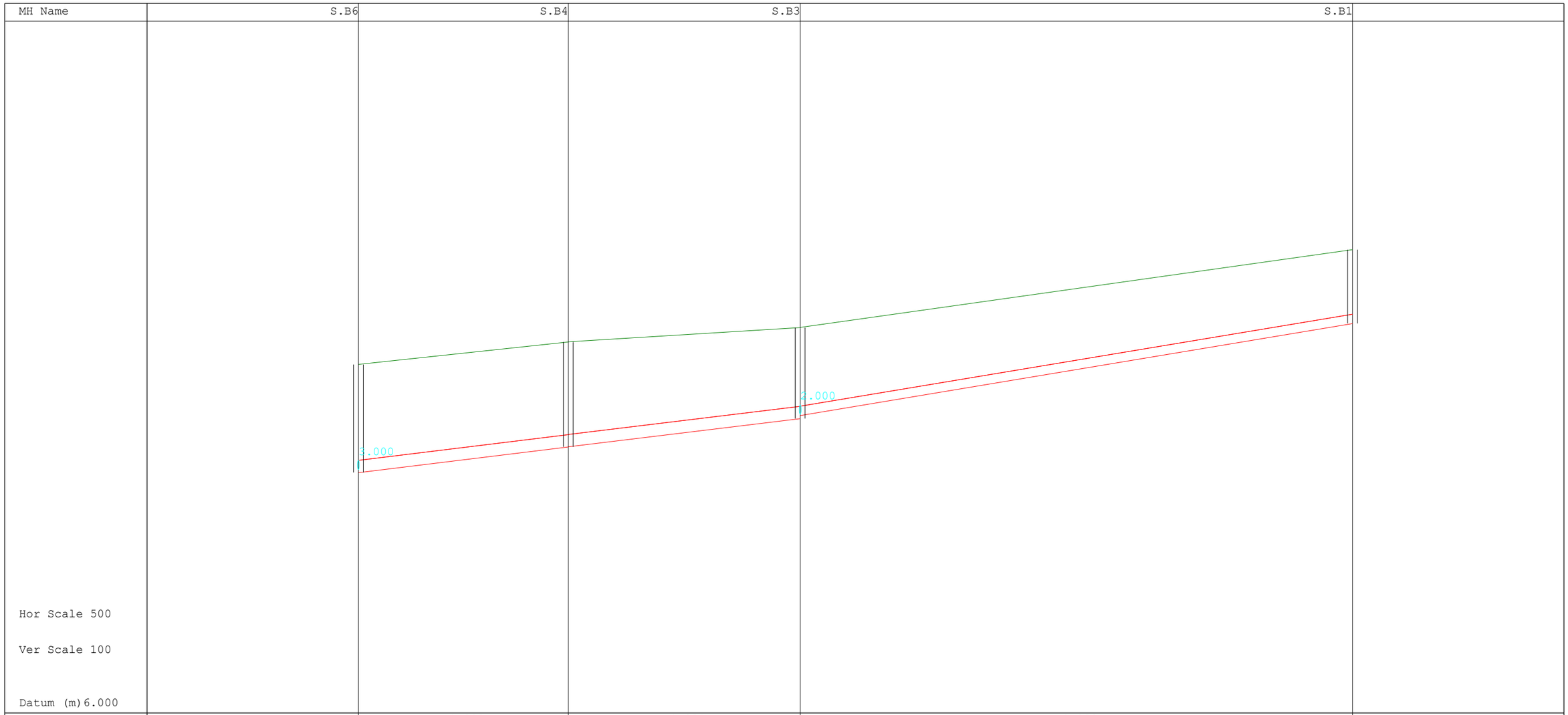
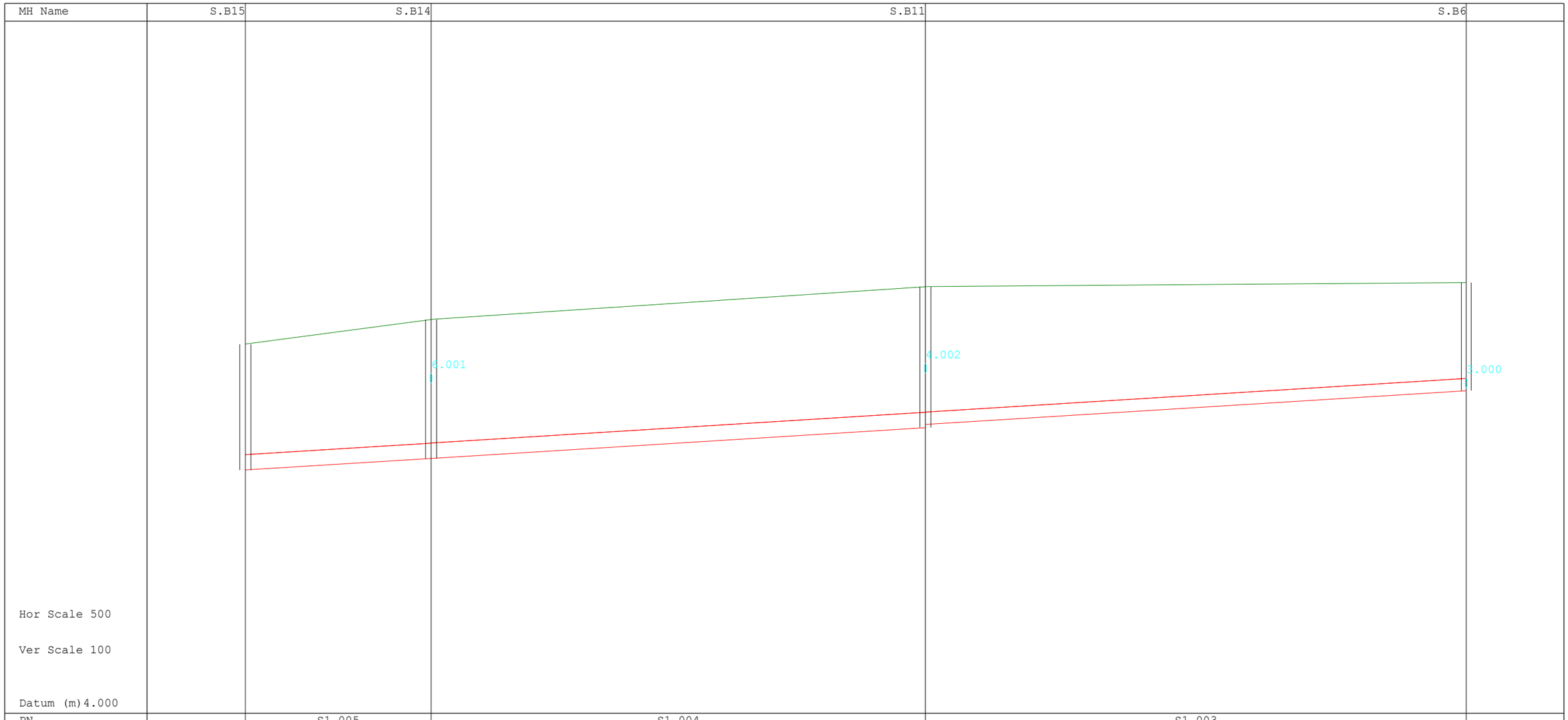
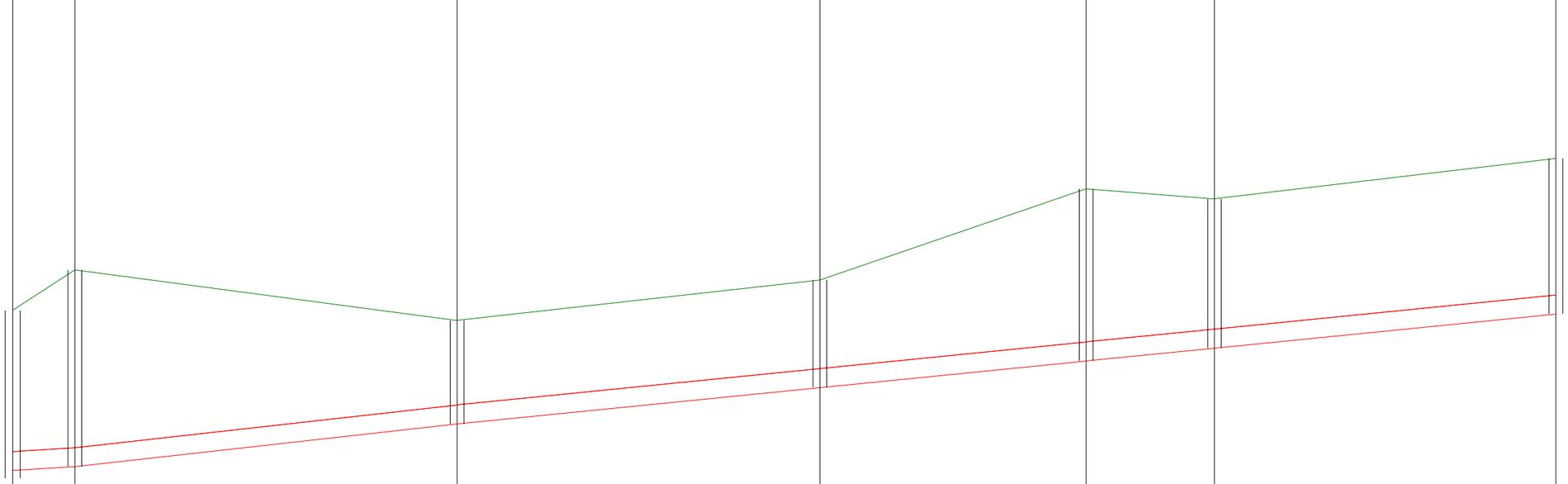


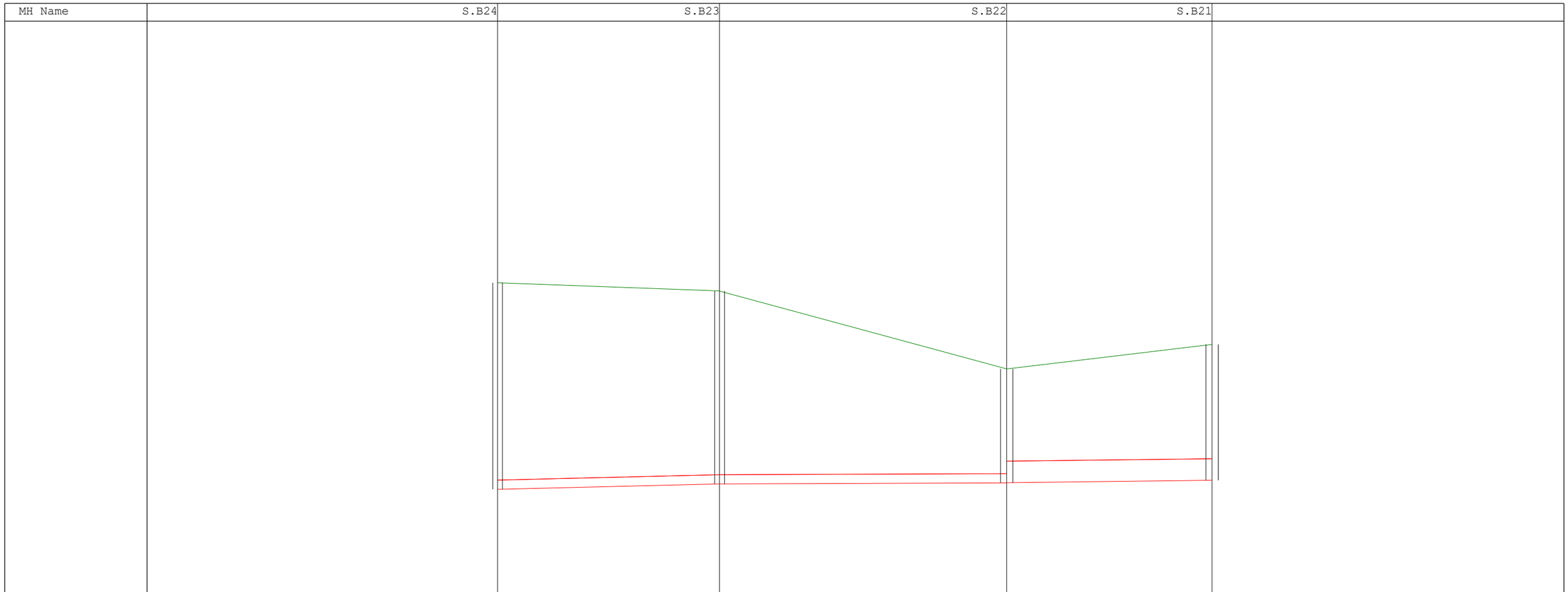
PN		S1.002	S1.001	S1.000	
Dia (mm)		300	300	225	
Slope (1:X)		40.8	41.0	30.0	
Cover Level (m)	14.500	15.050	15.400	17.300	
Invert Level (m)	11.864	12.491	12.491 / 13.180	13.255 / 15.500	
Length (m)		25.583	28.275	67.342	



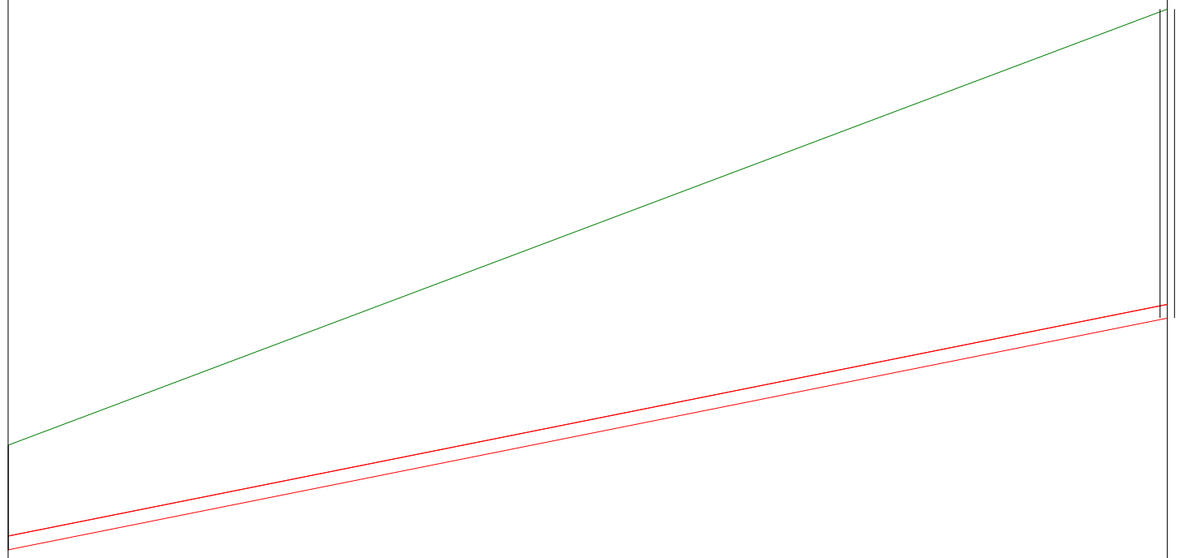
PN		S1.005	S1.004	S1.003	
Dia (mm)		375	375	300	
Slope (1:X)		80.0	80.0	80.0	
Cover Level (m)	13.000	13.600	14.400	14.500	
Invert Level (m)		9.928 / 10.211	10.211 / 10.965	11.040 / 11.864	
Length (m)		22.648	60.260	65.946	

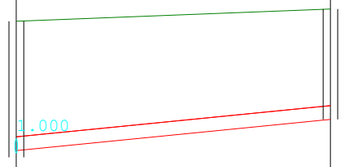


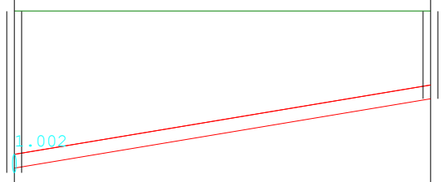
MH Name		S.B21	S.B20	S.B19	S.B18	S.B17	S.B16	S.B15	
Hor Scale 500 Ver Scale 100 Datum (m) 1.000									
PN			S1.011	S1.010	S1.009	S1.008	S1.007	S1.006	
Dia (mm)			375	375	375	375	375	375	
Slope (1:X)			78.0	44.8	50.0	50.0	50.0	50.0	
Cover Level (m)		10.000	10.800	9.800	10.600	12.400	12.200	13.000	
Invert Level (m)			6.837	6.916 / 6.916	7.759 / 7.759	8.475 / 8.475	9.001 / 9.001	9.254 / 9.254	9.928	
Length (m)			6.145	37.725	35.823	26.281	12.673	33.709	

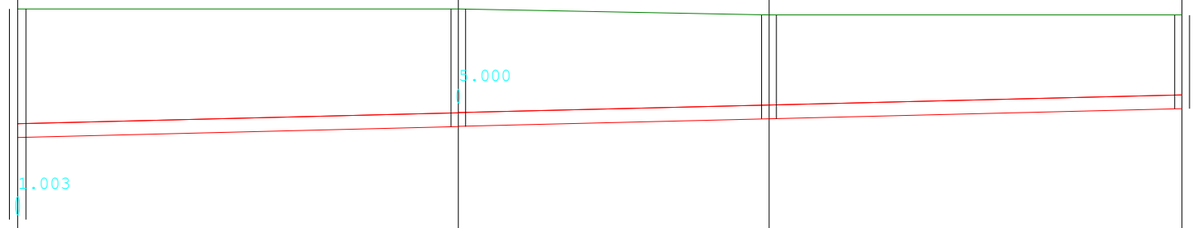


MH Name		S.B24	S.B23	S.B22	S.B21	
Hor Scale 500 Ver Scale 100 Datum (m) 1.000						
PN			S1.014	S1.013	S1.012	
Dia (mm)			225	225	525	
Slope (1:X)			200.5	1356.0	397.4	
Cover Level (m)		11.500	11.300	9.400	10.000	
Invert Level (m)		6.463	6.598	6.598	6.624	6.624	6.687	
Length (m)			27.061	35.011	25.039	

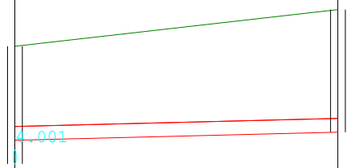
MH Name	S.A28		S.B24	
Hor Scale 500 Ver Scale 100 Datum (m)-1.000				
PN		S1.015		
Dia (mm)		225		
Slope (1:X)		25.0		
Cover Level (m)	4.390		11.500	
Invert Level (m)	2.683		6.463	
Length (m)		94.491		

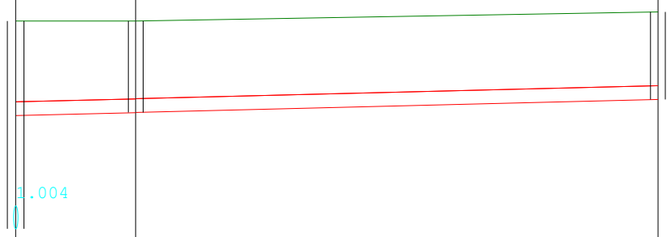
MH Name	S.B3	S.B2	
			
Hor Scale 500 Ver Scale 100 Datum (m) 6.000			
PN		S2.000	
Dia (mm)		225	
Slope (1:X)		50.0	
Cover Level (m)	15.400	15.600	
Invert Level (m)	13.288	13.800	
Length (m)		25.606	

MH Name	S.B6	S.B5	
			
Hor Scale 500 Ver Scale 100 Datum (m) 5.000			
PN		S3.000	
Dia (mm)		225	
Slope (1:X)		30.0	
Cover Level (m)	14.500	14.500	
Invert Level (m)	11.939	13.070	
Length (m)		33.931	



MH Name	S.B11	S.B10	S.B8	S.B7	
Hor Scale 500 Ver Scale 100 Datum (m) 4.000					
PN		S4.002	S4.001	S4.000	
Dia (mm)		225	225	225	
Slope (1:X)		200.0	200.0	200.0	
Cover Level (m)	14.400	14.400	14.300	14.300	
Invert Level (m)	12.301	12.481	12.481	12.608	12.608	12.776	
Length (m)		35.923	25.332	33.667	

MH Name	S.B10	S.B9	
			
Hor Scale 500 Ver Scale 100 Datum (m) 5.000			
PN		S5.000	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	14.400	15.000	
Invert Level (m)	12.868	13.000	
Length (m)		26.330	



MH Name	S.B14	S.B13	S.B12	
Hor Scale 500 Ver Scale 100 Datum (m) 4.000				
PN		S6.001	S6.000	
Dia (mm)		225	225	
Slope (1:X)		200.0	200.0	
Cover Level (m)	13.600	13.600	13.750	
Invert Level (m)	12.058	12.107	12.107 / 12.320	
Length (m)		9.779	42.571	

Appendix 11

ATTENUATION ESTIMATES, STORAGE TANK SIZING

PROJECT: **Bessborough SHD Development**

DESCRIPTION: **21207-JBB-PH2-XX-CA-C-04406_Attenuation_Assessment_(Phase_2)**

DATE: 17/02/2022 **SHEET** 100 Year +10%

BARRY & PARTNERS consulting engineers

Sheet 1

Catchment Characteristics

Site Area			1.480 ha
SAAR			1106 mm
Soil Category	4	SOIL =	**0.47**
M5-60			16.3 mm
M5-2D			76.6 mm
r = M5-60 / M5-2d =			0.21

Permissible flow (Q100) = **23.79** l/s

Developent Area = 1.480 ha
Impervious Area = 1.480 ha

Rainfall duration hrs	Rainfall depth (R100) mm	Including CCF (R100)*1.1 mm	Total volume of runoff m3	Average flow m3/s	Permsble Flow m3/s	Flow to be stored m3/s	Storage Volume m3
0.25	16.1	17.7	262.11	0.291	0.0238	0.267	241
0.5	21.6	23.8	351.65	0.195	0.0238	0.172	309
1	28.9	31.8	470.49	0.131	0.0238	0.107	385
2	38.7	42.6	630.04	0.088	0.0238	0.064	459
4	51.8	57.0	843.30	0.059	0.0238	0.035	501
6	61.5	67.7	1001.22	0.046	0.0238	0.023	487
12	82.3	90.5	1339.84	0.031	0.0238	0.007	312
24	110.3	121.3	1795.68	0.021	0.0238	-0.003	-260
48	128.3	141.1	2088.72	0.012	0.0238	-0.012	-2023
Required Volume = Maxum of storage volume, V100 =							**501** m3

Total attenuation storage required (m3) = **501** m3

STORMTECH Stormwater Management System Design Tool ver: Aug15

PROJECT REF: Bessborough SHD Development
LOCATION:
DATE: 17-Feb-22
CREATED BY: DOB

SYSTEM PARAMETERS

Required Total Storage	501	m^3
Stormtech chamber model	MC3500	
Filtration Permeable Geo or Impermeable Geo	Filter geo	
Number of Isolator Rows (IR)	1	

SITE PARAMETERS

			Minimum Requirement
Stone Porosity	43%		
Excavation Batter Angle (degrees)	60	°	*0.30*
Stone Above Chambers	0.3	m	*0.23*
Stone Below Chambers	0.3	m	*0.23*
In-between Row Spacing	0.23	m	
Additional Storage outside Excavation. E.g manholes, Header Pipe	0	m^3	

HEADER PIPE

Is Header pipe required within excavation	No	
Orientation of Header Pipe	Parrallel to IR	
Diameter of Header Pipe	0.6	m
Length of Header Pipe	0	m

CHAMBER SYSTEM DIMENSIONS

	Calculated	Adopted	
Number of Rows		8	ea
Number of units per Row		10	ea
System Installed Storage Depth (effective storage depth)	1.745		m
Tank overall installed Width at base	17.85	18.00	m
Tank overall installed Length at Base	23.54	23.7	m
Total Effective System Storage	**496.2**	**501.2**	m^3

STORMTECH SYSTEM DETAIL

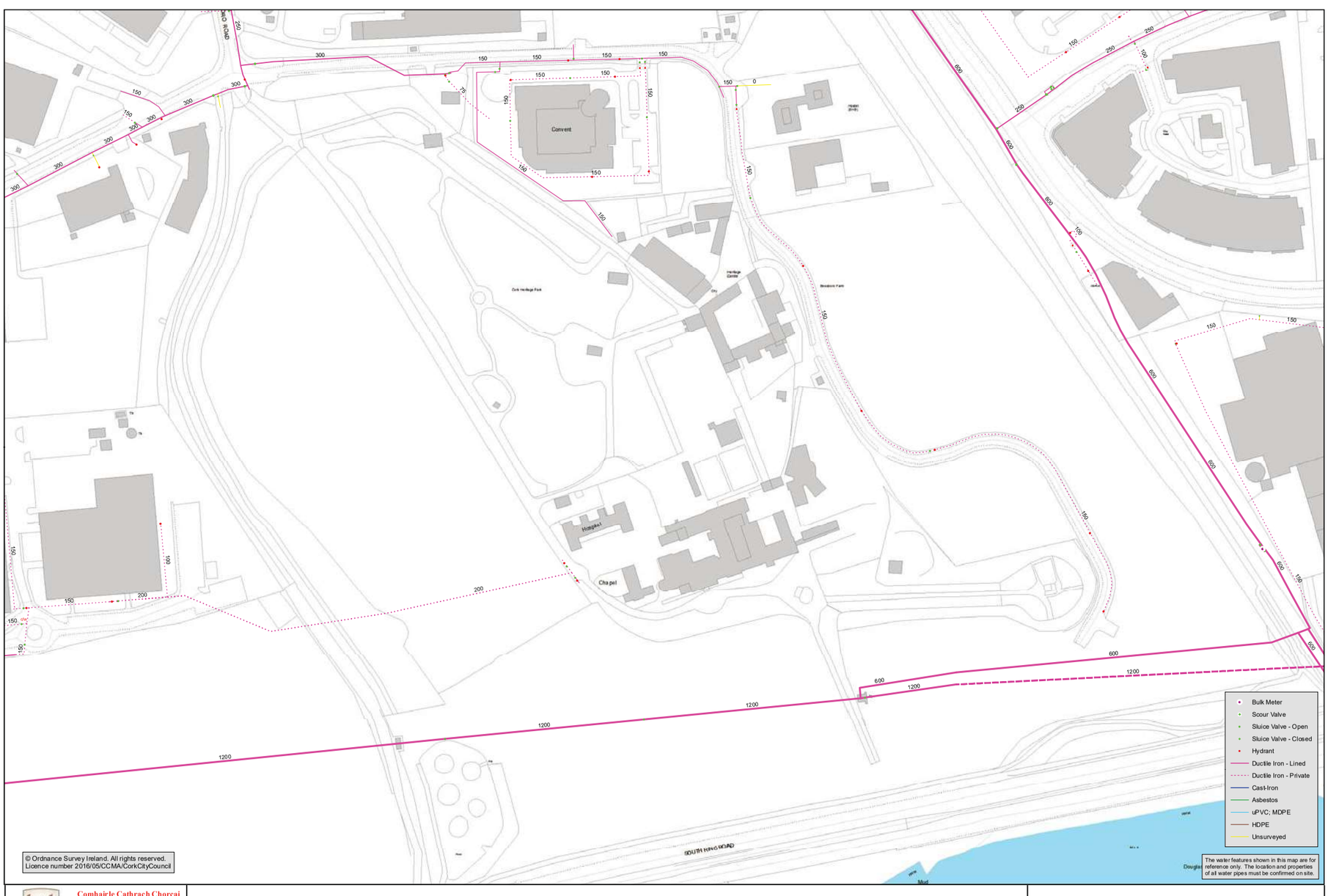
	MC3500	
StormTech Chamber Model		
Unit Width	1.955	m
Unit Length	2.18	m
Unit Height	1.145	m
Min Cover Over System	0.3	m
Max Cover Over Chamber	2.4	m
Chamber Internal Storage Vol.	3.11	m^3
Header Pipe Internal Storage Vol in Excavation	0.0	m^3

STONE AND EXCAVATION DETAIL

Volume of Dig for System	821	m^3
Width at base	18.00	m
Width at top	20.01	m
Length at base	23.70	m
Length at top	25.71	m
Depth Of System	1.75	m
Area of Dig at Base of System	427	m^2
Area of Dig at Top of System	515	m^2
Void Ratio	61%	
Stone Requirement - m3	564	m^3
Stone Requirement - tonne	924	tonne

Appendix 12

CORK CITY COUNCIL - EXISTING WATERMAIN RECORDS



Comhairle Cathrach Chorcaí
Cork City Council
Environment Directorate
Water Services (Distribution) Section
Tel: 021-4924026
Fax: 021-4924015
Web: www.corkcity.ie

Bessboro, Mahon
Public Watermain Records

Scale: 1:1000 Date: Jul 2018 DrgNo.
Drawn: LG Checked:

- Appendix 2-9 - Phase 1 ‘The Meadows’ Energy Statement prepared by DKPartnership

DKPartnership Dublin Cork London
T : 01-813-1930 T : 064-664-1686
E : post@dkpartnership.com

5240 ENERGY ANALYSIS REPORT

ENERGY USE ANALYSIS and PART L COMPLIANCE STATEMENT

Phase 1 - The Meadows - Bessborough

Proposed Residential Development

Bessborough,
Ballinure,
Blackrock,
Co. Cork

Estuary View Enterprises 2020 Ltd

DKP document no
5240

Project file no
DKP-M88-5240 ¦ 1P
2022-02-21

Document control

DKP project no: M88
DKP document no: 5240
Project file no: DKP-M88-5240

Circular		Issue >	1P#	1P
Clients	Estuary View Enterprises 2020 Ltd		☑	☑
Architects	Shipseybarry Architects		☑	☑
Planning consultants	HW Planning		☑	☑
Landscape architects	Ilsa Rutgers			☑

Issue	1P#	2022-01-12	Draft, for review
Issue	1P	2022-02-21	For final issue

Document issue status ID

#	Sketch/draft
P	Planning
C	Concept
D	Design
G	General information
T	Tender
W	Works/construction
Z	As-build/constructed

Issue	Prepared	Checked	Approved
1	214	201	201
2	201	201	201
3			

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Contents

1 Introduction

1.1 Report purpose

This report gives information on the projects energy status and carbon dioxide emissions, the statutory compliance requirements and energy/CO2 reduction achievements based on the proposed building / construction specifications.

1.2 Instruction

DKPartnership (DKP) have been commissioned by Estuary View Enterprises 2020 Ltd, to carry out the analysis and report for the proposed development at Bessborough, Co. Cork.

1.3 Development description

The development consists of 280 build to sell apartments , associated supporting uses , a 25 child creche facility , communal open space areas, landscaping, under-podium and car parking spaces (99 spaces), bicycle parking spaces, bin stores, public lighting and all ancillary site development works.
The development also consists of a new pedestrian and cycle way bridge connecting the site to the passage west greenway to the Eastern boundary. The development is arranged around 4 main L-shaped blocks ,Builds A,B,C,& D with a central spine public route running East-West. A raised landscape podium is located to the South of this route .Building Heights range form 1 - 10 storeys at varying locations.

1.4 Policy and building regulation requirements.

The project is subject to the following statutory and policy energy usage and CO2 emission target requirements:
TGD Part L 2019 for the residential element and Part L 2017 for the non residential element.

1.5 Approach

The energy usage and carbon emissions are calculated using the DEAP software and approached using the basic DKP energy reduction steps in the following order :

a) Reduce energy usage
b) Produce energy efficiently
c) Provide on-site energy

2 Executive summary

2.1 Analysis conducted

In this report the primary energy usage and carbon dioxide emissions have been analysed to provide an energy efficient building in compliance with the current standards and regulations.

2.2 Policy and building regulations applied

Given its time frame currently known the new development's requires compliance (energy) to Part L 2019 for the residential element and Part L 2017 for the non residential element . Compliance to both the above noted Part L would deem the development and developments residential units to be "Nearly Zero Energy Buildings" (NZEB) in accordance to the EU Energy performance of Buildings Directive Recast 2013/31/EU.

2.3 Calculation data, targets and achievements.

For the purpose of this report as the residential element dominates the few non residential facilities the calculation data provided in the tables below is based on Part L 2019 and covers the main criteria ; a) Primary energy, b) Carbon dioxide, c) Renewable energy. The calculation data given is the average residential unit size, occupation, configuration, orientation, etc. To comply to Part L the residential unit(s) requires to achieve a primary energy reduction of 70% (0.30 MEPC factor), a carbon emission reduction of 65% (0.35 MCPC factor) and a 20% renewable energy contribution on the reference residential unit. The reference residential unit is the proposed residential unit but by the SEIA stipulated standard (poorer) Part L calculation parameters, U-values/insulation levels, boiler efficiency, controls etc. The table below represents the reference residential unit data, the to be achieved data and the current achieved data of the average residential type across the development using the applied reduction measures and technologies listed in section 4.

In essence passive reduction measures and on-site produced renewable energy are most beneficial as they are a permanent reduction measures and alternative energy supply combatting not only the global climate change but also the inflation on energy cost.

SINGLE UNIT

ELEMENT	UNIT	REFERENCE	TO BE ACHIEVED	FACTOR	ACHIEVED	FACTOR
Primary Energy	kWh/y	13,122	**3,937**	0.30	**3,412**	0.26
Carbon Dioxide	kg/y	2,684	**939**	0.35	**671**	0.25
Renewable energy	kWh/y	0	**787**	20%	**1,058**	31%

Overall development achievements
Number of residential units : **280**

ELEMENT	UNIT	BASE LINE	ACHIEVED	FACTOR	REDUCTION	%
Primary Energy	kWh/y	3,674,160	**955,282**	0.26	**2,718,878**	74.0%
Carbon Dioxide	kg/y	751,520	**187,880**	0.25	**563,640**	75.0%
	UNIT	BASE LINE	ACHIVED	FACTOR	CONTRIBUTION	%
Renewable energy	kWh/y	0	**296,137**	31%	**842,852**	31%

We note the significant reduction in carbon dioxide of 564 ton CO2 per year and the renewable energy contribution of 842,852 kWh per year which is a huge benefit to the global environment

We note that for this report we have applied the air source heat pump option for the calculation results and TGD Part L compliance. However whereas PV panels are not a requirement with the air source heat pump option they have been shown on the roofs of buildings on the architects drawings to allow for flexibility from a planning perspective in the case that alternative energy / renewable energy solutions are to be considered.

2.4 Policy and building regulation compliance overview

The table below summarises the requirements of Part L for primary energy, CO2 and renewable energy ;

POLICY/REGULATION	REQUIREMENT	ACHIEVEMENTS
Primary Energy	To achieve a primary energy reduction factor (EPC) of 0.30 or less over the 2019 energy reference building.	An EPC of 0.26 was achieved which is lower then the maximum MEPC of 0.30 and is therefore compliant.
Carbon Dioxide	To achieve carbon dioxide emission reduction factor of 0.35 or less over the 2019 energy reference building.	An CPC of 0.25 was achieved which is lower then the maximum MCPC of 0.35 and is therefore compliant.
Renewable energy	To achieve at least a 20% renewable primary energy equivalent contribution.	An overall contribution of (primary energy) renewable energy of 44% was achieved with the heat pump renewable energy element.

2.5 Conclusion

Compliance to part L 2019 was achieved using proposed measures achieving a primary energy reduction in excess of the minimum required a 70% (or < 0.30), a carbon dioxide reduction in excess of the minimum required 65% (or < 0.35) and a renewable energy contribution in excess of 20%. As mentioned compliance could also be achieved by a number of other methods listed in section 4.8 in combination with proposed passive reduction measures outlined in section 4.7.

2.6 Mitigation measures / actions

There are no mitigation measures anticipated.

3 Geographical overview

3.1 Project overview

Image 3.1, the (google maps) site map below is a basic overview of the site with proposed development approximately outlined in the area site map.

Image 3.1: approximate proposed phase 1 (Meadows) development site area outlined

4 Approach, methodology and calculation results

4.1 General approach

The target of the building's energy usage and carbon dioxide emissions is to comply to the current building regulations and to design the building and building services in line with the "Nearly Zero Energy Building" energy policy adapted in Part L 2019. Calculations have been conducted on all the developments apartment units with the given data in this report representing the averages across all of the **280** no units with the average unit size to be **64**m2. The average unit (size) has been applied for these initial Part L calculations.

4.2 Building regulations requirements

Building regulation (residential) Part L : 2019 or any subsequent editions current at the time of completion.

4.3 Part L 2019 general approach

Part L 2019 requires a new residential unit to make primary energy and carbon dioxide emission reductions on a reference apartment by applying improved calculation parameters and technologies.
Part L 2019 also requires the apartment to provide at least 20% of its primary energy usage by means of renewable energy. The reference apartment is exactly the same as the actual apartment albeit with standard basic Part L calculation parameters, U-values/insulation levels, boiler efficiency, controls etc. and has no renewable energy which the new apartment has to improve upon.

4.4 Reduction targets

The following are the reference building or target values.

SINGLE UNIT

ELEMENT	UNIT	REFERENCE	TO BE ACHIEVED	FACTOR
Primary Energy	kWh/y	13,122	**3,937**	0.30
Carbon Dioxide	kg/y	2,684	**939**	0.35
Renewable energy	kWh/y	0	**787**	20%

4.5 Building minimum elemental parameters

The following are the main building minimum target values for Part L 2011 and Part L 2019 ;

Element	Unit	2011	2019
Primary energy	MPEPC *	0.40 - 60%	0.30 - 70%
Carbon emissions	MPCPC *	0.46 - 54%	0.35 - 65%
Renewable energy	RER (%) **	15% (estimated)	> 20%
External walls	U (W/m2K)	0.21	0.18
Windows/glazing	U (W/m2K)	1.60	1.40
Pitched roof horizontal	U (W/m2K)	0.16	0.16
Pitched roof pitched	U (W/m2K)	0.16	0.16
Flat roof	U (W/m2K)	0.20	0.20
Ground floor	U (W/m2K)	0.21	0.18
Cold bridging	U (W/m2K)	0.15 / 0.08	0.15 / 0.08
Air tightness	M3/m2*h	7	5 (3) ***
Air testing		Proportionally	All / every one
HRU/MVHR	W/l/s / %	1.5 + 66% efficient	1.2 + 70% efficient
DCV	W/l/s	0.8	0.6

4.6 Reduction hierarchy

To target the Part L minimum required reductions DKP use the following reduction hierarchy ;
1) Step 1 - Reduce energy usage
2) Step 2 – Produce energy efficiently
3) Step 3 – Provide on-site energy.

4.7 Step 1) Reducing energy usage

Energy use reduction is mainly achieved by reducing the actual heat loss of the building by :
a - Lowering the heat loss through the floors, walls, roof by increasing the thermal resistance of the elements.
b - Lowering the heat loss through the glazed elements by using windows with a higher thermal resistance.
c - Lowing the heat loss by using insulated construction joints.
d - Increasing the air tightness to minimise the involuntary air infiltration rate.

The following parameters have applied as a means to achieve compliance.

- Ground floors :

U = **0.10 – 0.13** W/m2K
120-150mm high density polyurethane foam board (HDPUF) floor insulation, k<=0.022/0.021 W/mK plus
12.5mm high density polyurethane foam board (HDPUF) edge insulation around the perimeter, k<=0.022W/mK

- External walls + walls to unheated common spaces:

U= **0.12 - 0.14** W/m2K
135 - 160mm partial or full fill cavity high density polyurethane foam board wall insulation, k<=0.022/0.021 W/mK
Emissivity factor : <=0.5

- Party walls :

U= x.x W/m2K where appropriate.
Solid plastered or skimmed both sides and sealed on all edges and joints.

- Roof :

U= **0.10 – 0.12** W/m2K
Flat : 100-125mm high density polyurethane (HDPUF), cold side (roof) insulation, k<=0.022/0.021 W/mK +
50-60mm density polyurethane (HDPUF), warm side insulated plasterboard, k<=0.022/0.021 W/mK

- Window & frame :

U<=**1.0** W/m2/K,
Double or triple glazed Argon filled insulated frame
Solar transmittance 0.55
Light transmittance : 0.72

- External door & frame :

U = **1.0** W/m2K
Insulated solid door or as above.

- Air tightness :

Design target **2.5** m3/m2*h
Design permeability is set at 2.5 m3/m2*h @ 50Pa or an approximate atmospheric exchange rate of 0.125 ach.
To be achieved with very good workmanship with taped and sealed construction joints and or purpose membrane.

- Cold bridging :

U<=**0.06** W/m2K
All construction joints to be insulated. Approved Part L joints as per appendix D.
The actual linear coefficient will be applied using the Part L appendix D approved construction details with some (15%) recalculated better insulated joints as listed below using ;

- Ventilation.

Demand controlled 24 hour/365 operated central mechanical extract system (no heat recovery)
Requires +/- 60% natural ventilation openings typically 4,000mm^2 per habitable room. 100% permanent.
All wet rooms fully ducted from central location typically Ø80mm duct work.

or

Demand controlled 24 hour/365 operated central mechanical supply and extract system (with heat recovery)
No natural ventilation opening. Sealed building. All habitable / wet rooms fully ducted typically Ø100mm duct work.

with

Separate manual operated on/off kitchen extract with the 2 options above.

- Lighting ;

Low energy lighting. **100%**
All lighting point are either LED or compact fluorescent fittings or fittings with LED or compact fluorescent filaments.

- Heating / hot-water controls ;

1 no. 2 channel (space heating / hot-water) battery backed programmable time clock with 1 hour boost facility.
1 no. Room thermostat / 2 port control valve.+ thermostatic radiator valves or individual room thermostats.
1 no. Hot water thermostat / 2 port control valve.

- Circulation pumps.

Class A Variable speed circulating pump(s)

- Avoid.

Chimney / open fire,
Chimney / biomass stove
Biomass stove
Gas stove
Electric fire

4.8 **Step 2 and 3) Provide energy efficiently and provide on-site renewable energy**

Energy and renewable energy can be provided in numerous ways.
Given the location of the project and its accessibility to grid utilities the following options could be considered for the provision of energy and renewable energy.

- Energy and alternative renewable on-site energy source.

a) LTHW (wet) Mains gas condensing system or instantaneous hot-water boiler (η>92%) + 5 PV 400Wp panels, or
b) LTHW (wet) Mains gas condensing hot-water storage boiler (η>92%) + 4 PV 400Wp panels, or
c) LTHW (wet) Split or mono block air source heat pump (η heating>540%, η hot-water >245%), or
d) Electric space heating (dry) + Hot water heat pump (η hot-water >485%) (apartments up to +/- 80m2 only), or
e) A communal form of heating system with any of the above options or a combination of any of the above options.

There are also other possible sources like city district heating networks CDHN, CHP heating networks, on site communal heating with CHP, geothermal heat or waste heat recovery from incineration or other industrial processes to be considered. As there are no city heating net works in close vicinity to the project site a local on-site energy source is to be applied.
CHP is not efficient as the projects base load is not sufficient to maintain viability on a CHP plant. The project, as it is relatively dense, may suit a communal heating system fed by a combination of mains gas boilers and heat pumps however this needs to be economically assessed for viability and if applied does bring the additional requirement of heat energy metering and invoicing to apartment occupiers.

For the report we have applied option c) the air source heat pump.

4.9 **Renewable energy**

This means producing on-site renewable energy by using;
a - Thermal solar panels for hot water and/or space heating.
b – Photovoltaic (PV) panels for electrical energy for all electrical requirements.
c - Wind mill(s) for electrical energy for all electrical requirements.
d - Biomass (wood, pellet, chip) plant for hot water and/or space heating.
e - Incinerator(s) for waste heat production
f – Heat pump renewable energy.

Given the configuration of the development and the urban location wind power has not been considered. Biomass, although theoretically a good renewable option, has given issue's in other project's with similar use due to maintenance problems with the actual plant giving rise to complaints from occupants / users. PV is generally a good and passive option to be considered.

For this report we have applied option (f) the heat pump renewable fraction. To maintain flexibility from a planning perspective PV panels have been included on the architects drawing allowing for alternative energy / renewable energy solutions.

4.10 **Calculation software**

Primary energy and carbon dioxide performance calculations are executed using the National Calculation Methodology government approved Domestic Energy Assessment Procedure (DEAP version 4).

4.11 **Over heating**

Over heating can be an issue and an over heating analysis was conducted using the Passive House PPH analysis software which concluded that the risk to overheating was minimal in accordance to CIBSE TM37. Overheating can also be addressed by applying glass with a higher solar reflection factor or lower emittance factor.

4.12 Calculation results

The table below shows the calculation results from the average size apartment with the average external wall area, glass area, orientation, floor * roof area etc. The table details the reference building primary energy, carbon dioxide and renewable energy data, the required reductions / contributions and what has been achieved using the more advanced building part L parameters from items 4.6 reduction parameters and 4.7 energy & renewable energy options.

SINGLE UNIT

ELEMENT	UNIT	REFERENCE	TO BE ACHIEVED	FACTOR	ACHIEVED	FACTOR
Primary Energy	kWh/y	13,122	**3,937**	0.30	**3,412**	0.26
Carbon Dioxide	kg/y	2,684	**939**	0.35	**671**	0.25
Renewable energy	kWh/y	0	**787**	20%	**1,058**	31%

Overall development achievements

Number of residential units : **280**

ELEMENT	UNIT	BASE LINE	ACHIEVED	FACTOR	REDUCTION	%
Primary Energy	kWh/y	3,674,160	**955,282**	0.26	**2,718,878**	74.0%
Carbon Dioxide	kg/y	751,520	**187,880**	0.25	**563,640**	75.0%

	UNIT	BASE LINE	ACHIVED	FACTOR	CONTRIBUTION	%
Renewable energy	kWh/y	0	**296,137**	31%	**842,852**	31%

We note the significant reduction in carbon dioxide of 564 ton CO2 per year and the renewable energy contribution of 842,852 kWh per year which is a huge benefit to the global environment

A decision on the final agreed energy supply solution will be made in due time after the proposed systems economical assessment.

4.13 Part L compliance conclusion

Compliance to part L 2019 is achieved by means of a 70% primary energy reduction on the reference dwelling or an EPC (primary energy) of 0.30 or less, a 65% carbon diode reduction or a CPC (carbon dioxide) of 0.35 or less and an equivalent primary renewable energy contribution of 20% or more.

As mentioned in the above sections this can be achieved by a number of methods listed in section 4.8 in combination with proposed passive reduction measures outlined in section 4.7.

- Appendix 2-10 - Phase 2 ‘The Farm’ Energy Statement prepared by DKPartnership

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5240 ENERGY ANALYSIS REPORT

ENERGY USE ANALYSIS and PART L COMPLIANCE STATEMENT

Phase 2 - The Farm - Bessborough

Proposed Residential Development

Bessborough,
Ballinure,
Blackrock,
Co. Cork

Estuary View Enterprises 2020 Ltd

DKP document no
5240

Project file no
DKP-M88-5240 ¦ 1P
2022-02-21

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Circular		Issue >	1P#	1P
Clients	Estuary View Enterprises 2020 Ltd		☑	☑
Architects	Shipseybarry Architects		☑	☑
Planning consultants	HW Planning		☑	☑
Landscape architects	Ilsa Rutgers			☑

Issue	1P#	2022-01-12	Draft, for review
Issue	1P	2022-02-21	For final issue

Document issue status ID

#	Sketch/draft
P	Planning
C	Concept
D	Design
G	General information
T	Tender
W	Works/construction
Z	As-build/constructed

Issue	Prepared	Checked	Approved
1	214	201	201
2	201	201	201
3			

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Contents

1 Introduction

1.1 Report purpose

This report gives information on the projects energy status and carbon dioxide emissions, the statutory compliance requirements and energy/CO2 reduction achievements based on the proposed building / construction specifications.

1.2

1.3 Instruction

DKPartnership (DKP) have been commissioned by Estuary View Enterprises 2020 Ltd, to carry out the analysis and report for the proposed development at Bessborough, Co. Cork.

1.4 Development description

The development consists of 140 build to sell apartments , associated supporting uses , a 25 child creche facility , communal open space areas, landscaping, surface car parking spaces, bicycle parking spaces, bin stores, public lighting and all ancillary site development works. The development also consists of the demolition of selected farm buildings and the refurbishment and incorporation of existing buildings on site. The development is arranged around 5 new blocks ,Builds A,B,C, D & E with buildings A ,B & C located in a parkland setting while buildings D & E located around the former farmyard area. A central landscape area forms the main communal spaces to the scheme.

1.5 Policy and building regulation requirements.

The project is subject to the following statutory and policy energy usage and CO2 emission target requirements:
TGD Part L 2019 for the residential element and Part L 2017 for the non residential element.

1.6 Approach

The energy usage and carbon emissions are calculated using the DEAP software and approached using the basic DKP energy reduction steps in the following order :

a) Reduce energy usage
b) Produce energy efficiently
c) Provide on-site energy

2 Executive summary

2.1 Analysis conducted

In this report the primary energy usage and carbon dioxide emissions have been analysed to provide an energy efficient building in compliance with the current standards and regulations.

2.2 Policy and building regulations applied

Given its time frame currently known the new development's requires compliance (energy) to Part L 2019 for the residential element and Part L 2017 for the non residential element . Compliance to both the above noted Part L would deem the development and developments residential units to be "Nearly Zero Energy Buildings" (NZEB) in accordance to the EU Energy performance of Buildings Directive Recast 2013/31/EU.

2.3 Calculation data and targets

For the purpose of this report as the residential element dominates the few non residential facilities the calculation data provided in the tables below is based on Part L 2019 and covers the main criteria ; a) Primary energy, b) Carbon dioxide, c) Renewable energy. The calculation data given is the average residential unit size, occupation, configuration, orientation, etc. To comply to Part L the residential unit(s) requires to achieve a primary energy reduction of 70% (0.30 MEPC factor), a carbon emission reduction of 65% (0.35 MCPC factor) and a 20% renewable energy contribution on the reference residential unit. The reference residential unit is the proposed residential unit but by the SEIA stipulated standard (poorer) Part L calculation parameters, U-values/insulation levels, boiler efficiency, controls etc. The table below represents the reference residential unit data, the to be achieved data and the current achieved data of the average residential type across the development using the applied reduction measures and technologies listed in section 4.

In essence passive reduction measures and on-site produced renewable energy are most beneficial as they are a permanent reduction measures and alternative energy supply combatting not only the global climate change but also the inflation on energy cost.

SINGLE UNIT

ELEMENT	UNIT	REFERENCE	TO BE ACHIEVED	FACTOR	ACHIEVED	FACTOR
Primary Energy	kWh/y	14,298	**4,289**	0.30	**3,717**	0.26
Carbon Dioxide	kg/y	2,928	**1,025**	0.35	**732**	0.25
Renewable energy	kWh/y	0	**858**	20%	**1,227**	33%

Overall development achievements
Number of residential units : **140**

ELEMENT	UNIT	BASE LINE	ACHIEVED	FACTOR	REDUCTION	%
Primary Energy	kWh/y	2,001,720	**520,447**	0.26	**1,481,273**	74.0%
Carbon Dioxide	kg/y	409,920	**102,480**	0.25	**307,440**	75.0%
	UNIT	BASE LINE	ACHIVED	FACTOR	CONTRIBUTION	%
Renewable energy	kWh/y	0	**171,748**	33%	**488,820**	33%

We note the significant reduction in carbon dioxide of 307 ton CO2 per year and the renewable energy contribution of 488,820 kWh per year which is a huge benefit to the global environment

We note that for this report we have applied the air source heat pump option for the calculation results and TGD Part L compliance. However whereas PV panels are not a requirement with the air source heat pump option they have been shown on the roofs of buildings on the architects drawings to allow for flexibility from a planning perspective in the case that alternative energy / renewable energy solutions are to be considered.

2.4 Policy and building regulation compliance overview

The table below summarises the requirements of Part L for primary energy, CO2 and renewable energy ;

POLICY/REGULATION	REQUIREMENT	ACHIEVEMENTS
Primary Energy	To achieve a primary energy reduction factor (EPC) of 0.30 or less over the 2019 energy reference building.	An EPC of 0.26 was achieved which is lower then the maximum MEPC of 0.30 and is therefore compliant.
Carbon Dioxide	To achieve carbon dioxide emission reduction factor of 0.35 or less over the 2019 energy reference building.	An CPC of 0.25 was achieved which is lower then the maximum MCPC of 0.35 and is therefore compliant.
Renewable energy	To achieve at least a 20% renewable primary energy equivalent contribution.	An overall contribution of (primary energy) renewable energy of 44% was achieved with the heat pump renewable energy element.

2.5 Conclusion

Compliance to part L 2019 was achieved using proposed measures achieving a primary energy reduction in excess of the minimum required a 70%, a carbon dioxide reduction in excess of the minimum required 65% and an equivalent primary renewable energy contribution in excess of 20%. As mentioned compliance could also be achieved by a number of other methods listed in section 4.8 in combination with proposed passive reduction measures outlined in section 4.7.

2.6 Mitigation measures / actions

There are no mitigation measures anticipated.

3 Geographical overview

3.1 Project overview

Image 3.1, the (google maps) site map below is a basic overview of the site with proposed development approximately outlined in the area site map.

Image 3.1: approximate proposed phase 2 (Farm) development site area outlined

4 Approach, methodology and calculation results

4.1 General approach

The target of the building's energy usage and carbon dioxide emissions is to comply to the current building regulations and to design the building and building services in line with the "Nearly Zero Energy Building" energy policy adapted in Part L 2019. Calculations have been conducted on all the developments apartment units with the given data in this report representing the averages across all of the **140** no units with the average unit size to be **62**m2. The average unit (size) has been applied for these initial Part L calculations.

4.2 Building regulations requirements

Building regulation (residential) Part L : 2019 or any subsequent editions current at the time of completion.

4.3 Part L 2019 general approach

Part L requires a new apartment to make primary energy and carbon dioxide emission reductions on a reference apartment by applying improved calculation parameters and technologies.
Part L also requires the apartment to provide at least 20% of its primary energy usage by means of renewable energy.
The reference apartment is exactly the same as the actual apartment albeit with standard basic Part L calculation parameters, U-values/insulation levels, boiler efficiency, controls etc. and has no renewable energy which the new apartment has to improve upon.

4.4 Reduction targets

The following are the reference building or target values.

SINGLE UNIT

ELEMENT	UNIT	REFERENCE	TO BE ACHIEVED	FACTOR
Primary Energy	kWh/y	14,298	**4,289**	0.30
Carbon Dioxide	kg/y	2,928	**1,025**	0.35
Renewable energy	kWh/y	0	**858**	20%

4.5 Building minimum elemental parameters

The following are the main building minimum target values for Part L 2011 and Part L 2019 ;

Element	Unit	2011	2019
Primary energy	MPEPC *	0.40 - 60%	0.30 - 70%
Carbon emissions	MPCPC *	0.46 - 54%	0.35 - 65%
Renewable energy	RER (%) **	15% (estimated)	> 20%
External walls	U (W/m2K)	0.21	0.18
Windows/glazing	U (W/m2K)	1.60	1.40
Pitched roof horizontal	U (W/m2K)	0.16	0.16
Pitched roof pitched	U (W/m2K)	0.16	0.16
Flat roof	U (W/m2K)	0.20	0.20
Ground floor	U (W/m2K)	0.21	0.18
Cold bridging	U (W/m2K)	0.15 / 0.08	0.15 / 0.08
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Air testing		Proportionally	All / every one
HRU/MVHR	W/l/s / %	1.5 + 66% efficient	1.2 + 70% efficient
DCV	W/l/s	0.8	0.6

4.6 Reduction hierarchy

To target the Part L minimum required reductions DKP use the following reduction hierarchy ;
1) Step 1 - Reduce energy usage
2) Step 2 – Produce energy efficiently
3) Step 3 – Provide on-site energy.

4.7 Step 1) Reducing energy usage

Energy use reduction is mainly achieved by reducing the actual heat loss of the building by :
a - Lowering the heat loss through the floors, walls, roof by increasing the thermal resistance of the elements.
b - Lowering the heat loss through the glazed elements by using windows with a higher thermal resistance.
c - Lowing the heat loss by using insulated construction joints.
d - Increasing the air tightness to minimise the involuntary air infiltration rate.

The following parameters have applied as a means to achieve compliance.

- Ground floors :

U = **0.10 – 0.13** W/m2K
120-150mm high density polyurethane foam board (HDPUF) floor insulation, k<=0.022/0.021 W/mK plus
12.5mm high density polyurethane foam board (HDPUF) edge insulation around the perimeter, k<=0.022W/mK

- External walls + walls to unheated common spaces:

U= **0.12 - 0.14** W/m2K
135 - 160mm partial or full fill cavity high density polyurethane foam board wall insulation, k<=0.022/0.021 W/mK
Emissivity factor : <=0.5

- Party walls :

U= x.x W/m2K where appropriate.
Solid plastered or skimmed both sides and sealed on all edges and joints.

- Roof :

U= **0.10 – 0.12** W/m2K
Flat : 100-125mm high density polyurethane (HDPUF), cold side (roof) insulation, k<=0.022/0.021 W/mK +
50-60mm density polyurethane (HDPUF), warm side insulated plasterboard, k<=0.022/0.021 W/mK

- Window & frame :

U<=**1.0** W/m2/K,
Double or triple glazed Argon filled insulated frame
Solar transmittance 0.55
Light transmittance : 0.72

- External door & frame :

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Insulated solid door or as above.

- Air tightness :

Design target **2.5** m3/m2*h
Design permeability is set at 2.5 m3/m2*h @ 50Pa or an approximate atmospheric exchange rate of 0.125 ach.
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Separate manual operated on/off kitchen extract with the 2 options above.

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All lighting point are either LED or compact fluorescent fittings or fittings with LED or compact fluorescent filaments.

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- Circulation pumps.

Class A Variable speed circulating pump(s)

- Avoid.

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Energy and renewable energy can be provided in numerous ways.
Given the location of the project and its accessibility to grid utilities the following options could be considered for the provision of energy and renewable energy.

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e) A communal form of heating system with any of the above options or a combination of any of the above options.

There are also other possible sources like city district heating networks CDHN, CHP heating networks, on site communal heating with CHP, geothermal heat or waste heat recovery from incineration or other industrial processes to be considered. As there are no city heating net works in close vicinity to the project site a local on-site energy source is to be applied.
CHP is not efficient as the projects base load is not sufficient to maintain viability on a CHP plant. The project, as it is relatively dense, may suit a communal heating system fed by a combination of mains gas boilers and heat pumps however this needs to be economically assessed for viability and if applied does bring the additional requirement of heat energy metering and invoicing to apartment occupiers.

For the report we have applied option c) the air source heat pump.

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This means producing on-site renewable energy by using;
a - Thermal solar panels for hot water and/or space heating.
b – Photovoltaic (PV) panels for electrical energy for all electrical requirements.
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The table below shows the calculation results from the average size apartment with the average external wall area, glass area, orientation, floor * roof area etc. The table details the reference building primary energy, carbon dioxide and renewable energy data, the required reductions / contributions and what has been achieved using the more advanced building part L parameters from items 4.6 reduction parameters and 4.7 energy & renewable energy options.

SINGLE UNIT

ELEMENT	UNIT	REFERENCE	TO BE ACHIEVED	FACTOR	ACHIEVED	FACTOR
Primary Energy	kWh/y	14,298	**4,289**	0.30	**3,717**	0.26
Carbon Dioxide	kg/y	2,928	**1,025**	0.35	**732**	0.25
Renewable energy	kWh/y	0	**858**	20%	**1,227**	33%

Overall development achievements

Number of residential units : **140**

ELEMENT	UNIT	BASE LINE	ACHIEVED	FACTOR	REDUCTION	%
Primary Energy	kWh/y	2,001,720	**520,447**	0.26	**1,481,273**	74.0%
Carbon Dioxide	kg/y	409,920	**102,480**	0.25	**307,440**	75.0%

	UNIT	BASE LINE	ACHIVED	FACTOR	CONTRIBUTION	%
Renewable energy	kWh/y	0	**171,748**	33%	**488,820**	33%

We note the significant reduction in carbon dioxide of 307 ton CO2 per year and the renewable energy contribution of 488,820 kWh per year which is a huge benefit to the global environment

A decision on the final agreed energy supply solution will be made in due time after the proposed systems economical assessment.

4.13 Part L compliance conclusion

Compliance to part L 2019 is achieved by means of a 70% primary energy reduction on the reference dwelling or an EPC (primary energy) of 0.30 or less, a 65% carbon diode reduction or a CPC (carbon dioxide) of 0.35 or less and an equivalent primary renewable energy contribution of 20% or more.

As mentioned in the above sections this can be achieved by a number of methods listed in section 4.8 in combination with proposed passive reduction measures outlined in section 4.7.