Appendix 14-2

Phase 1 Corrib Causeway Dyke Road Development

Outline Resource & Waste Management Plan

Galway City Council

Project number: 60710277
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Quality information

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1. Introduction

1.1 Background

AECOM Ireland Limited (hereafter referred to as "AECOM") was commissioned to prepare an outline Resource & Waste Management Plan (oRWMP) in support of the proposed works at Dyke Road, Terryland, Galway City.

This plan has been prepared to accompany the planning application for the Proposed Development. The proposed layout of the development is detailed in the planning drawings prepared by MOLA Architects and the development proposed is as described in section 2.2.

The purpose of this plan is to detail how the Contractor is required to manage waste during the construction phase of the proposed development. The objective of this plan is to ensure that the development's resources and construction & demolition (C&D) waste is managed in accordance with applicable legislation, local authority plans and policies and regional waste management targets. C&D wastes are defined as waste which arises from construction, renovation, and demolition activities. As per the EPA 'Best Practice Guidelines for the Preparation of Resource Management Plans for Construction & Demolition Projects', April 2021, this plan will be built upon by the design team and contractor following approval of the submission. A Construction and Environmental Management Plan (CEMP) has also been prepared to accompany this application.

The project lifecycle of the plan during the project is illustrated in **Figure 1-1**, taken from Section 3.1 of the EPA 'Best Practice Guidelines for the Preparation of Resource Management Plans for Construction & Demolition Projects'.

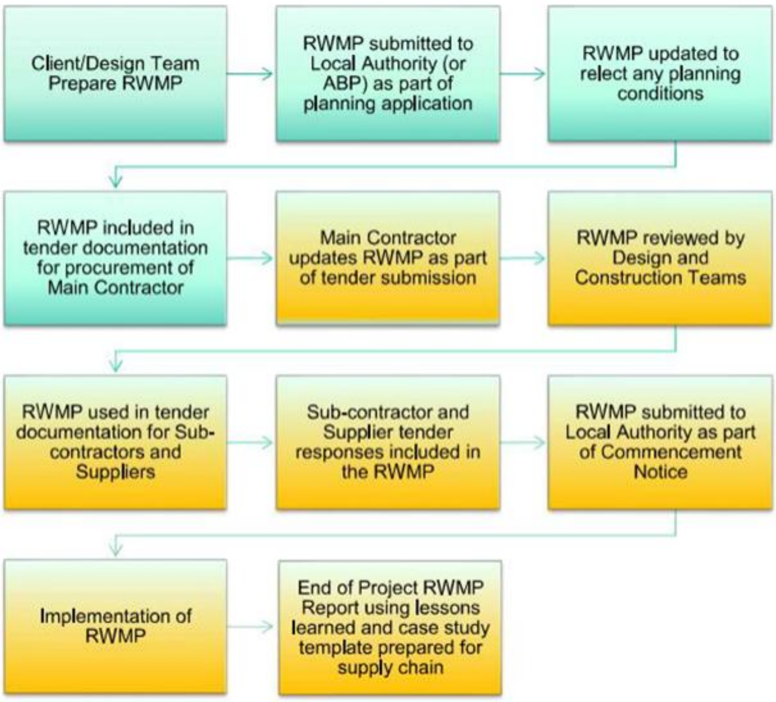

Figure 1-1: Project Life Cycle of the CDWMP / RWMP

1.2 Objectives

The objectives of the oRWMP are as follows:

- Promote an integrated approach to waste management throughout the project construction stage and to set out appropriate responsibilities;
- Promote sustainable waste management in line with the waste management hierarchy;
- Provide an outline plan for the management of wastes arising from construction works for the project in accordance with the relevant Irish and EU waste management legislation; and
- Provide a framework for the designers and the Principal Contractor to appropriately manage waste generated during the course of the project.

This plan outlines methods to achieve waste prevention, maximum recycling and recovery of waste and provides recommendations for the management of the various anticipated waste streams. This plan also provides guidance on collection and transport of waste to prevent issues associated with litter or more serious environmental pollution (e.g., contamination of soil or water resources).

As per Appendix C of the EPA ‘Best Practice Guidelines for the Preparation of Resource Management Plans for Construction & Demolition Projects’, this plan is to be updated to reflect the following at Construction Phase:

- A summary of any significant design changes imposed since the Design Stage RWMP through mechanisms such as value engineering or other.
- Details of planning permission (if relevant) and in particular any conditions imposed in relation to resource management.
- Any issues related to ground contamination which were identified during the construction phase.

2. Project Description

2.1 Location

The site, as shown in **Figure 2-1**, is located at Dyke Road Car Park on the edge of Galway City Centre, Galway Phase 1 lands are currently being used as a public car park. The existing site covers an area of approximately 1.144 ha. The total site area is outlined in red outlined in red in 2, where the phase 1 area is highlighted in yellow.

Figure 2-1: Site Location

2.2 Proposed Development

The proposed development will consist of the construction of a new residential development of 219 no. apartment units and a childcare facility (approx. 241 sq m) in the form of 1 no. new residential block (5 - 9 storeys over lower ground floor level) with associated car parking, bicycle parking, public and communal open spaces, and all ancillary works on a site area of 1.144 ha.

The proposed development will provide for:

a) 219 no. residential apartment units (109 no. 1-bedroom units, 100 no. 2-bedroom units and 10 no. 3-bedroom units) each with an associated private open space area in the form of a balcony/terrace.

b) A raised pedestrian boardwalk along the western elevation of the proposed building.

c) Open Space (approx. 2,778 sq m) is proposed in the form of (a) public open space (approx. 1,183 sq m) to the west of the proposed building fronting on to Dyke Road accommodating outdoor seating, planting, a sunken garden and pedestrian pathways and connections; and (b) communal open space (approx. 1,605 sq m) to the east of the proposed building in the form of a courtyard including outdoor seating, planting, a children's play area and outdoor sports equipment.

d) A childcare facility (approx. 241 sq m) at ground floor level with dedicated external play area (approx. 61 sqm) at surface level.

e) A total of 33 no. new car parking spaces at surface level to serve the proposed residential development (including 2 no. accessible spaces). In addition, 2 no. set down / drop off spaces are proposed to serve the childcare facility.

f) A total of 465 no. bicycle parking spaces to include 330 no. standard residential spaces, 100 no. visitor spaces, 25 no. cargo bicycle spaces and 10 no. bicycle parking spaces dedicated for the childcare facility staff, all at surface / lower ground floor level.

g) Vehicular access to serve the development is proposed via Dyke Road at 2 no. new locations along the western site boundary (to the north west and south west of the main development site). Pedestrian and Cyclist access is also proposed throughout the site via Dyke Road and a new pedestrian crossing is also delivered at Dyke Road. The proposed development will extinguish the existing pedestrian connection between Galway Retail Park and the subject site as part of wider proposals for local improvements to permeability.

h) The removal of 389 no. existing car parking spaces (311 no. from Car Park 1 and 78 no. from Car Park 2) is proposed to provide for the new development. An overall total of 165 no. existing car parking spaces will be maintained in Car Park 2.

i) The extinguishment of the main existing vehicular entrance serving Car Park 1 and Car Park 2 at Dyke Road with provision made for a new vehicular access point (to the south of the main development site) to facilitate continued access to existing Car Park 2 and the remaining car parking spaces (165 no.).

j) The removal of existing bring bank facilities including 2 no. clothing banks and 8 no. bottle banks from Dyke Road.

k) 2 no. telecommunications lattice towers (overall height 6.45 m and 7.67 m) affixed to the rooftop supporting 9 no. 2m 2G/3G/4G antennas; 9 no. 0.8m 5G antennas; 6 no. 0.3m microwave transmission links; together with all associated telecommunications equipment and cabinets. The proposed overall building height including the telecommunications towers is approx. 38.18 m (+43.18 AOD).

The development will also provide for all associated site development works, infrastructure, excavation and clearance works including decommissioning the existing Black Box Theatre waste water pumping station, provision for a new pumping station complete with below ground emergency storage, all boundary treatment/retaining walls, public lighting, internal roads and pathways, ESB substations, switch rooms, water tank rooms, cleaner store and WC, meter rooms, facilities management office, parcel store, comms rooms, plant room, generator room / associated plant space, bin storage, bicycle stores, hard and soft landscaping, play equipment, below ground attenuation tanks, nature based SUDs features, green roofs, roof plant, new and replacement site services and connections for foul drainage, surface water drainage and water supply.

This planning application is accompanied by an Environmental Impact Assessment Report and Natura Impact Statement.

2.3 Intrusive Ground Investigation

An intrusive ground investigation has been carried out by Ground Investigations Ireland. The investigation's objective was to investigate the foundations of the existing structures, ground conditions and also ground contamination (if present). The Contractor's RWMP should take cognisance of the findings of the ground investigation exercise.

2.4 Construction Programme

It is anticipated that Construction of the Proposed Development will commence in Q1 of 2027, and finish Q1 2028. The construction period will take approximately 2 years.

2.5 Proposed Site Clearance and Ground Works

The macadam layers & road buildup will be stripped from the entire site. Approximated volume of material = cut: 3,037m³.

Site will be profiled to formation level (modelled as 300mm below proposed finished ground level). Approximated volume of material = cut: 2,219m³.

Once the site is at the required formation level, a ground improvement technique known as “rigid concrete inclusions” will be implemented to the site outside of the building footprint. Rigid concrete inclusion is a ground improvement method using high deformation modulus columns constructed through compressible soils to reduce settlement and increase bearing capacity. The precise design proposal will be confirmed by the Contractor. The outline design methodology assumes the works will be undertaken systematically an area at a time with earthworks supported locally. Ground water will also be managed locally and shallow recharge wells will be utilised.

- Removal of typically circa 1.1m of soil below formation level. Depth will be deeper locally to ensure support for below ground drainage. Volume of cut material approximately equal to 7,500m^3
- Installation of piling matt, hardcore volume estimated as 3,750m^3
- Driving precast concrete inclusions to competent ground. The inclusions will be placed at 2m centre in both directions and installed across the entire site – excluding the building footprint.
- Installation of geogrid
- Backfill to formation level with competent hardcore, volume of hardcore estimated to be 3,750m^3

Once the ground improvement works are completed, the building foundations will be installed. The outline design of the building foundations assumed 640mm diameter ODEX piles with reinforced insitu concrete ground beams between pile caps and suspended slab.

Imported general construction materials for ground slab and pavement is estimated to have a total volume of fill: 3,072m^3.

3. Roles and Responsibilities

All parties involved in the Project will have responsibility for waste management. Responsibility will vary at different stages of the project lifecycle. Key responsibilities are set out in **Table 3-1**. The appointed Principal Contractor will be responsible for refining and implementing the findings of this oRWMP.

Table 3-1: Construction Stage Waste Management - Key Responsibilities

Responsible party	Responsibility	Project Stage
Client	Establish ambition and performance targets for Project	Project initiation and subsequent tendering phases
	Appointment of competent Principal Contractor and Design Team	
	Responsibility of waste management from 'cradle to grave', including documentation of same.	All project stages
Principal Contractor	Refinement and implementation of the RWMP	Project Implementation
	Appoint competent and authorized waste management contractor(s)	Project tendering phase
	Appoint trained, competent Resource Manager[1]	Construction phase
Resource Manager[1]	RWMP implementation	Project implementation
	Ensure that the objectives of the RWMP are achieved.	Construction stage
	Waste characterisation. Selection of techniques and design to minimize waste and to maximize recovery and recycling of waste during the project.	Project Design Phase and during project implementation
	Maintenance of Waste Documentation for 3 years.	Post-construction stage
	Completion of Final Waste Management Report	Construction stage
	Educate colleagues, site staff, external contractors, and suppliers about alternatives to conventional construction waste disposal.	Project Design Phase and during project implementation
Design Team	Identification of Key Waste Streams	Project Design Phase
	Design to minimize waste generation in lifecycle of completed construction.	Project Design Phase
	Design of Soil Excavation Plan	Project Design Phase
	Adequately provide for waste management in tender documents and declare all relevant information & data.	Project Procurement Phase
Subcontractors	Comply with RWMP	Project Implementation

[1] The Best Practice Guidelines on the Preparation of Resource & Waste Management Plans for Construction and Demolition Projects (EPA, 2021) outline that a Resource Manager should be appointed. This Resource Manager may well be a number of different individuals over the life cycle of the Project, but in general is intended to be a reliable person chosen from within the Planning/Design/Contracting Team, who is technically competent and appropriately trained, who takes the responsibility to ensure that the objectives and measures within the project Waste Management Plan are delivered and who is assigned the requisite authority to secure achievement of this purpose. The role will include the important activities of conducting waste checks/audits and adopting construction and demolition methodology that is designed to facilitate maximum reuse and/or recycling of waste.

4. General Waste Management Regulatory and Policy Requirements

Some specific points on waste management policy and regulatory requirements are set out as follows:

- Construction and Demolition (C&D) waste can be defined as all waste that arises from construction, renovation and demolition activities and includes all waste listed in Chapter 17 of the List of Waste (LoW), including hazardous and non-hazardous waste types.

- The EU Waste Framework Directive (2008/98/EC), enacted in Ireland under the Waste Directive Regulations, 2011 of the same title, requires Member States to take the necessary measures to achieve the minimum recycling/recovery target of 70% by weight for non-hazardous C&D waste, excluding naturally occurring materials, by 2020. The Directive specifies that such a target should be achieved by preparing for reuse, recycling, and other material recovery, including backfilling operations using waste to substitute other material.

- The Connacht Ulster Region Waste Management Plan 2015 – 2021 (CU-WMP) was published in May 2015 (no update available at time of writing this plan). Notable and relevant points are:
  - Approximately 76% of the C&D waste collected in the region was soil and stones. Traditionally the recovered material has been managed by placing it in in a variety of land use applications, including land reclamation & improvement of infill works. Given the sharp decrease in the number of operational landfills nationally, which have been a significant outlet for C&D waste in the past, alternative recovery options will be required to facilitate the recovery of C&D waste arising in future years. Therefore, there is a need to maximize diversion of infill of C&D waste and consider alternative uses, for example, concrete, stone and other masonry-type waste can be crushed and screened and used as a substitute for virgin quarried stone for re-use in a variety of engineering applications.
  - The need to progress towards a 'circular economy' whereby raw materials, traditionally almost entirely becoming waste in a linear life cycle, instead become a much smaller input into a circular approach to materials use from design through to production, through to consumption but then maximizing re-use and recycling to close the circle back to design. For example, C&D wastes can become raw materials in the design phase of a project.
  - The CU-WMP brings in the concept of 'upcycling' which is the re-purposing of items that otherwise are seen as waste or useless products. The process converts these waste materials into new material or products of higher value and quality, giving them a new purpose.

The Regional Waste Management Planning Offices (RWMPOs) have undertaken a study to quantify and analyse national capacity within the market for the management of soil and stone waste arisings, including hazardous, based on 2018 data. The findings are published in a report entitled "Construction & Demolition Waste Soil and Stone Recovery/ Disposal Capacity Update Report 2020". The report updates the Soil and Stone Recovery / Disposal Capacity report published in 2016. The report also documents data with respect to waste concrete and other CDW (construction and demolition waste).

The primary legislative instruments that govern waste management in Ireland and are applicable to this project are:

- Waste Management Act 1996 (S.I. No. 10 of 1996) (as amended) by the Waste Management (Amendment) Act 2001. Sub-ordinate legislation to this Act include:
  - European Communities (Waste Directive) Regulations 2011 (as amended)
  - Waste Management (Collection Permit) Regulations 2007 (S.I No 820 of 2007) (as amended)

- – Waste Management (Facility Permit and Registration) Regulations, S.I No. 821 of 2007 (as amended)
- – Waste Management (Licensing) Regulations 2000 (S.I No. 185 of 2000) (as amended)
- – Waste Management (Packaging) Regulations 2003 (S.I. No. 61 of 2003) (as amended)
- – Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997)
- – S.I. No. 194/2013 - Waste Management (Landfill Levy) (Amendment) Regulations 2013) (as amended)
- – Waste Management (Registration of Brokers and Dealers) Regulations 2008 (S.I. 113 of 2008); and

- Protection of the Environment Act 2003 (S.I. No. 413 of 2003).
- Litter Pollution Act 1997 (S.I. No. 12 of 1997).
- The Local Government (Water Pollution) Acts, 1977 & 1990
- Waste Management (Movement of Hazardous Waste) Regulations, 1998 (S.I. No. 147 of 1998)
- Waste Management (Transfrontier Shipment of Waste) Regulations, 1998 (S.I. No. 149 of 1998)

These Acts and subordinate Regulations enable the transposition of relevant European Union Policy and Directives into Irish law.

4.1 Guidance Reference Documents

This plan adheres to the Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects draft issued in April 2021 by the Environmental Protection Agency (EPA). These guidelines supersede the Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects of 2006 and are hereafter referred to as the EPA Draft Guidelines. The RWMP is compiled prior to construction and documents the measures implemented at preliminary design stage and will be updated and finalised by the Contractor prior to the construction stage. Other guidance documents referenced include:

- HSE ENV EP006 Company Waste Management Procedure
- HSE EB 04 Waste Management on site
- HSE ENV GN01 Site Waste Management Plan Guidance
- A Resource Opportunity – Waste Management Policy in Ireland (Department of the Environmental, Climate and Communications, 2012);
- National Hazardous Waste Management Plan 2021 – 2027 (EPA 2021);
- Guidance on Soil and Stone By-products in the context of article 27 of the European Communities (Waste Directive) Regulations 2011, Version 3 (EPA 2019);
- A Waste Action Plan for a Circular Economy, Ireland's National Waste Policy 2020 – 2025, Department of Communications, Climate Action and Environment, 2020;
- Waste Minimisation in Construction (SPU SP 133), Construction Industry Research and Information Association (CIRIA) 1997;
- Waste Classification, List of Waste and Determining if Waste is Hazardous or Non-hazardous, (EPA 2018);

5. Waste Hierarchy

Beside the requirements that the off-site handling of waste generated by this project are subject to the required statutory authorisations under the Waste Management Act, there is also a necessity that it conforms to the Waste Hierarchy[2], **Figure 5-1**. This hierarchy outlines that waste prevention and minimisation are the priority in managing wastes, followed by waste reuse and recycling, with disposal to landfill being considered as a last resort.

The EU Waste Directive (2008/98/EC) also mandates that hazardous waste generation should be avoided or at least limited.

Figure 5-1: EU Waste Hierarchy (EPA National Hazardous Waste Management Plan 2021 – 2027)

Definitions defined in the Waste Framework Directive of key terms indicated in are (in order of priority):

- **Prevention** includes measures taken before a substance, material or product has become waste, which reduce (a) the quantity of waste, including through the reuse of products or the extension of the lifespan of products, (b) the adverse impacts of the generated waste on the environment and human health or (c) the content of harmful substances in materials and products.
- **Reuse** is defined as any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.
- **Recycling** is any recovery operation by which waste materials are processed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.
- **Recovery** is defined as any operation, the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.

The Waste Hierarchy only applies to material that is defined as "waste", so does not apply to the proportion of the spoil that is handled on-site in conformity with the statutory exclusions.

The Waste Management Hierarchy will be activated for any material which does not satisfy the exclusions; in this regard the contract documents for the detailed design/ construction project will clearly

[2] Waste Hierarchy as set out in Article 4 of the Waste Framework Directive (2008/98/EC) and transposed into Irish law via Section 21A of the Waste Management Act.

set out the staged approach which the contractor will be required to adhere to through the use of the Waste Hierarchy.

5.1 Waste Minimisation

The following waste limiting measures will be implemented during the course of the construction works:

- Facilitate recycling and appropriate disposal by on site segregation of all waste materials generated during construction into appropriate categories, including:
  - Topsoil, subsoil, gravel hard-core
  - Concrete, bricks, tile, ceramics, plasterboard
  - Asphalt, tar and tar products
  - Metals
  - Dry Recyclables e.g., cardboard, plastic, timber
- All waste assessed by the Resource Manager as ‘not suitable for reuse’ will be stored in skips or other suitable receptacles in a designated area of the site, to prevent cross contamination between waste streams, dispersion and leaching;
- Wherever possible, leftover materials (e.g., timber off cuts) and any suitable demolition materials will be reused on-site;
- Uncontaminated excavated material (topsoil, sub soil, etc.) will be segregated, stockpiled and reused on site in preference to importation of clean fill, where possible;
- If excavated material cannot be reused on site, the potential for its transfer to another site under, for example, Article 27 of the European Communities (Waste Directive) Regulations 2011 should be explored;
- Where possible, the Resource Manager will ensure that all waste leaving site will be recycled or recovered or as a last resort be disposed in a suitably licenced facility.

Possible methods of waste minimisation are set out in **Table 5-1** below.

Table 5-1: Waste Minimisation

Type	Waste Minimisation Decision Taken	Intended Results
Demolition Methods	Segregate waste into separate skips for recycling	Increased recycling of materials, reduce material to landfill
Materials	Provide segregated skips for material recycling: timber, metals, plastic, etc.	Increased recycling of materials, reduce material to landfill
Materials	Request unpackaged materials from suppliers where applicable, e.g., palletised, skips, etc.	Reduced packaging waste
Hazardous Materials	Any hazardous materials to be segregated in hazardous waste bin	Hazardous waste items removed from site are to be disposed of by licenced contractor/ company.

6. Waste Identification, Classification, Quantification and Handling

6.1 Waste Identification, Classification and Quantification

The majority of waste generated will be associated with the removal of the carpark surfacing –wearing course and base courses; along soil excavated to achieve the proposed ground levels, to facilitate the ground improvement works and to facilitate construction of foundation. Should appropriate reuse be required, and practical, clean soil will be retained on site and reused in areas of soft landscaping, backfilling, etc. A record of the volumes and reuse requirements will be maintained by the Principal Contractor as part of the RWMP.

The Contractor's RWMP will identify suitability criteria for excavated soils to be reused on site or off site, as well as suitable recycling and/or recovery options where this is deemed a waste.

The presence of asbestos is unlikely and if present would be limited to redundant below ground pipework. If asbestos is identified it is to be removed by a specialist contractor. The asbestos removal works must include a management plan put in place for their safe removal and disposal before demolition takes place. Where required under the Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006, the works must be notified to the Health & Safety Authority at least 14 days in advance.

During the construction phase, there will be some building material and packaging waste generated. This will mainly include excess ready-mix concrete and mortar, timber off cuts, plastics, metal off cuts, cladding and tile offcuts, as well as plastic and cardboard waste from packaging and potential over-supply of materials.

Where possible, individual waste arisings shall be identified, classified, and quantified (volume, weight) as early in the project lifecycle as possible but, inevitably, unanticipated waste arisings may occur as site work progresses, necessitating the need for a procedure to provide for waste classification as the site work proceeds.

It is anticipated that the majority of non-hazardous and inert waste generated will be suitable for reuse, recovery or recycling and will be segregated to facilitate the reuse, recovery and/or recycling, as appropriate.

7. Excavated Material Management

The material to be excavated will be associated with the removal of the carpark surfacing – wearing course and base courses; along soil excavated to achieve the proposed ground levels, to facilitate the ground improvement works and to facilitate construction of foundation.

Ground investigation was undertaken by Ground Investigation Ireland in May 2024. Laboratory testing was carried out on representative samples. The soil to be excavated is typically very poor, with significant peat & silt content limiting the reuse of the material

The Principal Contractor will, as part of their RWMP, prepare a project-specific Excavated Material Management Plan, which will detail the following as a minimum:

- Detail in-situ (prior to excavation) and ex-situ (post excavation) methodologies to classify waste soil for appropriate disposal, in accordance with relevant Irish and EU legislation and guidance,
- Identify reuse requirements and soils suitable for reuse on site in consultation with the design team, including assessment methodology to determine which soils are suitable for re-use onsite,
- Site management procedures, including waste minimisation, stockpile management, temporary storage procedures, waste license requirements, and Waste Management documentation, including waste generation record keeping, waste transfer notes, confirmation of appropriate disposal and details of any rejected consignments.

7.1 Excavated Soil & Materials

The Contractor’s RWMP will detail relevant procedures including further environmental sampling, testing and assessment requirements, sampling protocols and sample density targets to supplement any existing soil data.

Where any hotspots of potential contamination are encountered, and prior to disposal, further assessment will be undertaken by a suitably qualified environmental scientist to determine the nature and extent of remediation required.

Relevant guidance should be followed, for example but not limited to the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (DEFRA, 2009).

7.1.1 Soil and Crushed Road for reuse on site

Where the Principal Contractor proposes to reuse excavated soil within the works, e.g., as backfill, and where reuse is permitted in accordance with the relevant legislation, the Principal Contractor shall set out their proposal for its management, documentation and reuse. This shall include:

- Define the criteria by which the suitability of the soils for reuse will be assessed (e.g., analytical parameters and limits), the engineering requirements such as geotechnical parameters for the material to be used within the works;
- Delineation of areas where excavated soil is intended for disposal off-site as waste, and where it is intended for reuse on site;
- Identification and recording of the location from where the soil will be excavated and its proposed reuse location and function;
- Engineering assessment to confirm its suitability for reuse; and
- Any proposed treatment or processing required to enable its reuse, as well as any associated treatment permits, or licences required.

7.1.2 Soil for removal from site

Where appropriate, excavated soil and material intended for recovery or disposal offsite shall require appropriate waste classification in order to select an appropriate receiving facility for the waste.

Assessment of the excavated material shall be carried out with due regard to the following guidance and legislation:

- EU Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II of Directive 1999/31/EC (2002);
- Regulation (EC) No. 1272/2008: the classification, labelling and packaging of substances and mixtures (CLP);
- Environmental Protection Agency document entitled Waste Classification; List of waste and determining if waste is Hazardous or Non-Hazardous;
- Environmental Protection Agency documented entitled Guidance on Waste Acceptance Criteria at Authorised Soil Recovery Facilities;
- UK Environment Agency Technical Guidance WM3: Waste Classification – Guidance on the classification and assessment of waste; and
- Any other that might be applicable or relevant at the time of disposal.

Waste soil and material intended for offsite disposal, recycling or recovery shall not be removed from site prior to appropriate waste classification and receiving written confirmation of acceptance from the selected waste receiving facility.

7.1.3 Bituminous Road Surfacing

The majority of the waste generated during site clearance will be the carpark wearing course and base course. The materials arising will be removed and disposed of by contractors licensed under the Waste Management Act of 1996, the Waste Management (Permit) Regulations of 1998 and the Waste Management (Collection Permit) Regulations of 2001. The material shall be reused / upcycled. One such use is in reclaimed asphalt (RAP) which is a fully approved as a constituent material by EN 13108.

7.1.4 Transport of waste soils

In order to minimise potential traffic impacts of excavation activities, truck movements will be limited to designated routes and movements during peak hours will be avoided as far as possible. Details of such provisions will be included in the Traffic Management Plan (TMP) for the proposed works.

7.1.5 Stockpile Management

Stockpiles of material (soil, concrete, asphalt etc) might be generated as part of the operations, for example while classification and acceptance at a waste facility is pending or awaiting reuse. The contractor should consider the following measures to ensure that stockpiles are managed in an appropriate manner:

- A suitable temporary storage area shall be identified and designated;
- All stockpiles shall be assigned a stockpile number;
- Stockpiles shall not be positioned adjacent to ditches, watercourses or existing or future excavations;

- Contaminated or potentially contaminated soil shall be stockpiled only on hard-standing or high-grade polythene sheeting to prevent cross-contamination of the soil below;
- Soil stockpiles shall be covered with high-grade polythene sheeting to prevent run-off of rainwater and leaching of potential contaminants from the stockpiled material generation and/or the generation of dust; and
- Mixing of unclassified stockpiles of different origin, or of stockpiles having different classification, should not be carried out. When a stockpile has been sampled for classification purposes, it shall be considered to be complete, and no more soil shall be added to that stockpile prior to disposal.

An excavation/ stockpile register shall be maintained on site showing at least the following information:

- Stockpile number;
- Origin (i.e., location and depth of excavation);
- Approximate volume of stockpile;
- Date of creation;
- Description and Classification of material;
- Date sampled;
- Date removed from site;
- Disposal/recovery destination; and
- Photograph.

8. Hazardous Materials Waste Management

A minor volume of hazardous waste may be generated during the course of the construction stage, see Section **Error! Reference source not found.** for anticipated material types.

Where hazardous waste is generated, the Principal Contractor will undertake the following:

- Immediate notification of the nature of the hazardous waste to the Design Team in writing;
- Submission of a revised RWMP detailing the nature and management of the hazardous waste prior to off-site waste disposal; and
- The Principal Contractor shall establish a specific procedure for the management of asbestos wastes that may arise during the construction works. The management of such wastes shall be co-ordinated with the Client representative and in accordance with the Safety and Health Plan for the overall works, in order to ensure that personnel within the construction site and the local residents and/or students/ staff are protected against exposure to asbestos. Prior to commencement of any asbestos removal works, the Principal Contractor shall identify a suitable Waste Collection Contractor with a Waste Collection Permit for the transfer of asbestos wastes from the site.

9. Waste Management Documentation

A Waste Documentation System will be prepared by the Principal Contractor and included in the RWMP.

The Principal Contractor will be responsible for implementation and auditing the Waste Documentation System on a regular basis. The Client's Representative may also undertake verification auditing.

The documentation to be maintained, as a minimum, shall be the following:

- The names of the agent(s) and transporter(s) of the wastes;
- The name(s) of the person(s) responsible for the ultimate recycling, recovery or disposal of the wastes;
- The ultimate destination(s) of the wastes;
- Written confirmation of the acceptance and recovery, recycling or disposal of any waste consignments;
- The tonnages and LoW code for all waste materials;
- Details of any rejected waste consignments;
- Waste Transfer Forms (WTF) for hazardous wastes transferred from site and associated appendices;
- Completed Transfrontier Shipment Forms (TFS) for hazardous wastes transferred abroad;
- Written documentation of waste classifications, including any related analyses; and
- Certificates of Recycling, Recovery, Reuse or Disposal for all wastes transferred from the site.

All waste records will be maintained for at least a period of 3 years and must be subject to verification and validation.

All waste documentation will be maintained by the Principal Contractor and made available for inspection. This will be stored in a safe place, preferably on site, during the project implementation phase. Electronic records will be placed on a secure server that is backed up regularly.

Allowance of time and resources will be made to collate outstanding waste records once the project implementation phase has been completed.

10. Financial Issues of Waste

An outline of the cost issues that should be considered associated with different aspects of waste management is provided below.

10.1 Reuse/ Recovery

By reusing materials on site, there will be a reduction in the transport and disposal costs associated with the requirement for a waste contractor to take the material away to landfill. Clean and inert soils, gravel, stones etc. which cannot be reused on site may be classified as a by-product (under Article 27 of the 2011 Waste Directive Regulations), used as capping material for landfill sites, or for the reinstatement of quarries etc. subject to approvals by EPA. This material is often taken free of charge for such purposes, or when used as capping in landfills will not attract the landfill tax levy, thereby reducing final waste disposal costs.

Rock excavated on the site could be used as granular fill within crib retaining walls if crushed and graded to form a well graded granular material with low fines content.

10.2 Recycling

Salvageable metals will earn a rebate which can be offset against the cost of collection and transportation of the skips. Clean, uncontaminated cardboard and certain hard plastics can be recycled. Waste contractors will charge considerably less to take segregated wastes such as recyclable waste from a site than mixed waste. Timber can be recycled as chipboard. Again, waste contractors will charge considerably less to take segregated wastes, such as timber from a site than mixed waste.

10.3 Disposal

Typically, the current cost of disposal of waste of landfill exceeds €200 per tonne. From 1st September 2023, in accordance with the Waste Management (Landfill Levy) (Amendment) regulations 2023, the landfill level increased to €85 per tonne for waste disposed to landfill.

In addition to disposal costs, waste contractors will also charge a collection fee for skips. Collection of segregated C&D waste usually costs less than municipal waste. Specific C&D waste contractors take the waste off-site to a licensed or permitted facility and, where possible, remove salvageable items from the waste stream before disposing of the remainder to landfill. Clean soil, rubble, etc. is also used as fill/capping material wherever possible.

A list of currently authorised waste sites in each Local Authority is available on the following website: http://facilityregister.nwcpo.ie/

A list of sites currently licensed by the EPA is available on the following websites: http://www.epa.ie/terminalfour/waste/

11. Waste Audits

Details of the inputs of materials to the project site and the outputs of wastage arising from the Project will be investigated and recorded in a Waste Audit undertaken by the Principal Contractor.

This audit will identify the amount, nature and composition of the waste generated on the site. The Waste Audit will examine the manner in which the waste is produced and will provide a commentary highlighting how management policies and practices may inherently contribute to the production of demolition waste.

The Principal Contractor will be responsible for undertaken regular waste auditing. The Design team may undertake verification audits to review the findings of the Contractor's audits during the course of the construction stage.

It is noted that the RWMP should be treated as a "live" document and regular review and update should be informed by the audit findings.

12. Resource & Waste Management Plan Awareness & Training

Copies of the RWMP will be made available to all personnel on site.

All site personnel and sub-contractors will be instructed about the objectives of these plans and informed of the responsibilities which will fall upon them as a consequence of its provisions. Where source segregation and selective material reuse techniques apply, each member of staff will be given instructions and training on how to comply with the RWMP.

Posters will be designed to reinforce the key messages within the RWMP and will be displayed prominently for the benefit of site staff. Specialist training (e.g., asbestos-containing materials handling) will be assessed and provided, as required.

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Appendix 14-3

Phase 1 Corrib Causeway Dyke Road Development

Outline Construction & Environmental Management Plan

Galway City Council

Project number: 60710277
60710277-ACM-XX-XX-RP-CE10-0005-P3

December 2024

Delivering a better world

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
01	14.03.25	Planning Issue	Emma McKendrick	Emma McKendrick	Regional Director

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1. Introduction

AECOM Ireland Limited (AECOM) has prepared an Outline Construction & Environmental Management Plan (OCEMP) for the development of Phase 1 lands at Dyke Road, Terryland, Galway City. The Dyke Road site is located on the edge of Galway City Centre, Galway.

This Outline Construction & Environmental Management Plan (OCEMP) has been prepared to accompany the planning application for a new residential development on the site.

Figure 1-1: Project Phasing, Stage 1 Development Framework, MOLA Architecture 2023

The Dyke Road site forms part of a strategic brownfield landbank located on the edge of Galway City Centre which has been identified for comprehensive redevelopment by the Galway Development Plan 2023-2029. The proposed development of the site will be subdivided into three distinct phases:

- Phase 1 lands (c. 1.144ha) are designated for residential development.
- Phase 2 is anticipated to comprise of commercial / office / civic development.
- Phase 3 would subsequently comprise the relocation of the Black Box Theatre and development of this final portion of the site for residential use.

1.1 Background

This Outline CEMP sets out the procedures, standards, work practices and management responsibilities to address potential environmental effects that may arise from the construction and demolition works proposed as part of the residential development at Dyke Road, Galway (hereafter referred to as the 'Project'). The primary aim is to reduce any adverse effects from construction on the environment.

This Outline CEMP will form part of the Contract Documents for the construction stage. The Outline CEMP remains at all times a live document, subject to amendment including the revision and addition of content throughout the works. In this context, the values and information presented herein is subject to change and refinement through the selection of the contractor and the delivery of the Project.

The Outline CEMP will be updated into a Contractors CEMP by the appointed Contractor (hereafter referred to as the Contractor). The Contractors CEMP will be prepared by the Contractor, approved by the Client, and agreed with Galway City Council prior to the commencement of works.

The Contractors CEMP will be treated as a live document throughout the lifecycle of the project, requiring regular review and update, as necessary.

At the end of the construction phase, the Contractor will prepare a Handover Environmental Management Plan (HEMP) that will contain essential environmental information needed by the bodies responsible for the future maintenance and operation of the Proposed Development.

1.2 Objectives

The objectives of a CEMP are to:

- Act as a continuous link and reference document for environmental issues between the design, construction, testing and commissioning stages of the project.

- Demonstrate how construction activities and supporting design will properly integrate the requirements of environmental legislation, planning consent conditions, policy, good practice, and those of the environmental regulatory authorities and third parties.

- Record environmental risks and identify how they will be managed during the construction period.

- Record the objectives, commitments, and mitigation measures to be implemented together with programme and date of achievement.

- Identify key staff structures and responsibilities associated with the delivery of the Project, and environmental control and communication and training requirements, as necessary.

- Describe the Contractor’s proposals for ensuring that the requirements of the environmental design are achieved, or are in the process of being achieved, during the Contract Period.

- Act as a vehicle for transferring key environmental information at handover to the body responsible for operational management. This will include details of the asset, short and long-term management requirements, and any monitoring or other environmental commitments.

Provide a review, monitoring, and audit mechanism to determine effectiveness of, and compliance with, environmental control measures and how any necessary corrective action will take place.

2. Project Description

2.1 Location

The site, as shown in **Figure 2-1**, is located at Dyke Road Car Park on the edge of Galway City Centre, Galway Phase 1 lands are currently being used as a public car park. The existing site covers an area of approximately 1.144 ha. The total site area is outlined in Figure 2-2, where the phase 1 area is highlighted in yellow.

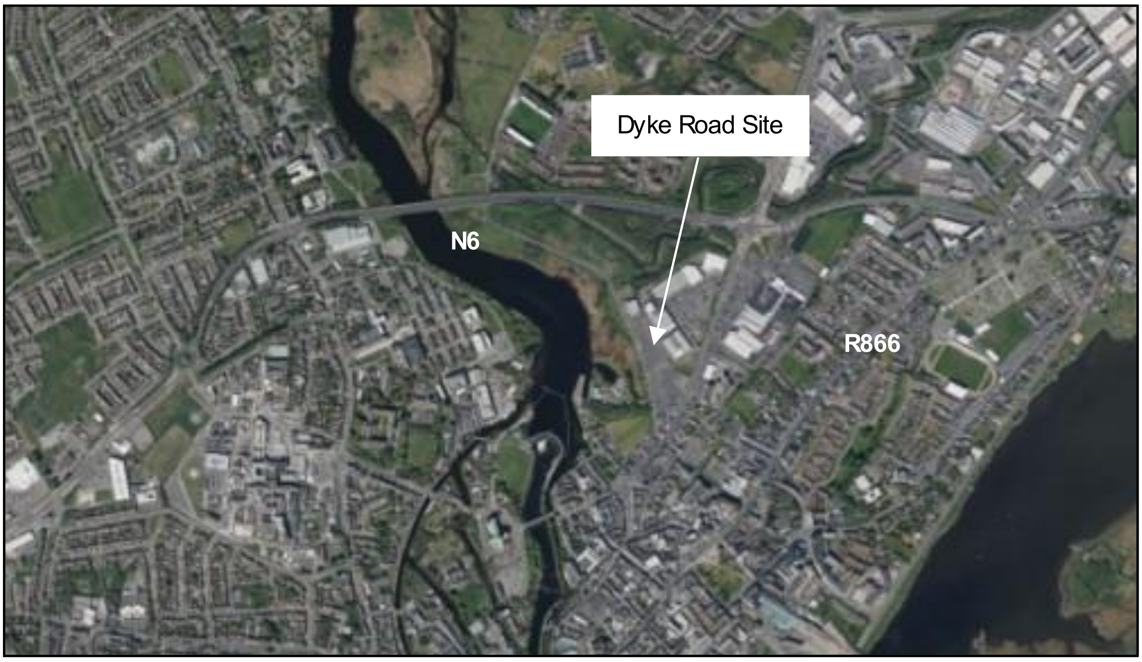

Figure 2-1: Site Location

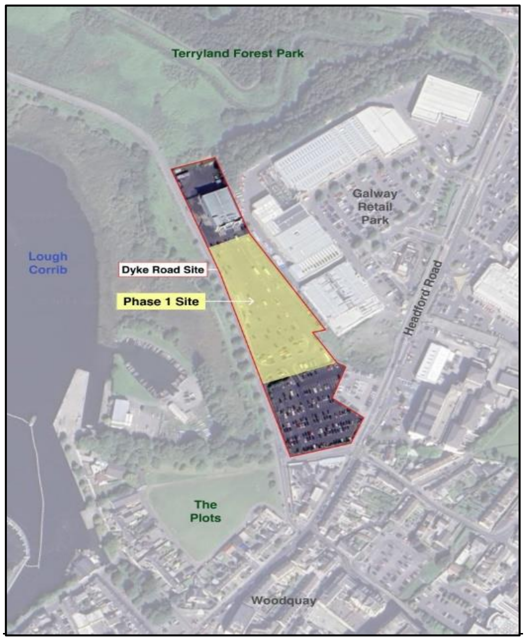

Figure 2-2: Site Location – Phase 1, Tóchar na Coiribe Vision, LDA & MOLA Architecture 2023

2.2 Development Description

The proposed development will consist of the construction of a new residential development of 219 no. apartment units and a childcare facility (approx. 241 sq m) in the form of 1 no. new residential block (5 - 9 storeys over lower ground floor level) with associated car parking, bicycle parking, public and communal open spaces, and all ancillary works on a site area of 1.144 ha.

The proposed development will provide for:

a) 219 no. residential apartment units (109 no. 1-bedroom units, 100 no. 2-bedroom units and 10 no. 3-bedroom units) each with an associated private open space area in the form of a balcony/terrace.

b) A raised pedestrian boardwalk along the western elevation of the proposed building.

c) Open Space (approx. 2,778 sq m) is proposed in the form of (a) public open space (approx. 1,183 sq m) to the west of the proposed building fronting on to Dyke Road accommodating outdoor seating, planting, a sunken garden and pedestrian pathways and connections; and (b) communal open space (approx. 1,605 sq m) to the east of the proposed building in the form of a courtyard including outdoor seating, planting, a children's play area and outdoor sports equipment.

d) A childcare facility (approx. 241 sq m) at ground floor level with dedicated external play area (approx. 61 sqm) at surface level.

e) A total of 33 no. new car parking spaces at surface level to serve the proposed residential development (including 2 no. accessible spaces). In addition, 2 no. set down / drop off spaces are proposed to serve the childcare facility.

f) A total of 465 no. bicycle parking spaces to include 330 no. standard residential spaces, 100 no. visitor spaces, 25 no. cargo bicycle spaces and 10 no. bicycle parking spaces dedicated for the childcare facility staff, all at surface / lower ground floor level.

g) Vehicular access to serve the development is proposed via Dyke Road at 2 no. new locations along the western site boundary (to the north west and south west of the main development site). Pedestrian and Cyclist access is also proposed throughout the site via Dyke Road and a new pedestrian crossing is also delivered at Dyke Road. The proposed development will extinguish the existing pedestrian connection between Galway Retail Park and the subject site as part of wider proposals for local improvements to permeability.

h) The removal of 389 no. existing car parking spaces (311 no. from Car Park 1 and 78 no. from Car Park 2) is proposed to provide for the new development. An overall total of 165 no. existing car parking spaces will be maintained in Car Park 2.

i) The extinguishment of the main existing vehicular entrance serving Car Park 1 and Car Park 2 at Dyke Road with provision made for a new vehicular access point (to the south of the main development site) to facilitate continued access to existing Car Park 2 and the remaining car parking spaces (165 no.).

j) The removal of existing bring bank facilities including 2 no. clothing banks and 8 no. bottle banks from Dyke Road.

k) 2 no. telecommunications lattice towers (overall height 6.45 m and 7.67 m) affixed to the rooftop supporting 9 no. 2m 2G/3G/4G antennas; 9 no. 0.8m 5G antennas; 6 no. 0.3m microwave transmission links; together with all associated telecommunications equipment and cabinets. The proposed overall building height including the telecommunications towers is approx. 38.18 m (+43.18 AOD).

The development will also provide for all associated site development works, infrastructure, excavation and clearance works including decommissioning the existing Black Box Theatre waste water pumping station, provision for a new pumping station complete with below ground emergency storage, all boundary treatment/retaining walls, public lighting, internal roads and pathways, ESB substations, switch rooms, water tank rooms, cleaner store and WC, meter rooms, facilities management office, parcel store, comms rooms, plant room, generator room / associated plant space, bin storage, bicycle stores, hard and soft landscaping, play equipment, below ground attenuation tanks, nature based SUDs features, green roofs, roof plant, new and replacement site services and connections for foul drainage, surface water drainage and water supply.

This planning application is accompanied by an Environmental Impact Assessment Report and Natura Impact Statement.

2.3 Construction Programme

It is anticipated that Construction of the Proposed Development will commence in Q1 of 2027, and finish Q1 2028. The construction period will take approximately 2 years.

3. Survey and Monitoring Requirements

It will be the Contractor's responsibility to ensure a hierarchy of environmental impact avoidance, reduction and mitigation is applied and adhered to onsite throughout the construction phase.

3.1 Surveys

The Contractor will ensure all required pre-construction surveys are carried out prior to commencement of works and that the Contractors CEMP is updated with any mitigation or monitoring measure identified within the survey report. The list of surveys will be agreed with the project Ecological Clerk of Works (ECoW) and GCC.

Should mitigation measures be required (subject to survey results) the site ECoW and the Contractor will prepare a methodology for inclusion within the appendices of the Contractors CEMP outlining all mitigation measures required and how they will be implemented and monitored on site. It would be the responsibility of the ECoW and the Contractor to ensure all licences required have been obtained prior to the commencement of works (for example any licences required from the NPWS related to protected species etc.).

It should be noted that all Irish bats are protected under national and EU legislation and bats and their roosts are legally protected. It is an offence to disturb or interfere with bats or their roosts without a licence.

The nesting and breeding season for birds is from 1 March to 31 August. It is illegal to disturb nesting birds and to cause harm to or disturb eggs and/or nests during this period.

3.2 Monitoring

It will be the responsibility of the Contractor and the ECoW to provide and implement a monitoring schedule for dust, noise and vibration, and water quality monitoring throughout the construction phase. The results of which will be available upon request and will be reported to the client on a monthly basis. Any exceedances will be reported to the client upon occurrence along with details of what caused the exceedance and how it was rectified. The Contractor will also provide a location plan of monitoring points for dust, noise and vibration, and water quality and will include a monitoring methodology as an appendix to the Contractors CEMP.

The frequency of monitoring and the monitoring parameters (such as noise limits) will be in line with best practice and guidance and will be agreed with Galway City Council prior to the commencements of works.

4. Site Logistics

The Main Contractor will be responsible for the overall site management during the proposed works. The Main Contractor will be required to submit a site layout plan that will indicate the site perimeter, the proposed details of site hoarding, site security and gate system along with the proposed location of the site compound, storage areas, etc.

This section sets out a number of areas which the Main Contractor will be required to address during the works.

This section is to be updated by the Contractor prior to the commencement of works to include further information such as information on the temporary water and electricity supply (if applicable).

4.1 Site Security and Hoarding

This section is to be updated by the Contractor prior to the commencement of works. The Main Contractor will be responsible for site security and will ensure that the site and site compound are adequately secured at all times.

All personnel will be required to sign-in and sign-out at the Main Contractor's site office. It will be the responsibility of the Main Contractor to ensure that a full, intact, and impenetrable site cordon is maintained at all times, and that all people entering and exiting the site do so with expressed and recorded granted permission.

The main contractor will be required to apply adequate security measures on this Project to exclude unauthorised persons from the site, including members of the public.

Site hoarding and barriers will prevent unauthorised access to each works area. A minimum 2.4 m high plywood painted timber hoarding is to be provided around working areas. Heras type fencing will be used on short term site boundaries where appropriate to suit the works.

The site compounds will each be fenced to deter unauthorised access. The contractor must regularly inspect and maintain the condition of the hoarding throughout the duration of the contract.

Controlled access points to the site, in the form of gates or doors/turnstiles, will be kept locked at any time that these areas are not monitored (e.g., outside working hours). During working hours, a gateman will control traffic movements and deliveries at any active site access to ensure safe access and egress to & from site onto the public roads. All personnel working on site must have a valid Safe Pass card and be inducted by the Main Contractor with regard to site specific information.

The external hoarding and walkways must be maintained in good condition during the construction period. The external hoardings and walkways must not obstruct any drainage, surface water channels or traffic signals, signs, or lights.

4.2 Signage

The Main Contractor will be responsible for the erection of all appropriate site, safety, road & traffic signage including:

- General warnings, keep out & safety signage to be displayed externally on-site boundary,
- General site warnings & safety signage to be displayed within the site boundary,
- Identification of vehicle & pedestrian access points,
- Location & direction of site parking, site offices, first aid boxes & equipment, and
- Construction site & traffic warning signage on public roads approaching the site entrance.

All signage used will meet the requirements of the Safety, Health & Welfare at Work (General Applications) Regulations 2007 and Chapter 8 Traffic Signs Manual.

4.3 Site Safety

This section is to be updated by the Contractor prior to the commencement of works.

The main contractor will be required to apply safety measures and provide safety awareness training to ensure the safe construction, access, and egress of the site. All construction works will be carried out under appropriate supervision. Works will be carried out by experienced contractors using appropriate and established safe methods of construction. All requirements arising from statutory obligations including the Safety, Health and Welfare at Work Act 2005 (as amended) and associated regulations will be met in full.

The Contractor will ensure the health, safety and welfare of all personnel and members of the public is protected and adequate safety measures are in place.

4.4 Site Lighting

During the winter months, site lighting may be necessary so that construction works can be carried out in a safe manner. Any use of site lighting will be designed to prevent any nuisance to neighbouring residents or road traffic and be used primarily for reasons of health and safety or security.

The Main Contractor will ensure that:

- Nearby resident's welfare is not adversely affected by light pollution from the site,

- An energy efficient lighting approach is adopted,
- Lighting does not pose a hazard, and
- Plant which is not in use is switched off and that lighting is used only when necessary (such as through the use of timers).

Site lighting will be located and aligned so as not to intrude into neighbouring or residential properties, on sensitive areas, or constitute a road hazard.

4.5 Site Set-up

A construction site compound will be utilised throughout the duration of the proposed works. The Main Contractor will be required to submit a site layout plan which will detail the proposed location of the site compound.

The compound will consist of:

- Site office / Cabins / Main Contractor personnel & welfare facilities,
- Car parking,
- Toilets,
- Canteen area, and
- Laydown & contractor storage / stockpile / plant & fuel depot area.

4.6 Working Hours

For the duration of the proposed infrastructure works, the maximum working hours will be 07:00 to 19:00 Monday to Friday (excluding bank holidays) and 08:00 to 13:00 Saturdays, subject to the restrictions imposed by the local authority.

Works will not be permitted on Sundays and Public Holidays.

Subject to the agreement of the local authority, out of hours working may be required for water main connections, foul drainage connections and utility connections. Where this is necessary, prior approval of Galway City Council will be sought.

In order to mitigate any impact of construction activities, the following measures are proposed:

- Coordination of deliveries to site within working hours,
- Scheduling of noisier activities early in the working day,
- Noise and vibration mitigation measures as per Section 6.8 of this plan,
- The delivery of materials to the site during the construction phase will be organised so that deliveries are minimised and do not cause traffic hazard, and
- Deliveries will not be permitted at peak times of traffic as follows;
  - 08:00 to 09:00,
  - 15:00 to 16:00,
  - 16:00 to 17:00.

Any works proposed outside of these periods will be strictly by agreement with the Local Authority in advance.

4.7 Health and Safety

All construction works will be carried out under appropriate supervision. Works will be carried out by experienced contractors using appropriate and established safe methods of construction. All requirements arising from statutory obligations including the Safety, Health and Welfare at Work Act and associated regulations will be met in full.

All site works to be completed as per the Safety, Health, and Welfare at Work (Construction) Regulations 2013 (as amended).

5. Traffic Management

The Contractor is to inform and educate all regular suppliers and all sub-contractors and delivery drivers of the basic protocols. All deliveries will be controlled at the identified compound location. The designated storage area will be identified prior to taking delivery of the materials and the driver will be directed to the compound. Site access, and the delivery of construction materials, will be carefully planned and managed throughout the construction works. A Traffic Management Plan (TMP) will be produced by the Contractor prior to construction to minimise congestion.

5.1 Outline Construction Traffic Management Plan

An Outline Construction Traffic Management Plan has been prepared to accompany this document and is included in Chapter 13 of the Traffic Impact Assessment prepared by PUNCH Consulting Engineers.

6. Waste Management

A Resource and Waste Management Plan has been prepared as a standalone document, document reference 60710277-ACM-XX-XX-RP-CE-00-0006 and submitted alongside this Outline CEMP.

7. Environmental Management

The Contractor will be required to be accredited with ISO14001 Environmental Management Systems. The Contractor will be required to mitigate the impact of the construction works on the environment.

7.1 Overview

The CEMP will be prepared by the Contractor and submitted to Galway City Council for approval prior to commencing construction works. It will be prepared in sufficient detail to describe the framework of the Contractor’s proposed management, control, and mitigation strategy for each environmental aspect with the consideration of relevant adjacent developments. The CEMP will include, where required, specific Method Statements for specific works (e.g., working in or near watercourses) and these will be included in Appendix B.

The CEMP will be developed/updated as necessary during the course of the design and construction phases and will be reviewed with the Client every 6 months as a minimum. It is the Contractors responsibility to ensure all the relevant legislation and guidance is adhered to during construction.

7.2 Environmental Aspects and Impacts

The Contractor will prepare a project specific Project Environmental Risk Assessment (ERA), which will be included in Appendix C. The Contractor will also include the following:

- Environmental guidelines on how to prepare an ERA;
- The guidelines and procedure on how to prepare/undertake an ERA and to assist in the identification of environmental aspects of the project activities, products, and services;
- Monitoring and checklists will be implemented to manage the environment; and
- Environmentally sensitive area(s) and control measures to be implemented on site which will be included as an appendix to the CEMP.

7.3 Roles & Responsibilities

The Contractor will employ a suitably experienced and qualified Construction Environmental Management Plan Co-ordinator (CEMPC) to undertake co-ordination of monitoring of the works’ impacts and implementation of the Contractor’s proposals, in respect of all environmental requirements.

A CEMPC will be present on-site for the duration of the project. The CEMPC will be the point of contact for dealing with environmental issues for the Contractor’s employees, Subcontractors, relevant authorities/environmental bodies, and members of the public. The CEMPC will also be responsible for controlling the construction impacts arising from the activities of the Contractor and Subcontractors in accordance with the CEMP.

The CEMPC will prepare, implement, manage, review, and revise the CEMP with the sole purpose of ensuring that the environment is safeguarded at all times from anticipated or unexpected adverse impacts during construction.

Within the Contractor's team, the CEMPC will have the authority to ensure that the CEMP is effectively implemented. The CEMPC must notify Galway City Council of any transgressions in respect of the CEMP so that necessary sanctions can be imposed.

In general, the duties of the CEMPC will include the following:

- Implementation of the CEMP procedures;
- Routine environmental monitoring, recording, and reporting;
- Maintaining and auditing the CEMP and documents that underpin it;
- Environmental training including daily toolbox talks to site staff and design staff;
- Liaison with statutory authorities as required;
- Assist in liaison with the relevant authorities/environmental bodies and local community; and
- Any other activities that may be necessary in order to protect wildlife and the environment during the works.

In addition, other environmental specialists as listed in **Table 7-1** must be available to provide advice on the CEMP during construction. The CEMP will typically place environmental responsibilities on the key roles within the project as set out below.

Table 7-1: Indicative Key Contractor Team Roles and Responsibilities (to be updated by the Contractor)

Role	Responsibilities
Contractor's Project Director	• Assign specific environmental duties to competent members of the Contractor's Team. • Identify the environmental training needs of personnel under their control and arrange appropriate training programmes and ensure records are being maintained. • Ensure that significant environmental aspects identified for the Project are managed. • Promote the continual improvement of environmental performance.

Role	Responsibilities
CEMP Coordinator/Environment Manager	• Develop, maintain, and audit the CEMP (and supporting documents/plans) to ensure all aspects, impacts and statutory requirements etc. are reflected in the CEMP. • Develop and implement a programme of regular project environmental inspections, monitoring, recording, and reporting in accordance with procedures set out in the CEMP. • Ensure that the works are constructed in line with the CEMP. • Liaise with statutory authorities. • Attend regular construction meetings to ensure environmental issues are discussed and addressed by the Contractor’s Team. • Liaise with relevant authorities/environmental bodies and the local community as required. • Comply with duties under relevant legislation and company procedures in relation to environmental incident investigation and reporting. • Provide support and training to the workforce with regard to understanding environmental aspects, impacts, regulatory requirements, best practice, constraints, and methods of working. • Appoint environmental specialists as required. • Ensure identified environmental specialists are in attendance on-site as required by the CEMP. • Review environmental non-conformance reports to identify any underlying issues or patterns to identify suitable ameliorative measures.
Contractor’s Project Manager	• Ensure that the CEMP is produced, maintained, implemented, and distributed to all relevant parties. • Provide an on-call 24hr resource as a first point of contact for environmental issues/incidents. • Monitor the completion of corrective actions by the Site Manager and act as required to expedite completion. • Provide regular reports to the Client and Galway City Council (where required) and any other relevant statutory bodies on environmental performance, including details of any identified incidents or non-conformances and corrective actions. • Ensure that all personnel for whom they are responsible are aware of the CEMP and implement the relevant requirements. • Evaluate the competence of all subcontractors and suppliers and ensure that they are made aware of and comply with the CEMP and associated procedures. • Establish a consultation and communication system with all relevant stakeholders and interested parties associated with the Project, including employees, partners, sub-contractors, designers and third parties, etc., where relevant.
Site Manager	• Ensure that all personnel undergo suitable and sufficient environmental induction before starting work on the project, and periodic refresher environmental awareness training throughout the construction phase. • Ensure staff attend the appropriate environmental courses that are organised by the CEMPC. Ensure the CEMPC is maintaining records of training delivered to site staff. • Monitor the performance of personnel and activities under their control and ensure arrangements are in place so that all personnel can work in a manner which minimises risks to them and to the environment. • Undertake a programme of regular environmental inspections in liaison with the CEMPC. • Complete any corrective actions identified by the CEMPC) and provide status reports as required to the Client and Galway City Council and any other relevant statutory bodies. • Assist and support the CEMPC and statutory bodies in the investigation of any incidents. • Notify the CEMPC of all environmental issues or incidents arising over the course of operations.

Role	Responsibilities
Environmental Specialists (i.e. Ecological Clerk of Works (ECoW) and CEMPC))	• Attend site as required to monitor the protection of asset in accordance with the requirements of relevant legislation, planning conditions, the construction contract, and the CEMP – ECoW and CEMPC. • Identify potential risks to wildlife and develop suitable control measures – CEMPC. • Provide status reports and updates to the CEMPC in the completion of their activities– ECoW. • Provide advice about ecological and environmental and issues during the construction of a development including advice on protected species, pollution, surface water management, material management, air quality and noise – ECoW and CEMPC. • The ECoW and CEMPC roles can be carried out by the same person once they are adequately qualified.

7.4 Environmental Training

Personnel and sub-contractors working on environmentally sensitive sites will be provided with environmental training to achieve a level of awareness and competence appropriate to their assigned activities. Targeted environmental awareness training may be provided to individuals or groups of workers with a specific authority or responsibility for environmental management or those undertaking an activity with a high risk of environmental impact. Environmental Training will be recorded, and the records will be available for inspection upon request. **Table 7-2** summarises the environmental training that will likely be required to be undertaken as a minimum as part of the Project.

Table 7-2: Summary of Training Requirements

Training	Target	Frequency	Record
Site Induction	All Site Personnel	Prior to working on-site	Induction record form
Daily Pre-working Briefings	All Site Personnel	Prior to commencing daily works	Daily report
Toolbox Talk	Personnel relevant to the topic	As required	Toolbox Record Form
Project Management meeting	Project Managers, Engineers and Site Supervisor	Monthly	Meeting Minutes Record
Environmental Training	Personnel relevant to the activity	Quarterly or more frequently as required	Training Attendance Form
Environmental Bulletin	All company and project personnel	As required	Environmental Bulletin Form

7.4.1 Site Inductions

A site induction will be attended by all personnel working on the project. Such personnel attending will also complete a site induction record acknowledging attendance and confirming that they understand and agree to comply with the requirements of the site. Furthermore, certificates of competency, licences and other qualifications as deemed necessary by the Contractor will be copied and documented. The environmental induction will run concurrently with the site induction and safety awareness training.

The induction will include the following information as a minimum:

- Overview of the goals and objectives of the environmental policy and CEMP,
- Awareness in relation to the environmental risk associated with the project and methods of avoiding environmental risks as identified within the CEMP, the planning conditions, and any other relevant plans, documents, or reports,
- Awareness of roles and individual responsibilities and environmental constraints to specific jobs,
- Location of any sensitive receptors on or adjacent to the Site,
- Location of habitats and species to be protected during construction, how activities may affect them and methods necessary to avoid impacts, controls to minimise noise and the importance of pollution prevention measures to protect any nearby sensitive receptors,
- Environmental Emergency Response Procedures, the storage locations of items such as spill kits on site and key contact persons for environmental incident reporting.

7.4.2 Daily Pre-Work Briefings, Toolbox Talks and Training

Daily briefings are required to be carried out at the commencement of each shift by all supervisors to ensure environmental issues specific to the work being performed are being addressed. All personnel involved with site works must be briefed and signed onto the daily briefing form prior to commencing activities.

Toolbox talks may be conducted prior to the start of specific work elements where there is a substantial environmental risk or when required to reinforce ongoing environmental issues. Any toolbox talk training conducted will ensure that relevant information is communicated to the workforce and that feedback can be provided on issues of interest or concern.

7.5 Environmental Emergency Response Procedures

This section is to be updated by the Contractor to include a site-specific environmental emergency response procedure/emergency and preparedness plan for potential environmental issues that may occur on site.

This will cover topics such as pollution prevention, environmental incident actions and procedures, reporting requirements, key contact persons, site evacuation procedures, types of response equipment (e.g., spill kits) and their correct use and disposal.

7.6 Consents and Licences

All statutory consents and licences required to commence on-site construction activities will be obtained ahead of works commencing, allowing for the appropriate notice period. It will be the responsibility of the Contractor to ensure all consents and licences required are in place prior to the start of construction.

These will include, but are not limited to:

- Site notices;

- Construction commencement notices;
- Licence to connect to existing utilities (inc. water) and mains sewers, where required;
- Abstraction and/or discharge licenses; and
- Road opening/closure licences.

These may also include licences from the NPWS such as Disturbance/Derogation Licences if required.

7.7 Monitoring and Inspections

Environmental focused monitoring and inspection activities will be carried out throughout the lifetime of the project. The frequency of these monitoring and inspection activities will be agreed in advance of construction with the Client and would be in line with planning conditions. Additional monitoring and inspection will take place outside of the agreed frequency where an incident occurs or where activities that can have a significant environmental impact are occurring.

Regular site inspections will be undertaken by the Contractor's CEMPC to monitor compliance with the CEMP and record inspection results. It is anticipated that a daily visual check and a detailed weekly check will be carried out and these records will be available to Client upon request.

During the construction phase the following monitoring measures will be considered:

- Regular inspection of surface water run-off and sediments controls;
- Regular inspection of construction/mitigation measures will be undertaken e.g., concrete pouring, refuelling etc.;
- Dust Monitoring and monitoring of dust control measures;
- Noise and vibration monitoring and monitoring of noise and vibration control measures;
- Surface water monitoring (if required); and
- Daily monitoring of general housekeeping on Site.

7.8 Environmental Auditing

Planned and documented audits (including waste and environmental audits) aimed at evaluating the conformance of the project will be carried out throughout the construction phase of the project. The frequency of the audits will be agreed in advance with the Client. As a minimum this would include;

- Weekly site walkover with results presented at the Contractors' regular meetings with the Client,
- Dedicated waste audits will be carried out at a frequency agreed in advance with the Client and Galway City Council. All waste types and records would be available for review upon request. (Also see the standalone outline resource and waste management plan produced for the project), and

- The CEMP will be reviewed and audited every 6 months at a minimum and updated in line with current guidance and legislation.

7.9 Site Housekeeping

Good housekeeping is an important part of good environmental practice and helps to maintain a more efficient and safer site. The site should be tidy, secure, and have clear access routes that are well signposted. The appearance of a tidy, well-managed site can reduce the likelihood of theft, vandalism, complaints and/or specific hazards that could affect the safe operation of the other businesses in the area, such as bird hazards and wind-blown litter.

As outlined in the fourth edition of CIRIA's 'Environmental good practice on site guide' (C741), when considering good housekeeping, the following steps can be implemented:

- Adequately plan the site with designated areas for materials and waste storage,
- Segregate and label different types of waste as it is produced and arrange frequent removal, in line with the requirements of the Resource and Waste Management Plan,
- Keep the site tidy and clean,
- Ensure that no wind-blown litter or debris leaves the site, use covered skips to prevent wind-blown litter,
- Keep hoarding tidy – repair and repaint when necessary, removing any fly posting or graffiti,
- Frequently brush-clean wheel washing facilities (where applicable) and keep haul routes clean from site derived materials,
- Keep roads free from mud by using a road sweeper, and
- Ensure the Site is secure.

7.10 Complaints

A Complaints Register for internal communication and for receiving, documenting, and responding to environmental complaints from external parties will be established and will be maintained.

The following information must be taken as a minimum when a complaint is received (telephone calls and letters of complaint etc.):

- Date and time of the complaint;
- Name of complainant (if provided);
- Nature of complaint; and
- Details of any remediation actions taken.

All complaints received from external sources and incidents must be reported to the CEMP Coordinator/Environment Manager and the appropriate site personnel (e.g., Senior Management). Complaints must be dealt with in a timely manner and reported to the Client.

8. Environmental Considerations and Mitigation

8.1 Groundworks

This section will be updated by the Contractor once further information becomes available.

A ground investigation has been carried out for the project site and will be made available to the Contractor upon appointment. The ground investigation report is included in Appendix E of the Infrastructure Report which accompanies the planning application.

During the site preparation and construction phase, all excavations and exposed sub-soils in open cuts will be blinded and protected with clean broken stone as soon as possible after exposing the subsoil in order to prevent erosion.

The macadam layers & road buildup will be stripped from the entire site. The site will be then be profiled to formation level.

Once the site is at the required formation level, a ground improvement technique known as “rigid concrete inclusions” will be implemented to the site outside of the building footprint. Rigid concrete inclusion is a ground improvement method using high deformation modulus columns constructed through compressible soils to reduce settlement and increase bearing capacity. The precise design proposal will be confirmed by the Contractor.

Soil stripping, earthworks and stockpiling on site will be carried out during the works. Stockpiles have the potential to cause negative impacts on air and water quality. The effects of soil stripping and stockpiling will be mitigated through the implementation of an appropriate earthworks handling protocol during construction. It is anticipated that any stockpiles will be formed within the boundary of the excavation and there will be no direct link or pathway from this area to any surface water body. It is anticipated that only local/low level of stockpiling will occur as the bulk of the material will be excavated either straight into trucks for transport off site or will be reused in other areas of the site as fill.

Excavated material to be disposed off-site will go to a licensed facility. Heavy goods vehicle movements will be kept to a minimum.

Once the ground improvement works are completed, the building foundations will be installed. The building foundations will include 640mm diameter ODEX piles with reinforced insitu concrete ground beams between pile caps and suspended slab.

8.2 Control of Concrete and Lime

Mitigation and monitoring measures related to the use of concrete and lime are as follows:

- Ready-mixed concrete will be brought to the site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated water (for example storm water) to the underlying subsoil and groundwater,
- The pouring of concrete will take place within a designated area protected (for example by a geosynthetic material) to prevent concrete runoff into the soil/groundwater media,

- Any use of concrete in proximity to drainage (or watercourses) will be carefully controlled to avoid spillage. No on-site batching will occur,
- Washout of concrete transporting vehicles will take place at an appropriate facility, offsite where possible such as the concrete manufactures premises. Where wash out of chutes takes place onsite, it will be carried out in a designated, carefully managed onsite wash out area in a designated contained impermeable area, and
- Wastewater from washing of concrete lorry chutes will be directed into a concrete washout container, lined with an impermeable membrane. The container should be of good condition, should not overflow or leak and should be easily accessible to vehicles.

  The containers must be checked and emptied at a frequency equivalent to the volume of concrete being used and no runoff should leave the washout location. The area will be clearly marked and be located away from storm drain inlets, open drainage facilities, water courses & ditches.

8.3 Air Quality and Climate

8.3.1 Potential Impacts

The main air quality impacts that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions;
- Elevated PM10 concentrations, as a result of dust generating activities on site;
- An increase in concentration of airborne particles and NO2 due to exhaust emissions from diesel powered vehicles and equipment on site and vehicles accessing the Site; and
- Fugitive emissions of airborne particulate matter (including dust) are readily produced through the action of abrasive forces on materials and therefore a wide range of site preparation and construction activities can have the potential to generate this type of emission, including:
  - Demolition;
  - Earthworks;
  - Construction; and
  - Track out (the transportation of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network).

8.3.2 Environmental Mitigation, Control Measures and Proposals

For each of the potential sources of an environmental impact on the existing environment, the Contractor will identify the control and protection measures to be implemented as part of the environmental risk assessment. The following mitigation and general control measures should be followed as a minimum to ensure no significant adverse direct and indirect effects on the environment arise from the project.

8.3.2.1 General Measures

The Contractor will be required to implement measures to minimise the amount of dust and emissions (including odour) produced during the project, including the production of a Dust Management Plan as part of the CEMP.

Standard industry best practice mitigation measures will be applied to the Site, for example that described in:

- 'Control of dust from construction and demolition activities' (Kukadia, V., Upton S., & Hall, D. (2003). Control of dust from construction and demolition activities, BRE);
- 'Best Practice Guidance: The control of dust and emissions from demolition and construction' (GLA. (2006);
- Best Practice Guidance: The control of dust and emissions from demolition and construction, Greater London Authority);
- Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management);
- Guidelines for the Treatment of Air Quality during Planning and Construction of National Roads (TII. (2011); and

General mitigation measures include:

- Works will be planned to consider the location of sensitive receptors, sensitive core activities associated with operation of other businesses, local topography, wind direction and any potential sources of pollution;
- Discussion with the planning authority will be undertaken at an early stage by the Contractor to determine any specific monitoring requirements and to agree to any proposed trigger/action levels;
- Community engagement will be undertaken before works commence onsite explaining the nature and duration of the works to local residents and businesses;
- Wind breaks and barriers;
- Frequent cleaning and watering of the construction site and associated access roads;
- Control of vehicle access;
- Vehicle speed restrictions;
- Covering of piles;
- Use of gravel at Site exit points to remove caked on dirt from tyres and tracks;
- Washing of equipment at the end of each workday;
- Prevention of onsite burning; and
- Where appropriate and practicable,
  - hard surface roads should be wet swept to remove any deposited materials;
  - un-surfaced roads should be restricted to essential Site traffic only; and
  - wheel-washing facilities should be located at all exits from the construction site.

There is a Duty of Care on the Contractor to ensure that dust-raising activities are located away from sensitive receptors, such as nesting birds and residential dwellings as much as feasibly possible and duration kept to a minimum when in proximity to a receptor.

Regular site inspections will be undertaken by the Contractor's CEMPC to monitor compliance with the CEMP and record inspection results. It is anticipated that a daily visual check will be carried out and these records will be available upon request.

8.3.2.2 Generation and Control of Dust

A number of mitigation measures can be adopted to reduce the production and/or dispersal of dust to lessen the harm to amenity and limit the human health impacts. Ideally dust should be controlled at the source as once airborne it is more difficult to suppress. Appropriate mitigation measures are provided in the IAQM 'Guidance on the assessment of dust from demolition and construction' (IAQM, 2014).

Table 8-1 lists the measures recommended by the IAQM as being highly recommended for the level of dust risk identified for the project.

Table 8-1: Potential Site Operations and Possible Methods of Controlling Dust

Activity	Possible Dust Control Methods
Communication	• Develop and implement a stakeholder communications plan that includes community engagement before work commences. • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary; • Display the head or regional office contact information; and • Develop and implement a Dust Management Plan (DMP).
Site Management	• Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken; • Make the complaints log available to the local authority when asked; and • 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.
Monitoring	• Undertake daily onsite and offsite inspections, where receptors (including roads) are nearby, to monitor dust, record inspection results and make the log available to the local authority when asked; • Increase the frequency of site inspections by the person accountable for air quality and dust issues on-site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions; and • Carry out regular site inspections by the person accountable for air quality and dust issues on-site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
Preparing and maintaining the site	• Plan site layout so that machinery and dust causing activities are located away from receptors as far as possible; • Erect solid screens or barriers around dusty activities that are at least as high as any stockpiles on-site; • Remove materials that have a potential to produce dust from Site as soon as possible unless being re-used on-site; • Cover, seed, or fence stockpiles to prevent wind whipping; • Avoid Site run-off of water or mud; and • Keep Site fencing, barriers and scaffolding clean using wet methods.
Operating vehicle/machinery and sustainable travel	• Ensure all vehicles switch off engines when stationary – no idling vehicles; • Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable; • Impose and signpost a maximum speed limit of 15 kmph on surfaced and 10 kmph on unsurfaced haul roads and work area.

Activity	Possible Dust Control Methods
	• Vehicles will not be overloaded, and all loads entering and leaving the construction site and carrying waste and other dusty materials will be adequately sheeted to prevent the spillage of material during transport.
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/mitigation; • Use enclosed chutes and conveyors and covered skips; and • Minimise drop heights.
Waste Management	• Avoid bonfires and burning of waste materials.
Earthworks	• Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover the topsoil as soon as practicable; and • Only remove the cover in small areas during work and not all at once.
Construction	• Avoid scabbling, if possible; and • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out; and • For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
Trackout	• Use water assisted dust sweeper(s) on the access and local roads, to remove, as necessary any material tracked out of the Site; • Avoid dry sweeping of large areas; • Ensure vehicles entering and leaving the Site are covered to prevent escape of materials during transport; and • Implement a wheel washing system.

As per industry standard for the construction phase, the TA Luft Regulations limit value of 350 mg/m^2/day (as accepted by the Irish EPA) will be adhered to by the Contractor.

8.3.2.3 Climate Mitigation Measures

The following GHG mitigation measures will be implemented during the construction stage of the project:

- An Outline Construction Traffic Management Plan has been prepared to accompany this document and is included in Chapter 13 of the Traffic Impact Assessment prepared by PUNCH Consulting Engineers. A Traffic Management Plan (TMP) will be produced by the Contractor prior to construction to minimise congestion and would include various measures to reduce GHG emissions including:
  - Specification of locally sourced materials with lower embodied carbon content where feasible, in line with circular economy principles;
  - Turning off machinery engines when not in use;
  - Ensuring regular maintenance of construction machinery; and
  - Handling materials efficiently on site to minimise the waiting time for loading and unloading, thereby reducing potential emissions.

8.4 Cultural Heritage

8.4.1 Potential Impacts

The footprint of the proposed development is located on already developed lands and has been significantly disturbed in the past therefore the potential for direct impacts on previously unrecorded archaeological material at this location was assessed as low.

8.4.2 Environmental Mitigation, Control Measures and Proposals

The Contractor will be responsible for compliance with any additional requirements of the Department for housing, Local Government and Heritage (DHLGH) or Galway City Council.

For each of the potential sources of an environmental impact on the existing environment, the Contractor will identify the control and protection measures to be implemented.

The following mitigation and general control measures should be followed as a minimum to ensure no significant adverse direct and indirect effects on the environment arise from the project.

8.4.2.1 General Measures

- The Contractor is to ensure that mitigating measures outlined in the Outline CEMP, planning consent, the Client's/ Galway City Council's requirements, and any updated or new supplementary environmental reports are included in the CEMP.
- The Contractor is to agree with the planning authority details regarding any further cultural heritage requirements (including if necessary further testing) prior to commencement of construction works and demolition on the Site.
- If any archaeology or features of archaeological potential are discovered during the course of the construction phase, works around it must be stopped and relevant authorities contacted to agree if further archaeological mitigation is required.

8.5 Biodiversity

8.5.1 Potential Impacts

Potential impacts during construction can include habitat disturbance (i.e., visual, vibration and noise, temporary barriers to connectivity, etc.) and the potential for the release of pollutants and contaminants (i.e., suspended solids, oils, fuels, paints, concrete, lime, etc.) to receiving watercourses.

A range of factors influence the potential significance of effects including vulnerability of individual receptors (e.g., condition of vegetation, or fitness of faunal populations), time of year and lifecycle stage of a species impacted, and the potential for unforeseen events such as extreme weather (including flooding of working areas), or introduction of invasive species to exacerbate predicted impacts.

8.5.2 Environmental Mitigation and Control Measures and Proposals

For each of the potential sources of an environmental impact on the existing environment, the Contractor will identify the control and protection measures to be implemented. The following general control and mitigation measures should be followed as a minimum.

8.5.2.1 Roles and Responsibilities

- Prior to commencement of construction, a suitably experienced Ecological Clerk of Works (ECoW), will be appointed by the contractor. The Ecologist will be a full member of a relevant professional institute such as the Chartered Institute of Ecology and Environmental Management (CIEEM), have relevant experience in the management of ecological constraints during construction, and hold or have held a protected species licence(s) in the Republic of Ireland. The Ecologist will be appointed sufficiently in advance of the project to arrange for any mitigation requirements to be incorporated into the Contractor's site-specific CEMP, Method Statements, and programme;
- The ECoW will be responsible for advice and provision of services in relation to implementation of any required ecological mitigation measures. The ECoW will be engaged and consulted on a regular basis by the Contractor and CEMPC;
- The Contractor, CEMPC and the ECoW will ensure that the ecological mitigation and control measures are satisfactorily implemented;
- The Contractor will liaise with the ECoW on all matters relating to ecology including mitigation (particularly protected species including bats and nesting birds); and
- The Contractor will engage and consult with the ECoW and a bat specialist prior to any demolition within the Site and if bats are unexpectedly encountered during any element of construction works.
- The Contractor will accommodate the ECoW, whose role will be to:
  - Oversee carrying out of pre-construction surveys to the appropriate specifications (see Section 4);
  - Communicate relevant matters to Galway City Council, and other stakeholders as relevant;
  - Attend site meetings and input to Contractor toolbox talks prior to commencement of the project (if required); and
  - Determine the potential requirement for licences and provide specialist input (if required).

8.5.2.2 General Mitigation Measures

The following are standard mitigation measures which will be implemented throughout construction phase of the project.

- All site personnel involved in the construction and operation of the project will be made aware of any ecological features present and the mitigation measures and working procedures which must be adopted (if ecological features present). This will be achieved as part of the site induction process through the delivery of a toolbox talk. In addition, briefings will be provided to all site personnel in advance of any works considered to present an increased risk of impacting upon ecological features.

- Best practice guidance on pollution prevention will be followed at all times during the construction and operation of the project, including implementation of the following:
  - Controls and contingency measures will be provided to manage run-off from construction areas and to manage sediment;
  - Pollution prevention measures will be implemented for all construction works, but in particular should these take place within 30 m of any watercourses. These must prevent pollution (including siltation) of the watercourses;
  - There will be no direct discharge of water from any construction area into any watercourses;
  - All oils, fuels, lubricants, or other chemicals will be stored in an appropriate secure container in a suitable storage area, with spill kits provided at the storage location and at places across the Site;
  - In order to avoid potential pollution impacts to waterbodies, soils, or vegetation from machinery during construction, all refuelling and servicing of vehicles and plant will be carried out in a designated area which is bunded and has an impermeable base;
  - No on-site batching of concrete will occur (also see Section 23 Control of Concrete and Lime); and
  - Soil exposure during the construction works will be reduced and exposed soil will be reinstated as rapidly as possible.
- The Contractor will produce a Pollution Prevention Plan (or similar document). This will include procedures and diagrams for:
  - Dewatering of excavations to SuDS treatment area;
  - Temporary soil storage;
  - Fuel storage/refuelling;
  - Concrete wash-out area;
  - Controlling surface water entering site;
  - Preventing existing drainage features becoming pathways for construction run-off;
  - Reducing soil exposure and reinstating as rapidly as possible; and
  - Contingency measures.
- The Principal Contractor will not be permitted to use materials that could cause heavy metal, sulphide, or strong acid pollution of run-off, and must use aggregates free of excessive fines clays.
- Standard measures for protected species and wildlife in general will be implemented, including:
  - A pre-construction walkover survey for protected species, those surveys outlined within Section 4 and any other Biodiversity surveys deemed required will be undertaken by a suitably experienced ecologist;

- Should tree felling and vegetation removal works be required, which will directly impact upon areas of vegetation which could be used by nesting birds, this will wherever possible, be undertaken outside the breeding season (taken to be March to August, inclusive). Where this cannot be achieved, a pre-works check for active nests will be conducted by a suitably experienced ornithologist. Each new construction/felling area will be checked not more than 72 hours prior to commencement of works since nests can be quickly established. Where any active nests are identified, suitable exclusion zone(s) will be established and maintained until the ornithologist determines that the breeding attempt(s) have concluded;
- Sightings of protected or notable species within the Site or immediate surrounds during the construction period will be recorded. If any evidence or sightings of protected or notable species occur within 30 m of works, then works in that area will stop immediately and the ECoW will be consulted;
- Any excavations will be left with a method of escape for any animal that may enter overnight, and will be checked at the start of each working day to ensure no animals are trapped within them; and
- Any pipes will be capped or otherwise blocked at the end of each working day, or if left for extended periods of time, to ensure no animals become trapped;

- There can be no storage of hydrocarbons or any polluting chemicals or refuelling of vehicles/equipment within 30m of the watercourse or any active/inactive drains connecting to the river.
- Any diesel or fuel oils stored on site must be bunded to 110% of the capacity of the storage tank. Design and installation of fuel tanks must be in accordance with best practice guidelines. Drip trays and spill kits must be kept available on site.
- All stationary plant must be placed on drip trays to prevent leaking oils reaching the river or entering groundwater.
- Machinery on site must have pollution control kits on hand in the event of an emergency
- Machinery will be kept in good order at all times and inspected for drips and leaks when kept onsite.
- The contractor will refer to the guidelines set out by CIRIA (2006) on the control of water pollution from linear construction projects and any other relevant legislation and guidance related to the control of water pollution on construction sites.

8.6 Land and Soils

8.6.1 Potential Impacts

The risk of potential negative impacts on the land and soils environment occurring during the construction phases of the project (in the absence of adequate management and mitigation measures) can arise from several activities; for example, weathering and erosion of the surface soils, increased silt levels or pollutants from the construction processes, accidental spills, and impacted runoff.

8.6.2 Environmental Mitigation and Control Measures and Proposals

For each of the potential sources of an environmental impact on the existing environment, the Contractor will identify the control and protection measures to be implemented. The following general control and mitigation measures should be followed as a minimum.

8.6.2.1 General

- Materials and equipment to implement the spill response and control plan will be available at various locations across Site (for example, spill kits, booms). These will be in clearly marked response points, which can be accessed by all staff. They will be checked on a daily basis to ensure that all required materials are in place. All staff on site will be aware of these items and be trained on procedures to implement in the case of a spill. Any used spill kits will be disposed of using a hazardous waste disposal contractor and in accordance with all relevant EU and Irish waste management legislation.
- Leaking or empty fuel drums will be removed from Site immediately and disposed of via an appropriately licensed waste disposal contractor.
- The Resource and Waste Management Plan will be consulted for mitigation measures related to stockpiling and waste management onsite.
- Contaminated or potentially contaminated soil will be stockpiled only on hard-standing or high-grade polythene sheeting to prevent cross-contamination;
- Mixing of unclassified stockpiles of different origin, or of stockpiles having different classification, will not be carried out. When a stockpile has been sampled for classification purposes, it will be considered to be complete, and no more soil will be added to that stockpile prior to disposal; and
- Stockpiles will not be positioned adjacent to ditches, watercourses or existing or future excavations.

8.6.2.2 Fuel and Chemical Handling

In order to prevent spillages of fuels to ground, and to prevent any consequent soil quality impacts, it will be necessary to adopt mitigation measures during the construction phase, which include:

- A designated bunded storage area will be located at the contractor's compound for all oils, solvents and chemicals used during construction. Oil and fuel storage tank design will be bunded to a volume of not less than the greater of 110% of the capacity of the largest tank or drum within the bunded area, or 25% of the total volume of the substance which could be stored within the bunded area, with impermeable bases within each contractor's storage area as required. Drainage from the bunded area will be diverted for collection and safe disposal. All containers within the storage area and on Site will be clearly labelled so that appropriate remedial action can be taken in the event of a spillage. When moving drums from the bunded storage area to locations within Site a suitably sized spill pallet will be used for containing any spillages during transit;
- Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be away from surface water gullies or drains. Spill kit facilities will be provided at the fuelling areas in order to provide for accidental releases or spillages in and around the area. Any used spill kit materials will be

disposed of using a licenced hazardous waste contractor in accordance with relevant legalisation;

- Should mobile fuel bowsers be used on the project, in the event of a machine requiring refuelling outside of the designated area, fuel will be transported in a mobile double skinned tank. Any flexible pipe tap, or valve will be fitted with a lock where it leaves the container and locked shut when not in use. Each bowser will carry a spill kit and each bowser operator will have spill response training; and
- The Contractor will develop procedures and contingency plans to deal with emergency accidental spills and leaks.

8.6.2.3 Depletion of Natural Resources

Mitigation and monitoring measures to limit potential impacts associated with the use of natural resources throughout the course of the project are as follows:

- The source of any backfill material (should it be required) will be vetted for environmental management status, regulatory and legal compliance status;
- Backfill material will be sourced from suppliers which comply with vetting requirements only;
- Periodic reviews of the backfill supplier's license will be undertaken;
- In the event recycled aggregate is used as backfill, chemical testing will be undertaken to confirm that it is 'clean'; and
- The resource and waste management plan will be implemented on Site and updated regularly.

8.7 Water

8.7.1 Potential Impacts

Development works by their nature have the potential to impact watercourses and groundwater by way of pollution. Appropriate control measures in accordance with the Contractor's CEMP and best management practices will be implemented on Site. Examples of potential sources of impacts include:

- Polluted discharges from Site;
  - discharge of vehicle wash-down water;
  - discharge of construction materials, e.g., uncured concrete;
  - uncontained spillage of wastewater effluent;
  - uncontrolled sediment erosion and contaminated silty runoff; and
  - refuelling facilities, chemical and waste storage, or handling areas.
- Changes to the existing drainage network including interception and redirection of natural and artificial watercourses (e.g., drainage channels); and
- Increased runoff from cleared and capped areas.

8.7.2 Environmental Mitigation and Control Measures and Proposals

For each of the potential sources of an environmental impact on the existing environment, the Contractor will identify the control and protection measures to be implemented.

8.7.2.1 General

The following mitigation and general control measures will be followed as a minimum on Site.

- The Contractor will develop an emergency response plan to be followed in the event of spills and leaks.
- Materials and equipment to implement the spill response and control plan must be available at various locations across Site (for example, spill kits, booms). These will be in clearly marked response points, which can be accessed by all staff. They must be checked on a daily basis to ensure that all required materials are in place. All staff on site must be aware of these items and be trained on procedures to implement in the case of a spill. Any used spill kits will be disposed of using a hazardous waste disposal contractor and in accordance with all relevant EU and Irish waste management legislation.
- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage areas.
- Bunded storage will be provided for potentially hazardous materials (i.e., oils, hydraulic fluids, greases, solvents, chemicals, and paints) used during the works. Oil and fuel storage tank design will be bunded to a volume of not less than the greater of 110% of the capacity of the largest tank or drum within the bunded area, or 25% of the total volume of the substance which could be stored within the bunded area, with impermeable bases within each contractor's storage area as required.
- Hazardous materials will be stored in designated appropriately bunded areas, which will be located away from all watercourses with nearby drains to be protected as appropriate.
- A plant and machinery maintenance programme will be implemented to keep plant and machinery in good working condition.
- Plant will be refuelled in designated refuelling areas where possible.
- All water runoff from designated refuelling areas will be channelled to an oil interceptor or an alternative treatment system prior to discharge.
- Drip trays will be used during refuelling operations if performed outside of a contained area and spill kits will be carried in the fuel bowser vehicle. Any used spill kits will be disposed of using a hazardous waste disposal contractor and in accordance with all relevant EU and Irish waste management legislation.
- Leaking or empty fuel drums will be removed from Site immediately and disposed of via an appropriately licensed waste disposal contractor.

8.7.2.2 Managing Runoff and Silty Water

The following mitigation measures will be followed as a minimum.

- Movement of material will be minimised in order to reduce degradation of soil structure and generation of dust.

- The Resource and Waste Management Plan will be consulted for mitigation measures related to stockpiling and waste management onsite.
- Stockpiles (should they occur on site) will be kept to a minimum, to control erosion areas of exposed ground, to reduce silty runoff. They will be located well away from watercourses, drains and dewatering points;
- Soil stockpiles will be covered with high-grade polythene sheeting to prevent run-off of rainwater and leaching of potential contaminants from the stockpiled material generation and/or the generation of dust;
- Contaminated or potentially contaminated soil will be stockpiled only on hard-standing or high-grade polythene sheeting to prevent cross-contamination;
- Drainage channels will be clearly identified on site and shown on method statements and site plans. Existing drainage channels will be protected during works.

8.8 Noise and Vibration

8.8.1 Potential Impacts

Noise and vibration impacts may arise from a wide variety of sources during construction and to varying degrees during the course of the works, depending upon the stage of construction (i.e., ground works, etc.). There is the potential for the generation of noise and vibration levels above those currently experienced in the surrounding environment during the construction phase.

8.8.1.1 Noise

A noise assessment as part of the planning application has been undertaken by Allegro Acoustics, report number DC2256-06. Noise sensitive locations have been identified in close proximity to the Site. These locations include residential dwellings surrounding the site and a school to the west of the site. The assessment proposes that the construction noise limits outlined by the National Roads Authority in “Guidelines for the Treatment of Noise and Vibration in National Road Schemes” are appropriate for this development, **Table 8-2.**

Table 8-2: Proposed Construction Noise Limits

Day & Times	dB $L_{aeq\ (1hr)}$	dB L^{Amax}
Monday – Friday (07:00 to 19:00)	70	80
Monday – Friday (19:00 to 22:00)	60	65
Saturday (08:00 to 16:30)	65	75
Sundays and Bank Holidays (08:00 to 16:30)	60	65

These limits will be enforced using continuous noise monitoring, with the monitoring station equipped with real time text/email alerts.

8.8.1.2 Vibration

The Contractor will carry out their works such that the effect of vibration on the surroundings is minimised and does not cause any damage.

In the case of this development, vibration levels used for the purposes of evaluating building protection and human comfort are expressed in terms of Peak Particle Velocity (PPV) in mm/s. BS 5228 and BS 7385 define the thresholds, given in **Table 8-3**, for cosmetic damage to residential or light commercial buildings.

Table 8-3: Vibration Limits

Type of Building	Transient Vibration	Continuous Vibration
Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s	25 mm/s
Unreinforced or light framed structures. Residential or light commercial-type buildings	15 mm/s	7.5 mm/s
Protected and Historic Buildings (Note 1)	6 mm/s - 15 mm/s	3 mm/s - 7 mm/s
Identified Potentially Vulnerable Structures and Buildings with Low Vibration Threshold	3 mm/s	3 mm/s

Note 1: The relevant threshold value to be determined on a case-by-case basis. Where sufficient structural information is unavailable at the time of assessment, the lower values within the range will be used, depending on the specific vibration frequency.

BS 5228-2 also provides guidance relating to the human response to vibration. Guidance is provided in terms of PPV in mm/s since this parameter is routinely measured when monitoring the structural effects of vibration. The potential human response at different vibration levels, as set out in BS 5228-2, is summarised in **Table 8-4**.

Table 8-4: Potential Human Response

Vibration Level (Notes 3, 4, 5)	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.

10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

Note 2: The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient.

Note 3: A transfer function (which relates an external level to an internal level) needs to be applied if only external measurements are available.

Note 4: Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.

8.8.2 Environmental Mitigation and Control Measures and Proposals

The Contractor will be responsible for compliance with any noise and vibration limits prescribed by Galway City Council. The Contractor will adhere to noise and vibration best practice and guidance such as BS 5228 and BS 6187. This will apply to all works carried out by the Contractor and any sub-contractors under its control. The requirement whether or not to undertake noise and vibration monitoring will be agreed with Galway City Council prior to the commencement of works.

For each of the potential sources of an environmental impact on the existing environment, the Contractor will identify the control and protection measures to be implemented. The following mitigation and general control measures will be followed on Site as a minimum.

8.8.2.1 General Measures

The following mitigation and general control measures will be followed as a minimum on Site.

- A CEMPC and designated noise liaison responsible for matters relating to noise and vibration will be appointed prior to construction on site. Any complaints will be logged, investigated, and followed up in a prompt fashion and, where required, measures taken to ameliorate the source of the noise complaint. In addition, prior to particularly noisy construction activity, e.g., excavation close to a property, etc., the site contact will inform the nearest noise sensitive locations of the time and expected duration of the works.
- The site CEMPC and designated noise liaison will also liaise with relevant authorities/environmental bodies and the local community as required with respect to noise and vibration impacts during the construction phase.
- The Contractor will highlight through method statements and/or risk assessment specific activities that will create significant noise and vibration levels. Contractors will demonstrate how they will mitigate/manage these emissions. The Contractor will implement mitigation measures where noise sources are located near sensitive receptors and where required on Site.

Best Practicable Means for the control of construction noise and vibration to be implemented on site include:

- Ensuring that modern plant is used, complying with the latest European noise emission requirements.
- Selection of inherently quiet or low vibration plant where possible.
- Use of lower noise and vibration piling techniques (such as vibratory, rotary bored or hydraulic jacking) rather than driven piling techniques where possible.
- Off-site pre-fabrication where practical.
- Noisier plant will be positioned to optimise screening by other plant.
- Where earth movers dump material into dumper trucks, the material fall height will be minimised as much as practical so that noise generation is minimised.
- Use temporary noise screens or site hoardings as noise barriers where possible.
- Where possible, carry out noisy works during less sensitive hours, e.g., daytimes rather than at night.
- All plant and equipment being used for the works to be properly maintained, silenced where appropriate, operated to prevent excessive noise and switched off when not in use.
- Ensuring contractors are made familiar and follow the guidance in:
  - BS 5228 Code of practice for noise and vibration control on construction and open sites: Part 1 Noise and Part 2 Vibration;
  - NR/L2/ENV/015 Environment and Social Minimum Requirements for Projects – Design and Construction; and
  - NR/L2/ENV/121 Managing environmental and social impact of noise and vibration.
- Loading and unloading of vehicles, dismantling of site equipment, or moving equipment or materials around the Site to be conducted in such a manner as to minimise noise generation.
- Communication with local residents as appropriate to advise of potential noisy works that are due to take place.
- Brief site staff on the most preventable causes of complaint: shouting, car radios, slamming doors etc.
- Monitoring of noise complaints and reporting to the contractor for immediate investigation.
- Machinery will be switched off when it is not in use instead of leaving it on idle.
- As far as reasonably practical, sources of significant noise will be enclosed. Acoustic screens will be used close to noisy operations where required.
- Temporary hoarding will be erected around items such as generators or high duty compressors where required.
- Noisy plant will be located as far away from noise sensitive facades as practical and as permitted by site constraints.
- Diesel engines will be substituted with electric motors where practical.

8.9 Landscape and Visual

8.9.1 Potential Impacts

Construction effects are most likely to be associated with the visibility of construction traffic and construction works within the Site including construction machinery. The majority of visual receptors will be school staff, students, local residents and vehicle drivers who pass through the area.

8.9.2 Environmental Mitigation and Control Measures and Proposals

For each of the potential sources of an environmental impact on the existing environment, the Contractor will identify the control and protection measures to be implemented. The following mitigation and general control measures will be followed on Site as a minimum.

8.9.2.1 General Measures

Adherence to the CEMP will be a contract requirement and this will ensure good working practices are followed to minimise and manage any significant, negative environmental impacts arising from construction.

Appendix 15-1

Corrib Causeway Phase 1, Dyke Road

Infrastructure Report

Galway City Council

Project number: 60710277
60710277-ACM-XX-XX-RP-CE-10-0007-P3

1 March 2025

Delivering a better world

Quality information

Prepared by	Checked by	Verified by	Approved by
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
01	14.03.25	Planning issue		Emma McKendrick	Regional Director

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1. Introduction

1.1 Project Background

AECOM Ireland Ltd (AECOM) has prepared the Infrastructure Report for the development of the Corrib Causeway Phase 1 lands at Dyke Road, Terryland, Galway City (Refer to **Figure 1-1** & **Figure 1-2**). The Dyke Road site is located on the edge of Galway City Centre, Galway.

The Infrastructure Report has been prepared to accompany the planning application for a new residential development on the site.

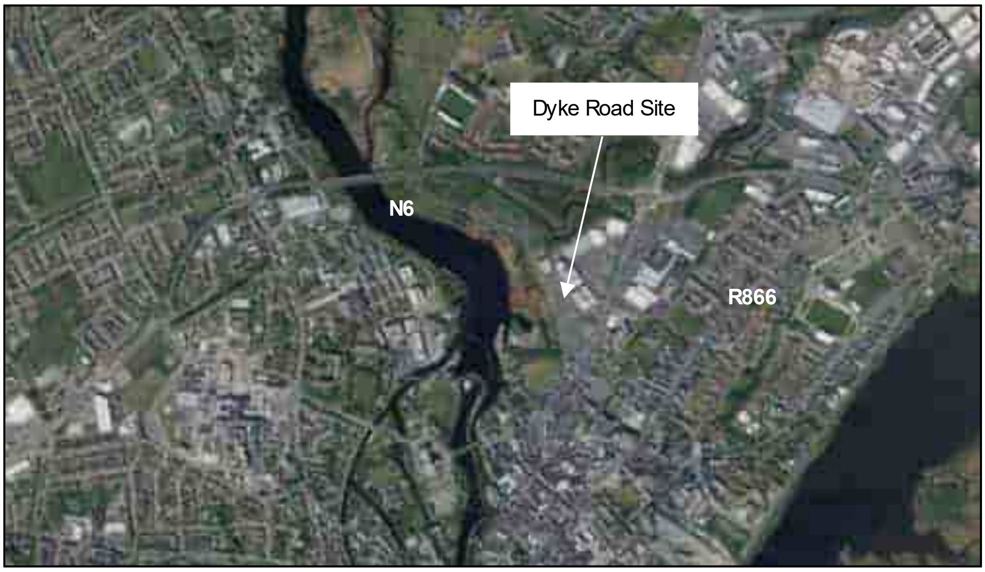


Figure 1-1: Site Location Map

Figure 1-2: Site Location – Phase 1, Tóchar na Coiribe Vision, LDA & MOLA Architecture 2023

The Dyke Road site forms part of a strategic brownfield landbank located on the edge of Galway City Centre which has been identified for comprehensive redevelopment by the Galway Development Plan 2023-2029. The proposed development of the site will be on a phased basis as indicated in **Figure 1-3**. This report pertains to Phase 1 lands only.

The Phase 1 lands are currently used as a public carpark. In the Tóchar na Coiribe Vision the Emerging design proposal explains that "there is also potential to redevelop the south of the car park for civic, commercial, and cultural uses (phase 2). If the Black Box theatre is relocated, there is potential to develop an additional residential block overlooking Terryland Forest Park (Phase 3). In the meantime, the existing uses comprising the Black Box theatre and car parking unaffected by Phase 1 will remain operational as normal, **Figure 1-4**." (LDA 2024).

Figure 1-3: Project Phasing, Stage 1 Masterplan, MOLA Architecture 2023

Figure 1-4: Emerging Design Proposal, Tóchar na Coiribe Vision, LDA and MOLA 2024

1.2 Existing Development

The existing development consists of a tarmacadam car park which spans over phases 1 & 2 respectively. The most northern part of the existing landholding is home to the Black Box Theatre. The topography of the entire site naturally falls from south to north.

A topographic survey undertaken by Apex Surveys in October 2023 of the overall landholding indicates that ground levels on the site range from 3.84m at the northern end of the site to 7.12m in the southern portion of the site. There is a small retaining wall in the southern portion of the site where the car park levels step up from about 6.0m to around 7.0m. The ground levels on the phase 1 lands typically range from 4.8m to 5.9m with the level in the centre of the site typically being around 5.3m.

It must be noted that the entire site is of hardstanding area. Refer to **Figure 1-5** below.

Figure 1-5: Existing Development

1.3 Proposed Development

The proposed development will consist of the construction of a new residential development of 219 no. apartment units and a childcare facility (approx. 241 sq m) in the form of 1 no. new residential block (5 - 9 storeys over lower ground floor level) with associated car parking, bicycle parking, public and communal open spaces, and all ancillary works on a site area of 1.144 ha.

The proposed development will provide for:

a) 219 no. residential apartment units (109 no. 1-bedroom units, 100 no. 2-bedroom units and 10 no. 3-bedroom units) each with an associated private open space area in the form of a balcony/terrace.

b) A raised pedestrian boardwalk along the western elevation of the proposed building.

c) Open Space (approx. 2,778 sq m) is proposed in the form of (a) public open space (approx. 1,183 sq m) to the west of the proposed building fronting on to Dyke Road accommodating outdoor seating, planting, a sunken garden and pedestrian pathways and connections; and (b) communal open space (approx. 1,605 sq m) to the east of the proposed building in the form of a courtyard including outdoor seating, planting, a children's play area and outdoor sports equipment.

d) A childcare facility (approx. 241 sq m) at ground floor level with dedicated external play area (approx. 61 sqm) at surface level.

e) A total of 33 no. new car parking spaces at surface level to serve the proposed residential development (including 2 no. accessible spaces). In addition, 2 no. set down / drop off spaces are proposed to serve the childcare facility.

f) A total of 465 no. bicycle parking spaces to include 330 no. standard residential spaces, 100 no. visitor spaces, 25 no. cargo bicycle spaces and 10 no. bicycle parking spaces dedicated for the childcare facility staff, all at surface / lower ground floor level.

g) Vehicular access to serve the development is proposed via Dyke Road at 2 no. new locations along the western site boundary (to the north west and south west of the main development site). Pedestrian and Cyclist access is also proposed throughout the site via Dyke Road and a new pedestrian crossing is also delivered at Dyke Road. The proposed development will extinguish the existing pedestrian connection between Galway Retail Park and the subject site as part of wider proposals for local improvements to permeability.

h) The removal of 389 no. existing car parking spaces (311 no. from Car Park 1 and 78 no. from Car Park 2) is proposed to provide for the new development. An overall total of 165 no. existing car parking spaces will be maintained in Car Park 2.

i) The extinguishment of the main existing vehicular entrance serving Car Park 1 and Car Park 2 at Dyke Road with provision made for a new vehicular access point (to the south of the main development site) to facilitate continued access to existing Car Park 2 and the remaining car parking spaces (165 no.).

j) The removal of existing bring bank facilities including 2 no. clothing banks and 8 no. bottle banks from Dyke Road.

k) 2 no. telecommunications lattice towers (overall height 6.45 m and 7.67 m) affixed to the rooftop supporting 9 no. 2m 2G/3G/4G antennas; 9 no. 0.8m 5G antennas; 6 no. 0.3m microwave transmission links; together with all associated telecommunications equipment and cabinets. The proposed overall building height including the telecommunications towers is approx. 38.18 m (+43.18 AOD).

The development will also provide for all associated site development works, infrastructure, excavation and clearance works including decommissioning the existing Black Box Theatre waste water pumping station, provision for a new pumping station complete with below ground emergency storage, all boundary treatment/retaining walls, public lighting, internal roads and pathways, ESB substations, switch rooms, water tank rooms, cleaner store and WC, meter rooms, facilities management office, parcel store, comms rooms, plant room, generator room / associated plant space, bin storage, bicycle stores, hard and soft landscaping, play equipment, below ground attenuation tanks, nature based SUDs features, green roofs, roof plant, new and replacement site services and connections for foul drainage, surface water drainage and water supply.

This planning application is accompanied by an Environmental Impact Assessment Report and Natura Impact Statement.

1.4 Galway City Development Plan (2023 - 202)

In the preparation of this Infrastructure Report, AECOM has considered the Galway City Council Development Plan (2023 - 2029). Chapter 9, which focuses on Environment and Infrastructure, is particularly relevant to the production of this report.

1.4.1 Galway City Development Plan – Flood Risk Assessment Policy

Policy .1 of the Galway City Development Plan sets out the following objectives regarding Flood Risk:

1. *Support, in co-operation with the OPW, the implementation of EU Flood Risk Directive (2007/60/EC), the Flood Risk Regulations (SI No, 122 of 2010) and the DECLG and OPW Guidelines for Planning Authorities, the Planning System and Flood Risk Assessment Management (2009), updated/superseding legislation or departmental guidelines and have regard to the findings and relevant identified actions of the Corrib Catchment Flood Risk Management (CFRAM) Study.*
2. *Support and facilitate the implementation of the Coirib go Cósta Galway City Flood Relief Scheme in conjunction with the OPW to support a climate resilient city, protect against flooding and minimise the impact of future climate events. Support in general the associated mitigation and adaptation measures in order to prevent flooding and coastal erosion, subject to appropriate environmental, visual, built heritage and other relevant considerations.*
3. *Ensure the recommendations of the Strategic Flood Risk Assessment (SFRA) for the Galway City Development Plan 2023-2029 are taken into consideration in the assessment of developments in identified areas of flood risk and require site specific Flood Risk Assessment (FRA) and associated design and construction measures appropriate to the scale and nature of the development and the risks arising, in all areas of identified flood risk including on sites where a only small proportion of the site is at risk of flooding and adopt a sequential approach in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities (2009).*
4. *Protect and promote sustainable management and uses of water bodies and watercourses from inappropriate development, including rivers, streams, associated undeveloped riparian strips, wetlands, and natural floodplains.*
5. *Ensure flood risk is incorporated into the preparation of any future local area plans, framework plans and masterplans in the city.*
6. *Ensure any proposed measure designed to alleviate flooding/coastal erosion is subject to Appropriate Assessment in accordance with Article 6 of the EU Habitats Directive, where appropriate.*
7. *Continue to protect the coastal area and the foreshore and avoid inappropriate development in areas at risk of coastal erosion and/or would cause and escalate coastal erosion in adjoining areas. 8. Protect and maintain, where feasible, undeveloped riparian zones and natural floodplains along the River Corrib and its tributaries.*
8. *Protect and maintain, where feasible, undeveloped riparian zones and natural floodplains along the River Corrib and its tributaries.*

1.4.2 Galway City Development Plan – Water Services Policy

Policy .3 of the Galway City Development Plan sets out the following objectives regarding Water Services:

1. *Work in close liaison with Irish Water in the operation of water and wastewater facilities in the city and the upgrade and expansion of the network and the delivery of strategic projects such as the Terryland Water Treatment Plant Intake Works.*
2. *Support the delivery of the objectives of the Irish Water Water Services Strategic Plan (2015) and implementation of the Irish Water Capital Investment Plan 2020 - 2024.*
3. *Work in conjunction with Irish Water to ensure the provision and maintenance, of a high quality and efficient water supply capable of meeting existing and future needs of the city and support any ongoing water mains rehabilitation and water conservation projects.*
4. *Encourage all significant water users to use best practices in water conservation and continue to promote water conservation measures in the design of all new development in the city, such as rainwater harvesting and re-use of grey water, in liaison with Irish Water.*
5. *Support and liaise with Irish Water in the provision of a sustainable and effective wastewater drainage collection and treatment system capable of meeting the existing and future needs of domestic, commercial, and industrial users in the city and MASP area.*
6. *Support the Irish Water ongoing watermain rehabilitation and water leak reduction programme in order to conserve the city's water supply.*
7. *Support the decommissioning of existing individual effluent treatment systems which include septic tanks at locations which include Ballyloughane, where there is a feasible option to connect to the public sewer network. Galway City Council will collaborate with Irish Water in this regard.*
8. *Support the development and implementation of Drinking Water Safety Plans by Irish Water, which seek to protect human health by identifying, assessing, and managing risks to water quality and quantity; taking a holistic approach from source to tap.*
9. *Support the promotion of effective management of trade in discharges to sewers by Irish Water in order to maximise the capacity of existing sewer networks and minimise detrimental impacts on sewage treatment works.*

1.4.3 Galway City Development Plan – Sustainable Urban Drainage Systems (SuDS) Policy

Policy .4 of the Galway City Development Plan sets out the following objectives regarding SuDs:

1. *Ensure the use of Sustainable Urban Drainage Systems (SuDS) and sustainable surface water drainage management, wherever practical in the design of development to enable surface water run-off to be managed as near to its source as possible and achieve wider benefits such as sustainable development, water quality, biodiversity local amenity and climate adaptation.*
2. *Promote the use of green infrastructure e.g. green roofs, green walls, bioswales, planting and green spaces for surface water retention purposes as an integrated part of SUDS and to deliver all the ancillary benefits.*

1.5 Terryland River

As per the Galway City – County Geological Site Report (Hennessy et al., 2020. Geological Survey Ireland), the Terryland River exhibits a unique flow pattern; It can either flow out of the River Corrib and disappear underground, acting as a natural sink, or rise and flow toward the Corrib, facilitated by two estavelles akin to springs. The river's general groundwater flow direction originates from the Ballindooley Lough area, flowing southward through an underground conduit system. Within the karst depression, the Eastern and Western estavelles play a crucial role. Although these estavelles connect to Galway Bay or Lough Atalia, the precise discharge locations into these bodies of water remain unidentified. The Terryland River (European Code IE_WE_30T010500) is subject to various sensitivities, including hydro morphology pressures, urban run-off pressures, and being considered a River waterbody risk ('At risk') under the Water Framework Directive.

1.6 Pre-Planning Consultations with Galway City Council

There have been a number of preplanning consultations with GCC and the pre-planning design was shared with GCC in March 2024. All comments raised with respect to the pre-planning design have been addressed in the developed planning stage design through a collaborative and iterative design process.

AECOM presented the surface water strategy during a Teams meeting on 18.06.24, attended by the following GCC representatives Frank Clancy, Padraic MacGoillabhride and Peter Staunton. AECOM outlined the current conditions, the constraints, and the surface water strategy. The strategy which proposes limiting surface water run-off from the site to 25 l/s, by providing two (2) shallow Reinforcement Concrete (RC) attenuation tanks and SuDS measures including Green Roofs, exfiltration permeable paving and lengths of raingarden / swale (also exfiltration systems) was agreed.

1.7 Summary

This report outlines the proposed wastewater drainage, surface water drainage, and water supply network to serve the development. Additionally, it discusses the site constraints that were taken into account during the preliminary design phase.

1.7.1 Surface Water

Current conditions:

The carpark site is nearly 100% impermeable and currently unattenuated flows discharge to the Terryland Steam via an existing drainage network.

Proposal:

It is proposed to restrict the surface water run-off from the site to 25 l/s, by providing two (2) shallow Reinforcement Concrete (RC) attenuation tanks. It is also proposed to incorporate SuDS measures such as an area of Intensive Green Roof, exfiltration permeable paving and lengths of raingarden / swales. The ground conditions are unsuitable for discharge of surface water to ground. Hence, it is simply proposed to attenuate the run-off.

It is also proposed to provide a new separate gravity surface water drainage network to serve the development. The new network will discharge into the existing 525mm Ø concrete pipe and continues northwards to the discharge point into the Terryland Stream.

Further, it is proposed to divert the surface water sewer which serves the Retail development on the Headford Road around the new building and then reconnect it to the 525mm Ø concrete pipe. It is also proposed to relay circa ±155m of the GCC 525mm Ø concrete trunk surface water pipe that runs through the site.

Refer to **Section 2.2** for further details.

1.7.2 Wastewater

Current conditions:

Based on the record drawings from Uisce Éireann and a utility survey, the existing Black Box Theatre is serviced with a foul sewer that runs south to a pumping station (“Black Box WWPS”) located close to the current main entrance to the Dyke Road car park. From there, with a chamber invert level of 2.3m, the sewage is pumped further south along Dyke Road until it joins a combined sewer network on Headford Road at a level of 6.8m.

Proposal:

It is proposed to relay the gravity foul sewer serving the Black Box Theatre and install a new gravity sewer network to serve the development. The existing wastewater pumping station (WWPS) that serves the Black Box Theatre is to be decommissioned and a new WWPS constructed.

The new WWPS has been positioned based on the flood extents within the site and to maximize the separation from buildings. An emergency tank with 24-hour storage capacity at DWF has been provided to serve Phase 1 development and the Black Box Theatre.

The existing 150mm rising main serving the existing WWPS is to be retained and reused. Uisce Éireann have confirmed that a 20m upgrade of a 150mm diameter sewer from Dyke Road to Wood Quay will be required. These works will be undertaken by UÉ.

Refer to **Section 3.2** for further details.

1.7.3 Water Supply

Current Conditions:

A 9” cast-iron watermain runs along Dyke Road. From this watermain, a water connection feeds the Black Box theatre and the Headford Road shopping centre. A 300mm asbestos-cement watermain runs in Headford Road and Bóthar Na Dige Road, while a shorter section of 100mm uPVC water distribution main runs along a short section of Headford Road.

Proposal:

It is proposed to take a connection off the 250mm asbestos watermain on the Dyke Road. The new watermain will pass through the phase 1 lands and loop around 3 sides (south, east, and north) of the development. Refer to **Section 4.2** for further details.

1.7.4 Flood Risk Management

A Stage 3 Site-Specific Flood Risk Assessment has been prepared to accompany this application which addresses the requirements of the Galway City Development Plan 2023 – 2029, the Regional Spatial and Economic Strategy 2020 - 2032 and “The Planning System and Flood Risk Management Guidelines for Planning Authorities”.

2. Surface Water Drainage

2.1 Existing Surface Water Drainage

Based on the record drawings supplied by Uisce Éireann and a utility survey of the site, there are surface water drainage pipes within the proposed Dyke Road development site, collecting surface water from the site and areas to the south of the site (at an invert level of 5.8m), and discharging unattenuated flows into the Terryland wetlands area, north of the existing Black Box Theatre.

The main surface water pipe running south to north along the western boundary of the site is a 450mm Ø concrete pipe. The pipe starts at an invert level of 5.8m on Bóthar Na Dige Road and falls to an invert level of 3.73m around the middle of the subject site, where it increases in size to a 525mm Ø concrete pipe and continues northwards to the discharge point. There is also a surface water pipe running through the site which serves the Retail development on the Headford Road to the east of the proposed development which discharges into this surface water pipe.

Based on the information shown on the record mapping, the existing network runs in a northerly direction to an existing drain within the green area which further discharges to the Terryland Stream. GCC have confirmed the surface water drainage discharges into the Terryland Stream. The approx. bed level of the anticipated discharge point is ~2.9m. The utility records and utility survey are included in **Appendix D**. Refer to **Figure 2-1** for the layout of surface water infrastructure in the vicinity of the site.

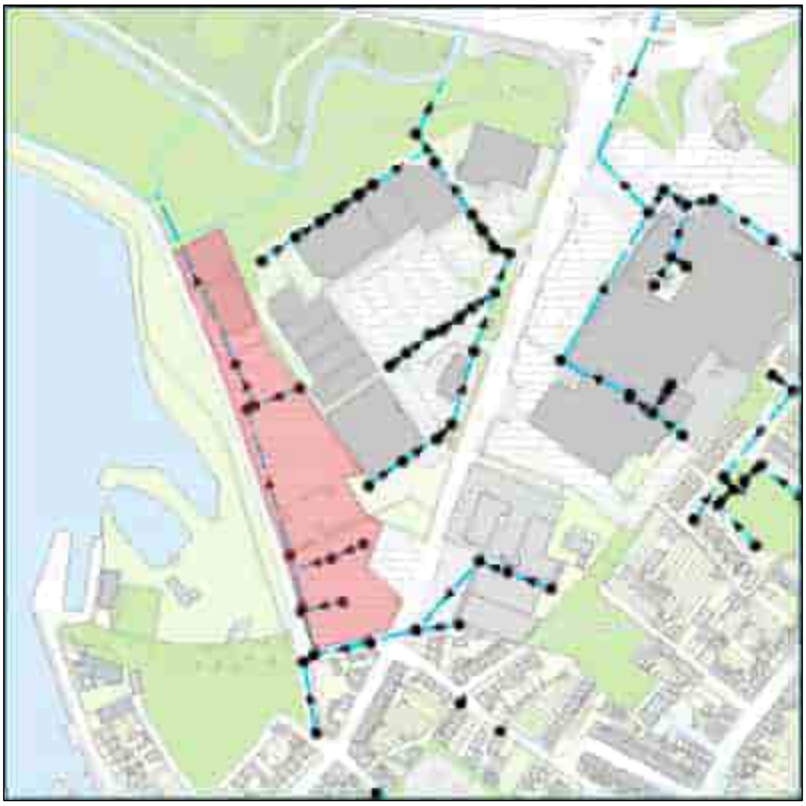


Figure 2-1: Existing Surface Water Infrastructure, UÉ 2024

2.2 Proposed Surface Water Drainage

It is proposed to install a new separate gravity surface water drainage network to serve the development which will discharge to the existing GCC 525mm Ø concrete pipe network which runs from south – north along the western boundary of the site and ultimately discharges to the Terryland Stream. The discharge flow will be limited to 25 l/s by providing two (2) shallow Reinforced Concrete (RC) attenuation tanks with a hydrobrake installed at each outfall manhole. It is also proposed to incorporate SuDS measures such as an area of Intensive Green Roof, exfiltration permeable paving and lengths of raingarden / swales.

Separate connections to the existing surface water network will be provided on the downstream end of each of the attenuation tanks.

Further, it is proposed to divert the surface water sewer which serves the retail development on the Headford Road around the new building and then reconnect it to the 525mm Ø concrete pipe. It is also proposed to relay circa ±155m of the GCC 525mm Ø concrete trunk surface water pipe that runs through the site.

Preliminary investigations undertaken by GCC in 2025 indicate sections of the pipe north of the Phase 1 site (on Phase 3 lands) may require repairs. GCC has confirmed it will carry out any repairs (as may be required) to ensure the Phase 1 development can connect to the existing surface water infrastructure.

<u>Treatment of Run-Off</u>

The quality of the surface water run-off will be much improved from the current situation with the inclusion of the green roofs, exfiltration permeable paving and lengths of raingarden / swales. In addition to these measures, it is proposed to provide a Class I By-Pass hydrocarbon separator upstream of the main development attenuation tanks to remove any hydrocarbons suspended in the site run-off prior to connection to the 525mm Ø concrete pipe.

2.2.1 Design Criteria

The design of residential developments would normally be based on Section 11.3 of the Department of Environment, Heritage and Local Government Recommendations for Site Development Works for Residential Areas and the requirements of Galway City Council.

The following design standards and guidelines have been followed in the design of the proposed surface water drainage network for the site:

- BS EN 752 – Drains and sewer system outside buildings.
- Greater Dublin Strategic Drainage Study (GDSDS) Volume 2 – New Developments.
- BS EN 858-2 – Separator System for Light Liquids (e.g. oil and petrol).
- Pipe network has been designed to ensure no surcharging during a 1 in 5-year return period rainfall event.
- No pipe flooding during a 1 in 100-year return period rainfall event.
- Surface water storage sized based on a 1 in 30-year return period rainfall event.
- An additional 20% has been allowed for climate change in relation to rainfall intensities.
- The following design criteria have been used in the design of the proposed surface water drainage network:

- Carrier pipe network – 1.0m/s to 3.0m/s.
- Colebrook White roughness value of 0.6mm for all pipework.
- Time of entry: 4 minutes.
- Return Period: 5 years.
- Met Eireann rainfall data for site.
- M5/60 = 17.2 mm.
- Ratio r = 0.3.

The following drawings illustrate the proposed surface water drainage network to serve the site:

- 60710277-ACM-XX-XX-DR-CE-00-0500,
- 60710277-ACM-XX-XX-DR-CE-00-0501, and
- 60710277-ACM-XX-XX-DR-CE-00-0502.

Please refer to **Appendix B** for the proposed surface water network calculations.

2.3 Surface Water Attenuation

'The SuDS Manual' published by CIRIA Document No. C753, was utilised for the management of surface water run-off within the development. This document promotes the use of a variety of alternative measures in the design of sustainable drainage systems, which take into account quantity, quality, and amenity. SuDS encourages the use of soft systems that replicate as far as possible, the natural treatment of surface water and attenuation storage to manage surface water run-off.

Given the existing site is 100% impermeable, the introduction of SuDS measures to manage surface water run-off will result in an improvement in the quantity & quality of run-off discharged from the site. It is proposed to restrict the rate of run-off discharged from the proposed development to 25 l/s. During a 1 in 5-year return period rainfall event, the rate of run-off discharge from the existing site/ car park is approximately 130l/s, resulting in a reduction of ~80% in the proposed scenario.

Several engineering challenges exist with regards the introduction of surface water attenuation.

Ground Conditions;

The ground conditions encountered during the ground investigation are summarised below with reference to in situ and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of the ground investigation report compiled by Ground Investigation Ireland (GII) Limited.

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

- Surfacing,
- Made Ground,
- Organic Deposits,
- Soft Cohesive Deposits,

- Cohesive Deposits,
- Granular Deposits,
- Bedrock.

While the Ground Investigation (GI) confirmed that the investigation did not come across any karst features, the possibility of karst features was identified in a Geophysical Survey (GS) undertaken by Minerex Geophysics Limited.

The ground conditions are extremely poor, resulting from a combination of high-water table, and very soft silts and peat to depths of circa 6m. Further, soakaway testing took place and confirmed the water level dropped too slowly to allow calculation of ‘f’, the soil infiltration rate. Therefore, the ground conditions preclude the use of infiltration systems.

Refer to **Appendix E** for the Ground Investigation and Geophysical Survey reports.

Existing Networks;

The invert level of the existing surface water drainage and bed depth of the Terryland Stream are both relatively shallow compared with the subject site. The limited cover precludes the use of crate systems or hydro chamber systems to provide attenuation storage of run-off.

Considering these engineering constraints and as noted above, it is proposed to limit the surface water run-off from the site to 25 l/s by providing two (2) shallow Reinforced Concrete (RC) attenuation tanks with a hydrobrake installed at each outfall manhole. It is also proposed to incorporate SuDS measures such as an area of Intensive Green Roof, exfiltration permeable paving and lengths of raingarden / swales.

2.3.1 Attenuation Storage

The estimated surface water storage was calculated using the “*hr Wallingford Storm Water Storage Estimation Online Tool*”. **Table 2-1** below illustrates the design criteria used to complete the calculation.

The total storage required has been sized based on the volume required (**204m^3)** to store run-off from the development site during a 1 in 100 – year return period rainfall event. A 20% increase in rainfall intensities as a result of the impacts of climate changes has also been incorporated in this design.

Table 2-1: hr Wallingford Storm Water Storage Estimation Online Tool Design Criteria

Design Criteria	
Methodology	IH124
Q_{BAR} Estimation Method	Specify Q_{BAR} Manually
Q_{BAR} for total Site Area	25 l/s
SOIL Type	4
SPR	0.47
Climate Change Allowance Factor	1.2
Interception Rainfall Depth	5mm
Minimum Flow Rate	2 l/s

SAAR	1281
M5-60 Rainfall Depth	17mm
‘r’ Ratio M5-60/M5-2 day	0.3

The proposed intensive green/ blue roof substructure can be seen in **Table 2-2** below. It was agreed that the Intensive Green Roof will be utilized for this development as the available roof space of 1799m^2 will yield the required storage of 131.2 m^3. The remaining 72.8 m^3 will be stored in the two (2) RC Attenuation Tanks.

Table 2-2: Proposed Intensive Green/Blue Roof Substructure

Green Roof	Blue Roof
Roof Area Required	Roof Area Required
Intensive green roof with 300 mm deep substrate	100 mm deep substrate for planting and 100 mm deep attenuation cell
BauderGREEN intensive landscape system	BauderBLUE STORMCell System

2.3.2 Rainwater Harvesting

Rainwater harvesting has been considered by the AECOM design team; the concept was further discussed with GCC. It is advised that the small roof footprint to water demand ratio didn’t lend itself to rainwater harvesting. RWH is much more effective for developments with a large roof footprint and small demand.

3. Wastewater Drainage

3.1 Existing Wastewater Drainage

Based on the record drawings from Uisce Éireann and a utility survey, the existing Black Box Theatre is serviced with a foul sewer that runs south to a pumping station ("Black Box WWPS") located close to the current main entrance to the Dyke Road car park. From there, with a chamber invert level of 2.3m, the sewage is pumped further south along Dyke Road until it joins a combined sewer network on Headford Road at a level of 6.8m. The Headford Road retail park to the east of the site has a foul gravity sewer running from north to south to a pumping station.

The utility records and utility survey are included in **Appendix D**.

Refer to **Figure 3-1** for the layout of foul sewer infrastructure in the vicinity of the site.

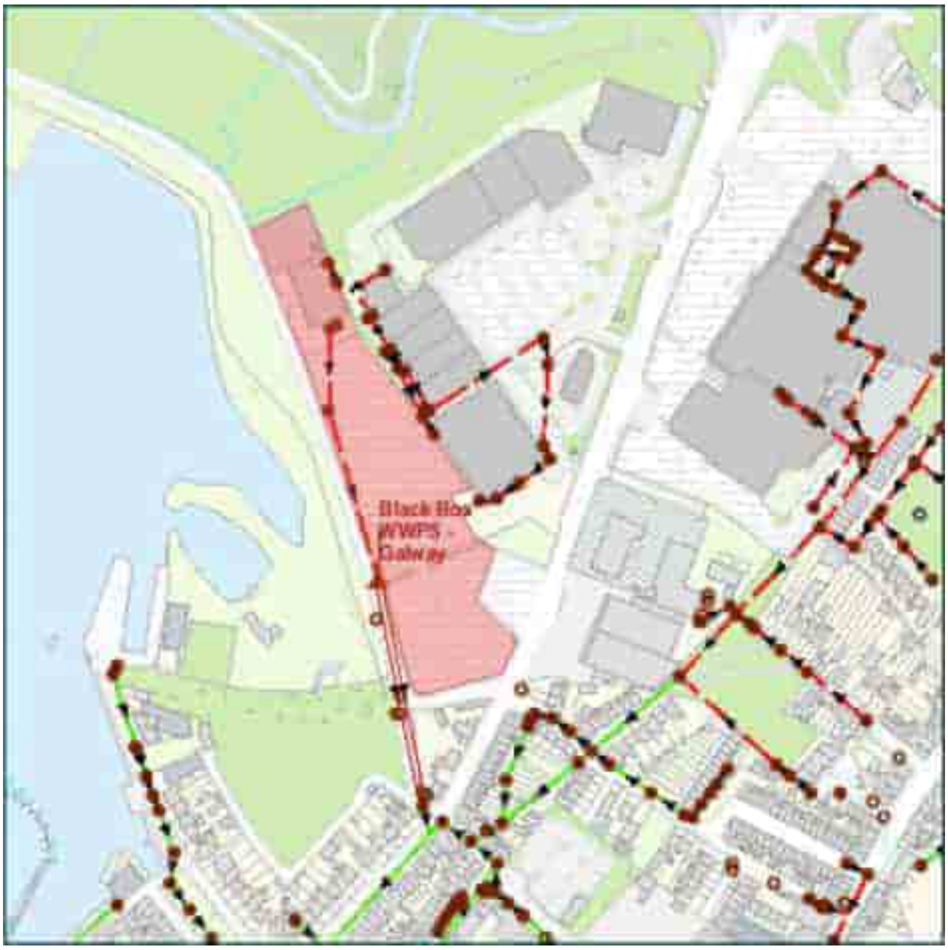


Figure 3-1: Existing Foul Water Infrastructure, UÉ 2024

3.1.1 Uisce Éireann Pre-Connection Enquiry

Pre-Connection Enquiries were submitted to Uisce Éireann on 16th of February 2024 for;

- Phase 1 only,
- Phases 1 & 2, and

- Phases 1 to 3.

Confirmation of Feasibility (CoF) letters for all 3 phases of development have been received and the CoF for Phase 1 is discussed in section 3.2.2 and is included in Appendix A.

Uisce Éireann have confirmed that the existing Dyke Road waste water pumping station was designed to cater only for the Black Box Theatre and that it doesn't have capacity to cater for any additional flows.

3.1.2 CCTV Survey

A CCTV survey of the existing wastewater drainage network within the proposed site was carried out to confirm the pipe routes and confirm the condition of the existing network. The CCTV was issued to UÉ as part of the wastewater diversion application.

3.2 Proposed Wastewater Drainage

Based on the Confirmation of Feasibility and the contents of such noted in **Section 3.2.2.** It is proposed to relay the gravity foul sewer serving the Black Box Theatre and install a new gravity sewer network to serve the development. The existing wastewater pumping station (WWPS) that serves the Black Box Theatre is to be decommissioned and a new WWPS constructed.

The new WWPS has been positioned based on the flood extents within the site and to maximize the separation from buildings. An emergency tank with 24-hour storage capacity at DWF has been provided to serve Phase 1 development and the Black Box Theatre.

The existing 150mm rising main serving the existing WWPS is to be retained and reused. Uisce Éireann have confirmed that a 20m upgrade of a 150mm diameter sewer from Dyke Road to Wood Quay will be required. These works will be undertaken by UÉ.

3.2.1 Foul Pumping Station and Emergency Storage

The foul pumping station has been positioned based on the flood extents within the site. The pumping station is located so that it is above the 1 in 100-year return period event water level and as far away from all buildings as possible. In addition, the above ground elements (kiosk and control room) are located above the 1:200-year return period. IW/UÉ's minimum separation distance to be provided between pumping stations and habitable buildings is 15m which can be achieved within the site.

An emergency tank with 24-hour storage capacity at DWF has been provided to serve Phase 1 development and the Black Box Theatre.

The existing rising main is to be utilised along Dyke Road, and thus a new 25m section is to be laid running from the new WWPS to the existing rising main.

3.2.2 Confirmation of Feasibility

The Confirmation of Feasibility (CoF) was received on the 23rd of May 2024. The wastewater connection is confirmed to be feasible subject to upgrades. This letter noted the following in relation to the wastewater drainage network:

Please note, the existing Black Box pumping station would require upgrading to cater for the wastewater loading and to provide adequate emergency storage for the proposed development. Alternatively, a new Pump Station could be constructed by the customer within their own site, the new pump station (WWPS) should be designed to cater for the proposed development wastewater loading. The existing Black Box pumping station shall be decommissioned with this option, and the existing flows diverted to the new WWPS. The customer will be responsible for designing the new WWPS required for the proposed development and the diverted flows that currently discharge to the existing Black Box Pumping station.

A 20m Approx. foul sewer network upgrade from 150mm diameter to 225mm diameter minimum is required to cater the proposed development at the start of Dyke Road and Wood quay. Any such network upgrade would have to be funded by the customer.

The developer should investigate the separation of storm water and foul on their development lands and that any existing storm water which is entering into the Uisce Eireann (UE) combined system will need to be eliminated. There should be no storm water discharge to the UE network.

Please note that according to our records there is an existing sewer running through this site (see drawing below). Any structures or works over or in close proximity to Uisce Eireann infrastructure that will inhibit access for maintenance or endanger structural or functional integrity of the infrastructure are not allowed. The layout of the development must ensure that this pipe is protected, and adequate separation distances are provided between Uisce Eireann infrastructure and any structures on site. Alternatively, you may enter into a diversion agreement with Uisce Eireann and divert the pipe to accommodate your development. If you wish to proceed with this option, please contact Uisce Eireann at Diversions@water.ie and submit detailed design drawings before submitting your planning application. It will be necessary to provide a wayleave over this pipe to the benefit of Uisce Eireann and ensure that it is accessible for maintenance.

Confirmation of Feasibility for the diversion of the wastewater pipework serving the Black Box Theatre and decommissioning of the existing Dyke Road wastewater pumping station has also been received and is included in Appendix A.

3.2.3 Statement of Design Acceptance

A Statement of Design Acceptance (SoDA) has been issued by UÉ. Refer to Appendix A for details.

3.2.4 Wastewater loading

Three (3) separate PCE applications were submitted to UÉ to determine if there is capacity within the existing Uisce Éireann wastewater infrastructure to cater for the increased load associated within the increase in residents.

3.2.4.1 Phase 1

Phase 1: The Dry Weather Flow (DWF) has been calculated as 1.132 l/s while the peak daily flow (taken as 6 times the Dry Weather Flow) has been calculated as 6.800 l/s. Refer to **Table 3-1** below.

Table 3-1: Phase 1 Wastewater Loading

Source	Unit	Quantity	Flow (l/day/unit or l/s/ha)	Daily (l/day)	DWF (m^3/day)	DWF (l/s)	6xDWF (l/s)	Avg Day / Peak Wk demand (l/s)	Peak Wk Demand (l/s)
Residential Apartments	Pers	646	150	96900	96.9	1.12	6.73	1.40	2.94
Creche	Pers	20	50	1000	1.00	0.012	0.069	0.014	0.030
			Total	**7 00**	**7.**	**1.132**	**6.800**	**1.414**	**2. 70**

3.2.4.2 Phase 2

Phase 2: The Dry Weather Flow (DWF) has been calculated as 1.208 l/s while the peak daily flow (taken as 6 times the Dry Weather Flow) has been calculated as 7.248 l/s. Refer to **Table 3-2** below.

Table 3-2: Phase 2 Wastewater Loading

Source	Unit	Quantity	Flow (l/day/unit or l/s/ha)	Daily (l/day)	DWF (m^3/day)	DWF (l/s)	6xDWF (l/s)	Avg Day / Peak Wk demand (l/s)	Peak Wk Demand (l/s)
Commercial Area 0.6 l/s/ha: Community Room (1989 m^3)	Ha	0.199	0.6	10310.96	10.31	0.119	0.72	0.149	0.313
Hotel	Pers	360	250	90000	90.00	1.042	6.25	1.302	2.734
Hotel FTE	Pers	60	60	3600	3.60	0.042	0.25	0.052	0.109
Retail GIA	Employees	15	30	454.50	0.455	0.005	0.03	0.007	0.014
			Total	**105462. 8**	**105.46**	**1.208**	**7.248**	**1.510**	**3.171**

3.2.4.3 Phase 3

Phase 3: The Dry Weather Flow (DWF) has been calculated as 0.33 l/s while the peak daily flow (taken as 6 times the Dry Weather Flow) has been calculated as 1.98 l/s. Refer to **Table 3-3** below.

Table 3-3: Phase 3 Wastewater Loading

Source	Unit	Quantity	Flow (l/day/unit or l/s/ha)	Daily (l/day)	DWF (m^3/day)	DWF (l/s)	6xDWF (l/s)	Avg Day / Peak Wk demand (l/s)	Peak Wk Demand (l/s)
Residential Apartments	Pers	190	150	28500	28.5	**0.33**	**1. 8**	0.41	0.87

The proposed wastewater drainage network has been designed to achieve self-cleansing velocities of 0.75 m/s, as set out in Section 3.6 of the Code of Practice. The proposed network has been designed to convey between 2.5 and 6 times the DWF.

3.2.5 Wastewater Network Design

The following design standards and guidelines have been followed in the design of the proposed wastewater drainage network for the site:

- Uisce Éireann Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03),
- BS EN 752 – Drains and sewer systems outside buildings,
- Sewers for Adoption, 6th Edition,
- Micro Drainage Software Pipeline Design,
- All pipework will be provided at gradients that will provide velocities in the range of 0.75 m/ sec and 2.5 m/sec, when flowing half full,
- Part H Building Regulations.

The following drawings illustrate the proposed wastewater drainage network and diversions associated with the proposals:

- 60710277-ACM-XX-XX-DR-CE-00-0500,
- 60710277-ACM-XX-XX-DR-CE-00-0501,
- 60710277-ACM-XX-XX-DR-CE-00-0502 and
- 60710277-ACM-XX-XX-DR-CE-00-0503.

Please refer to Appendix C for more information on the wastewater drainage network design calculations.

4. Water Supply

4.1 Existing Water Supply Infrastructure

Utility records were obtained from Uisce Éireann (UÉ) to indicate existing watermains in the vicinity of the site. The location of the watermain was verified with a utility survey.

A 9" cast-iron watermain runs along Dyke Road. From this watermain, a water connection feeds the Black Box theatre and the Headford Road shopping centre. A 300mm asbestos-cement watermain runs in Headford Road and Bóthar Na Dige Road, while a shorter section of 100mm uPVC water distribution main runs along a short section of Headford Road.

The utility records and utility survey are included in **Appendix D**.

Refer to **Figure 4-1** for the layout of potable water infrastructure in the vicinity of the site.

Figure 4-1: Existing Watermain Infrastructure, UÉ 2024

4.1.1 Uisce Éireann Pre-Connection Enquiry

Pre-Connection Enquiries have been submitted to Uisce Éireann for

- Phase 1 only,
- Phases 1 & 2, and
- Phases 1 to 3.

On-site water storage for firefighting may be required by the Galway City Fire Service.

4.2 Proposed Water Supply Network

It is proposed to take a connection off the 250mm asbestos watermain on the Dyke Road. The new watermain will pass through the phase 1 lands and loop around 3 sides (south, east, and north) of the development.

The following drawings illustrate the proposed watermain network within the site:

- 60710277-ACM-XX-XX-DR-CE-00-2700,
- 60710277-ACM-XX-XX-DR-CE-00-2701, and
- 60710277-ACM-XX-XX-DR-CE-00-2702.

The internal water supply network is based on the requirements of the Uisce Éireann Code of Practice for Water Supply and the Technical Guidance Document – Part B of the Building Regulations 2006:

- Hydrants are positioned within 46m of the proposed buildings.
- A bulk water meter has been provided at the connection to the existing Uisce Éireann distribution watermain at the site entrance.
- No new watermain up to and including 150mm in diameter shall be laid within 3m of an existing or proposed structure. See Section 3.5.9 of Water Code of Practice.

Uisce Éireann will be consulted with regard network upgrades to accommodate future demand and consolidate the resilience of the local network.

Firefighting water supplies and fire hydrants will be provided as required in accordance with the Building Regulations and the requirement of Galway City Fire Service.

4.2.1 Confirmation of Feasibility

The Confirmation of Feasibility (CoF) was received on the 23rd of May 2024. The water connection is confirmed to be feasible without infrastructure upgrade by Uisce Éireann (UÉ). This letter noted the following in relation to the water network:

> *The water main along Dyke Road is the preferred connection point for the proposed development.*

4.2.2 Statement of Design Acceptance

A Statement of Design Acceptance (SoDA) has been issued by UÉ. Refer to Appendix A for details.

5. Access and Traffic

The existing access to the development and car park will be decommissioned and a new access to the proposed development will form as part of the proposed works. Please refer to AECOM Drawing **60710277-ACM- - -DR-CE-00-0002** & **60710277-ACM- - -DR-CE-00-0003** for the location of the access.

Please refer to the project Traffic and Transport Assessment and Mobility Management Plan reports compiled by PUNCH for further information on site accessibility.

6. Flood Risk Assessment

As part of the preliminary design of the proposed development, AECOM prepared a site-specific Stage 3 Flood Risk Assessment which describes the flood risks to the site and addresses the requirements of Galway City Development Plan (2023– 2029). This FRA has been prepared in accordance with the *Planning System and Flood Risk Management Guidelines*, (OPW, 2009).

Appendix A Uisce Éireann

7. Confirmation of Feasibility for Phase 1 Development

8. Statement of Design Compliance (SoDA)

9. Confirmation of Feasibility for Wastewater Diversion

CONFIRMATION OF FEASIBILITY

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na Cathrach Theas
Cathair Chorcaí

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Sumana Jain Kelly
Aecom
1st Floor Montrose
Carrigaline Road
Douglas
Cork
T12H90H

11 March 2025

Our Ref: CDS24001446 Pre-Connection Enquiry
Site at, Dyke Road Car Park, Galway City, Galway

Dear Applicant/Agent,

We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 219no. unit(s) and 1no. Creche unit at Site at, Dyke Road Car Park, Galway City, Galway, (the **Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection**
  - Feasible without infrastructure upgrade by Irish Water
  - **Water Treatment Plant**
    There is sufficient capacity for the proposed development.

    Water Network
    The water main along Dyke Road is the preferred connection point for the proposed development.
- **Wastewater Connection**
  - Feasible Subject to upgrades
  - **Wastewater Treatment Plant**
    There is sufficient capacity for the proposed development.

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na Cathrach Theas
Cathair Chorcaí

Uisce Éireann
PO Box 448
South City Delivery Office
Cork City

www.water.ie

Sumana Jain Kelly
1st Floor Montrose
Carrigaline Road
Douglas, Cork T12H90H

9 October 2024

**Re: Design Submission for Site at, Dyke Road Car Park, Galway City, Galway (the "Development")
(the "Design Submission") / Connection Reference No: CDS24001446**

Dear Sumana Jain Kelly,

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, Uisce Éireann has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before you can connect to our network you must sign a connection agreement with Uisce Éireann. This can be applied for by completing the connection application form at www.water.ie/connections. Uisce Éireann'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 Uisce Éireann's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Uisce Éireann does not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Uisce Éireann representative:
Name: Kyle Jackson
Email: kyle.jackson@water.ie

Yours sincerely,

Dermot Phelan
Connections Delivery Manager

Appendix A

Document Title & Revision

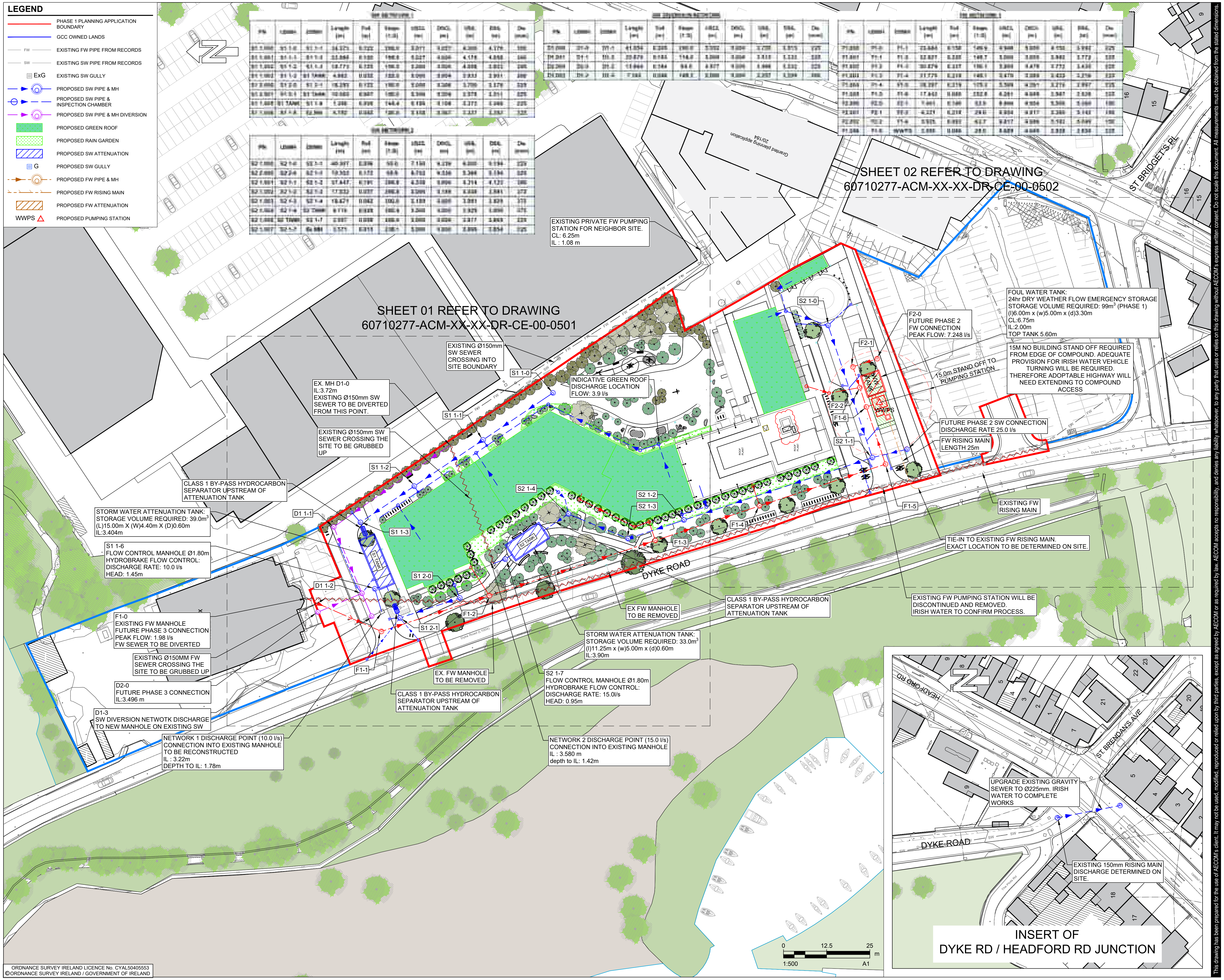
- [60710277-ACM-XX-XX-DR-CE-00-0500_P3_01_ProposedDrainage]
- [60710277-ACM-XX-XX-DR-CE-00-0501_P3_01_ProposedDrainage]
- [60710277-ACM-XX-XX-DR-CE-00-0502_P3_01_ProposedDrainage]
- [60710277-ACM-XX-XX-DR-CE-00-0503_P3_01_ProsposedWWPS]
- [60710277-ACM-XX-XX-DR-CE-00-0500_P1_01_ ProsposedWWPS]
- [60710277-ACM-XX-XX-DR-CE-00-0501_P3_01_ProposedWater]
- [60710277-ACM-XX-XX-DR-CE-00-0500_P3_01_ProposedWater01]
- [60710277-ACM-XX-XX-DR-CE-00-0501_P3_01_ProposedWater02]

Standard Details/Code of Practice Exemption:

Not applicable

*For further information, visit **www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Uisce Éireann will not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.



ISO A1 594mm x 841mm

Approved: ______ Checked: ______ Designer: ______ Project Management Initials: ______

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Last saved by: PETER.SMITH1(2024-06-28) Last Plotted: 2024-07-03

AECOM

PROJECT

Phase 1
Corrib Causeway
Dyke Road, Galway

CLIENT

Land Development Agency (LDA) / GCC

CONSULTANT

AECOM
BLOCK 6, GALWAY TECHNOLOGY PARK
PARKMORE
GALWAY, H91 W30F, IRELAND
www.aecom.com

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF THE DESIGNER.
2. ALL DIMENSIONS TO BE CHECKED BY THE CONTRACTOR ON SITE PRIOR TO COMMENCEMENT OF WORKS.
3. AECOM LIMITED TO BE INFORMED BY THE CONTRACTOR OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF WORKS ON SITE.
4. DIMENSIONS OF ALL BOUNDARIES AND ADJOINING ROADS TO BE CHECKED ON SITE PRIOR TO COMMENCEMENT OF WORKS.
5. DO NOT SCALE, ALL MEASUREMENTS AND COORDINATES TO BE CHECKED ON SITE.
6. THE LOCATION & DEPTH OF SERVICES TO BE CHECKED ON SITE PRIOR TO COMMENCING ANY WORKS.
7. MANHOLE COVERS AND FRAMES IN PUBLICLY ACCESSIBLE AREAS SHALL BE HEAVY DUTY CAST IRON, CLASS D400, DOUBLE SEALED AND LOCKABLE TYPE COMPLYING WITH BS EN 124-2:2015.
8. GULLY GRATINGS & FRAMES SHALL COMPLY WITH BS EN 124-2:2015.
9. EXISTING INVERT LEVELS TO BE VERIFIED ON SITE BEFORE COMMENCING CONSTRUCTION.
10. SURFACE WATER & FOUL SEWER PIPES LESS THAN 1.2m BELOW THE ROAD SURFACE OR LESS THAN 0.9m IN NON-TRAFFICKED FOOTPATHS AND LANDSCAPE AREAS (WITH AN ABSOLUTE MINIMUM DEPTH OF COVER ABOVE THE EXTERNAL CROWN OF THE PIPE Ø750mm) SHALL BE PROTECTED FROM DAMAGE BY PROVIDING MINIMUM 150mm THICK CONCRETE C16/20 HAUNCH IN ACCORDANCE WITH IS EN 12620.
11. CCTV SURVEY TO BE CONDUCTED PRIOR TO COMMENCEMENT OF ANY WORKS TO DETERMINE THE CONDITION AND VERIFY LEVELS OF THE EXISTING FOUL AND SURFACE WATER PIPES/ MANHOLES. ANY SUB-STANDARD OR DEFECTIVE ELEMENTS OF THE EXISTING PIPES/MANHOLES TO BE REPORTED AND CORRECTED.
13. ALL SURFACE WATER DRAINAGE DETAILS TO BE IN ACCORDANCE WITH TII SPECIFICATIONS FOR ROAD WORKS.
14. ALL FOUL DRAINAGE TO BE IN ACCORDANCE WITH THE IRISH WATER STANDARD DETAILS AND CODES OF PRACTICE.
15. CONNECTIONS TO THE EXISTING DRAINAGE NETWORK REQUIRE APPROVAL FROM IRISH WATER & GALWAY CITY COUNCIL.
16. REFER TO ARCHITECT DRAWINGS FOR ARCHITECTURAL DETAILS.
17. REFER TO LANDSCAPE ARCHITECT DRAWINGS FOR LANDSCAPING DETAILS.

AECOM PLANNING

PURPOSE

P3 PLANNING

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	05.07.2024	FOR PLANNING

PROJECT NUMBER

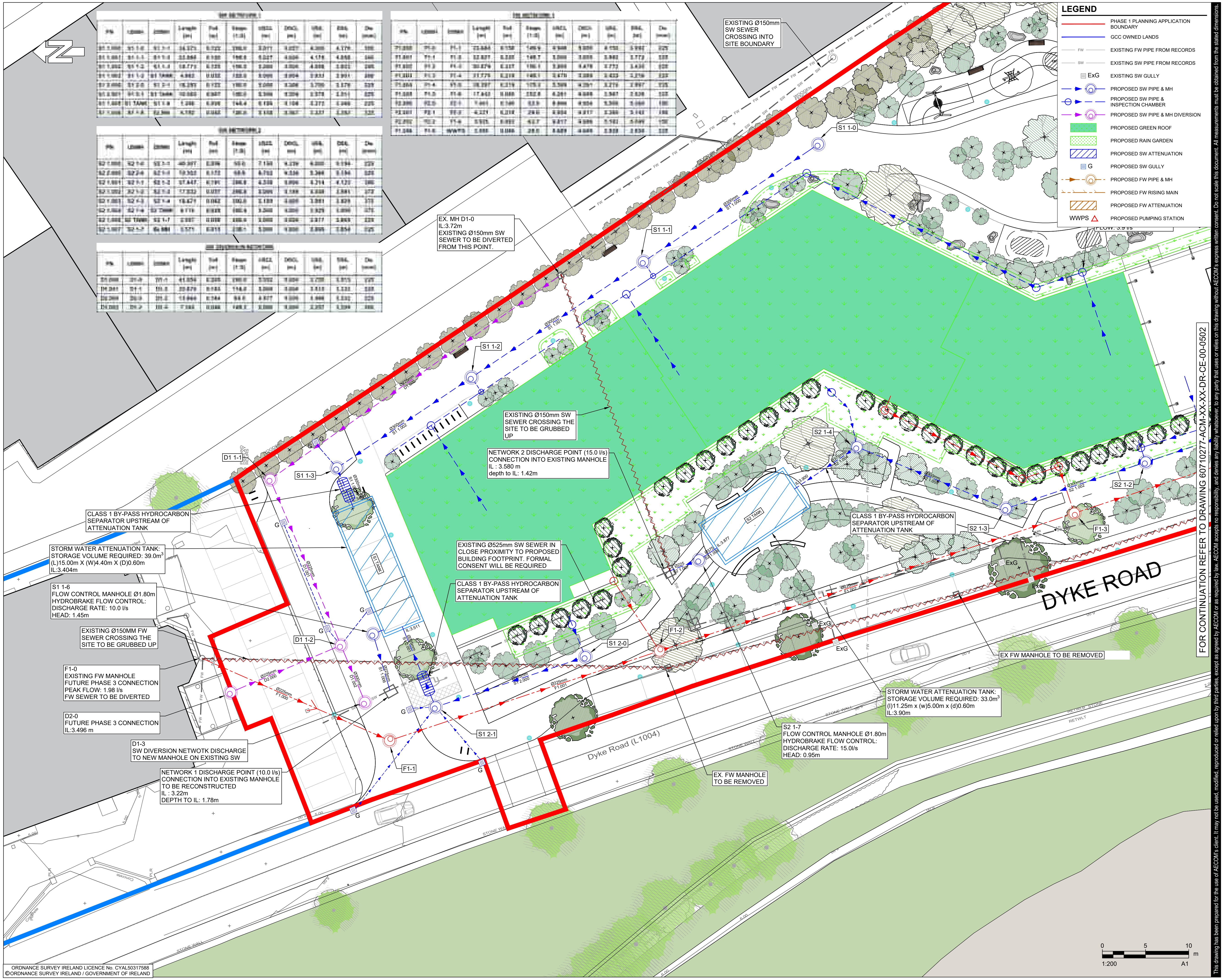
60710277

SHEET TITLE

PROPOSED DRAINAGE KEYPLAN

SHEET NUMBER

60710277-ACM-XX-XX-DR-CE-00-0500



Filename: C:\USERS\PETER.SMITH1\ONEDRIVE - AECOM\SHAREPOINT\LDA DYKE ROAD GALWAY\GENERAL\900_CAD_GIS\910_CAD\904_CE\01_WIP\02_SHEETS\60710277-ACM-XX-XX-DR-CE-00-0501_P3_01_PROPOSEDDRAINAGE.DWG
Last saved by: PETER.SMITH1(2024-06-28) Last Plotted: 2024-07-03
Project Management Initials: Designer: Checked: Approved:
ISO A1 594mm x 841mm

AECOM

PROJECT

Phase 1
Corrib Causeway
Dyke Road, Galway

CLIENT

Land Development Agency (LDA) / GCC

CONSULTANT

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9. EXISTING INVERT LEVELS TO BE VERIFIED ON SITE BEFORE COMMENCING CONSTRUCTION.
10. SURFACE WATER & FOUL SEWER PIPES LESS THAN 1.2m BELOW THE ROAD SURFACE OR LESS THAN 0.9m IN NON-TRAFFICKED FOOTPATHS AND LANDSCAPE AREAS (WITH AN ABSOLUTE MINIMUM DEPTH OF COVER ABOVE THE EXTERNAL CROWN OF THE PIPE Ø750mm) SHALL BE PROTECTED FROM DAMAGE BY PROVIDING MINIMUM 150mm THICK CONCRETE C16/20 HAUNCH IN ACCORDANCE WITH IS EN 12620.
11. CCTV SURVEY TO BE CONDUCTED PRIOR TO COMMENCEMENT OF ANY WORKS TO DETERMINE THE CONDITION AND VERIFY LEVELS OF THE EXISTING FOUL AND SURFACE WATER PIPES/ MANHOLES. ANY SUB-STANDARD OR DEFECTIVE ELEMENTS OF THE EXISTING PIPES/MANHOLES TO BE REPORTED AND CORRECTED.
13. ALL SURFACE WATER DRAINAGE DETAILS TO BE IN ACCORDANCE WITH TII SPECIFICATIONS FOR ROAD WORKS.
14. ALL FOUL DRAINAGE TO BE IN ACCORDANCE WITH THE IRISH WATER STANDARD DETAILS AND CODES OF PRACTICE.
15. CONNECTIONS TO THE EXISTING DRAINAGE NETWORK REQUIRE APPROVAL FROM IRISH WATER & GALWAY CITY COUNCIL.
16. REFER TO ARCHITECT DRAWINGS FOR ARCHITECTURAL DETAILS.
17. REFER TO LANDSCAPE ARCHITECT DRAWINGS FOR LANDSCAPING DETAILS.

AECOM PLANNING

PURPOSE

P3 PLANNING

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	05.07.2024	FOR PLANNING

PROJECT NUMBER

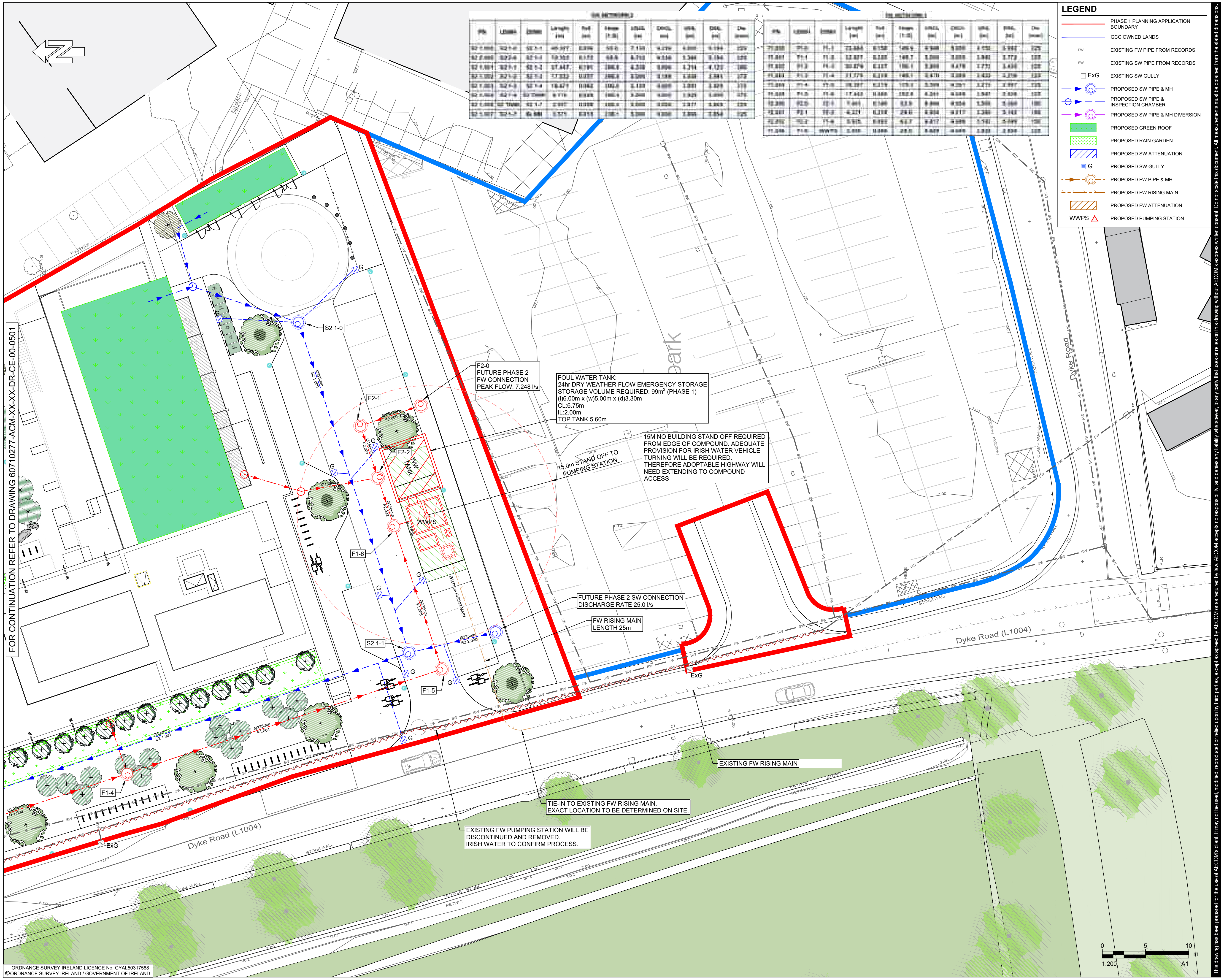
60710277

SHEET TITLE

PROPOSED DRAINAGE
SHEET 01

SHEET NUMBER

60710277-ACM-XX-XX-DR-CE-00-0501



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LEGEND

- PHASE 1 PLANNING APPLICATION BOUNDARY
- GCC OWNED LANDS
- FW — EXISTING FW PIPE FROM RECORDS
- SW — EXISTING SW PIPE FROM RECORDS
- ExG — EXISTING SW GULLY
- PROPOSED SW PIPE & MH
- PROPOSED SW PIPE & INSPECTION CHAMBER
- PROPOSED SW PIPE & MH DIVERSION
- PROPOSED GREEN ROOF
- PROPOSED RAIN GARDEN
- PROPOSED SW ATTENUATION
- G — PROPOSED SW GULLY
- PROPOSED FW PIPE & MH
- PROPOSED FW RISING MAIN
- PROPOSED FW ATTENUATION
- WWPS — PROPOSED PUMPING STATION

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Last saved by: PETER.SMITH1(2024-06-28) Last Plotted: 2024-07-03
Project Management Initials: Designer: Checked: Approved:

AECOM

PROJECT

Phase 1
Corrib Causeway
Dyke Road, Galway

CLIENT

Land Development Agency (LDA) / GCC

CONSULTANT

AECOM
BLOCK 6, GALWAY TECHNOLOGY PARK
PARKMORE
GALWAY, H91 W30F, IRELAND
www.aecom.com

NOTES

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AECOM
PLANNING

PURPOSE

P3 PLANNING

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	05.07.2024	FOR PLANNING

PROJECT NUMBER

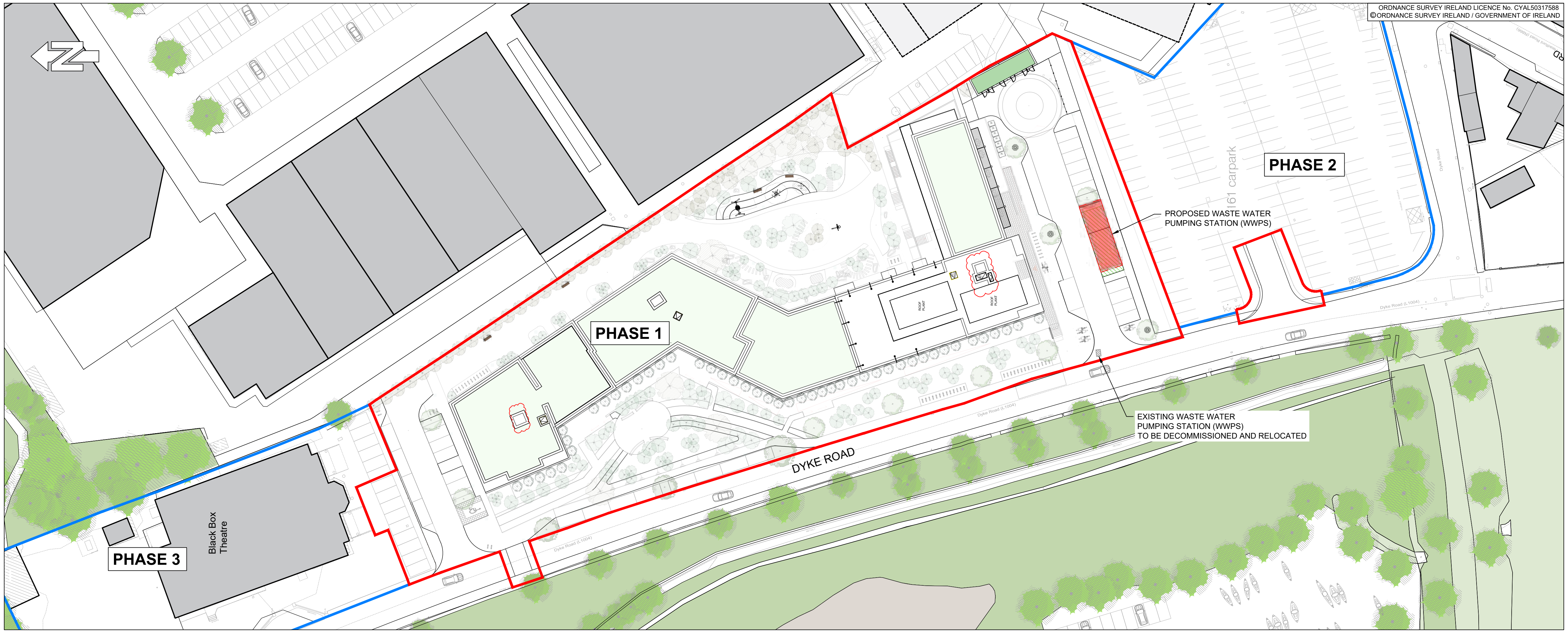
60710277

SHEET TITLE

PROPOSED DRAINAGE
SHEET 02

SHEET NUMBER

60710277-ACM-XX-XX-DR-CE-00-0502



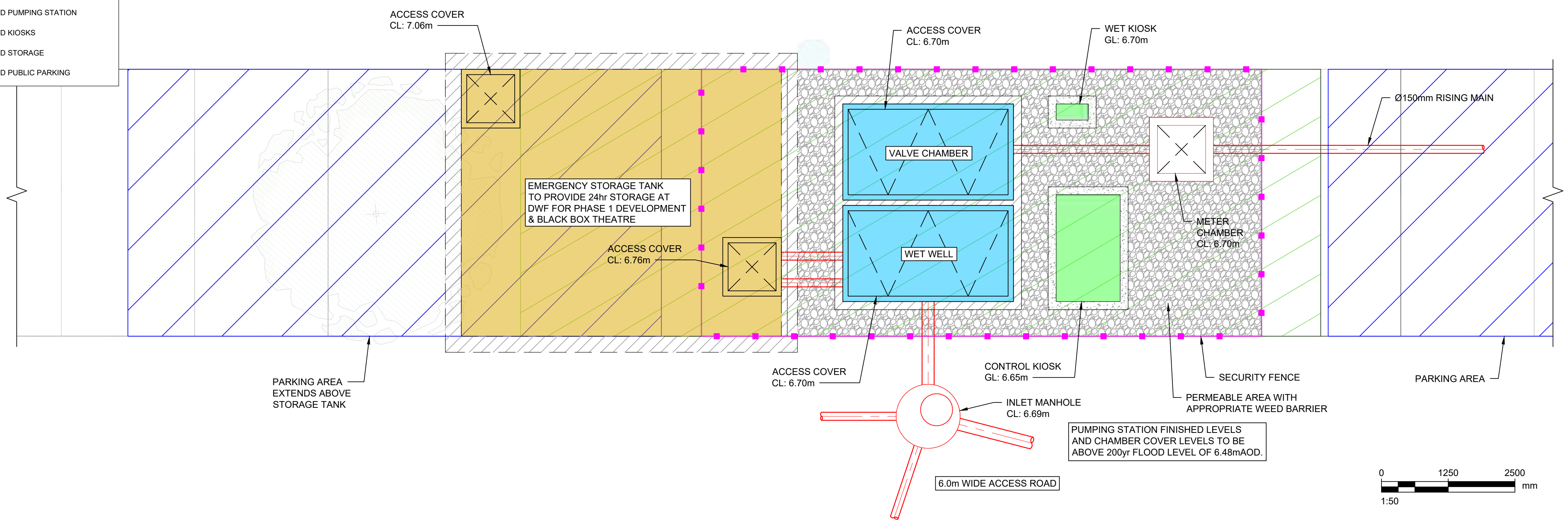
LOCATION PLAN

1:500

0 12.5 25 m

LEGEND

- PHASE 1 PROPOSED BOUNDARY
- CLIENT OWNED LAND BOUNDARY
- PROPOSED SECURITY FENCE
- PROPOSED FW PIPE
- PROPOSED PUMPING STATION
- PROPOSED KIOSKS
- PROPOSED STORAGE
- PROPOSED PUBLIC PARKING



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1:50

WWPS DETAILS

1:500

AECOM

PROJECT

Phase 1
Corrib Causeway
Dyke Road, Galway

CLIENT

Land Development Agency (LDA) / GCC

CONSULTANT

AECOM
BLOCK 6, GALWAY TECHNOLOGY PARK
PARKMORE
GALWAY, H91 W30F, IRELAND
www.aecom.com

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AECOM PLANNING

PURPOSE

P3 PLANNING

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	05.07.2024	FOR PLANNING

PROJECT NUMBER

60710277

SHEET TITLE

PROPOSED PHASE 1
WASTE WATER PUMPING STATION (WWPS)

SHEET NUMBER

60710277-ACM-XX-XX-DR-CE-00-0503

ISO A1 594mm x 841mm
Designer: Checked: Approved:
Project Management Initials:
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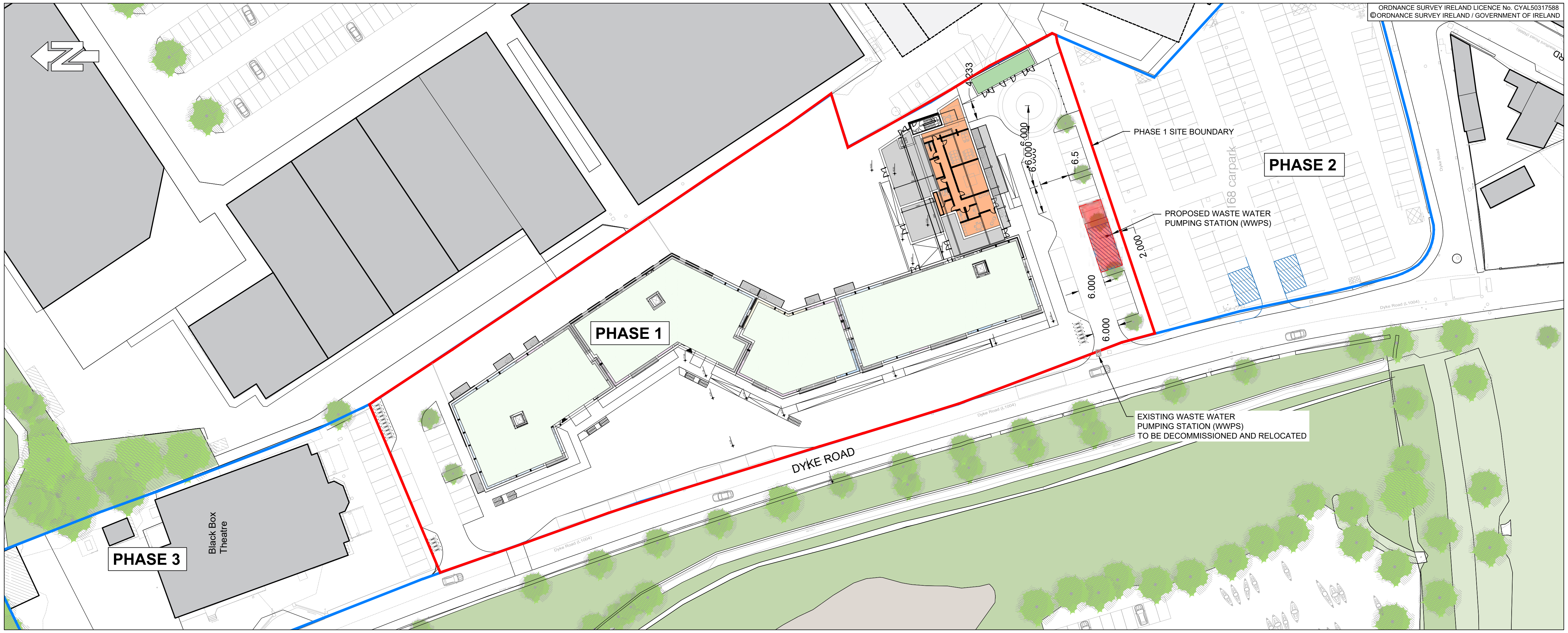
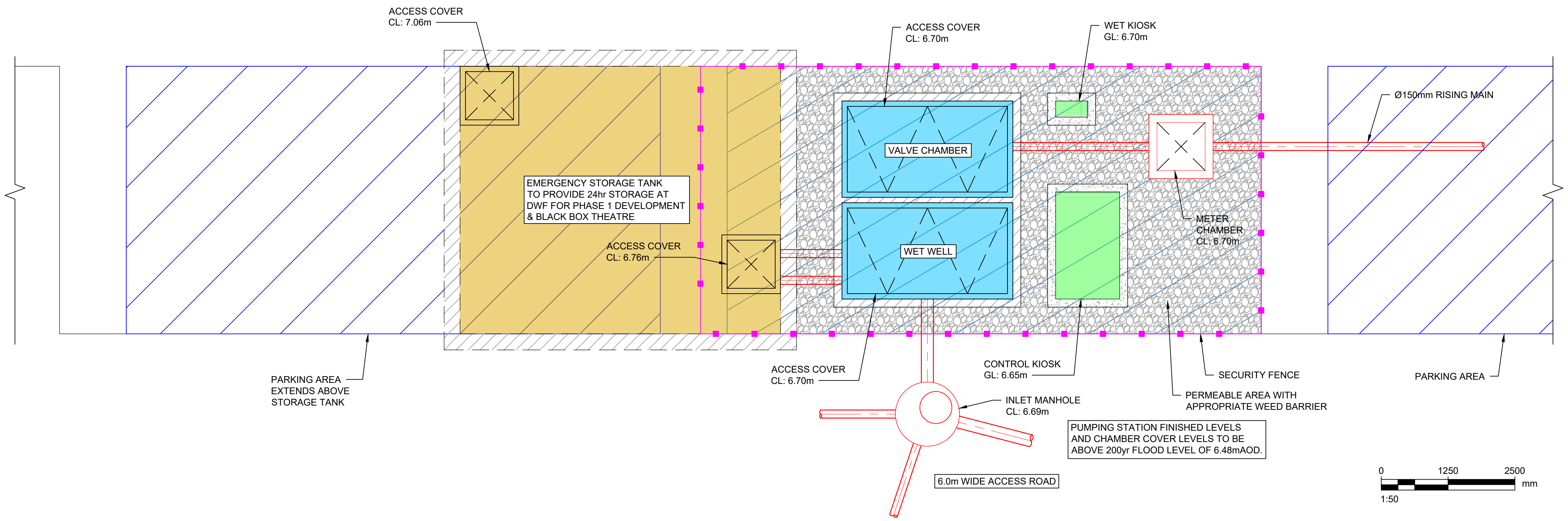


LOCATION PLAN

1:500

0 12.5 25 m



0 1250 2500 mm
1:50

WWPS DETAILS

1:500

AECOM

PROJECT
Dyke Road, Galway

CLIENT
Land Development Agency

CONSULTANT
AECOM
BLOCK 6, GALWAY TECHNOLOGY PARK
PARKMORE
GALWAY, H91 W30F, IRELAND
www.aecom.com

NOTES
1. THIS DRAWING IS A CONCEPT LAYOUT ONLY, FOR INFORMATION.
2. COORDINATES AND ELEVATIONS IN METRES TO IRISH TRANSVERSE MERCATOR (ITM) AND MALIN HEAD DATUM, UNLESS SPECIFIED OTHERWISE.
3. DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.
4. FOR PROPOSED DRAINAGE REFER TO DRAWING 60710277-ACM-XX-XX-DR-CE-00-0501.

LEGEND
- PHASE 1 PROPOSED BOUNDARY
- CLIENT OWNED LAND BOUNDARY
- PROPOSED SECURITY FENCE
- PROPOSED FW PIPE
- PROPOSED PUMPING STATION
- PROPOSED KIOSKS
- PROPOSED STORAGE
- PROPOSED PUBLIC PARKING

PURPOSE
P1 INFORMATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	05.06.2024	FIRST ISSUE FOR INFORMATION

DRAFT COPY

PROJECT NUMBER
60710277

SHEET TITLE
PROPOSED PHASE 1 WASTE WATER PUMPING STATION (WWPS)

SHEET NUMBER
60710277-ACM-XX-XX-DR-CE-00-0506

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ISO A1 594mm x 841mm

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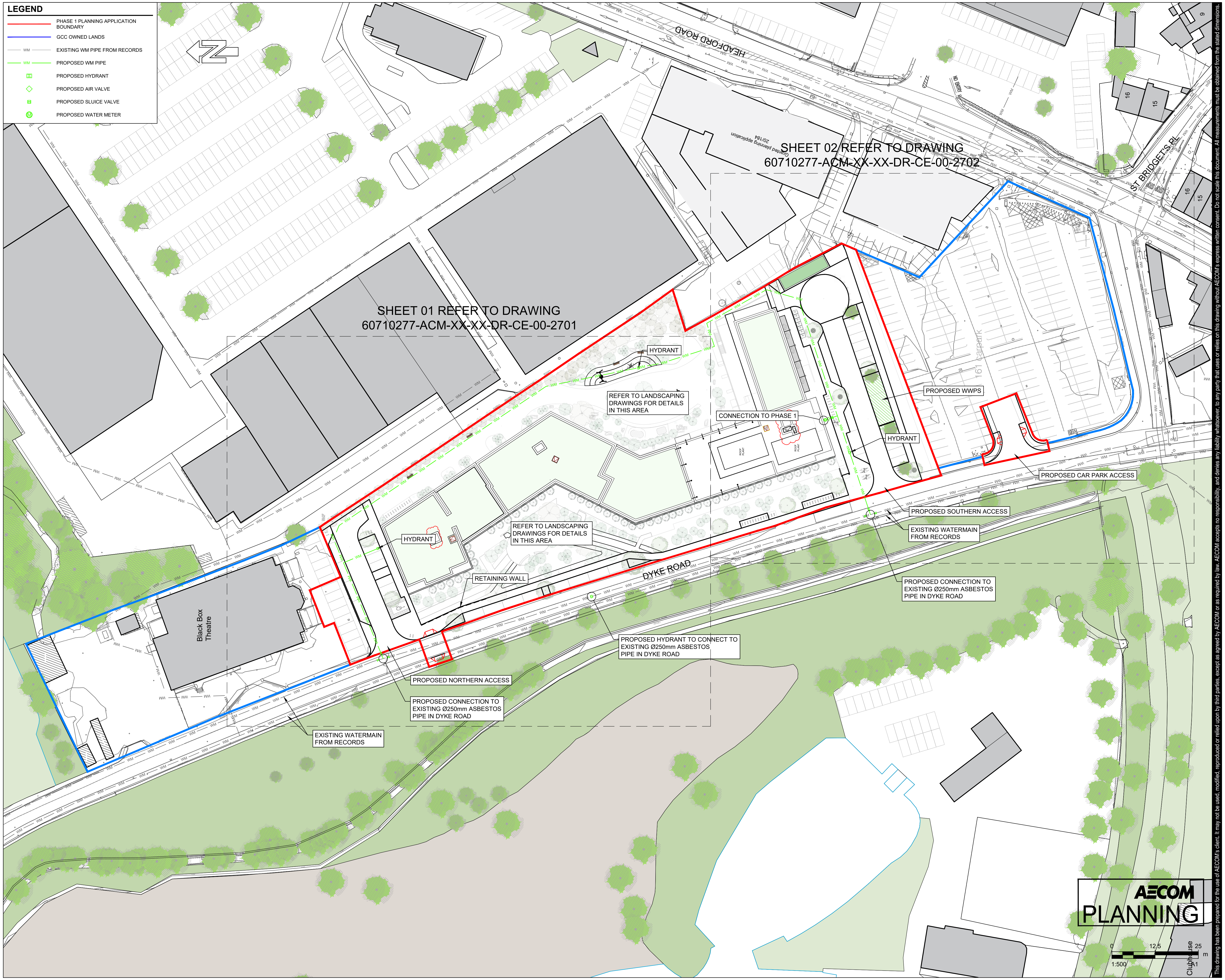

AECOM

PROJECT

Phase 1
Corrib Causeway
Dyke Road, Galway

CLIENT

Land Development Agency (LDA) / GCC

CONSULTANT

AECOM
BLOCK 6, GALWAY TECHNOLOGY PARK
PARKMORE
GALWAY, H91 W30F, IRELAND
www.aecom.com

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5. DO NOT SCALE, ALL MEASUREMENTS AND COORDINATES TO BE CHECKED ON SITE.
6. RIGID INCLUSION GROUND IMPROVEMENT TECHNIQUES TO BE EMPLOYED PRIOR TO THE CONSTRUCTION OF ANY ROADS OR BELOW GROUND SERVICES. REFER TO STRUCTURAL ENGINEERS DRAWINGS FOR DETAILS
7. THE DEVELOPMENT IS TO HAVE A BULK WATER METER (EXACT LOCATION TO BE AGREED WITH UISCE ÉIREANN) IN ACCORDANCE WITH UISCE ÉIREANN CODE OF PRACTICE SECTION 3.15.4.
8. THE CONNECTION POINT IS TO HAVE A METER INSTALLED IN ACCORDANCE WITH THE UISCE ÉIREANN CODE OF PRACTICE FOR WATER INFRASTRUCTURE SECTION 3.15.2.
9. ALL PROPOSED WATERMAIN PIPEWORK TO BE HDPE WITH MINIMUM PE80 RATING IN ACCORDANCE WITH UISCE ÉIREANN CODE OF PRACTICE FOR WATER INFRASTRUCTURE.
10. THE MINIMUM PIPE DIAMETER PROPOSED IS 150mm.
11. ALL WATERMAINS WILL HAVE A MINIMUM COVER OF 900mm. ALL SERVICE PIPES CONNECTING PROPERTIES WILL HAVE MINIMUM COVER OF 750mm.
12. HYDRANTS SHALL BE DOUBLE FLANGED DRILLED TO PN16 AND SHALL COMPLY WITH BS EN 14339, IS EN 1074 PART 6 AND 135 750. REFER TO UISCE ÉIREANN CODE OF PRACTICE FOR WATER INFRASTRUCTURE SECTION 3.16.5.
13. SLUICE VALVES HAVE BEEN PROVIDED SO THAT INDIVIDUAL SECTIONS CAN BE ISOLATED & WILL COMPLY TO BS 5163. THE DEPTH OF THE SLUICE VALVE SPINDLE CAP BELOW FINISHED GROUND WILL NOT EXCEED 300mm.
14. ALL WATERMAIN DETAILS TO BE IN ACCORDANCE WITH THE UISCE ÉIREANN INFRASTRUCTURE STANDARD DETAILS AND CODE OF PRACTICE FOR WATER INFRASTRUCTURE.
15. ALL WATERMAIN WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL AND THE CODE OF PRACTICE FOR WATER INFRASTRUCTURE DOCUMENT CDS-5030-03.
16. ALL PIPE MATERIALS SHALL BE IN COMPLIANCE WITH SECTION 3.9 OF UISCE EIREANN CODE OF PRACTICE DOCUMENT CDS-5020-03.
17. INDIVIDUAL WATER SERVICE CONNECTIONS AND BOUNDARY BOXES TO EACH DWELLING SHALL BE IN COMPLIANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-02
18. SEPARATION DISTANCES FROM OTHER SERVICES, BOUNDARY WALLS ETC. SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-11.
19. SEPARATION DISTANCES FROM TREES, SHRUBS ETC. SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-12 & 12A.
20. ON-LINE AND OFF-LINE AIR VALVE DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-22 & STD-W-23 RESPECTIVELY.
21. SLUICE VALVE DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-15.
22. ON-LINE AND OFFLINE HYDRANT DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-18 & STD-W-19 RESPECTIVELY.
23. WATER MAIN LAYOUTS SHALL BE ARRANGED IN LOOPS OR RINGS SO AS TO AVOID "DEAD ENDS" OR TERMINAL POINTS. ALL MAINS SHALL TERMINATE IN A LOOP OR RING TO ACCOMMODATE ONE-DIRECTIONAL FLUSHING OF THE NETWORK.
24. SCOUR VALVE AND CHAMBER DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-30.

PURPOSE

P3 PLANNING

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	05.07.2024	FOR PLANNING

PROJECT NUMBER

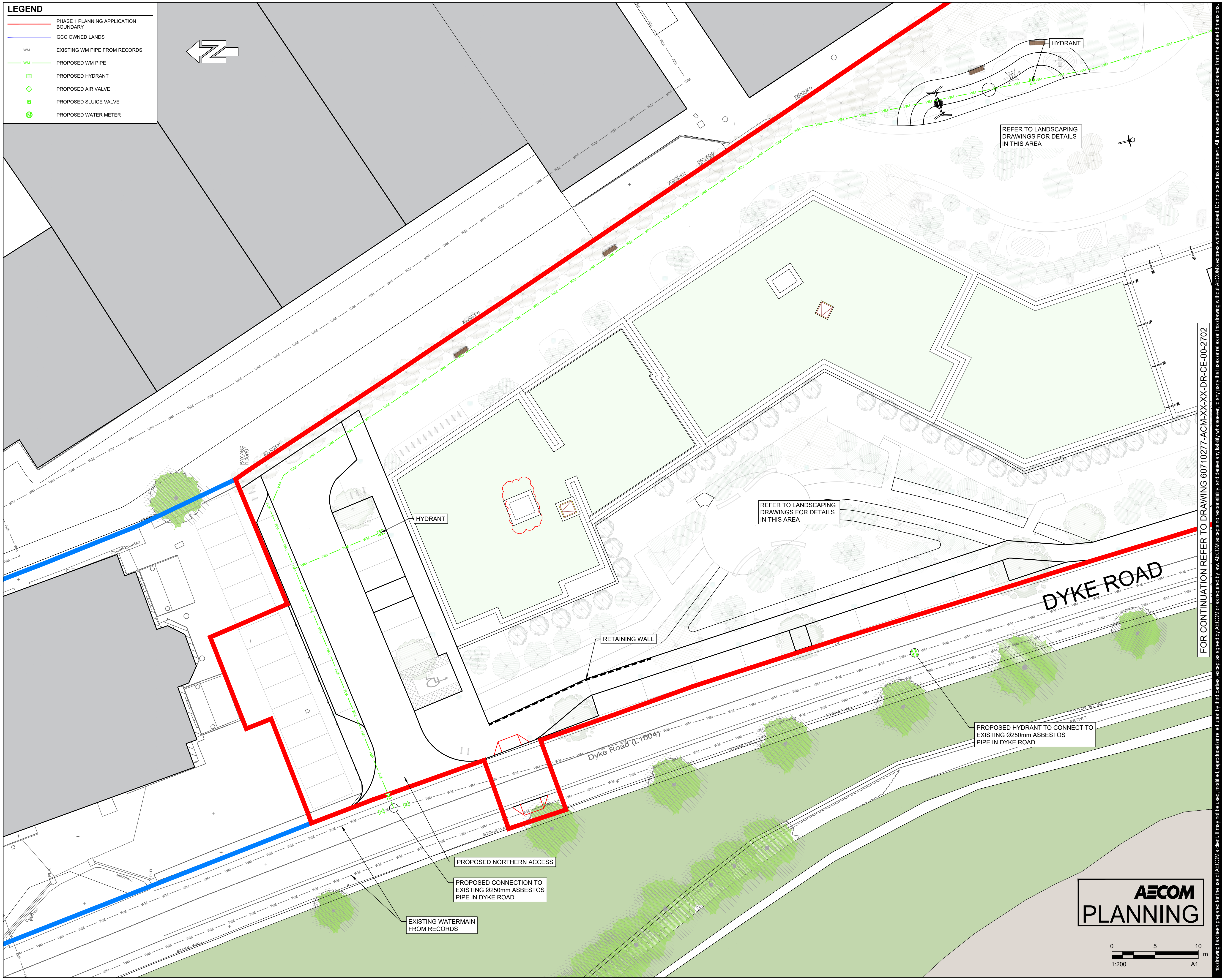
60710277

SHEET TITLE

PROPOSED WATERMAIN KEYPLAN

SHEET NUMBER

60710277-ACM-XX-XX-DR-CE-00-2700



FOR CONTINUATION REFER TO DRAWING 60710277-ACM-XX-XX-DR-CE-00-2702

AECOM PLANNING

0 5 10 m
1:200 A1

AECOM

PROJECT

Phase 1
Corrib Causeway
Dyke Road, Galway

CLIENT

Land Development Agency (LDA) / GCC

CONSULTANT

AECOM
BLOCK 6, GALWAY TECHNOLOGY PARK
PARKMORE
GALWAY, H91 W30F, IRELAND
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10. THE MINIMUM PIPE DIAMETER PROPOSED IS 150mm.
11. ALL WATERMAINS WILL HAVE A MINIMUM COVER OF 900mm. ALL SERVICE PIPES CONNECTING PROPERTIES WILL HAVE MINIMUM COVER OF 750mm.
12. HYDRANTS SHALL BE DOUBLE FLANGED DRILLED TO PN16 AND SHALL COMPLY WITH BS EN 14339, IS EN 1074 PART 6 AND 135 750. REFER TO UISCE ÉIREANN CODE OF PRACTICE FOR WATER INFRASTRUCTURE SECTION 3.16.5.
13. SLUICE VALVES HAVE BEEN PROVIDED SO THAT INDIVIDUAL SECTIONS CAN BE ISOLATED & WILL COMPLY TO BS 5163. THE DEPTH OF THE SLUICE VALVE SPINDLE CAP BELOW FINISHED GROUND WILL NOT EXCEED 300mm.
14. ALL WATERMAIN DETAILS TO BE IN ACCORDANCE WITH THE UISCE ÉIREANN INFRASTRUCTURE STANDARD DETAILS AND CODE OF PRACTICE FOR WATER INFRASTRUCTURE.
15. ALL WATERMAIN WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL AND THE CODE OF PRACTICE FOR WATER INFRASTRUCTURE DOCUMENT CDS-5030-03.
16. ALL PIPE MATERIALS SHALL BE IN COMPLIANCE WITH SECTION 3.9 OF UISCE EIREANN CODE OF PRACTICE DOCUMENT CDS-5020-03.
17. INDIVIDUAL WATER SERVICE CONNECTIONS AND BOUNDARY BOXES TO EACH DWELLING SHALL BE IN COMPLIANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-02
18. SEPARATION DISTANCES FROM OTHER SERVICES, BOUNDARY WALLS ETC. SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-11.
19. SEPARATION DISTANCES FROM TREES, SHRUBS ETC. SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-12 & 12A.
20. ON-LINE AND OFF-LINE AIR VALVE DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-22 & STD-W-23 RESPECTIVELY.
21. SLUICE VALVE DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-15.
22. ON-LINE AND OFFLINE HYDRANT DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-18 & STD-W-19 RESPECTIVELY.
23. WATER MAIN LAYOUTS SHALL BE ARRANGED IN LOOPS OR RINGS SO AS TO AVOID "DEAD ENDS" OR TERMINAL POINTS. ALL MAINS SHALL TERMINATE IN A LOOP OR RING TO ACCOMMODATE ONE-DIRECTIONAL FLUSHING OF THE NETWORK.
24. SCOUR VALVE AND CHAMBER DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-30.

PURPOSE

P3 PLANNING

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	05.07.2024	FOR PLANNING

PROJECT NUMBER

60710277

SHEET TITLE

PROPOSED WATERMAIN (SHEET 01)

SHEET NUMBER

60710277-ACM-XX-XX-DR-CE-00-2701

Filename: C:\USERS\PROPHETT\AECOM\LDA DYKE ROAD GALWAY - GENERAL\900_CAD_GIS\910_CAD\904_CE\01_WIP\02_SHEETS\60710277-ACM-XX-XX-DR-CE-00-2702_P3_01_PROPOSEDWATER02.DWG

Last saved by: PROPHETT(2024-07-25) Last Plotted: 2024-07-25

Project Management Initials: ____ Designer: ____ Checked: ____ Approved: ____ ISO A1 594mm x 841mm

AECOM

PROJECT

Phase 1
Corrib Causeway
Dyke Road, Galway

CLIENT

Land Development Agency (LDA) / GCC

CONSULTANT

AECOM
BLOCK 6, GALWAY TECHNOLOGY PARK
PARKMORE
GALWAY, H91 W30F, IRELAND
www.aecom.com

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS, ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF THE DESIGNER.
2. ALL DIMENSIONS TO BE CHECKED BY THE CONTRACTOR ON SITE PRIOR TO COMMENCEMENT OF WORKS.
3. AECOM LIMITED TO BE INFORMED BY THE CONTRACTOR OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF WORKS ON SITE.
4. DIMENSIONS OF ALL BOUNDARIES AND ADJOINING ROADS TO BE CHECKED ON SITE PRIOR TO COMMENCEMENT OF WORKS.
5. DO NOT SCALE, ALL MEASUREMENTS AND COORDINATES TO BE CHECKED ON SITE.
6. RIGID INCLUSION GROUND IMPROVEMENT TECHNIQUES TO BE EMPLOYED PRIOR TO THE CONSTRUCTION OF ANY ROADS OR BELOW GROUND SERVICES. REFER TO STRUCTURAL ENGINEERS DRAWINGS FOR DETAILS
7. THE DEVELOPMENT IS TO HAVE A BULK WATER METER (EXACT LOCATION TO BE AGREED WITH UISCE ÉIREANN) IN ACCORDANCE WITH UISCE ÉIREANN CODE OF PRACTICE SECTION 3.15.4.
8. THE CONNECTION POINT IS TO HAVE A METER INSTALLED IN ACCORDANCE WITH THE UISCE ÉIREANN CODE OF PRACTICE FOR WATER INFRASTRUCTURE SECTION 3.15.2.
9. ALL PROPOSED WATERMAIN PIPEWORK TO BE HDPE WITH MINIMUM PE80 RATING IN ACCORDANCE WITH UISCE ÉIREANN CODE OF PRACTICE FOR WATER INFRASTRUCTURE.
10. THE MINIMUM PIPE DIAMETER PROPOSED IS 150mm.
11. ALL WATERMAINS WILL HAVE A MINIMUM COVER OF 900mm. ALL SERVICE PIPES CONNECTING PROPERTIES WILL HAVE MINIMUM COVER OF 750mm.
12. HYDRANTS SHALL BE DOUBLE FLANGED DRILLED TO PN16 AND SHALL COMPLY WITH BS EN 14339, IS EN 1074 PART 6 AND 135 750. REFER TO UISCE ÉIREANN CODE OF PRACTICE FOR WATER INFRASTRUCTURE SECTION 3.16.5.
13. SLUICE VALVES HAVE BEEN PROVIDED SO THAT INDIVIDUAL SECTIONS CAN BE ISOLATED & WILL COMPLY TO BS 5163. THE DEPTH OF THE SLUICE VALVE SPINDLE CAP BELOW FINISHED GROUND WILL NOT EXCEED 300mm.
14. ALL WATERMAIN DETAILS TO BE IN ACCORDANCE WITH THE UISCE ÉIREANN INFRASTRUCTURE STANDARD DETAILS AND CODE OF PRACTICE FOR WATER INFRASTRUCTURE.
15. ALL WATERMAIN WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL AND THE CODE OF PRACTICE FOR WATER INFRASTRUCTURE DOCUMENT CDS-5030-03.
16. ALL PIPE MATERIALS SHALL BE IN COMPLIANCE WITH SECTION 3.9 OF UISCE EIREANN CODE OF PRACTICE DOCUMENT CDS-5020-03.
17. INDIVIDUAL WATER SERVICE CONNECTIONS AND BOUNDARY BOXES TO EACH DWELLING SHALL BE IN COMPLIANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-02
18. SEPARATION DISTANCES FROM OTHER SERVICES, BOUNDARY WALLS ETC. SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-11.
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20. ON-LINE AND OFF-LINE AIR VALVE DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-22 & STD-W-23 RESPECTIVELY.
21. SLUICE VALVE DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-15.
22. ON-LINE AND OFFLINE HYDRANT DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-18 & STD-W-19 RESPECTIVELY.
23. WATER MAIN LAYOUTS SHALL BE ARRANGED IN LOOPS OR RINGS SO AS TO AVOID "DEAD ENDS" OR TERMINAL POINTS. ALL MAINS SHALL TERMINATE IN A LOOP OR RING TO ACCOMMODATE ONE-DIRECTIONAL FLUSHING OF THE NETWORK.
24. SCOUR VALVE AND CHAMBER DETAILS SHALL BE IN ACCORDANCE WITH UISCE EIREANN STANDARD DETAIL STD-W-30.

PURPOSE

P3 PLANNING

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	05.07.2024	FOR PLANNING

PROJECT NUMBER

60710277

SHEET TITLE

PROPOSED WATERMAIN (SHEET 02)

SHEET NUMBER

60710277-ACM-XX-XX-DR-CE-00-2702

Wastewater Network
Please note, the existing Black Box pumping station would require upgrading to cater for the wastewater loading and to provide adequate emergency storage for the proposed development.
Alternatively, a new Pump Station could be constructed by the customer within their own site, the new pump station (WWPS) should be designed to cater for the proposed development wastewater loading. The existing Black Box pumping station shall be decommissioned with this option, and the existing flows diverted to the new WWPS. The customer will be responsible for designing the new WWPS required for the proposed development and the diverted flows that currently discharge to the existing Black Box Pumping station.

A 20m Approx. foul sewer network upgrade from 150mm diameter to 225mm diameter minimum is required to cater the proposed development at the start of Dyke Road and Wood quay. Any such network upgrade would have to be funded by the customer.

The developer should investigate the separation of storm water and foul on their development lands and that any existing storm water which is entering into the Uisce Eireann (UE) combined system will need to be eliminated. There should be no storm water discharge to the UE network.

Please note that according to our records there is an existing sewer running through this site (see drawing below). Any structures or works over or in close proximity to Uisce Eireann infrastructure that will inhibit access for maintenance or endanger structural or functional integrity of the infrastructure are not allowed. The layout of the development must ensure that this pipe is protected and adequate separation distances are provided between Uisce Eireann infrastructure and any structures on site. Alternatively you may enter into a diversion agreement with Uisce Eireann and divert the pipe to accommodate your development. If you wish to proceed with this option please contact Uisce Eireann at Diversions@water.ie and submit detailed design drawings before submitting your planning application. It will be necessary to provide a wayleave over this pipe to the benefit of Uisce Eireann and ensure that it is accessible for maintenance. For more information, please see go to the link below: https://www.water.ie/connections/developer-services/diversions/

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

Where can you find more information?

- **Section A -** What is important to know?
- **Section B -** Details of Uisce Éireann's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.

For any further information, visit **www.water.ie/connections**, **email** **newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,

Dermot Phelan
Connections Delivery Manager

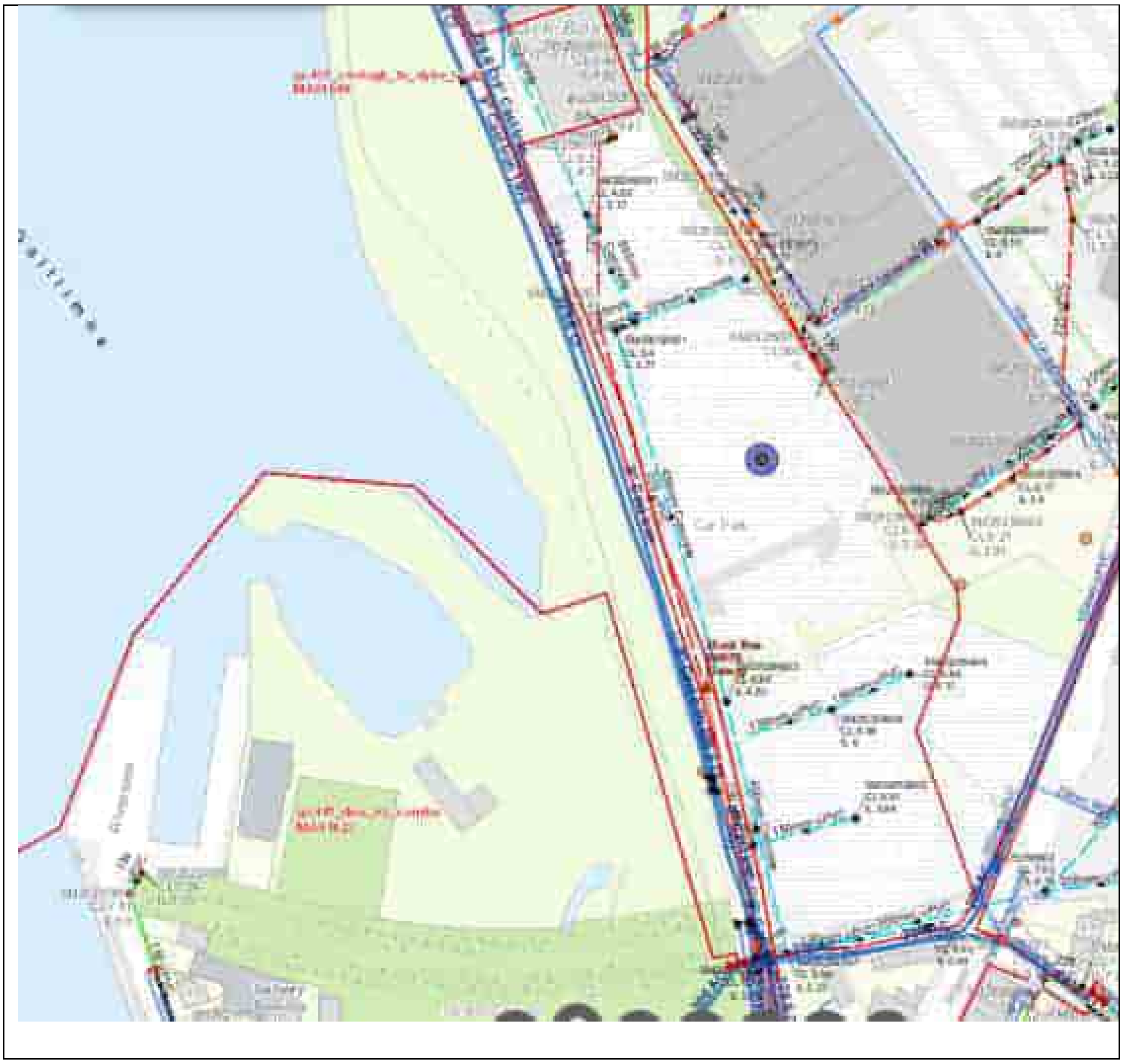
Section A - What is important to know?

What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s). • Before the Development can connect to Uisce Éireann's network(s), you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Uisce Éireann connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Uisce Éireann's network(s), including works in the public space, must be carried out by Uisce Éireann*. *Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine. • **What to do?** - Contact the relevant Local Fire Authority
Plan for disposal of storm water	• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Uisce Éireann's network(s)?	• Requests for maps showing Uisce Éireann's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this Development shall comply with ***the Uisce Éireann Connections and Developer Services Standard Details and Codes of Practice,*** available at www.water.ie/connections
Trade Effluent Licensing	• Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

Section B – Details of Uisce Éireann's Network(s)

The map included below outlines the current Uisce Éireann infrastructure adjacent the Development: To access Uisce Éireann Maps email datarequests@water.ie



Note: The information provided on the included maps as to the position of Uisce Éireann's underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Uisce Éireann.

Whilst every care has been taken in respect of the information on Uisce Éireann's network(s), Uisce Éireann assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Uisce Éireann’s underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Uisce Éireann’s underground network(s) 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.

Uisce Éireann
Teach Colvill
24-26 Sráid Thalbóid
Baile Átha Cliath 1
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Éire

Uisce Éireann
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D01 NP86
Ireland

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www.water.ie

Emma McKendrick,
AECOM,
Block 6,
Galway Technology Park,
Parkmore,
Galway

5 December 2024

Dear Emma,

Re: Diversion Reference DIV24324 Diversion enquiry. Subject to contract | Contract denied

Uisce Éireann has reviewed your enquiry in relation to a diversion of Uisce Éireann's 225mm uPVC sewer as part of the proposed Development at Dyke Road Carpark, Galway as indicated on drawing no. 60710277-ACM-XX-XX-DR-CE-00-0501 Rev02 and 60710277-ACM-XX-XX-DR-CE-00-05 Rev 01.

Based upon the details you have provided with your enquiry and as assessed by Uisce Éireann, we wish to advise you that, subject to valid agreement/s being put in place, the proposed diversion can be facilitated.

A deed of easement will be required over the diverted sewer.

You are advised that this correspondence does not constitute an agreement in whole or in part to provide a diversion or to build near any Uisce Éireann infrastructure and is provided subject to diversion agreement being executed at a later date. You are advised to make contact with the diversions team at diversions@water.ie once planning permission has been granted and prior to any works commencing on site in order to enter into a diversion agreement with Uisce Éireann Water.

If you have any further questions, please contact Niall Byrne from the diversions team on 087 165 7337 or email niall.byrne@water.ie. For further information, visit **www.water.ie/connections.**

Yours sincerely,

D Phelan

Dermot Phelan
Connections Delivery Manager

Appendix B Surface Water Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	17.200	Add Flow / Climate Change (%)	20
Ratio R	0.300	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.000
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)	200

Designed with Level Soffits

Network Design Table for Storm 1

« - Indicates pipe capacity < flow

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 1.000	24.373	0.122	200.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1 1.001	23.988	0.120	199.9	0.285	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1 1.002	18.773	0.125	150.0	0.035	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1 1.003	4.863	0.032	152.0	0.036	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1 1.004	14.666	0.029	500.0	0.000	0.00	0.0	0.600	[]	-1	Pipe/Conduit	
S1 2.000	18.293	0.122	150.0	0.020	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1 2.001	10.065	0.067	150.0	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1 2.002	2.237	0.015	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1 1.005	1.300	0.009	144.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1 1.006	6.782	0.045	150.0	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 1.000	50.00	4.37	4.300	0.000	0.0	0.0	0.0	1.11	78.3	0.0
S1 1.001	50.00	4.73	4.178	0.285	0.0	0.0	7.7	1.11	78.3	46.3
S1 1.002	50.00	4.97	4.058	0.320	0.0	0.0	8.7	1.28	90.6	52.0
S1 1.003	50.00	5.04	3.933	0.356	0.0	0.0	9.6	1.27	90.0	57.8
S1 1.004	50.00	5.16	3.404	0.356	0.0	0.0	9.6	1.90	15175.3	57.8
S1 2.000	50.00	4.29	3.700	0.020	0.0	0.0	0.5	1.07	42.4	3.2
S1 2.001	50.00	4.44	3.578	0.053	0.0	0.0	1.4	1.07	42.4	8.6
S1 2.002	50.00	4.48	3.511	0.053	0.0	0.0	1.4	1.07	42.4	8.6
S1 1.005	50.00	5.18	3.375	0.409	0.0	0.0	11.1	1.09	43.2«	66.5
S1 1.006	50.00	4.11	3.337	0.000	10.0	0.0	1.7	1.07	42.4	10.0

Manhole Schedules for Storm 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1 1-0	5.071	0.771	Open Manhole	1500	S1 1.000	4.300	300				
S1 1-1	5.027	0.849	Open Manhole	1350	S1 1.001	4.178	300	S1 1.000	4.178	300	
S1 1-2	5.000	0.942	Open Manhole	1350	S1 1.002	4.058	300	S1 1.001	4.058	300	
S1 1-3	5.000	1.067	Open Manhole	1350	S1 1.003	3.933	300	S1 1.002	3.933	300	
S1 1-4	5.004	1.600	Open Manhole	1500	S1 1.004	3.404	-1	S1 1.003	3.901	300	
S1 2-0	5.000	1.300	Open Manhole	1200	S1 2.000	3.700	225				
S1 2-1	5.306	1.728	Open Manhole	1200	S1 2.001	3.578	225	S1 2.000	3.578	225	
S1 2-2	5.209	1.698	Open Manhole	1200	S1 2.002	3.511	225	S1 2.001	3.511	225	
S1 1-5	5.186	1.811	Open Manhole	1500	S1 1.005	3.375	225	S1 1.004	3.375	-1	
								S1 2.002	3.496	225	121
S1 1-6	5.108	1.771	Open Manhole	1800	S1 1.006	3.337	225	S1 1.005	3.366	225	29
S1 Ex MH	5.067	1.775	Open Manhole	525		OUTFALL		S1 1.006	3.292	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1 1-0	529879.590	725989.868	529879.590	725989.868	Required	
S1 1-1	529865.991	726010.095	529865.991	726010.095	Required	
S1 1-2	529852.608	726030.003	529852.608	726030.003	Required	
S1 1-3	529842.136	726045.583	529842.136	726045.583	Required	
S1 1-4	529837.643	726043.722	529837.643	726043.722	Required	
S1 2-0	529820.276	726016.828	529820.276	726016.828	Required	
S1 2-1	529814.467	726034.174	529814.467	726034.174	Required	
S1 2-2	529823.777	726038.000	529823.777	726038.000	Required	
S1 1-5	529823.405	726040.206	529823.405	726040.206	Required	
S1 1-6	529822.907	726041.407	529822.907	726041.407	Required	
S1 Ex MH	529816.410	726039.462			No Entry	

PIPELINE SCHEDULES for Storm 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1 1.000	o	300	S1 1-0	5.071	4.300	0.471	Open Manhole	1500
S1 1.001	o	300	S1 1-1	5.027	4.178	0.549	Open Manhole	1350
S1 1.002	o	300	S1 1-2	5.000	4.058	0.642	Open Manhole	1350
S1 1.003	o	300	S1 1-3	5.000	3.933	0.767	Open Manhole	1350
S1 1.004	[]	-1	S1 1-4	5.004	3.404	0.800	Open Manhole	1500
S1 2.000	o	225	S1 2-0	5.000	3.700	1.075	Open Manhole	1200
S1 2.001	o	225	S1 2-1	5.306	3.578	1.503	Open Manhole	1200
S1 2.002	o	225	S1 2-2	5.209	3.511	1.473	Open Manhole	1200
S1 1.005	o	225	S1 1-5	5.186	3.375	1.586	Open Manhole	1500
S1 1.006	o	225	S1 1-6	5.108	3.337	1.546	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1 1.000	24.373	200.0	S1 1-1	5.027	4.178	0.549	Open Manhole	1350
S1 1.001	23.988	199.9	S1 1-2	5.000	4.058	0.642	Open Manhole	1350
S1 1.002	18.773	150.0	S1 1-3	5.000	3.933	0.767	Open Manhole	1350
S1 1.003	4.863	152.0	S1 1-4	5.004	3.901	0.803	Open Manhole	1500
S1 1.004	14.666	500.0	S1 1-5	5.186	3.375	1.011	Open Manhole	1500
S1 2.000	18.293	150.0	S1 2-1	5.306	3.578	1.503	Open Manhole	1200
S1 2.001	10.065	150.0	S1 2-2	5.209	3.511	1.473	Open Manhole	1200
S1 2.002	2.237	150.0	S1 1-5	5.186	3.496	1.465	Open Manhole	1500
S1 1.005	1.300	144.4	S1 1-6	5.108	3.366	1.517	Open Manhole	1800
S1 1.006	6.782	150.0	S1 Ex MH	5.067	3.292	1.550	Open Manhole	525

Free Flowing Outfall Details for Storm 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1 1.006	S1 Ex MH	5.067	3.292	3.220	525	0

Simulation Criteria for Storm 1

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

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	2
Number of Online Controls	1	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.100	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for Storm 1

Hydro-Brake® Optimum Manhole: S1 1-6, DS/PN: S1 1.006, Volume (m³): 4.5

Unit Reference	MD-SHE-0139-1000-1450-1000	Sump Available	Yes
Design Head (m)	1.450	Diameter (mm)	139
Design Flow (l/s)	10.0	Invert Level (m)	3.337
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	**Head (m)**	**Flow (l/s)**	**Control Points**	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.450	10.0	Kick-Flo®	0.911	8.0
Flush-Flo™	0.430	10.0	Mean Flow over Head Range	-	8.7

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	5.0	0.800	9.1	2.000	11.6	4.000	16.2	7.000	21.2
0.200	9.1	1.000	8.4	2.200	12.2	4.500	17.1	7.500	21.9
0.300	9.8	1.200	9.1	2.400	12.7	5.000	18.0	8.000	22.6
0.400	10.0	1.400	9.8	2.600	13.2	5.500	18.8	8.500	23.2
0.500	10.0	1.600	10.5	3.000	14.1	6.000	19.6	9.000	23.9
0.600	9.8	1.800	11.1	3.500	15.2	6.500	20.4	9.500	24.5

Storage Structures for Storm 1

Bio-Retention Area Manhole: S1 2-0, DS/PN: S1 2.000

Invert Level (m)	4.700	Infiltration Coefficient Side (m/hr)	0.00000
Porosity	0.30	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000		

Depth (m)	Area (m²)	Perimeter (m)	Depth (m)	Area (m²)	Perimeter (m)
0.000	117.0	81.000	0.300	142.0	84.000

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

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 2
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) 17.200 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.300 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

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 (%) 20, 20, 20

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)	Flooded Volume (m³)
S1 1.000	S1 1-0	15 Summer	1	+20%					4.300	-0.300	0.000
S1 1.001	S1 1-1	360 Winter	1	+20%					4.212	-0.266	0.000
S1 1.002	S1 1-2	360 Winter	1	+20%					4.098	-0.260	0.000
S1 1.003	S1 1-3	15 Winter	1	+20%					3.987	-0.246	0.000
S1 1.004	S1 1-4	30 Winter	1	+20%					3.456	-0.748	0.000
S1 2.000	S1 2-0	15 Winter	1	+20%					3.743	-0.182	0.000
S1 2.001	S1 2-1	15 Winter	1	+20%					3.647	-0.156	0.000
S1 2.002	S1 2-2	15 Winter	1	+20%					3.588	-0.148	0.000
S1 1.005	S1 1-5	30 Winter	1	+20%	100/60 Winter				3.456	-0.144	0.000
S1 1.006	S1 1-6	30 Winter	1	+20%	30/120 Winter				3.454	-0.108	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1 1.000	S1 1-0	0.00			0.0	OK	
S1 1.001	S1 1-1	0.03			2.1	OK	
S1 1.002	S1 1-2	0.04			3.4	OK	
S1 1.003	S1 1-3	0.07			4.4	OK	
S1 1.004	S1 1-4	0.00			3.7	OK	
S1 2.000	S1 2-0	0.08		5	3.1	OK	
S1 2.001	S1 2-1	0.20			7.1	OK	
S1 2.002	S1 2-2	0.25			7.1	OK	
S1 1.005	S1 1-5	0.21			6.2	OK	
S1 1.006	S1 1-6	0.21			6.2	OK	

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

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	2
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)	17.200	Cv (Summer)	0.750
Region	Scotland and Ireland	Ratio R	0.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

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 (%)	20, 20, 20

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)	Flooded Volume (m³)
S1 1.000	S1 1-0	15 Summer	30	+20%					4.300	-0.300	0.000
S1 1.001	S1 1-1	120 Winter	30	+20%					4.250	-0.228	0.000
S1 1.002	S1 1-2	120 Winter	30	+20%					4.146	-0.212	0.000
S1 1.003	S1 1-3	120 Winter	30	+20%					4.043	-0.190	0.000
S1 1.004	S1 1-4	240 Winter	30	+20%					3.588	-0.616	0.000
S1 2.000	S1 2-0	15 Winter	30	+20%					3.764	-0.161	0.000
S1 2.001	S1 2-1	15 Winter	30	+20%					3.693	-0.110	0.000
S1 2.002	S1 2-2	15 Winter	30	+20%					3.643	-0.093	0.000
S1 1.005	S1 1-5	240 Winter	30	+20%	100/60 Winter				3.588	-0.012	0.000
S1 1.006	S1 1-6	240 Winter	30	+20%	30/120 Winter				3.590	0.028	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1 1.000	S1 1-0	0.00			0.0	OK	
S1 1.001	S1 1-1	0.13			9.1	OK	
S1 1.002	S1 1-2	0.19			14.7	OK	
S1 1.003	S1 1-3	0.29			17.2	OK	
S1 1.004	S1 1-4	0.00			13.5	OK	
S1 2.000	S1 2-0	0.18		6	6.9	OK	
S1 2.001	S1 2-1	0.51			18.2	OK	
S1 2.002	S1 2-2	0.63			17.9	OK	
S1 1.005	S1 1-5	0.33			9.9	OK	
S1 1.006	S1 1-6	0.32			9.5	SURCHARGED	

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

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	2
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)	17.200	Cv (Summer)	0.750
Region	Scotland and Ireland	Ratio R	0.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

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 (%)	20, 20, 20

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)	Flooded Volume (m³)
S1 1.000	S1 1-0	15 Summer	100	+20%					4.300	-0.300	0.000
S1 1.001	S1 1-1	60 Winter	100	+20%					4.266	-0.212	0.000
S1 1.002	S1 1-2	60 Winter	100	+20%					4.164	-0.194	0.000
S1 1.003	S1 1-3	120 Winter	100	+20%					4.065	-0.168	0.000
S1 1.004	S1 1-4	240 Winter	100	+20%					3.709	-0.495	0.000
S1 2.000	S1 2-0	15 Winter	100	+20%					3.774	-0.151	0.000
S1 2.001	S1 2-1	15 Winter	100	+20%					3.713	-0.090	0.000
S1 2.002	S1 2-2	240 Winter	100	+20%					3.710	-0.026	0.000
S1 1.005	S1 1-5	240 Winter	100	+20%	100/60 Winter				3.709	0.109	0.000
S1 1.006	S1 1-6	240 Winter	100	+20%	30/120 Winter				3.710	0.148	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1 1.000	S1 1-0	0.00			0.0	OK	
S1 1.001	S1 1-1	0.19			13.1	OK	
S1 1.002	S1 1-2	0.27			21.0	OK	
S1 1.003	S1 1-3	0.40			23.9	OK	
S1 1.004	S1 1-4	0.00			17.2	OK	
S1 2.000	S1 2-0	0.24		5	8.9	OK	
S1 2.001	S1 2-1	0.67			23.7	OK	
S1 2.002	S1 2-2	0.17			4.8	OK	
S1 1.005	S1 1-5	0.35			10.4	SURCHARGED	
S1 1.006	S1 1-6	0.33			10.0	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	17.200	Add Flow / Climate Change (%)	20
Ratio R	0.300	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.000
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)	200

Designed with Level Soffits

Network Design Table for Storm 2

« - Indicates pipe capacity < flow

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
S2 1.000	40.307	0.806	50.0	0.138	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2 2.000	10.303	0.172	59.9	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2 1.001	57.447	0.191	300.8	0.047	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2 1.002	17.032	0.057	298.8	0.027	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2 1.003	18.671	0.062	300.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2 1.004	8.710	0.029	300.4	0.022	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2 1.005	11.269	0.023	500.0	0.000	0.00	0.0	0.600	[]	-2	Pipe/Conduit	
S2 1.006	2.507	0.008	300.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2 1.007	7.444	0.050	150.0	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)
S2 1.000	50.00	4.36	6.000	0.138	0.0	0.0	3.7	1.85	73.7	22.4
S2 2.000	50.00	4.10	5.366	0.000	25.0	0.0	4.2	1.69	67.3	25.0
S2 1.001	50.00	5.42	4.314	0.185	25.0	0.0	10.0	0.90	63.7	60.1
S2 1.002	50.00	5.70	4.048	0.212	25.0	0.0	10.7	1.04	115.2	64.4
S2 1.003	50.00	6.00	3.991	0.212	25.0	0.0	10.7	1.04	115.0	64.4
S2 1.004	50.00	6.14	3.929	0.234	25.0	0.0	11.3	1.04	114.9	68.0
S2 1.005	50.00	6.25	3.900	0.234	25.0	0.0	11.3	1.60	9145.2	68.0
S2 1.006	50.00	6.31	3.877	0.234	25.0	0.0	11.3	0.75	29.8«	68.0
S2 1.007	50.00	4.12	3.869	0.000	15.0	0.0	2.5	1.07	42.4	15.0

Manhole Schedules for Storm 2

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S2 1-0	7.150	1.150	Open Manhole	1200	S2 1.000	6.000	225				
S2 2-0	6.702	1.336	Open Manhole	1200	S2 2.000	5.366	225				
S2 1-1	6.336	2.022	Open Manhole	1200	S2 1.001	4.314	300	S2 1.000	5.194	225	805
								S2 2.000	5.194	225	805
S2 1-2	5.000	0.952	Open Manhole	1350	S2 1.002	4.048	375	S2 1.001	4.123	300	
S2 1-3	5.189	1.198	Open Manhole	1350	S2 1.003	3.991	375	S2 1.002	3.991	375	
S2 1-4	5.000	1.071	Open Manhole	1350	S2 1.004	3.929	375	S2 1.003	3.929	375	
S2 1-5	5.000	1.100	Open Manhole	3000	S2 1.005	3.900	-2	S2 1.004	3.900	375	
S2 1-6	5.000	1.123	Open Manhole	3000	S2 1.006	3.877	225	S2 1.005	3.877	-2	
S2 1-7	5.000	1.131	Open Manhole	1200	S2 1.007	3.869	225	S2 1.006	3.869	225	
S2 Ex MH	5.299	1.480	Open Manhole	600		OUTFALL		S2 1.007	3.819	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S2 1-0	529899.110	725910.236	529899.110	725910.236	Required	
S2 2-0	529863.275	725887.424	529863.275	725887.424	Required	
S2 1-1	529860.886	725897.446	529860.886	725897.446	Required	
S2 1-2	529842.822	725951.978	529842.822	725951.978	Required	
S2 1-3	529837.432	725968.135	529837.432	725968.135	Required	
S2 1-4	529844.564	725985.390	529844.564	725985.390	Required	
S2 1-5	529839.705	725992.619	529839.705	725992.619	Required	
S2 1-6	529832.887	726001.592	529832.887	726001.592	Required	
S2 1-7	529831.488	726003.672	529831.488	726003.672	Required	
S2 Ex MH	529824.069	726004.278			No Entry	

PIPELINE SCHEDULES for Storm 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2 1.000	o	225	S2 1-0	7.150	6.000	0.925	Open Manhole	1200
S2 2.000	o	225	S2 2-0	6.702	5.366	1.111	Open Manhole	1200
S2 1.001	o	300	S2 1-1	6.336	4.314	1.722	Open Manhole	1200
S2 1.002	o	375	S2 1-2	5.000	4.048	0.577	Open Manhole	1350
S2 1.003	o	375	S2 1-3	5.189	3.991	0.823	Open Manhole	1350
S2 1.004	o	375	S2 1-4	5.000	3.929	0.696	Open Manhole	1350
S2 1.005	[]	-2	S2 1-5	5.000	3.900	0.500	Open Manhole	3000
S2 1.006	o	225	S2 1-6	5.000	3.877	0.898	Open Manhole	3000
S2 1.007	o	225	S2 1-7	5.000	3.869	0.906	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2 1.000	40.307	50.0	S2 1-1	6.336	5.194	0.917	Open Manhole	1200
S2 2.000	10.303	59.9	S2 1-1	6.336	5.194	0.917	Open Manhole	1200
S2 1.001	57.447	300.8	S2 1-2	5.000	4.123	0.577	Open Manhole	1350
S2 1.002	17.032	298.8	S2 1-3	5.189	3.991	0.823	Open Manhole	1350
S2 1.003	18.671	300.0	S2 1-4	5.000	3.929	0.696	Open Manhole	1350
S2 1.004	8.710	300.4	S2 1-5	5.000	3.900	0.725	Open Manhole	3000
S2 1.005	11.269	500.0	S2 1-6	5.000	3.877	0.523	Open Manhole	3000
S2 1.006	2.507	300.0	S2 1-7	5.000	3.869	0.906	Open Manhole	1200
S2 1.007	7.444	150.0	S2 Ex MH	5.299	3.819	1.255	Open Manhole	600

Free Flowing Outfall Details for Storm 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S2 1.007	S2 Ex MH	5.299	3.819	0.000	600	0

Simulation Criteria for Storm 2

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

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	1
Number of Online Controls	1	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.100	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for Storm 2

Hydro-Brake® Optimum Manhole: S2 1-7, DS/PN: S2 1.007, Volume (m³): 1.3

Unit Reference	MD-SHE-0176-1500-0950-1500	Sump Available	Yes
Design Head (m)	0.950	Diameter (mm)	176
Design Flow (l/s)	15.0	Invert Level (m)	3.869
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	15.0	Kick-Flo®	0.676	12.8
Flush-Flo™	0.313	15.0	Mean Flow over Head Range	-	12.7

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	6.2	0.800	13.8	2.000	21.3	4.000	29.7	7.000	39.0
0.200	14.5	1.000	15.3	2.200	22.3	4.500	31.5	7.500	40.3
0.300	15.0	1.200	16.7	2.400	23.3	5.000	33.1	8.000	41.6
0.400	14.8	1.400	18.0	2.600	24.2	5.500	34.7	8.500	42.8
0.500	14.5	1.600	19.2	3.000	25.9	6.000	36.2	9.000	44.0
0.600	13.9	1.800	20.3	3.500	27.9	6.500	37.6	9.500	45.2

Storage Structures for Storm 2

Bio-Retention Area Manhole: S2 1-2, DS/PN: S2 1.002

Invert Level (m) 4.700 Infiltration Coefficient Side (m/hr) 0.00000
Porosity 0.30 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000

Depth (m)	Area (m²)	Perimeter (m)	Depth (m)	Area (m²)	Perimeter (m)
0.000	181.0	130.000	0.300	220.0	132.000

Bio-Retention Area Manhole: S2 1-4, DS/PN: S2 1.004

Invert Level (m) 4.700 Infiltration Coefficient Side (m/hr) 0.00000
Porosity 0.30 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000

Depth (m)	Area (m²)	Perimeter (m)	Depth (m)	Area (m²)	Perimeter (m)
0.000	118.0	87.000	0.300	145.0	90.000

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm 2

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	1
Number of Online Controls	1	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	17.200	Cv (Summer)	0.750
Region	Scotland and Ireland	Ratio R	0.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

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 (%)	20, 20, 20

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)	Flooded Volume (m³)	Flow / Cap.
S2 1.000	S2 1-0	360 Winter	1	+20%					6.012	-0.213	0.000	0.01
S2 2.000	S2 2-0	15 Summer	1	+20%					5.366	-0.225	0.000	0.00
S2 1.001	S2 1-1	15 Winter	1	+20%					4.376	-0.238	0.000	0.10
S2 1.002	S2 1-2	15 Winter	1	+20%					4.126	-0.297	0.000	0.09
S2 1.003	S2 1-3	15 Winter	1	+20%					4.071	-0.295	0.000	0.09
S2 1.004	S2 1-4	15 Winter	1	+20%					4.021	-0.283	0.000	0.14
S2 1.005	S2 1-5	30 Winter	1	+20%					3.971	-0.529	0.000	0.00
S2 1.006	S2 1-6	30 Winter	1	+20%					3.971	-0.131	0.000	0.22
S2 1.007	S2 1-7	30 Winter	1	+20%					3.968	-0.126	0.000	0.19

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S2 1.000	S2 1-0			0.8	OK	
S2 2.000	S2 2-0			0.0	OK	
S2 1.001	S2 1-1			5.8	OK	
S2 1.002	S2 1-2		8	8.9	OK	
S2 1.003	S2 1-3			8.9	OK	
S2 1.004	S2 1-4		10	11.3	OK	
S2 1.005	S2 1-5			9.1	OK	
S2 1.006	S2 1-6			6.1	OK	
S2 1.007	S2 1-7			6.1	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm 2

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	1
Number of Online Controls	1	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	17.200	Cv (Summer)	0.750
Region	Scotland and Ireland	Ratio R	0.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

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 (%)	20, 20, 20

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)	Flooded Volume (m³)	Flow / Cap.
S2 1.000	S2 1-0	120 Winter	30	+20%					6.032	-0.193	0.000	0.05
S2 2.000	S2 2-0	15 Summer	30	+20%					5.366	-0.225	0.000	0.00
S2 1.001	S2 1-1	15 Winter	30	+20%					4.419	-0.195	0.000	0.25
S2 1.002	S2 1-2	15 Winter	30	+20%					4.180	-0.243	0.000	0.25
S2 1.003	S2 1-3	15 Winter	30	+20%					4.129	-0.237	0.000	0.24
S2 1.004	S2 1-4	15 Winter	30	+20%					4.085	-0.219	0.000	0.36
S2 1.005	S2 1-5	30 Winter	30	+20%					4.033	-0.467	0.000	0.01
S2 1.006	S2 1-6	30 Winter	30	+20%					4.033	-0.069	0.000	0.44
S2 1.007	S2 1-7	30 Winter	30	+20%					4.031	-0.063	0.000	0.39

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S2 1.000	S2 1-0			3.4	OK	
S2 2.000	S2 2-0			0.0	OK	
S2 1.001	S2 1-1			15.1	OK	
S2 1.002	S2 1-2		4	23.7	OK	
S2 1.003	S2 1-3			23.2	OK	
S2 1.004	S2 1-4		6	29.3	OK	
S2 1.005	S2 1-5			23.1	OK	
S2 1.006	S2 1-6			12.2	OK	
S2 1.007	S2 1-7			12.1	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm 2

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 1
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 17.200 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.300 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

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 (%) 20, 20, 20

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)	Flooded Volume (m³)	Flow / Cap.
S2 1.000	S2 1-0	60 Winter	100	+20%					6.039	-0.186	0.000	0.07
S2 2.000	S2 2-0	15 Summer	100	+20%					5.366	-0.225	0.000	0.00
S2 1.001	S2 1-1	15 Winter	100	+20%					4.436	-0.178	0.000	0.32
S2 1.002	S2 1-2	15 Winter	100	+20%					4.202	-0.221	0.000	0.33
S2 1.003	S2 1-3	15 Winter	100	+20%					4.152	-0.214	0.000	0.32
S2 1.004	S2 1-4	15 Winter	100	+20%					4.110	-0.193	0.000	0.46
S2 1.005	S2 1-5	30 Winter	100	+20%					4.067	-0.433	0.000	0.01
S2 1.006	S2 1-6	30 Winter	100	+20%					4.067	-0.035	0.000	0.52
S2 1.007	S2 1-7	30 Winter	100	+20%					4.062	-0.032	0.000	0.45

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S2 1.000	S2 1-0			4.9	OK	
S2 2.000	S2 2-0			0.0	OK	
S2 1.001	S2 1-1			19.6	OK	
S2 1.002	S2 1-2		5	30.7	OK	
S2 1.003	S2 1-3			30.1	OK	
S2 1.004	S2 1-4		9	38.0	OK	
S2 1.005	S2 1-5			29.7	OK	
S2 1.006	S2 1-6			14.5	OK	
S2 1.007	S2 1-7			14.2	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Diversion

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	17.200	Add Flow / Climate Change (%)	20
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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)	200

Designed with Level Soffits

Network Design Table for Storm Diversion

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
D1.000	17.805	0.079	225.4	0.000	4.00	11.0	0.600	o	225	Pipe/Conduit	
D1.001	80.189	0.356	225.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
D1.002	19.124	0.085	225.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
D2.000	13.864	0.164	84.5	0.360	4.00	0.0	0.600	o	225	Pipe/Conduit	
D1.003	6.532	0.048	137.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
D3.000	14.067	0.056	250.0	0.000	4.00	11.0	0.600	o	450	Pipe/Conduit	
D3.001	59.020	0.295	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
D3.002	9.749	0.049	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
D3.003	37.209	0.248	150.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
D3.004	35.667	0.224	159.0	0.000	0.00	0.0	0.600	o	600	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)
D1.000	50.00	4.34	3.852	0.000	11.0	0.0	2.2	0.87	34.5	13.2
D1.001	50.00	5.88	3.773	0.000	11.0	0.0	2.2	0.87	34.5	13.2
D1.002	50.00	6.25	3.417	0.000	11.0	0.0	2.2	0.87	34.5	13.2
D2.000	50.00	4.16	3.496	0.000	25.0	0.0	4.2	1.42	56.6	25.0
D1.003	50.00	6.33	3.257	0.000	36.0	0.0	7.2	1.34	94.6	43.2
D3.000	50.00	4.18	4.242	0.000	11.0	0.0	2.2	1.28	203.8	13.2
D3.001	50.00	4.87	4.186	0.000	11.0	0.0	2.2	1.43	228.1	13.2
D3.002	50.00	4.98	3.891	0.000	11.0	0.0	2.2	1.43	228.1	13.2
D3.003	50.00	5.36	3.842	0.000	11.0	0.0	2.2	1.66	263.6	13.2
D3.004	50.00	4.31	3.444	0.000	15.0	0.0	2.5	1.93	545.3	15.0

Manhole Schedules for Storm Diversion

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
D1-0	5.330	1.478	Open Manhole	1200	D1.000	3.852	225				
D1-1	5.114	1.341	Open Manhole	1200	D1.001	3.773	225	D1.000	3.773	225	
D1-2	5.000	1.583	Open Manhole	1200	D1.002	3.417	225	D1.001	3.417	225	
D2-0	4.977	1.481	Open Manhole	1200	D2.000	3.496	225				
D1-3	5.000	1.743	Open Manhole	1200	D1.003	3.257	300	D1.002	3.332	225	
								D2.000	3.332	225	
D	5.000	1.791	Open Manhole	525		OUTFALL		D1.003	3.209	300	
D3-0	6.330	2.088	Open Manhole	1350	D3.000	4.242	450				
D3-1	6.278	2.092	Open Manhole	1350	D3.001	4.186	450	D3.000	4.186	450	
D3-2	6.001	2.110	Open Manhole	1350	D3.002	3.891	450	D3.001	3.891	450	
D3-3	5.886	2.044	Open Manhole	1350	D3.003	3.842	450	D3.002	3.842	450	
D3-4	5.131	1.687	Open Manhole	1500	D3.004	3.444	600	D3.003	3.594	450	
D	5.002	1.782	Open Manhole	600		OUTFALL		D3.004	3.220	600	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
D1-0	529896.296	725973.256	529896.296	725973.256	Required	
D1-1	529883.944	725986.080	529883.944	725986.080	Required	
D1-2	529839.206	726052.629	529839.206	726052.629	Required	
D2-0	529816.164	726057.896	529816.164	726057.896	Required	
D1-3	529821.607	726045.145	529821.607	726045.145	Required	
D	529815.600	726042.580			No Entry	
D3-0	529857.422	725890.199	529857.422	725890.199	Required	
D3-1	529851.166	725902.798	529851.166	725902.798	Required	
D3-2	529833.549	725959.127	529833.549	725959.127	Required	
D3-3	529835.121	725968.749	529835.121	725968.749	Required	
D3-4	529824.069	726004.278	529824.069	726004.278	Required	
D	529816.551	726039.144			No Entry	

PIPELINE SCHEDULES for Storm Diversion

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
D1.000	o	225	D1-0	5.330	3.852	1.253	Open Manhole	1200
D1.001	o	225	D1-1	5.114	3.773	1.116	Open Manhole	1200
D1.002	o	225	D1-2	5.000	3.417	1.358	Open Manhole	1200
D2.000	o	225	D2-0	4.977	3.496	1.256	Open Manhole	1200
D1.003	o	300	D1-3	5.000	3.257	1.443	Open Manhole	1200
D3.000	o	450	D3-0	6.330	4.242	1.638	Open Manhole	1350
D3.001	o	450	D3-1	6.278	4.186	1.642	Open Manhole	1350
D3.002	o	450	D3-2	6.001	3.891	1.660	Open Manhole	1350
D3.003	o	450	D3-3	5.886	3.842	1.594	Open Manhole	1350
D3.004	o	600	D3-4	5.131	3.444	1.087	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
D1.000	17.805	225.4	D1-1	5.114	3.773	1.116	Open Manhole	1200
D1.001	80.189	225.0	D1-2	5.000	3.417	1.358	Open Manhole	1200
D1.002	19.124	225.0	D1-3	5.000	3.332	1.443	Open Manhole	1200
D2.000	13.864	84.5	D1-3	5.000	3.332	1.443	Open Manhole	1200
D1.003	6.532	137.5	D	5.000	3.209	1.491	Open Manhole	525
D3.000	14.067	250.0	D3-1	6.278	4.186	1.642	Open Manhole	1350
D3.001	59.020	200.0	D3-2	6.001	3.891	1.660	Open Manhole	1350
D3.002	9.749	200.0	D3-3	5.886	3.842	1.594	Open Manhole	1350
D3.003	37.209	150.0	D3-4	5.131	3.594	1.087	Open Manhole	1500
D3.004	35.667	159.0	D	5.002	3.220	1.182	Open Manhole	600

Free Flowing Outfall Details for Storm Diversion

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
D1.003	D	5.000	3.209	3.209	525	0

Free Flowing Outfall Details for Storm Diversion

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
D3.004	D	5.002	3.220	3.220	600	0

Simulation Criteria for Storm Diversion

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.100	Storm Duration (mins)	30
Ratio R	0.300		

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

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 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 17.200 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.300 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

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 (%) 20, 20, 20

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)	Flooded Volume (m³)
D1.000	D1-0	15 Summer	1	+20%					3.945	-0.132	0.000
D1.001	D1-1	960 Winter	1	+20%					3.861	-0.137	0.000
D1.002	D1-2	15 Winter	1	+20%	30/15 Summer				3.541	-0.100	0.000
D2.000	D2-0	15 Winter	1	+20%	1/15 Summer	100/15 Summer			3.749	0.028	0.000
D1.003	D1-3	15 Winter	1	+20%	30/15 Summer				3.518	-0.039	0.000
D3.000	D3-0	15 Summer	1	+20%					4.321	-0.371	0.000
D3.001	D3-1	15 Summer	1	+20%					4.252	-0.384	0.000
D3.002	D3-2	15 Summer	1	+20%					3.968	-0.372	0.000
D3.003	D3-3	15 Summer	1	+20%					3.905	-0.387	0.000
D3.004	D3-4	15 Summer	1	+20%					3.507	-0.537	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
D1.000	D1-0	0.36			11.0	OK	
D1.001	D1-1	0.33			11.0	OK	
D1.002	D1-2	0.41			12.9	OK	
D2.000	D2-0	1.07			52.7	SURCHARGED	2
D1.003	D1-3	1.00			61.3	OK	
D3.000	D3-0	0.07			11.0	OK	
D3.001	D3-1	0.05			11.0	OK	
D3.002	D3-2	0.07			11.0	OK	
D3.003	D3-3	0.05			11.1	OK	
D3.004	D3-4	0.02			11.0	OK	

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

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	0	Number of Storage Structures	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	17.200	Cv (Summer)	0.750
Region	Scotland and Ireland	Ratio R	0.300	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

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 (%)	20, 20, 20

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)	Flooded Volume (m³)
D1.000	D1-0	15 Summer	30	+20%					3.945	-0.132	0.000
D1.001	D1-1	10080 Summer	30	+20%					3.861	-0.137	0.000
D1.002	D1-2	15 Winter	30	+20%	30/15 Summer				3.729	0.087	0.000
D2.000	D2-0	15 Winter	30	+20%	1/15 Summer	100/15 Summer			4.514	0.793	0.000
D1.003	D1-3	15 Winter	30	+20%	30/15 Summer				3.710	0.153	0.000
D3.000	D3-0	15 Summer	30	+20%					4.321	-0.371	0.000
D3.001	D3-1	15 Summer	30	+20%					4.252	-0.384	0.000
D3.002	D3-2	15 Summer	30	+20%					3.968	-0.372	0.000
D3.003	D3-3	15 Summer	30	+20%					3.905	-0.387	0.000
D3.004	D3-4	15 Summer	30	+20%					3.507	-0.537	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
D1.000	D1-0	0.36			11.0	OK	
D1.001	D1-1	0.33			11.0	OK	
D1.002	D1-2	0.60			18.8	SURCHARGED	
D2.000	D2-0	2.21			108.8	SURCHARGED	2
D1.003	D1-3	1.87			114.8	SURCHARGED	
D3.000	D3-0	0.07			11.0	OK	
D3.001	D3-1	0.05			11.0	OK	
D3.002	D3-2	0.07			11.0	OK	
D3.003	D3-3	0.05			11.1	OK	
D3.004	D3-4	0.02			11.0	OK	

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

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 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 17.200 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.300 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

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 (%) 20, 20, 20

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)	Flooded Volume (m³)	Flow / Cap.
D1.000	D1-0	15 Summer	100	+20%					3.945	-0.132	0.000	0.36
D1.001	D1-1	15 Winter	100	+20%					3.875	-0.123	0.000	0.33
D1.002	D1-2	15 Winter	100	+20%	30/15 Summer				3.826	0.184	0.000	0.72
D2.000	D2-0	15 Winter	100	+20%	1/15 Summer	100/15 Summer			4.978	1.257	0.896	2.69
D1.003	D1-3	15 Winter	100	+20%	30/15 Summer				3.802	0.245	0.000	2.27
D3.000	D3-0	15 Summer	100	+20%					4.321	-0.371	0.000	0.07
D3.001	D3-1	15 Summer	100	+20%					4.252	-0.384	0.000	0.05
D3.002	D3-2	15 Summer	100	+20%					3.968	-0.372	0.000	0.07
D3.003	D3-3	15 Summer	100	+20%					3.905	-0.387	0.000	0.05
D3.004	D3-4	15 Summer	100	+20%					3.507	-0.537	0.000	0.02

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
D1.000	D1-0			11.0	OK	
D1.001	D1-1			11.2	OK	
D1.002	D1-2			22.4	SURCHARGED	
D2.000	D2-0			132.6	FLOOD	2
D1.003	D1-3			139.4	SURCHARGED	
D3.000	D3-0			11.0	OK	
D3.001	D3-1			11.0	OK	
D3.002	D3-2			11.0	OK	
D3.003	D3-3			11.1	OK	
D3.004	D3-4			11.0	OK	

Appendix C Wastewater Drainage Calculations

FOUL SEWERAGE DESIGN

Design Criteria for Foul

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	20
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.000
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	0.000
Persons per House	3.00	Min Design Depth for Optimisation (m)	0.000
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 Inverts

Network Design Table for Foul

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	23.663	0.158	149.8	0.000	0	2.0	1.500	o	225	Pipe/Conduit	
F1.001	32.927	0.220	149.7	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.002	50.579	0.337	150.1	0.000	0	6.8	1.500	o	225	Pipe/Conduit	
F1.003	31.775	0.219	145.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.004	38.397	0.219	175.3	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F2.000	6.544	0.084	77.9	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.005	17.443	0.069	252.8	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F3.000	7.401	0.140	52.9	0.000	0	7.3	1.500	o	150	Pipe/Conduit	
F3.001	6.321	0.218	29.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F3.002	5.925	0.093	63.7	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.006	2.000	0.069	29.0	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	4.150	0.000	2.0	0	0.4	39	0.52	0.94	37.3	2.4
F1.001	3.992	0.000	2.0	0	0.4	39	0.52	0.94	37.3	2.4
F1.002	3.772	0.000	8.8	0	1.8	82	0.81	0.94	37.2	10.6
F1.003	3.435	0.000	8.8	0	1.8	81	0.82	0.95	37.9	10.6
F1.004	3.216	0.000	8.8	0	1.8	85	0.76	0.87	34.4	10.6
F2.000	3.081	0.000	0.0	0	0.0	0	0.00	1.30	51.7	0.0
F1.005	2.997	0.000	8.8	0	1.8	95	0.67	0.72	28.6	10.6
F3.000	5.500	0.000	7.3	0	1.5	67	1.15	1.21	21.3	8.8
F3.001	5.360	0.000	7.3	0	1.5	57	1.43	1.63	28.8	8.8
F3.002	5.142	0.000	7.3	0	1.5	71	1.07	1.10	19.4	8.8
F1.006	2.928	0.000	16.1	0	3.2	73	1.73	2.14	85.0	19.3

Manhole Schedules for Foul

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F1-0	4.953	0.803	Open Manhole	1200	F1.000	4.150	225				
F1-1	5.000	1.008	Open Manhole	1200	F1.001	3.992	225	F1.000	3.992	225	
F1-2	5.805	2.033	Open Manhole	1200	F1.002	3.772	225	F1.001	3.772	225	
F1-3	5.478	2.043	Open Manhole	1200	F1.003	3.435	225	F1.002	3.435	225	
F1-4	5.589	2.373	Open Manhole	1200	F1.004	3.216	225	F1.003	3.216	225	
F2-0	6.164	3.083	Open Manhole	1200	F2.000	3.081	225				
F1-5	6.261	3.264	Open Manhole	1200	F1.005	2.997	225	F1.004	2.997	225	
								F2.000	2.997	225	
F3-0	6.986	1.486	Open Manhole	1200	F3.000	5.500	150				
F3-1	6.954	1.594	Open Manhole	1200	F3.001	5.360	150	F3.000	5.360	150	
F3-2	6.817	1.675	Open Manhole	1200	F3.002	5.142	150	F3.001	5.142	150	
F1-6	6.689	3.761	Open Manhole	1200	F1.006	2.928	225	F1.005	2.928	225	
								F3.002	5.049	150	2046
FWWPS	6.689	3.830	Open Manhole	0		OUTFALL		F1.006	2.859	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F1-0	529820.352	726061.058	529820.352	726061.058	Required	
F1-1	529810.592	726039.502	529810.592	726039.502	Required	
F1-2	529820.962	726008.251	529820.962	726008.251	Required	
F1-3	529836.889	725960.245	529836.889	725960.245	Required	
F1-4	529846.896	725930.087	529846.896	725930.087	Required	
F2-0	529853.728	725889.749	529853.728	725889.749	Required	
F1-5	529858.987	725893.643	529858.987	725893.643	Required	
F3-0	529889.491	725896.046	529889.491	725896.046	Required	
F3-1	529887.143	725903.065	529887.143	725903.065	Required	
F3-2	529881.148	725901.059	529881.148	725901.059	Required	
F1-6	529875.529	725899.178	529875.529	725899.178	Required	
FWWPS	529876.164	725897.282			No Entry	

PIPELINE SCHEDULES for Foul

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	225	F1-0	4.953	4.150	0.578	Open Manhole	1200
F1.001	o	225	F1-1	5.000	3.992	0.783	Open Manhole	1200
F1.002	o	225	F1-2	5.805	3.772	1.808	Open Manhole	1200
F1.003	o	225	F1-3	5.478	3.435	1.818	Open Manhole	1200
F1.004	o	225	F1-4	5.589	3.216	2.148	Open Manhole	1200
F2.000	o	225	F2-0	6.164	3.081	2.858	Open Manhole	1200
F1.005	o	225	F1-5	6.261	2.997	3.039	Open Manhole	1200
F3.000	o	150	F3-0	6.986	5.500	1.336	Open Manhole	1200
F3.001	o	150	F3-1	6.954	5.360	1.444	Open Manhole	1200
F3.002	o	150	F3-2	6.817	5.142	1.525	Open Manhole	1200
F1.006	o	225	F1-6	6.689	2.928	3.536	Open Manhole	1200

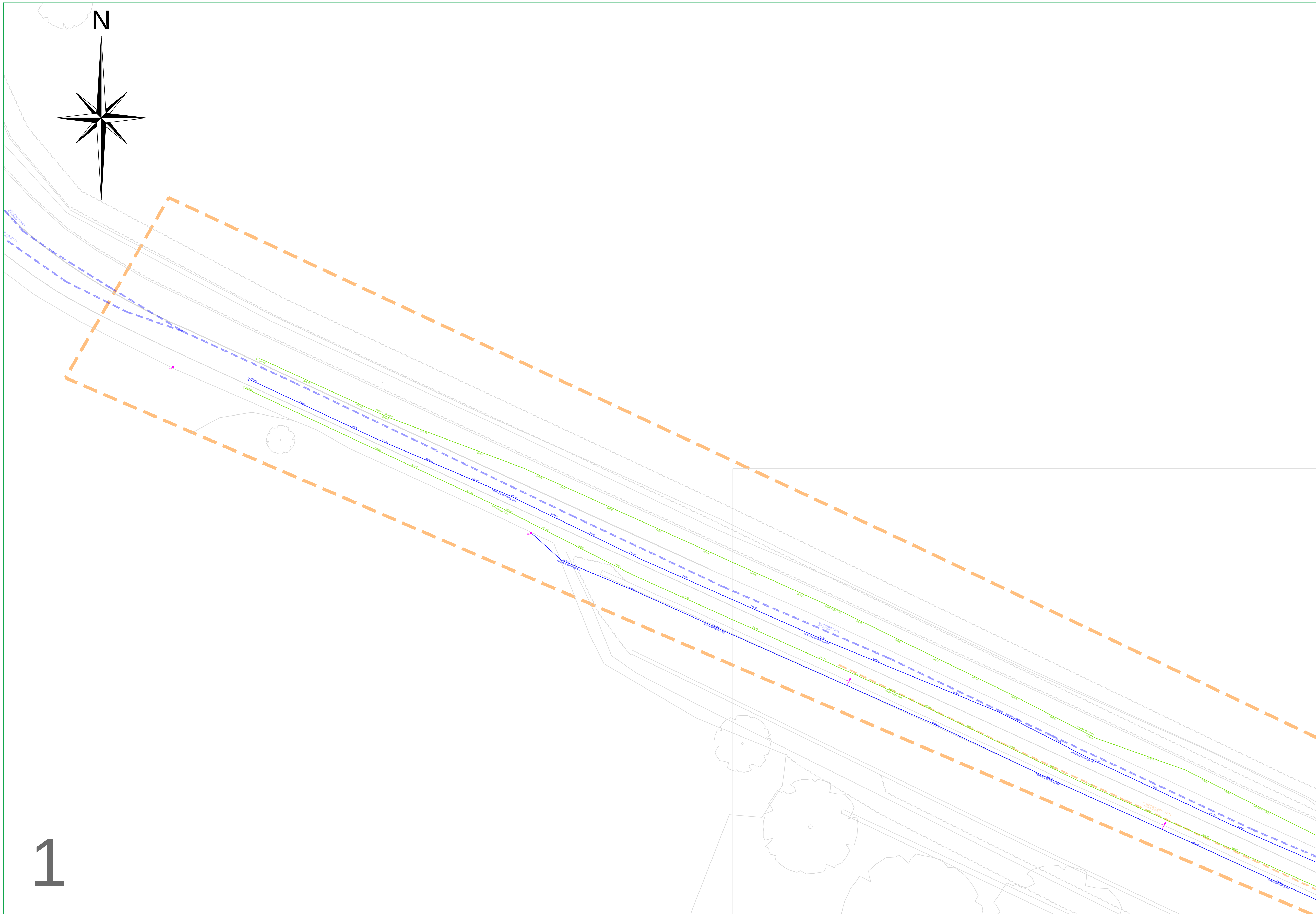
Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	23.663	149.8	F1-1	5.000	3.992	0.783	Open Manhole	1200
F1.001	32.927	149.7	F1-2	5.805	3.772	1.808	Open Manhole	1200
F1.002	50.579	150.1	F1-3	5.478	3.435	1.818	Open Manhole	1200
F1.003	31.775	145.1	F1-4	5.589	3.216	2.148	Open Manhole	1200
F1.004	38.397	175.3	F1-5	6.261	2.997	3.039	Open Manhole	1200
F2.000	6.544	77.9	F1-5	6.261	2.997	3.039	Open Manhole	1200
F1.005	17.443	252.8	F1-6	6.689	2.928	3.536	Open Manhole	1200
F3.000	7.401	52.9	F3-1	6.954	5.360	1.444	Open Manhole	1200
F3.001	6.321	29.0	F3-2	6.817	5.142	1.525	Open Manhole	1200
F3.002	5.925	63.7	F1-6	6.689	5.049	1.490	Open Manhole	1200
F1.006	2.000	29.0	FWWPS	6.689	2.859	3.605	Open Manhole	0

Free Flowing Outfall Details for Foul

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.006	FWWPS	6.689	2.859	0.000	0	0

Appendix D Utility Records and Utility Survey



PAS 128: 2014 (Quality of Survey Level Outputs):

DESKTOP UTILITY RECORDS SEARCH

QL-D	Drafted from utility records

SITE RECONNAISSANCE

QL-C	Location Demonstrated by visual reference to street furniture or evidence of previous streetworks, ie - reinstatement scars

DETECTION

QL-B4	A segment of utility suspected to exist but has not been detected by a geophysical technique
QL-B3	Horizontal location only of the utility detected by one of the geophysical techniques used
QL-B2	Horizontal and vertical location of the utility detected by one of the geophysical techniques used
QL-B1	Horizontal and vertical location of the utility detected by multiple geophysical techniques

VERIFICATION

QL-A	Horizontal and vertical location of the top and/or bottom of the utility

Apex Surveys Ltd. Disclaimer - Utility Survey

The interpretative nature and the non-intrusive, indirect and non-destructive survey methods must be taken into account when considering the results of the surveys. Therefore Apex Surveys, while using appropriate practice to execute, interpret and present the data, gives no guarantees that all underground utilities and underground structures will be located and mapped. Furthermore, Apex Surveys cannot guarantee the accuracy of the utility depths annotated on the survey drawings.
Apex Survey shall not be liable for any omissions or inaccuracies in the survey which arise due to the limitations of the survey. No liability shall attach to Apex Surveys, in any circumstances, howsoever arising, in respect of any consequential loss or damages suffered by the Client.

The following is a non-exhaustive list of the limitations of utility surveys:

The Survey aims to map existing utilities subsurface utilities and provide information with respect to pipe size, material type and drainage connectivity. However utility surveying is limited by the following guidelines and it may not be possible to accurately survey, define and locate all services and sub-surface features.

- Depth of Utility: The depth and size of a utility affect the signal response and the degree with which a utility can be located. Due to attenuation of the radar signal with depth, resolution is restricted, hence making identification of utilities more difficult with increasing depth.
- Size of Utility: The smaller the diameter of a utility the more difficult it is to locate. This difficulty increases with depth.
- Ground Conditions: The depth penetration and quality of the data depends on the ground conditions of the site. GPR Surveying works best within high resistivity material. Clay overburden can impair GPR Surveying. Poor data may be a result of areas with high conductivity.
- Utility Congestion: Where different utilities converge together into a service corridor or cross paths it becomes difficult to isolate a specific utility and to map its route. The reflected signal will display a single response to multiple utilities. Therefore multiple utilities may appear to be a single utility. Where similar services run on close proximity, separation may be impossible.
- Signal Jumping: Signal from surrounding services may 'jump' to a highly conductive line masking its true identity.
- Shadowing: (of deeper utilities by shallower objects) Shallow utilities will mask the existence of deeper utilities where they are in close proximity. Also, high reflective materials close to the surface i.e rebar may hide deeper anomalies.
- Surface Obstructions: The GPR system relies on a relatively flat and even surface on which to perform radar passes. If ground obstructions such as vehicles, organic material (long grass, scrub) or undulating ground surface are present then the acquired data will be of lower resolution and in some cases not viable.
- Loss of signal: It is not always possible to trace the entire length of each underground service.
- Connections between manholes: Connections between manhole chambers are assumed to be straight.
- Non-metallic objects: Nonmetallic objects are amongst the most difficult to trace therefore successful tracing of non-metallic pipes/ utilities may be limited.
- Fiber Optic Cables: Fiber optic cables may not be possible to locate except where laid with a built in tracer wire or similar conductor system.
- Defective / flooded manholes or pipework: It may not be possible to establish connections between flooded or defective manholes or pipework.
- Acute bends in pipework: It may not be possible to trace a pipe past an acute bend.

Accuracy estimates:

- Locational accuracy is determined by referring to the manufacturers guidelines for the detector used.
- In ideal conditions the spatial accuracies for the underground utilities may be +/- 5% for Radiodetection and +/- 10% of depth for the GPR to 2.5m deep. However variations within the subsurface, depth below the ground, close proximity of other services and local magnetic, atmospheric or ground conditions, bends, lateral service connections and any of the other limitations listed in this disclaimer may alter this estimated accuracy.
- Plan accuracies of + or - 150mm may be achieved but this figure will depend on the depth of service below ground level. However variations within the subsurface subsurface, depth below the ground, close proximity of other services and local magnetic, atmospheric or ground conditions, bends, lateral service connections and any of the other limitations listed in this disclaimer may alter this estimated accuracy.
- DP represents distance from the surface level to the top of the service/ target
- Where technically possible, depth indications will be given. These along with plan positions should be used for guidance only and wherever critical accuracy is required these should be confirmed by the client by undertaking trial excavations or similar.

Record Drawing Information

- Services which have been untraceable are shown from records where possible or available. These lines are annotated as "Taken From Records" or "From Records".
- Existing record information showing underground services is often incomplete and with unknown accuracies therefore it should be regarded as indicative only.
- Where Apex Surveys issue a utility drawing, this should be read in conjunction with all available public or private utility records.
- Apex Surveys endeavor to add relevant Public Utility record information onto the final drawing. However, we would recommend that direct contact is made with the asset owner or statutory undertaker.
- We shall not be held responsible for the accuracy, or otherwise, of the location of a service, as issued by the utility provider and therefore shown as "Taken for Records" on the drawing.

The following have been excluded from the survey:

- Location of individual service feeds to properties or buildings as access would be required into each property to apply direct connections to inlet points and this would significantly increase the scope of works, survey cost and also cause possible disruption to occupants.
- Pot ended or disconnected cables or terminated short lengths of pipe.
- Internal building services.
- Small diameter cables less than 20mm diameter or pipes less than 40mm diameter.
- Above ground services unless specifically requested.
- Lifting manholes which require longer than 10 minutes effort using standard heavy duty apparatus.

All works carried out be Apex Surveys conforms to the guidelines set out by The Survey Association (TSA) and PAS:128 Standard for utility mapping

APEX SURVEYS

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00353 1 691 0156

STREET FURNITURE :

BOLLARDS	BD
BUS STOP	BS
CRASH BARRIER	CB
GATE	
ELECTRICITY POLE	EP
TELEPHONE POLE	TP
EARTHING ROD	ER
LAMP POST	LP
MARKER POST	MKR
SIGN POST	SIGN
TRAFFIC LIGHT	TL
TELEPHONE BOX	TB
POST	POST
POST BOX	POST BOX
ROADSIGN	RS · RS
BORE HOLE	BH
TRIAL PIT	TPIT
BOTTOM OF CHAMBER	BOC
CAST-IRON	C/I
CONCRETE	CONC
DIAMETER	DIA

SERVICES :

AIR VALVE	AV
ARMSTRONG JUNCTION	AJ
CABLE TV IC	CATV
COVER LEVEL	CL
EIRCOM COVER	EIRCOM
EIRCOM JUNCTION BOX	EIRCOM BOX
ELECTRICAL CABLE PIT	ECP
ESAT COVER	ESAT
ESB COVER	ESB
ESB JUNCTION BOX	ESB BOX
FIRE HYDRANT	FH
GAS VALVE	GV
GULLY	G
INSPECTION COVER	IC
MANHOLE	MH
SEPTIC TANK	SEPTIC
SLUICE VALVE	SV
DOWNPIPE	DP
EARTHENWARE	E/W
NO FURTHER TRACE	NFT
OFFSITE	O/S

STOPCOCK	ST
SERVICE BOX (UNKNOWN)	BOX
TRAFFIC COVER	TLIC
VENT	VENT
WATER METER	WM

LEVELS :

BED LEVEL	BED101.50
FLOOR LEVEL	FL101.50
INVERT LEVEL	IL101.50
ROAD LEVEL	101.50
SOFFIT LEVEL	SL101.50
SPOT LEVEL	101.50
TOP OF WALL LEVEL	TOW101.50
WATER LEVEL	WL101.50
SURVEY CONTROL STATION	
START OF RUN	SOR
UNABLE TO OPEN	UTO
UNABLE TO TRACE	UTT

UNDERGROUND LEGEND :

WATER MAIN	WATER
GAS MAIN	GAS
STORM DRAIN	STORM
FOUL SEWER	FOUL
COMBINED SEWER	COMB
ELECTRIC CABLE	POWER
ELECTRIC LIGHTING	LIGHTING
EIRCOM	EIRCOM
FIBRE OPTIC CABLE	F.OPTIC
BROADBAND	BROADBAND
CABLE TV	TV
TRAFFIC AND SIGNAL CABLE	TRAFFIC
CCTV	CCTV
IRRIGATION PIPE	IRRIGATION
EMPTY DUCT	EMPTY
GPR ANOMALY	ANOMALY
UNKNOWN CABLE	CABLE
O/HEAD ELECTRICITY	OE
O/HEAD TELECOM	OT

SHEET LAYOUT :

PLAN PRODUCED BY:

APEX SURVEYS

CONTACT INFORMATION:

Apex Surveys
Unit 78 Dunboyne Business Park
Dunboyne, Co. Meath, Ireland
www.apexsurveys.ie
info@apexsurveys.ie
00353 1 691 0156

CLIENT:

Aecom

GRID SYSTEM:	Irish Transverse Mercator
DATUM:	Malin Head (OSGM15)
NOTES:	Drawing Contains Scale Factor

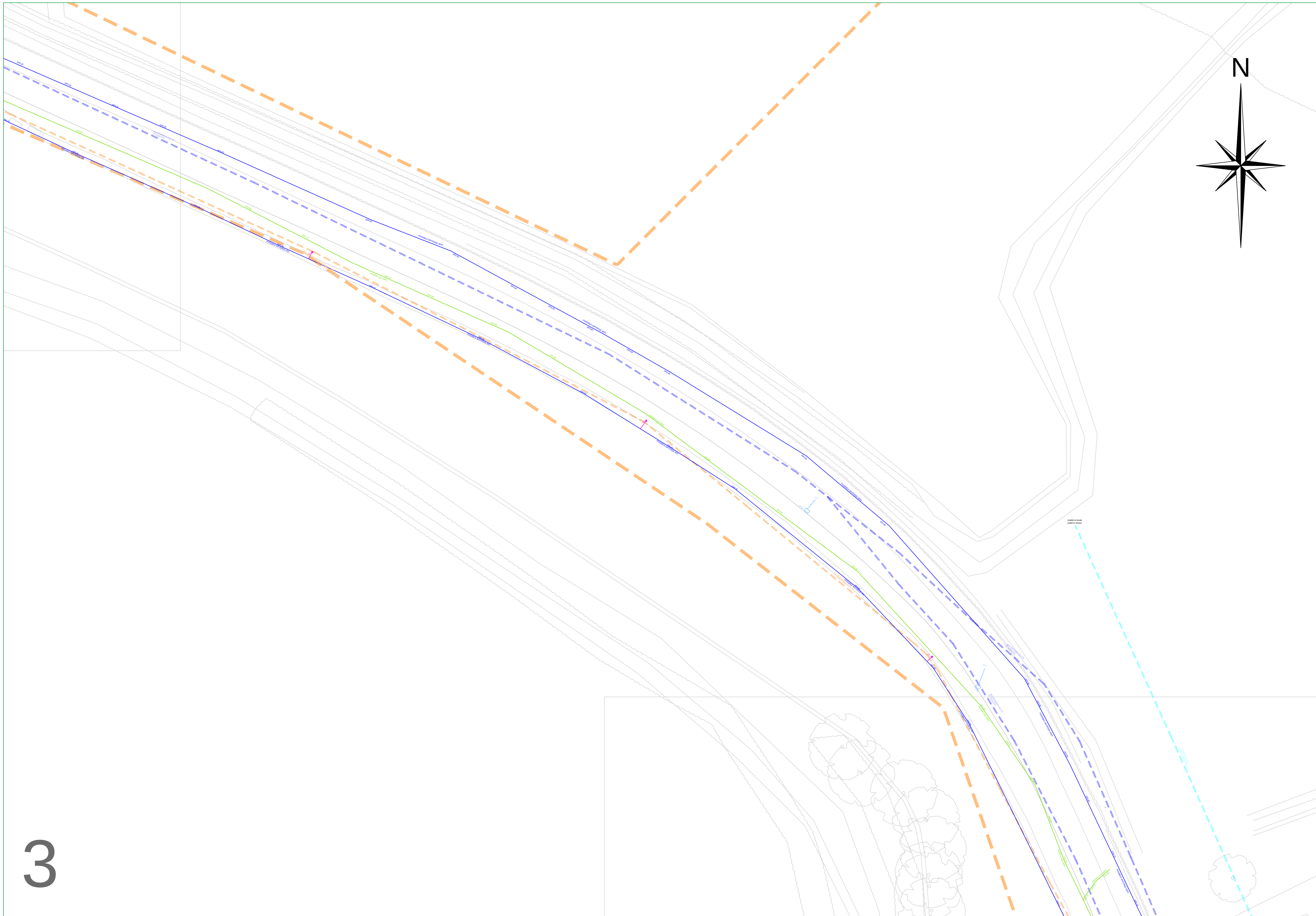
REVISIONS:

No.	Date	Description
001	00/00	Original Drawing
002	19/12/23	Anomalies Updated

PROJECT:

Dyke Road, Galway

SCALE :	1/200 A1	DATE :	10/11/2023
DRG No:	5999	DESCRIPTION :	2D Utilities
		SURVEYED BY :	K.K.
SHEET:	1 of 11	PROCESSED BY :	J.P.
		CHECKED BY :	Alan Brady



PAS 128: 2014 (Quality of Survey Level Outputs):

DESKTOP UTILITY RECORDS SEARCH	
QL-D	Drafted from utility records
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QL-C	Location Demonstrated by visual reference to street furniture or evidence of previous streetworks, ie - reinstatement scars
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VERIFICATION	
QL-A	Horizontal and vertical location of the top and/or bottom of the utility

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- Size of Utility: The smaller the diameter of a utility the more difficult it is to locate. This difficulty increases with depth.
- Ground Conditions: The depth penetration and quality of the data depends on the ground conditions of the site. GPR Surveying works best within high resistivity material. Clay overburden can impair GPR Surveying. Poor data may be a result of areas with high conductivity.
- Utility Congestion: Where different utilities converge together into a service corridor or cross paths it becomes difficult to isolate a specific utility and to map its route. The reflected signal will display a single response to multiple utilities. Therefore multiple utilities may appear to be a single utility. Where similar services run on close proximity, separation may be impossible.
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BOLLARDS	BD
BUS STOP	BS
CRASH BARRIER	CB
GATE	
ELECTRICITY POLE	EP
TELEPHONE POLE	TP
EARTHING ROD	ER +
LAMP POST	LP
MARKER POST	MKR +
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BORE HOLE	BH +
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STOPCOCK	ST
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WATER METER	WM +

LEVELS :

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INVERT LEVEL	+ IL101.50
ROAD LEVEL	+ 101.50
SOFFIT LEVEL	+ SL101.50
SPOT LEVEL	+ 101.50
TOP OF WALL LEVEL	+ TOW101.50
WATER LEVEL	+ WL101.50
SURVEY CONTROL STATION	

BOTTOM OF CHAMBER	BOC
CAST-IRON	C/I
CONCRETE	CONC
DIAMETER	DIA
DOWNPIPE	DP
EARTHENWARE	E/W
NO FURTHER TRACE	NFT
OFFSITE	O/S
START OF RUN	SOR
UNABLE TO OPEN	UTO
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UNDERGROUND LEGEND :

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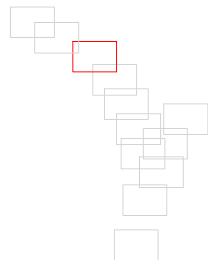

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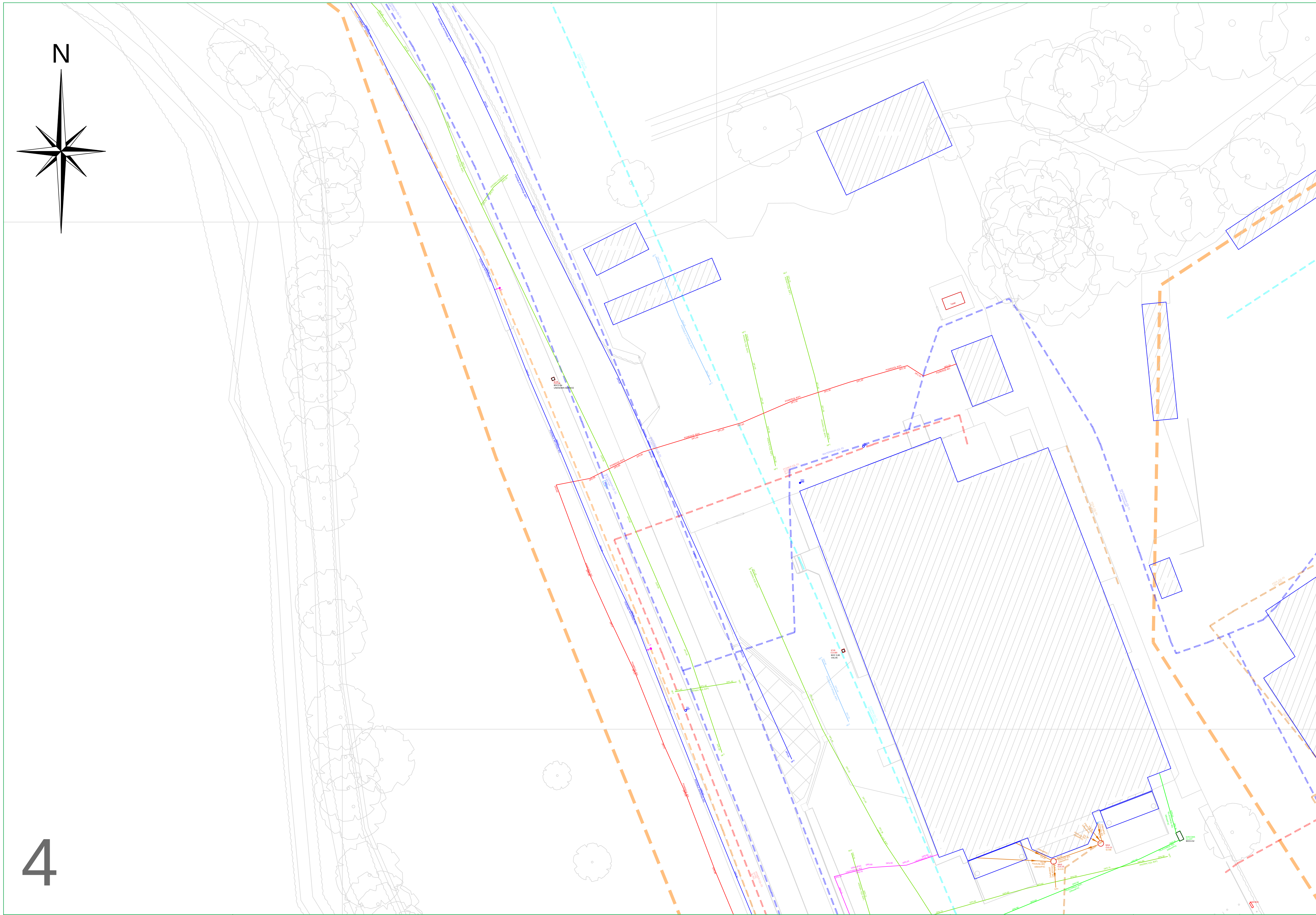

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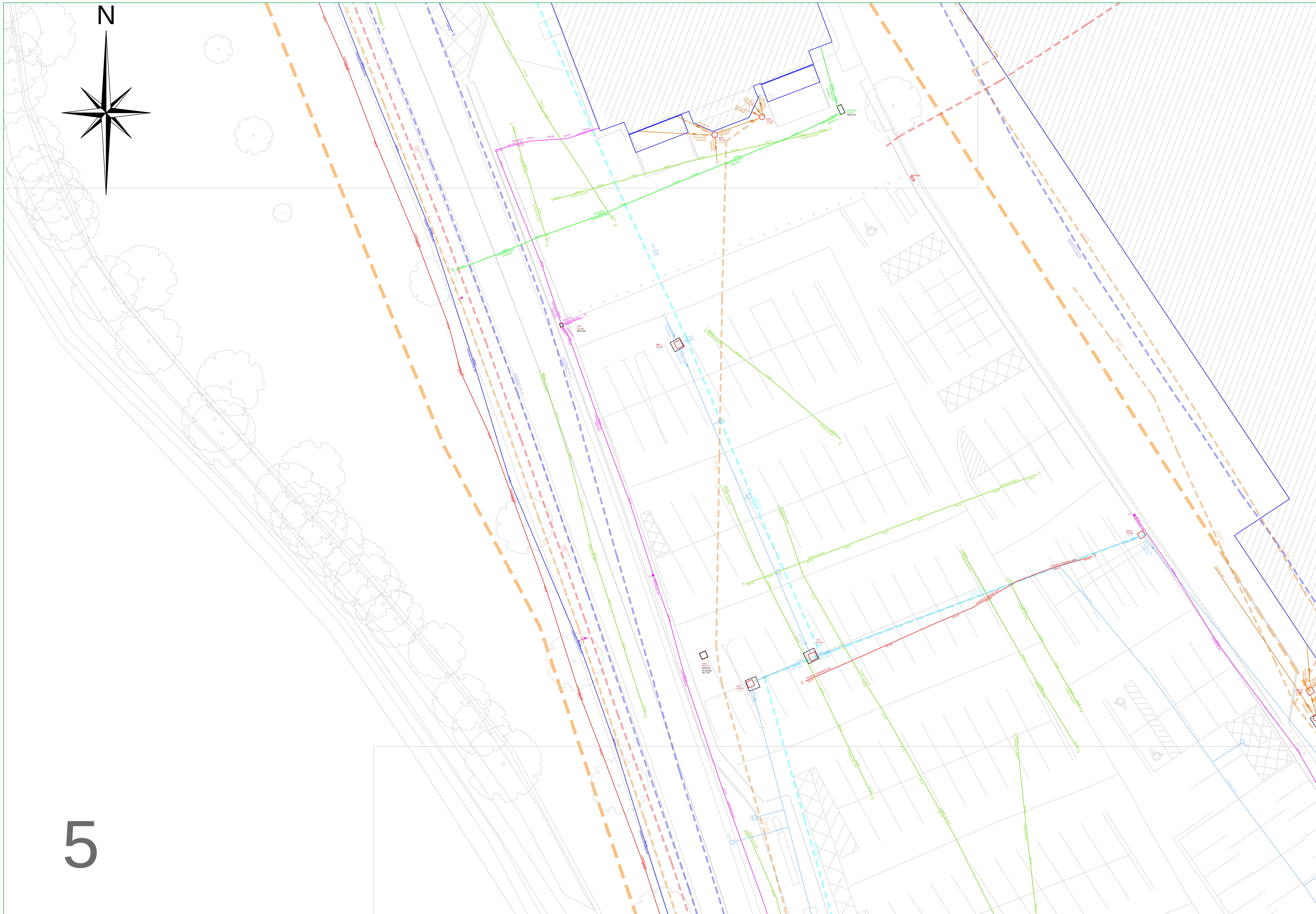

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INVERT LEVEL	+ IL101.50
ROAD LEVEL	+ 101.50
SOFFIT LEVEL	+ SL101.50
SPOT LEVEL	+ 101.50
TOP OF WALL LEVEL	+ TOW101.50
WATER LEVEL	+ WL101.50
SURVEY CONTROL STATION	
START OF RUN	SOR
UNABLE TO OPEN	UTO
UNABLE TO TRACE	UTT

UNDERGROUND LEGEND :

WATER MAIN	WATER
GAS MAIN	GAS
STORM DRAIN	STORM
FOUL SEWER	FOUL
COMBINED SEWER	COMB
ELECTRIC CABLE	POWER
ELECTRIC LIGHTING	LIGHTING
EIRCOM	EIRCOM
FIBRE OPTIC CABLE	F.OPTIC
BROADBAND	BROADBAND
CABLE TV	TV
TRAFFIC AND SIGNAL CABLE	TRAFFIC
CCTV	CCTV
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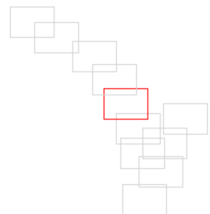
EMPTY DUCT	EMPTY
GPR ANOMALY	ANOMALY
UNKNOWN CABLE	CABLE
O/HEAD ELECTRICITY	OE
O/HEAD TELECOM	OT

SHEET LAYOUT :



PLAN PRODUCED BY:

CONTACT INFORMATION:

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CLIENT:

Aecom

PROJECT:

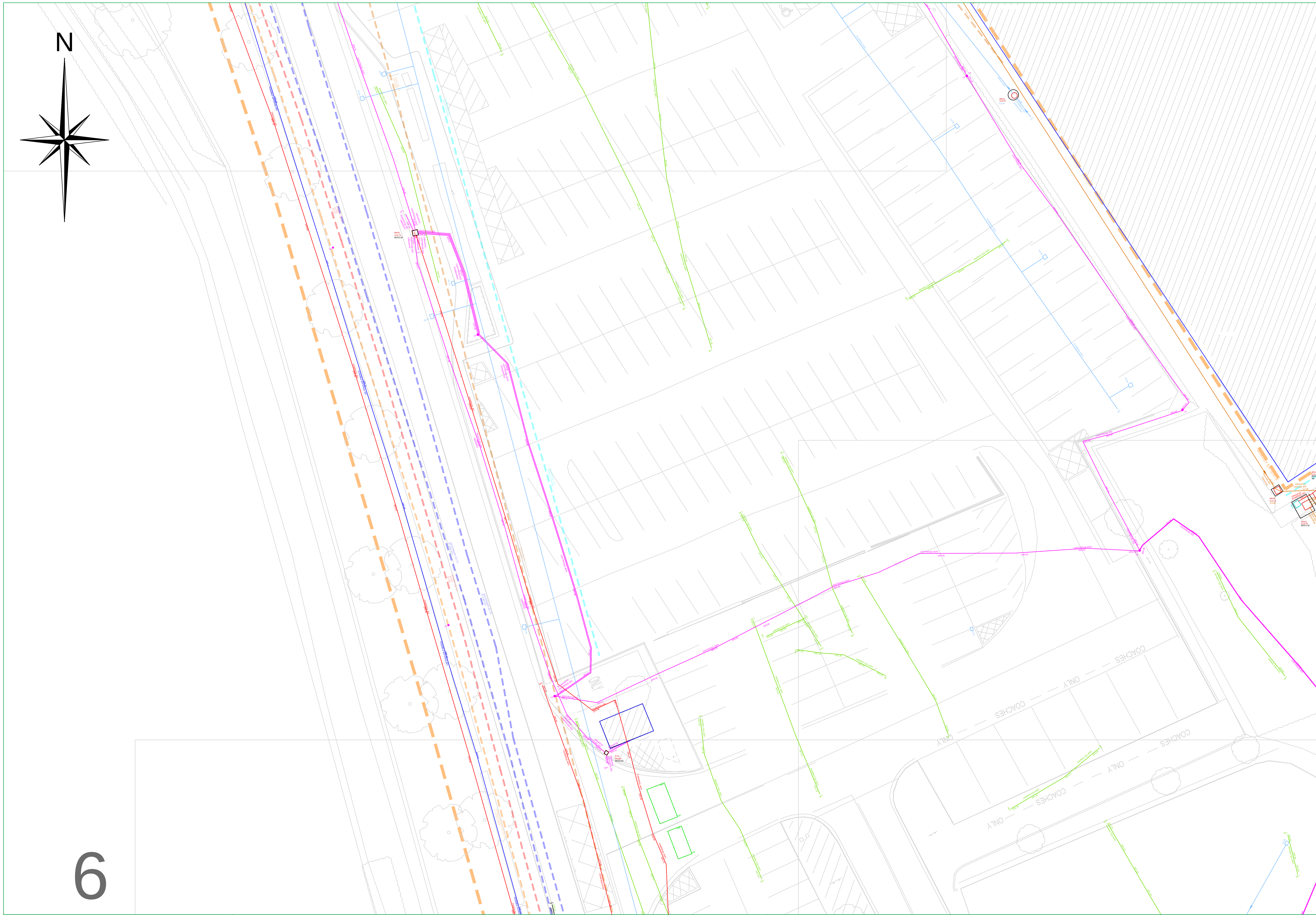
Dyke Road, Galway

GRID SYSTEM:	Irish Transverse Mercator
DATUM:	Malin Head (OSGM15)
NOTES:	Drawing Contains Scale Factor

REVISIONS:

No.	Date	Description
001	00/00	Original Drawing
002	19/12/23	Anomalies Updated

SCALE :	1/200 A1	DATE :	10/11/2023
DRG No:	5999	DESCRIPTION :	2D Utilities
		SURVEYED BY :	K.K.
SHEET:	5 of 11	PROCESSED BY :	J.P.
		CHECKED BY :	Alan Brady



PAS 128: 2014 (Quality of Survey Level Outputs):

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VERIFICATION	
QL-A	Horizontal and vertical location of the top and/or bottom of the utility

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STREET FURNITURE :

BOLLARDS	BD
BUS STOP	BS
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GATE	
ELECTRICITY POLE	EP
TELEPHONE POLE	TP
EARTHING ROD	ER
LAMP POST	LP
MARKER POST	MKR
SIGN POST	SIGN
TRAFFIC LIGHT	TL
TELEPHONE BOX	TB
POST	POST
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OFFSITE	O/S
STOPCOCK	ST
SERVICE BOX (UNKNOWN)	BOX
TRAFFIC COVER	TLIC
VENT	VENT
WATER METER	WM
START OF RUN	SOR
UNABLE TO OPEN	UTO
UNABLE TO TRACE	UTT

LEVELS :

BED LEVEL	+ BED101.50
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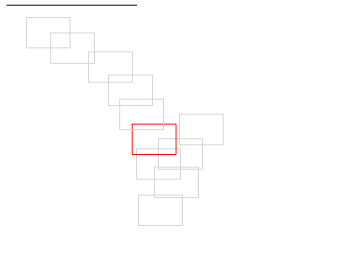

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SURVEYED BY :	K.K.
SHEET:	6 of 11
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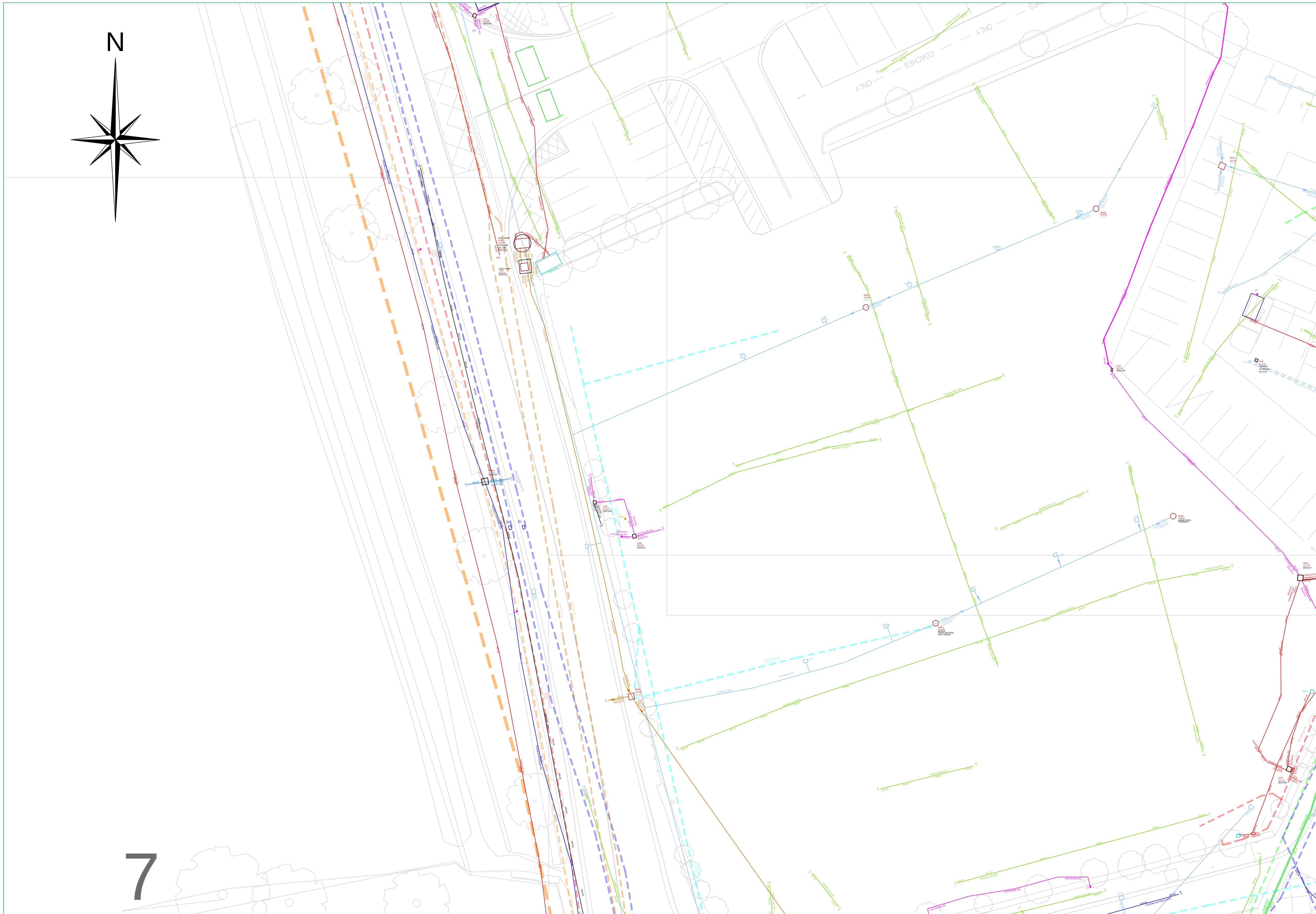

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Dyke Road, Galway

SCALE : 1/200 A1

DATE : 10/11/2023

DRG No: 5999

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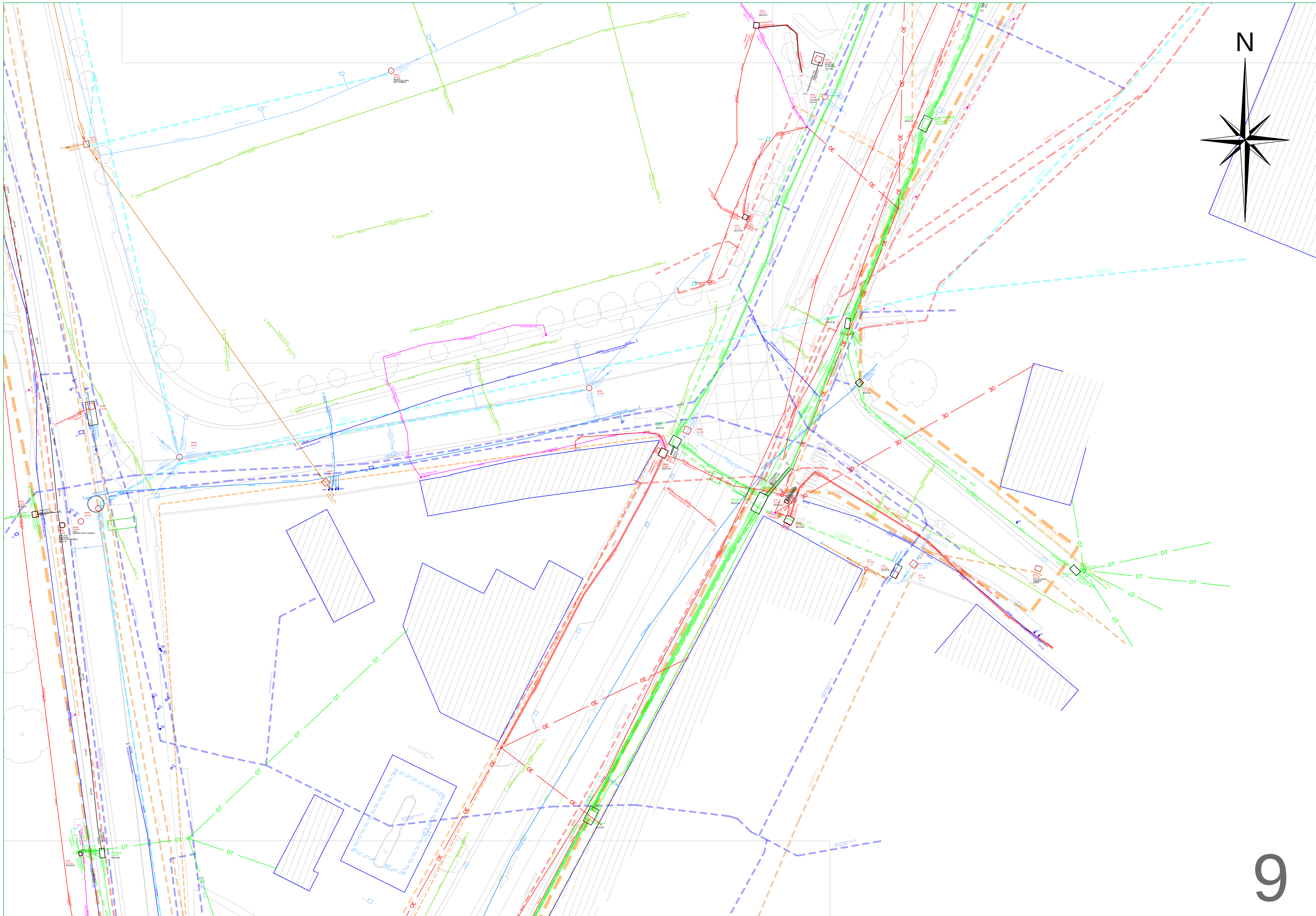
SURVEYED BY : K.K.

PROCESSED BY : J.P.

CHECKED BY : Alan Brady

SHEET: 7 of 11



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MARKER POST	MKR +
SIGN POST	SIGN
TRAFFIC LIGHT	TL
TELEPHONE BOX	TB
POST	POST
POST BOX	POST BOX
ROADSIGN	RS · RS
BORE HOLE	BH +
TRIAL PIT	TPIT +

SERVICES :

AIR VALVE	AV
ARMSTRONG JUNCTION	AJ
CABLE TV IC	CATV
COVER LEVEL	CL
EIRCOM COVER	EIRCOM
EIRCOM JUNCTION BOX	EIRCOM BOX
ELECTRICAL CABLE PIT	ECP
ESAT COVER	ESAT
ESB COVER	ESB
ESB JUNCTION BOX	ESB BOX
FIRE HYDRANT	FH
GAS VALVE	GV
GULLY	G
INSPECTION COVER	IC
MANHOLE	MH
SEPTIC TANK	SEPTIC
SLUICE VALVE	SV
STOPCOCK	ST
SERVICE BOX (UNKNOWN)	BOX
TRAFFIC COVER	TLIC
VENT	VENT
WATER METER	WM +

LEVELS :

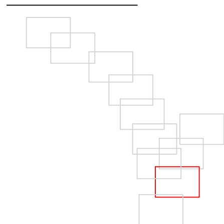
BED LEVEL	+ BED101.50
FLOOR LEVEL	+ FL101.50
INVERT LEVEL	+ IL101.50
ROAD LEVEL	+ 101.50
SOFFIT LEVEL	+ SL101.50
SPOT LEVEL	+ 101.50
TOP OF WALL LEVEL	+ TOW101.50
WATER LEVEL	+ WL101.50
SURVEY CONTROL STATION	

BOTTOM OF CHAMBER	BOC	DOWNPIPE	DP	START OF RUN	SOR
CAST-IRON	C/I	EARTHENWARE	E/W	UNABLE TO OPEN	UTO
CONCRETE	CONC	NO FURTHER TRACE	NFT	UNABLE TO TRACE	UTT
DIAMETER	DIA	OFFSITE	O/S		

UNDERGROUND LEGEND :

WATER MAIN	WATER
GAS MAIN	GAS
STORM DRAIN	STORM
FOUL SEWER	FOUL
COMBINED SEWER	COMB
ELECTRIC CABLE	POWER
ELECTRIC LIGHTING	LIGHTING
EIRCOM	EIRCOM
FIBRE OPTIC CABLE	F.OPTIC
BROADBAND	BROADBAND
CABLE TV	TV
TRAFFIC AND SIGNAL CABLE	TRAFFIC
CCTV	CCTV
IRRIGATION PIPE	IRRIGATION
EMPTY DUCT	EMPTY
GPR ANOMALY	ANOMALY
UNKNOWN CABLE	CABLE
O/HEAD ELECTRICITY	OE
O/HEAD TELECOM	OT

SHEET LAYOUT :



PLAN PRODUCED BY:

CONTACT INFORMATION:

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info@apexsurveys.ie
00353 1 691 0156

CLIENT: Aecom

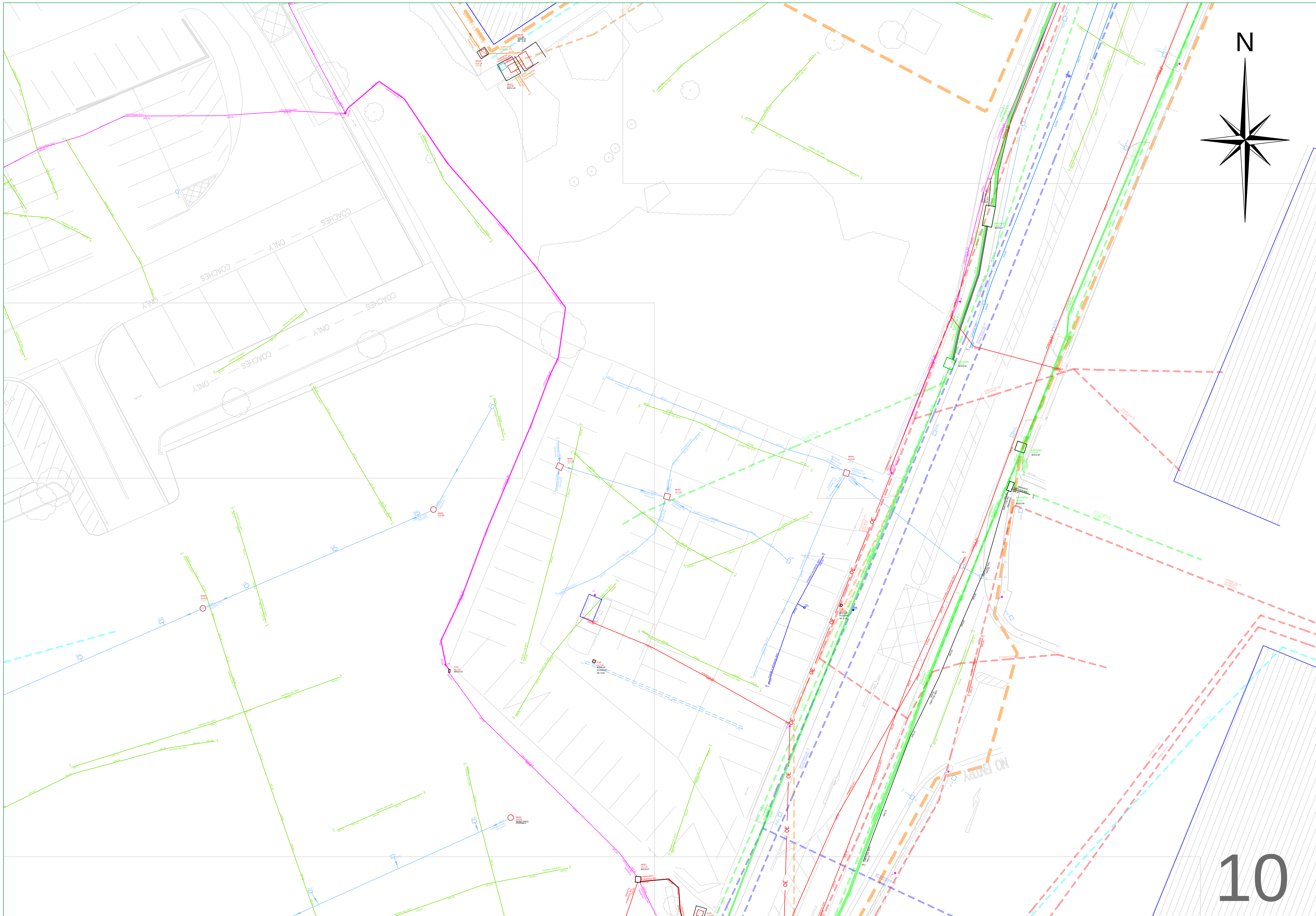
PROJECT: Dyke Road, Galway

GRID SYSTEM:	Irish Transverse Mercator
DATUM:	Malin Head (OSGM15)
NOTES:	Drawing Contains Scale Factor

REVISIONS:

No.	Date	Description
001	00/00	Original Drawing
002	19/12/23	Anomalies Updated

SCALE :	1/200 A1	DATE :	10/11/2023
DRG No:	5999	DESCRIPTION :	2D Utilities
		SURVEYED BY :	K.K.
SHEET:	9 of 11	PROCESSED BY :	J.P.
		CHECKED BY :	Alan Brady



PAS 128: 2014 (Quality of Survey Level Outputs):

DESKTOP UTILITY RECORDS SEARCH

QL-D	Drafted from utility records

SITE RECONNAISSANCE

QL-C	Location Demonstrated by visual reference to street furniture or evidence of previous streetworks, ie - reinstatement scars

DETECTION

QL-B4	A segment of utility suspected to exist but has not been detected by a geophysical technique
QL-B3	Horizontal location only of the utility detected by one of the geophysical techniques used
QL-B2	Horizontal and vertical location of the utility detected by one of the geophysical techniques used
QL-B1	Horizontal and vertical location of the utility detected by multiple geophysical techniques

VERIFICATION

QL-A	Horizontal and vertical location of the top and/or bottom of the utility

Apex Surveys Ltd. Disclaimer - Utility Survey

The interpretative nature and the non-intrusive, indirect and non-destructive survey methods must be taken into account when considering the results of the surveys. Therefore Apex Surveys, while using appropriate practice to execute, interpret and present the data, gives no guarantees that all underground utilities and underground structures will be located and mapped. Furthermore, Apex Surveys cannot guarantee the accuracy of the utility depths annotated on the survey drawings.
Apex Survey shall not be liable for any omissions or inaccuracies in the survey which arise due to the limitations of the service. No liability shall attach to Apex Surveys, in any circumstances, howsoever arising, in respect of any consequential loss or damages suffered by the Client.

The following is a non-exhaustive list of the limitations of utility surveys:

The Survey aims to map existing utilities subsurface utilities and provide information with respect to pipe size, material type and drainage connectivity. However utility surveying is limited by the following guidelines and it may not be possible to accurately survey, define and locate all services and sub-surface features.

- Depth of Utility: The depth and size of a utility affect the signal response and the degree with which a utility can be located.
  Due to attenuation of the radar signal with depth, resolution is restricted, hence making identification of utilities more difficult with increasing depth.
- Size of Utility: The smaller the diameter of a utility the more difficult it is to locate. This difficulty increases with depth.
- Ground Conditions: The depth penetration and quality of the data depends on the ground conditions of the site. GPR Surveying works best within high resistivity material. Clay overburden can impair GPR Surveying. Poor data may be a result of areas with high conductivity.
- Utility Congestion: Where different utilities converge together into a service corridor or cross paths it becomes difficult to isolate a specific utility and to map its route. The reflected signal will display a single response to multiple utilities. Therefore multiple utilities may appear to be a single utility. Where similar services run on close proximity, separation may be impossible.
- Signal Jumping: Signal from surrounding services may 'jump' to a highly conductive line masking its true identity.
- Shadowing: (of deeper utilities by shallower objects) Shallow utilities will mask the existence of deeper utilities where they are in close proximity. Also, high reflective materials close to the surface i.e rebar may hide deeper anomalies.
- Surface Obstructions: The GPR system relies on a relatively flat and even surface on which to perform radar passes. If ground obstructions such as vehicles, organic material (long grass, scrub) or undulating ground surface are present then the acquired data will be of lower resolution and in some cases not viable.
- Loss of signal: It is not always possible to trace the entire length of each underground service.
- Connections between manholes: Connections between manhole chambers are assumed to be straight.
- Non-metallic objects: Nonmetallic objects are amongst the most difficult to trace therefore successful tracing of non-metallic pipes/ utilities may be limited.
- Fiber Optic Cables: Fiber optic cables may not be possible to locate except where laid with a built in tracer wire or similar conductor system.
- Defective / flooded manholes or pipework: It may not be possible to establish connections between flooded or defective manholes or pipework.
- Acute bends in pipework: It may not be possible to trace a pipe past an acute bend.

Accuracy estimates:

- Locational accuracy is determined by referring to the manufacturers guidelines for the detector used.
- In ideal conditions the spatial accuracies for the underground utilities may be +/- 5% for Radiodetection and +/- 10% of depth for the GPR to 2.5m deep. However variations within the subsurface, depth below the ground, close proximity of other services and local magnetic, atmospheric or ground conditions, bends, lateral service connections and any of the other limitations listed in this disclaimer may alter this estimated accuracy.
- Plan accuracies of + or - 150mm may be achieved but this figure will depend on the depth of service below ground level. However variations within the subsurface subsurface, depth below the ground, close proximity of other services and local magnetic, atmospheric or ground conditions, bends, lateral service connections and any of the other limitations listed in this disclaimer may alter this estimated accuracy.
- DP represents distance from the surface level to the top of the service/ target
- Where technically possible, depth indications will be given. These along with plan positions should be used for guidance only and wherever critical accuracy is required these should be confirmed by the client by undertaking trial excavations or similar.

Record Drawing Information

- Services which have been untraceable are shown from records where possible or available. These lines are annotated as “Taken From Records” or “From Records”.
- Existing record information showing underground services is often incomplete and with unknown accuracies therefore it should be regarded as indicative only.
- Where Apex Surveys issue a utility drawing, this should be read in conjunction with all available public or private utility records.
- Apex Surveys endeavor to add relevant Public Utility record information onto the final drawing. However, we would recommend that direct contact is made with the asset owner or statutory undertaker.
- We shall not be held responsible for the accuracy, or otherwise, of the location of a service, as issued by the utility provider and therefore shown as “Taken for Records” on the drawing.

The following have been excluded from the survey:

- Location of individual service feeds to properties or buildings as access would be required into each property to apply direct connections to inlet points and this would significantly increase the scope of works, survey cost and also cause possible disruption to occupants.
- Pot ended or disconnected cables or terminated short lengths of pipe.
- Internal building services.
- Small diameter cables less than 20mm diameter or pipes less than 40mm diameter.
- Above ground services unless specifically requested.
- Lifting manholes which require longer than 10 minutes effort using standard heavy duty apparatus.

All works carried out be Apex Surveys conforms to the guidelines set out by The Survey Association (TSA) and PAS:128 Standard for utility mapping

APEX SURVEYS
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info@apexsurveys.ie
00353 1 691 0156

STREET FURNITURE :

BOLLARDS	BD
BUS STOP	BS
CRASH BARRIER	CB
GATE	
ELECTRICITY POLE	EP
TELEPHONE POLE	TP
EARTHING ROD	ER +
LAMP POST	LP
MARKER POST	MKR +
SIGN POST	SIGN
TRAFFIC LIGHT	TL
TELEPHONE BOX	TB
POST	POST
POST BOX	POST BOX
ROADSIGN	RS · RS
BORE HOLE	BH +
TRIAL PIT	TPIT +
BOTTOM OF CHAMBER	BOC
CAST-IRON	C/I
CONCRETE	CONC
DIAMETER	DIA

SERVICES :

AIR VALVE	AV
ARMSTRONG JUNCTION	AJ
CABLE TV IC	CATV
COVER LEVEL	CL
EIRCOM COVER	EIRCOM
EIRCOM JUNCTION BOX	EIRCOM BOX
ELECTRICAL CABLE PIT	ECP
ESAT COVER	ESAT
ESB COVER	ESB
ESB JUNCTION BOX	ESB BOX
FIRE HYDRANT	FH
GAS VALVE	GV
GULLY	G
INSPECTION COVER	IC
MANHOLE	MH
SEPTIC TANK	SEPTIC
SLUICE VALVE	SV
DOWNPIPE	DP
EARTHENWARE	E/W
NO FURTHER TRACE	NFT
OFFSITE	O/S
STOPCOCK	ST
SERVICE BOX (UNKNOWN)	BOX
TRAFFIC COVER	TLIC
VENT	VENT
WATER METER	WM +

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INVERT LEVEL	+ IL101.50
ROAD LEVEL	+ 101.50
SOFFIT LEVEL	+ SL101.50
SPOT LEVEL	+ 101.50
TOP OF WALL LEVEL	+ TOW101.50
WATER LEVEL	+ WL101.50
SURVEY CONTROL STATION	
START OF RUN	SOR
UNABLE TO OPEN	UTO
UNABLE TO TRACE	UTT

UNDERGROUND LEGEND :

WATER MAIN	WATER
GAS MAIN	GAS
STORM DRAIN	STORM
FOUL SEWER	FOUL
COMBINED SEWER	COMB
ELECTRIC CABLE	POWER
ELECTRIC LIGHTING	LIGHTING
EIRCOM	EIRCOM
FIBRE OPTIC CABLE	F.OPTIC
BROADBAND	BROADBAND
CABLE TV	TV
TRAFFIC AND SIGNAL CABLE	TRAFFIC
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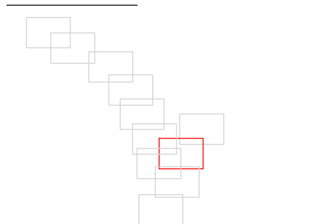
IRRIGATION PIPE	IRRIGATION
EMPTY DUCT	EMPTY
GPR ANOMALY	ANOMALY
UNKNOWN CABLE	CABLE
O/HEAD ELECTRICITY	OE
O/HEAD TELECOM	OT

SHEET LAYOUT :



PLAN PRODUCED BY:

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00353 1 691 0156

CLIENT: Aecom

PROJECT: Dyke Road, Galway

GRID SYSTEM: Irish Transverse Mercator
DATUM: Malin Head (OSGM15)
NOTES: Drawing Contains Scale Factor

REVISIONS:

No.	Date	Description
001	00/00	Original Drawing
002	19/12/23	Anomalies Updated

SCALE : 1/200 A1
DATE : 10/11/2023
DRG No: 5999
SHEET: 10 of 11
DESCRIPTION : 2D Utilities
SURVEYED BY : K.K.
PROCESSED BY : J.P.
CHECKED BY : Alan Brady

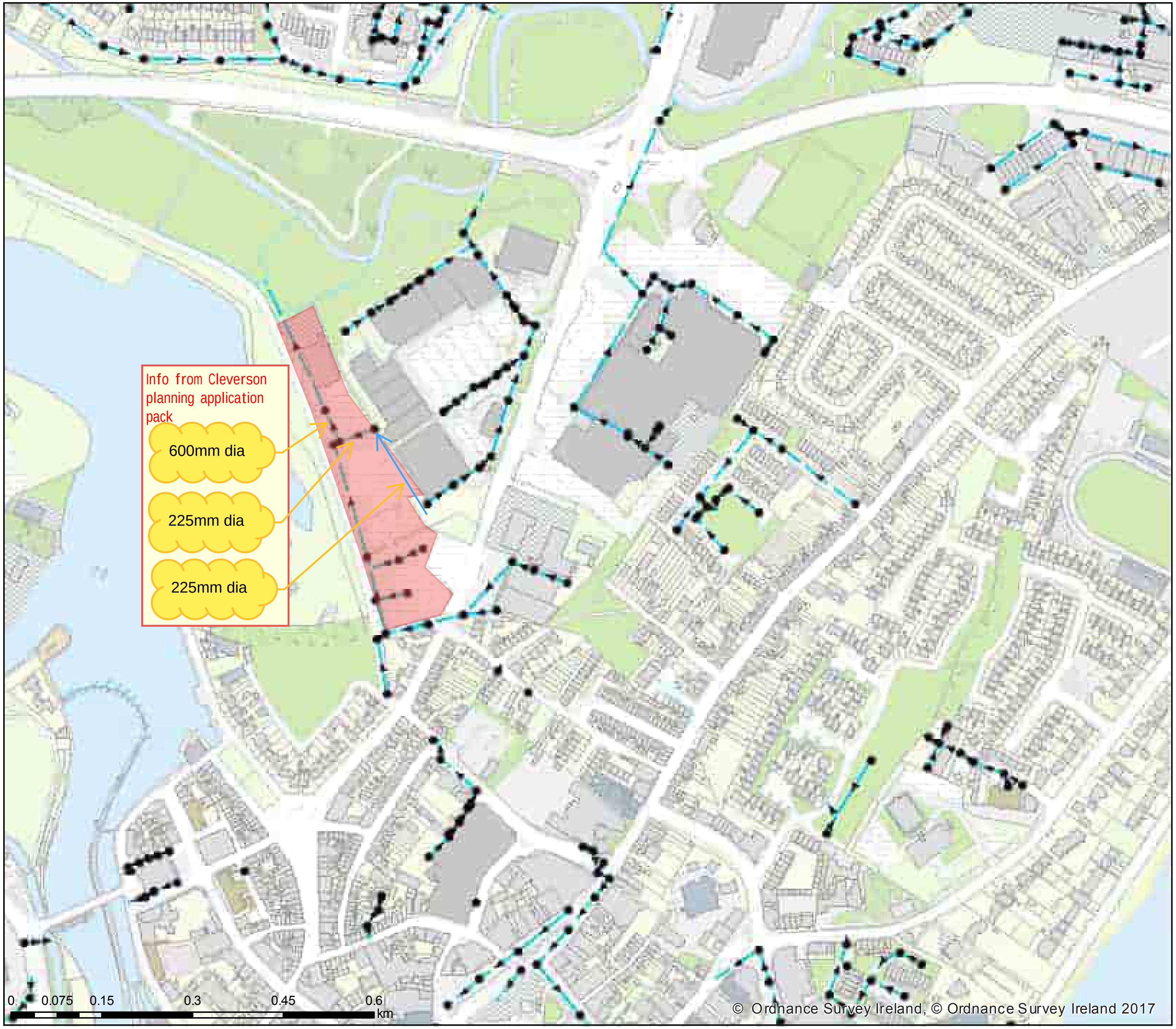
Dyke Road - Sewer

UISCE ÉIREANN : IRISH WATER

Print Date: 13/07/2023

Printed by:Irish Water

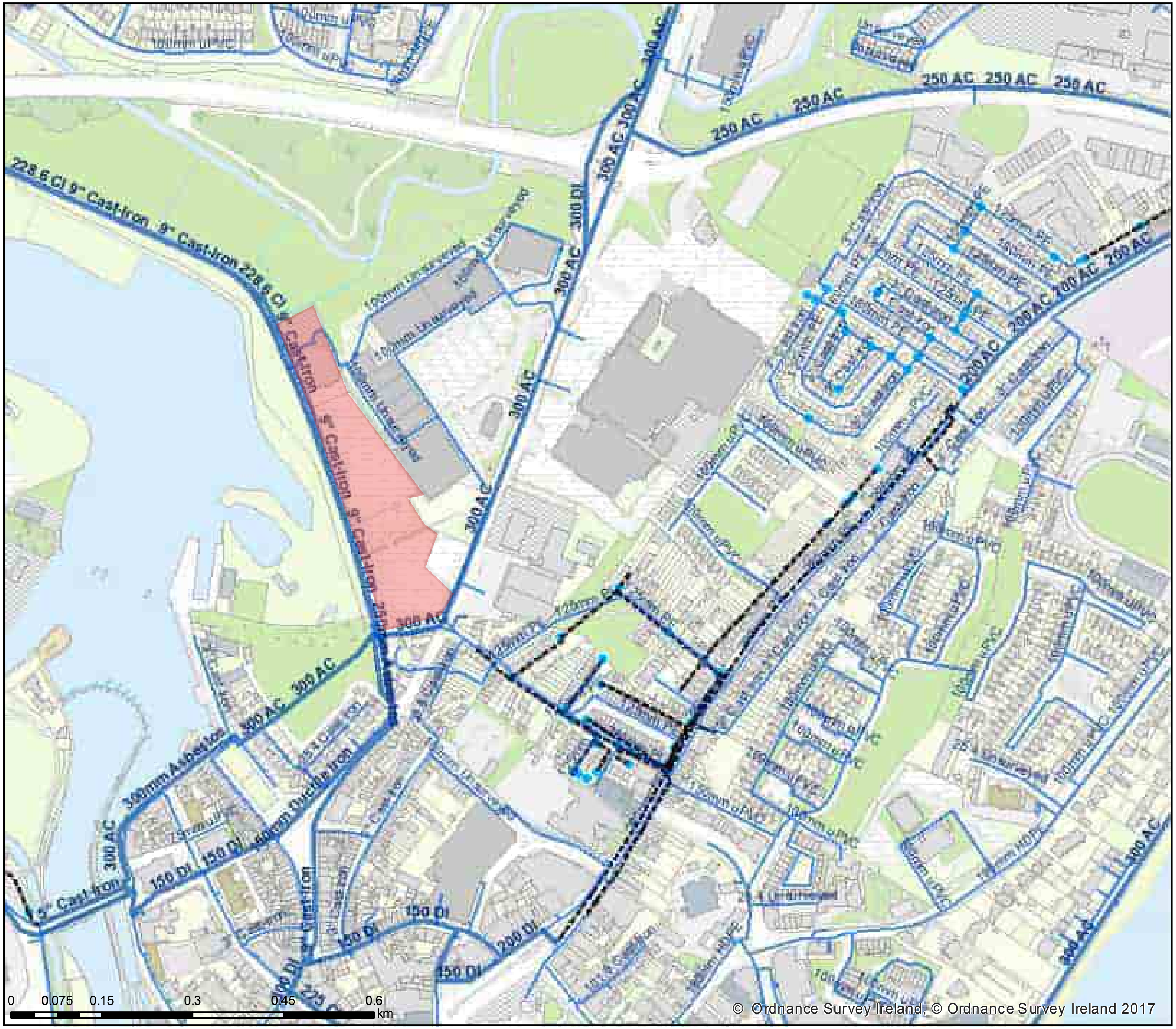
Dyke Road - Storm



Print Date: 13/07/2023

Printed by: Irish Water

Dyke Road - Water



UISCE ÉIREANN : IRISH WATER

Print Date: 13/07/2023

Printed by:Irish Water

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NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI regas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 289 389) or can be downloaded free of charge at www.hsa.ie."

Appendix E Ground Investigation Reports

E.1 Ground Investigation Report (Ground Investigation Ireland Ltd)

E.2 Geophysical Survey (Minerex Geophysics Ltd)

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Ground Investigations Ireland

Dyke Road Galway

Aecom

Ground Investigation Report

July 2024

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D22 YD52

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DOCUMENT CONTROL SHEET

Project Title	Dyke Road Galway
Client	Land Development Agency
Engineer	Aecom
Project No	13614-02-24
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Interim	A Mann	M Sutton	M Sutton	Dublin	24 June 2024
B	Final	A Mann	M Sutton	M Sutton	Dublin	04 July 2024

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

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APPENDICES

Appendix 1	**Site Location Plan**
Appendix 2	**Trial Pit Records**
Appendix 3	**Slit Trench Records**
Appendix 4	**Soakaway Records**
Appendix 5	**Borehole Records**
Appendix 6	**Insitu Plate Bearing Test Results**
Appendix 7	**TRL Dynamic Cone Penetrometer Records**
Appendix 8	**Laboratory Results**
Appendix 9	**Groundwater Monitoring Records**

1.0 Preamble

On the instructions of Aecom Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., between April and June 2024 at the site of the proposed development in Galway City.

2.0 Overview

2.1. Background

It is proposed to construct a new residential and commercial/retail development with associated services, access roads and car parking at the proposed site. The site is currently occupied by a car park and is situated near the centre of Galway City. The proposed construction is envisaged to consist of piled foundations and pavement make up with some local excavations for services and plant

2.2. Purpose and Scope

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

- Visit project site to observe existing conditions
- Carry out 6 No. Trial Pits to a maximum depth of 3.0m BGL
- Carry out 4 No. Slit Trenches to determine existing service details
- Carry out 2 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Carry out 11 No. Cable Percussion boreholes to a maximum depth of 10.10m BGL
- Carry out 7 No. Rotary Core Boreholes to a maximum depth of 20.10m BGL
- Carry out 1 No. Insitu Plate Bearing Tests
- Carry out 4 No. TRL Dynamic Cone Penetrometer Tests
- Installation of 4 No. Groundwater monitoring wells
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Trial Pits

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

3.3. Slit Trenching

The slit trenches were excavated using a 3T tracked excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The soil was slowly stripped using a spotter on the trench to alert the driver if any services were seen, to avoid damage to any underlying services. The slit trenches were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the slit trench records which are provided in Appendix 3 of this Report.

3.4. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 4 of this Report.

3.5. Cable Percussion Boreholes

The Cable Percussion Boreholes were drilled using a Dando 2000 drilling rig with regular in-situ testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.
The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals

down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata.
Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60º cone. The Standard Penetration Test number referred to as the 'N' value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil. The cable percussion borehole logs are provided in Appendix 5 of this Report.

3.6. Rotary Boreholes

The rotary coring was carried out by a track mounted T44 Beretta rig at the locations shown on the location plan in Appendix 1. The rotary boreholes were completed from the ground surface or alternatively, where noted on the individual borehole log, from the base of the cable percussion borehole where a temporary liner was installed to facilitate follow-on rotary coring.
The T44 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T44 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the "overshoot" recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids.
It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 5 of this Report.

3.7. Surveying

The exploratory hole locations have been recorded using a KQ GEO Technologies KQ-M8 System which records the coordinates and elevation of the locations to ITM or Irish National Grid as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.8. Groundwater/Gas Monitoring Installations

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

3.9. Insitu Plate Bearing Test

The plate bearing tests were carried out using a 450mm diameter plate at the locations shown on the site plan in Appendix 1. The plate was loaded in increments using a hydraulic jack and an excavator to provide a reaction and the displacement was monitored in accordance with BS1377 Part 9 using independently mounted digital strain gauges. The constrained modulus and equivalent CBR are calculated in accordance with HD29/75 and are provided on the test reports in Appendix 6 of this Report.

3.10. TRL Dynamic Cone Penetrometer

The TRL DCP tests were carried out at locations specified by the Consulting Engineer to determine a CBR design value for the design of external pavements. The testing was carried out below the Topsoil or existing pavement at the depths detailed on the test report. The test consists of dropping a 10kg weight on an anvil to drive a small diameter cone and recording the blows for a given penetration. The results of the DCP testing are included in Appendix 7 of this Report.

3.11. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.
Environmental & Chemical testing as required by the specification, including the Rilta Suite and Engineers Ireland Suites E and D was carried out by Element Materials Technology Laboratory in the UK. The Rilta suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria. Chemical testing including organic matter content, sulphate content, chloride content and pH was carried out in Professional Soils Laboratory (PSL Ltd) in the UK.
Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD), hydrometer and Moisture Condition Value (MCV) tests were also carried out in Professional Soils Laboratory (PSL Ltd). Specialist shear strength testing consisting of quick undrained, shear box and consolidation testing was carried out on undisturbed U100 or piston samples where recovered.
Rock strength testing including Point Load (Is_{50}) and Unconfined Compressive Strength (UCS) testing was carried out by Construction Materials Testing Laboratories (CTML) Ireland. The results of the laboratory testing are included in Appendix 8 of this Report.

4.0 Ground Conditions

4.1. General

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

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

- Surfacing
- Made Ground
- Organic Deposits
- Soft Cohesive Deposits
- Cohesive Deposits
- Granular Deposits
- Bedrock

SURFACING: Tarmac surfacing was present typically to a depth of 0.06m BGL.

MADE GROUND: Made Ground deposits were encountered beneath the Surfacing and were generally present to depths of between 0.5m and 1.0m BGL and a maximum of 3.4m BGL in BRC04. These deposits were described generally as *grey Sand and Gravel FILL and contained occasional fragments of tarmacadam* occasionally overlying *grey slightly sandy gravelly Clay* and *brownish black gravelly Peat with occasional red brick, ceramic and rubbish fragments.*

ORGANIC DEPOSITS: Organic deposits were generally encountered beneath the Made Ground and were described typically as *brownish black slightly clayey slightly gravelly PEAT.* The secondary constituents varied across the site, with silt and clay lenses occasionally present in the peat. The strength of the deposits was typically very soft based on SPT N values.

SOFT COHESIVE DEPOSITS: Soft Cohesive deposits were encountered beneath the organic deposits and were generally described as *beige or cream clayey SILT with frequent shell fragments* occasionally onto *light grey slightly sandy slightly gravelly clayey SILT with occasional cobbles.* The secondary sand and gravel constituents varied across the site and with depth, and peat lenses were occasionally present within the deposits. The strength of the soft cohesive deposits was typically very soft to soft.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the soft cohesive deposits at some locations and were described typically as *light grey to grey slightly sandy slightly gravelly silty CLAY with occasional cobbles*. The secondary sand and gravel constituents varied across the site and with depth. The strength of the cohesive deposits typically increased with depth and was stiff or very stiff below 6.0m BGL in the majority of the exploratory holes. These deposits had some occasional cobble content, where noted on the exploratory hole logs.

GRANULAR DEPOSITS: Granular deposits were occasionally encountered at the base of the cohesive deposits and were typically described as *grey very sandy subangular to subrounded fine to coarse GRAVEL with occasional cobbles.* The secondary sand constituents varied across the site while occasional cobble content was also present where noted on the exploratory hole logs.
Based on the SPT N values the deposits are typically medium dense to dense and become dense with depth. Groundwater strikes were occasionally noted in the boreholes on encountering the granular deposits.

BEDROCK: The rotary core boreholes recovered Strong thinly to medium bedded grey fine to medium grained fossiliferous LIMESTONE, with the exception of BRC04 which recovered strong to very strong thinly to thickly banded dark green medium to coarsely crystalline METAGABBRO. Occasional calcite veins were noted during logging.
The depth to rock increases to the southeast from 11.2m BGL in BH01 in the north western corner of the site to a maximum of 15.3m BGL in BRC03 in the centre of the site. The depth to rock decreases to 9.4m BGL in BRC06, and further decreases to between 6.6m and 6.1m BGL respectively in BRC04 and BRC05 in the southeastern portion of the site. The total core recovery is typically 100% within bedrock. The SCR and RQD are generally poorer in the upper weathered zone, however both indices show an increase with depth in each of the boreholes.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in BRC1, BRC02, BRC04 and BRC05 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 9 of this Report.

4.3. Laboratory Testing

4.3.1. Geotechnical Laboratory Testing

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of high plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded to gap graded with percentages of sands and gravels ranging between 1% and 48% generally with fines contents of 14 to 97%.

The Particle Size Distribution tests confirm that generally the granular deposits are gap graded with percentages of silt/clay typically between 1% and 2% with a sand content of typically 7% to 14%. gravel content of typically 53% to 68%.

Undrained shear strength testing on undisturbed samples gave results ranging between 3kPa and 13 kPa which correlated with results of laboratory vane tests which gave peak shear strengths ranging from 6 to 27 kPa.

MCV Values ranged between <1 to 4.5 in the cohesive deposits meaning the material would be considered unsuitable for reuse.

4.3.2. Chemical Laboratory Testing

The pH and sulphate testing carried out indicate that pH results are near neutral to alkaline, with values ranging from 7.1 to 9.6, and that the water soluble sulphate results range from low to elevated (DS-1 to DS-2) when compared to the guideline values from BRE Special Digest 1:2005. Samples of the Peat (TP3 0.6-1.1m BGL) have elevated Total Sulphur results (0.52%) which result in a high Total Potential Sulphate (TPS) and a subsequent higher classification of the Design Sulphate values in accordance with the BRE digest. Caution is recommended and the removal of the Peat and Made ground stratum to reduce the risk of sulphate attack adjacent to concrete elements as part of the permanent works. Piles in the organic and very soft deposits are recommended to incorporate appropriate measures to resist sulphate attack.

4.3.3. Environmental Laboratory Testing

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

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

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

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

4.3.4. Rock Laboratory Testing

The rock testing carried out on samples recovered from the boreholes reported Unconfined Compressive Strength (UCS) values ranging between 88.1 and 140.7 MPa while the point load testing gave Is50 values ranging between 2.93 to 8.79 MPa. The Is_{50} results correlate to the UCS values using a factor of approximately 20, giving values of 58.6 MPa and 175.8 MPa. These results correlate to the strength descriptions ranging between of Strong to very strong and confirming the descriptions on the logs.

The results from the completed laboratory testing are included in Appendix 8 of this report

4.4. Geotechnical Design Parameters

Preliminary geotechnical design parameters for the materials encountered during the ground investigation have been summarised in Table 1 Geotechnical Design Parameters. Both laboratory test and SPT N results, using standard empirical relationships, have been used to determine the geotechnical parameters of the overburden strata.

Shear strength parameters have been determined using laboratory testing and established empirical relationships for the relevant materials. Based on the relationship published by Stroud, the correlation of $Cu = f_1 \times N$ is used to estimate the undrained shear strength of the cohesive deposits, where f1 is determined using a correlation with the plasticity index.

The shear strength parameters from the granular stratum are provided using the effective shear strength parameters determined from the uncorrected SPT N values after Peck et al. reported by Tomlinson Foundation Design and Construction 7th Ed. (2001).

A range is provided for the compressibility parameter m_v based on correlations with the SPT N value based on the relationship published by Stroud, the correlation of $M_v = 1/(f_2 \times N)$ where f_2 is determined using a correlation with the plasticity index

Table 1 Recommended Geotechnical Parameters based on GII GI Data

Stratum	Bulk Density (kN/m^3)	SPT 'N' Correlated	Undrained Shear Strength C_u (kN/m^2)	Effective Strength Parameters		Poisson's Ratio v (v_u)	Co-efficient of Compressibility
				Cohesion c' (kN/m^2)	ϕ' degrees		m_v (m^2/MN)
Granular Made Ground Deposits	16 – 20[*1]	1 - 20	n/a	-	28 – 30[*4]	0.1 – 0.3	n/a
Cohesive Made Ground Deposits	16 – 20[*1]	1 - 20	5 – 100[*2]	0	25 - 30[*4]	0.2 (0.5)	0.1-1.5[*3]
Soft Peat	10	n/a	0 – 5 kPa	0 – 2	n/a	n/a	>1.5
Soft Cohesive Deposits	16 – 20[*1]	1 - 8	5 - 40[*2]	0 - 1	25 - 28[*4]	0.2 (0.5)	0.1 – 1.5[*3]
Firm Cohesive Deposits	18 – 20[1]	8 – 15	40 - 75[*2]	0 - 3	28 – 30[*4]	0.2 (0.5)	0.1 – 0.3[*3]
Stiff Cohesive Deposits	19 – 20[*1]	15 – 25	75 - 150[*2]	0 - 5	30 - 33[*4]	0.2 (0.5)	0.05 – 0.1[*3]
Very Stiff Cohesive Deposits	20 – 22	25+	150+	0 – 5	30 – 33+[*4]	0.2 (0.5)	0.05 – 0.1[*3]
Loose Granular Deposits[1]	16 – 18[*1]	1 - 10	n/a	n/a	28 – 30 [*4]	0.1 – 0.3	n/a
Medium Dense Granular Deposits[1]	18 – 21[*1]	10 - 30	n/a	n/a	30 – 36 [*4]	0.1 – 0.3	n/a
Dense Granular Deposits[1]	21 - 23[*1]	30+	n/a	n/a	36+ [*4]	0.1 – 0.3	n/a

*1 Values for bulk density assumed

*2 Based on correlated SPT N values

*3 Based on correlated SPT N values and published data. Caution should be exercised when selecting design values for the variable Made Ground Stratum.

*4 Testing on undisturbed samples is recommended to determine the design value of this parameter for detailed design.

NOTE: The values in Table 1 represent a range of recommended values based on the typical soil types, insitu testing and laboratory testing scheduled by the Consulting Engineer. The values presented are recommended for outline guidance only and specific designs should derive design values based on the exploratory hole logs and lab testing for each specific site. To determine specific design values relevant to the design being undertaken in a particular area, reference should be made to the relevant specific exploratory hole logs. Further testing is recommended to determine the specific geotechnical parameters required for foundation design and temporary works design

5.0 Recommendations & Conclusions

5.1. General

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

5.2. Foundations

Due to the presence of soft and compressible Cohesive deposits beneath the footprint of the proposed structure and high loading anticipated, piled foundations are recommended for the proposed building. The type, size and depth of the pile foundations should be confirmed by a specialist piling contractor based on the loading from the proposed building. The floor slab is recommended be suspended and also supported on the building piles.
Negative skin friction from the very soft cohesive deposits should be considered in the pile design due to the possibility of loading from working platforms or the adjacent pavement make up.

The pH and sulphate testing carried out indicate that pH results are near neutral to alkaline, with values ranging from 7.1 to 9.6, and that the water soluble sulphate results range from low to elevated (DS-1 to DS-2) when compared to the guideline values from BRE Special Digest 1:2005. Samples of the Peat (TP3 0.6-1.1m BGL) have elevated Total Sulphur results (0.52%) which result in a high Total Potential Sulphate (TPS) and a subsequent higher classification of the Design Sulphate values in accordance with the BRE digest. Caution is recommended and the removal of the Peat and Made ground stratum to reduce the risk of sulphate attack adjacent to concrete elements as part of the permanent works. Piles in the organic and very soft deposits are recommended to incorporate appropriate measures to resist sulphate attack.

5.3. External Pavements

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

5.4. Excavations

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

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

Any excavations which penetrate the granular deposits will require to be appropriately battered or the sides supported and are likely to require dewatering due to the groundwater seepages noted in the exploratory hole logs in the Appendices of this Report.

The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations. Generally, where significant excavations are required in water bearing granular deposits a cut-off wall may be more cost effective than extensive dewatering. An assessment by a specialist dewatering contractor is recommended to determine the most cost effective approach to the proposed excavation.

Excavations in the upper cohesive are expected to be excavatable with conventional excavation equipment Any waste material to be removed off site should be disposed of to a suitably licenced landfill.

The environmental testing completed during the ground investigation is reported under the cover of a separate GII Waste Classification/Subsoil Assessment Report.

5.5. Soakaway Design

At the locations of IT01 and IT02 the water level dropped too slowly to allow calculation of ‘f’ the soil infiltration rate. These locations are therefore not recommended as suitable for soakaway design and construction.

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

APPENDIX 1 - Site Location Plan

529800E 529900E 530000E

726100N 726000N 725900N

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

Client:

LDA

0 11 22 33 44 55 m

Project Title:
Dyke Road Galway

Drawing Title:
Investigation Locations

GII Project Reference:
13614-02-24

Drawn By: MS

Date: 24-06-24

Trial Pits
Slit Trench Locations
Borehole
Infiltration Test

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Trial Pit Number: TP01

Machine : 3T Tracked Excavator Method : Trial Pit	Dimensions: 2.20 x 0.87 x 2.20m	Ground Level (mOD): 4.27	Client: Aecom	Job Number: 13614-02-24
	Location: 529801.3 E 726122.3 N	Dates: 17/04/2024	Engineer:	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				4.20	(0.07) 0.07	TARMACADAM		
					(0.67)	MADE GROUND: Grey sandy angular to subrounded fine to coarse Gravel		
0.50	B							
				3.53	0.74	MADE GROUND: Black plastic net membrane		
				3.52	0.75	Brown fibrous PEAT		
1.00	HV 34kPa		44,38,20/Av. 34.00					
1.00	B							
					(1.45)			
				2.07	2.20	Complete at 2.20m		

Plan

Remarks

No groundwater encountered during excavation
Trial pit sidewalls stable
DCP carried out at 0.8m BGL.
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	LB	13614-02-24.TP01

Ground Investigations Ireland Ltd www.gii.ie	Site Dyke Road Galway	Trial Pit Number TP02

Machine : 3T Tracked Excavator Method : Trial Pit	Dimensions 2.10 x 0.88 x 2.20m	Ground Level (mOD) 5.01	Client Aecom	Job Number 13614-02-24
	Location 529812.4 E 726036.9 N	Dates 17/04/2024	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				4.94	(0.07) 0.07	TARMACADAM		
					(0.52)	MADE GROUND: Grey sandy subangular to subrounded fine to coarse Gravel with medium angular to subangular cobble content		
0.50	B							
				4.42	0.59	MADE GROUND: Black plastic net membrane		
				4.41	0.60	MADE GROUND: Brown fibrous Peat with frequent wood fragments and occasional plastic glass and wire fragments		
0.70	HV 14kPa		10,16,16/Av. 14.00					
1.00	B							
					(1.20)			
			Slow(1) at 1.30m.					1
				3.21	1.80	Very soft cream clayey SILT with frequent shell fragments		
					(0.40)			
2.00	HV 9kPa		10,10,8/Av. 9.33					
2.00	B							
				2.81	2.20	Complete at 2.20m		

Plan

Remarks

Groundwater encountered at 1.30m BGL. Slow
Trial pit sidewalls stable
DCP carried out at 0.7m BGL
Trail pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	LB	13614-02-24.TP02

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Trial Pit Number: TP03

Machine : 3T Tracked Excavator Method : Trial Pit	Dimensions: 1.80 x 0.63 x 2.30m	Ground Level (mOD): 5.06	Client: Aecom	Job Number: 13614-02-24
	Location: 529879.9 E 725980.6 N	Dates: 15/04/2024	Engineer:	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				4.96	(0.10) 0.10	TARMACADAM		
0.50	B			4.46	(0.50) 0.60	MADE GROUND: Grey sandy angular to subrounded fine to coarse Gravel		
				4.45	0.61	MADE GROUND: Membrane		
0.65	HV 53kPa		50,60,50/Av. 53.33					
1.00	B			3.96	(0.49) 1.10	Dark brown fibrous PEAT with occasional rootlets		
1.50	HV 9kPa		10,10,6/Av. 8.67					
2.00	B			2.76	(1.20) 2.30	Very soft cream clayey SILT with frequent shell fragments		
						Complete at 2.30m		

Plan

Remarks

No groundwater encountered during excavation
Trial pit sidewalls stable
Plate baering test carried out at 0.20m BGL
DCP carried out at 0.7m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	LB	13614-02-24.TP03

Ground Investigations Ireland Ltd
www.gii.ie

Machine : 3T Tracked Excavator **Method :** Trial Pit	**Dimensions** 2.40 x 1.00 x 1.20m	**Ground Level (mOD)** 6.24	**Client** Aecom	**Job Number** 13614-02-24
	Location 529863.4 E 725899.1 N	**Dates** 15/04/2024	**Engineer**	**Sheet** 1/1

Site: Dyke Road Galway

Trial Pit Number: TP04

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				6.17	(0.07) 0.07	TARMACADAM		
0.50	B				(0.93)	MADE GROUND: Grey slightly clayey sandy angular to subrounded fine to coarse Gravel with medium cobble and boulder content		
1.00	B			5.24	1.00 (0.20)	MADE GROUND: Brown slightly sandy slightly gravelly Clay with occasional red brick fragments		
				5.04	1.20	Complete at 1.20m		

Plan

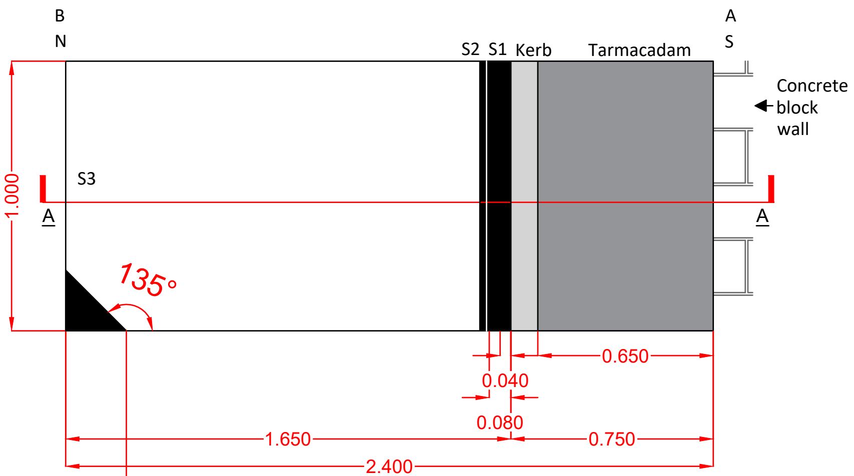
Remarks

No groundwater encountered during excavation
Trial pit sidewalls collapsing
DCP carried out at 0.9m BGL.
Trial pit backfilled upon completion

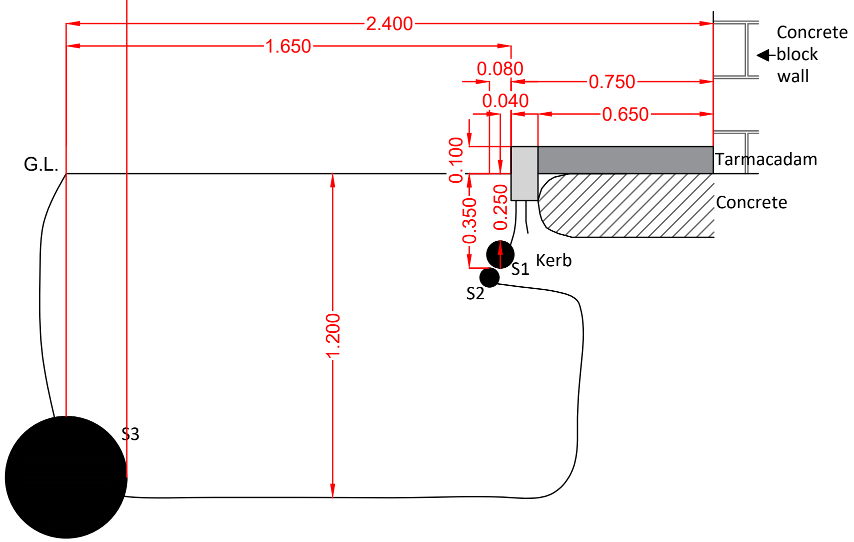
Scale (approx)	Logged By	Figure No.
1:25	LB	13614-02-24.TP04

TP04

PLAN VIEW



SECTION A-A



FOUNDATION PIT LOG

0.00 - 0.07	TARMACADAM.
0.07 - 1.00	MADE GROUND: Grey slightly clayey sandy angular to subrounded fine to coarse Gravel with some cobbles and boulders.
1.00 - 1.20	MADE GROUND: Brown slightly sandy slightly gravelly Clay with some red brick fragments.

SERVICES:

S1 - Ø0.100m black duct 90°
S2 - Ø0.070m black duct 90°
S3 - Approximately Ø0.450m concrete 45°

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PROJECT:	13614-02-24 - Dyke Road Galway
DRAWING No.:	TP-04
DATE:	15/04/2024
CLIENT:	Aecom
SCALE:	NTS

Version:	Date:	Drawn By:	Checked By:
1	14/05/2024	J.S.	M.S.

Ground Investigations Ireland Ltd www.gii.ie		Site: Dyke Road Galway	Trial Pit Number: TP05
Machine : 3T Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.80 x 0.60 x 1.35m / **Ground Level (mOD)** 6.24	**Client** Aecom	**Job Number** 13614-02-24
	Location 529863.4 E 725899.1 N / **Dates** 15/04/2024	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				6.17	(0.07) 0.07	TARMACADAM		
					(0.48)	MADE GROUND: Grey slightly sandy angular to subrounded fine to coarse Gravel		
0.50	B			5.69	0.55	MADE GROUND: Light brown slightly clayey slightly gravelly fine to coarse Sand with medium angular to subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse.		
1.00	B				(0.80)			
				4.89	1.35	Complete at 1.35m		

Plan

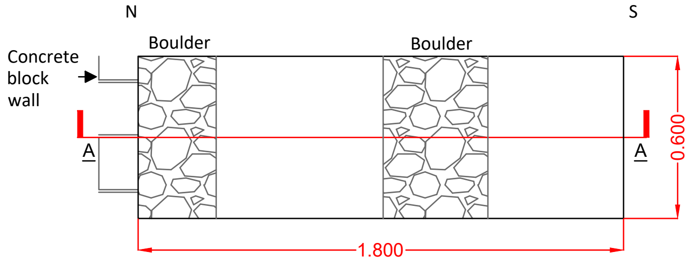
Remarks

No groundwater encountered during excavation
Trial pit sidewalls stable
Trial pit backfilled upon completion

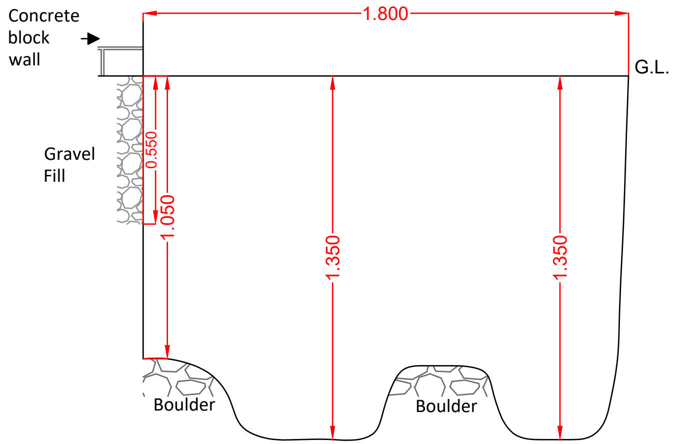
Scale (approx)	Logged By	Figure No.
1:25	LB	13614-02-24.TP05

TP05

PLAN VIEW



SECTION A-A



FOUNDATION PIT LOG

0.00 - 0.07	TARMACADAM.
0.07 - 0.55	MADE GROUND: Grey slightly sandy angular to subrounded fine to coarse Gravel.
0.55 - 1.35	MADE GROUND: Light brown slightly clayey slightly gravelly fine to coarse Sand with some angular to subrounded cobbles and boulders.

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PROJECT:	13614-02-24 - Dyke Road Galway
DRAWING No.:	TP-05
DATE:	15/04/2024
CLIENT:	Aecom
SCALE:	NTS

Version:	Date:	Drawn By:	Checked By:
1	14/05/2024	J.S.	M.S.

Ground Investigations Ireland Ltd www.gii.ie	Site Dyke Road Galway	Trial Pit Number **TP06**

Machine : 3T Tracked Excavator Method : Trial Pit	Dimensions 2.30 x 0.80 x 0.80m	Ground Level (mOD) 7.16	Client Aecom	Job Number 13614-02-24
	Location 529902.4 E 725842.8 N	Dates 17/04/2024	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				7.06	(0.10) 0.10	TARMACADAM		
					(0.50)	MADE GROUND: Grey slightly sandy angular to subrounded fine to coarse Gravel with high angular to subangular cobble content and an old wire		
0.50	B							
				6.56	0.60	POSSIBLE MADE GROUND: Brown clayey slightly gravelly fine to coarse Sand		
0.70	B				(0.20)			
				6.36	0.80	Complete at 0.80m		

Plan

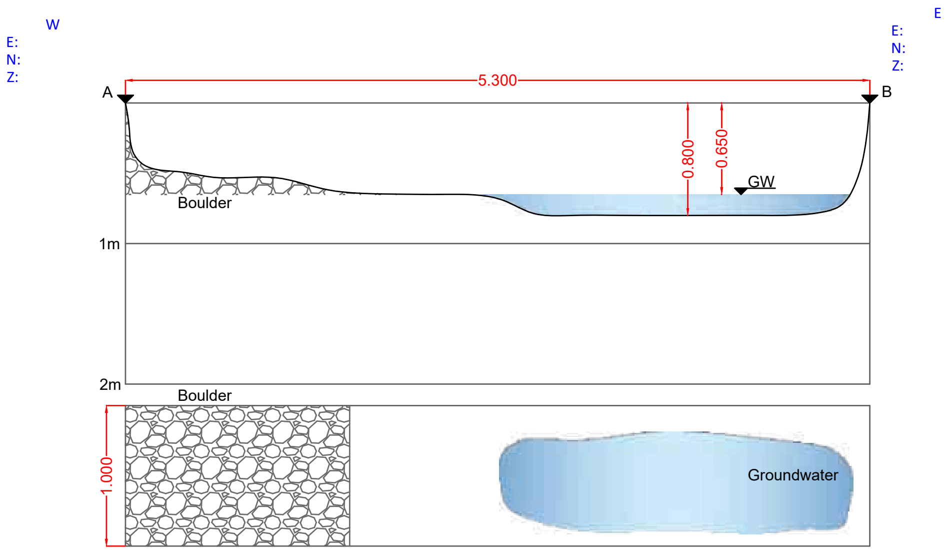
Remarks

No groundwater encountered during excavation
Trial pit sidewalls stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	LB	13614-02-24.TP06

APPENDIX 3 – Slit Trench Records

ST-01



Service No	ø (m)	Colour - Material	Utility	Angle to trench	Coordinates		Level
					East	North	

Surface from/to (m)		Surface type
0.00	5.30	TARMACADAM

Sample depth (m)	Sample type
0.5	B

From (m)	To (m)	Description
0.00	0.05	TARMACADAM.
0.05	0.20	MADE GROUND: Dark grey slightly sandy angular to subangular fine to coarse Gravel.
0.20	0.80	MADE GROUND: Greyish brown sandy gravelly Clay with some fragments of metal, cans and some angular to subangular cobble content.

Groundwater	Y/N	Depth	Notes
Slow	Y	0.65	

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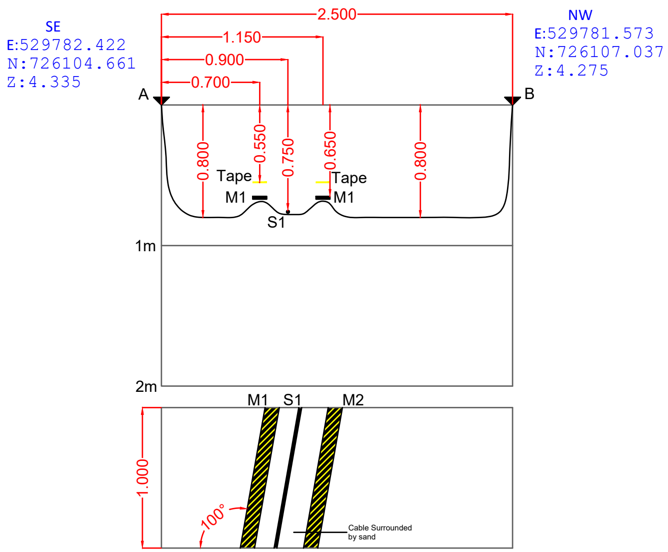
PROJECT:	13614-02-24 - Dyke Road Galway
DRAWING No.:	ST-01
DATE:	11/04/2024
CLIENT:	Aecom
SCALE:	NTS

Version:	Date:	Drawn By:	Checked By:
1	23/04/2024	J.S.	L.B.

ST-02



Service No	ø (m)	Colour - Material	Utility	Angle to trench	Coordinates		Level
					East	North	
S1	0.020	Black	ESB	100°	529782.061	726105.5	3.559
M1	0.100	Black rubber	-	100°	529782.112	726105.334	3.698
M2	0.100	Black rubber	-	100°	529782.016	726105.736	3.676

From (m)	To (m)	Description
0.00	0.05	TARMACADAM.
0.05	0.15	MADE GROUND: Dark grey slightly sandy angular to subrounded fine to coarse Gravel.
0.15	0.80	MADE GROUND: Grey sandy gravelly Clay.

Surface from/to (m)		Surface type
0.00	2.50	TARMACADAM

Sample depth (m)	Sample type
0.5	B

Groundwater	Y/N	Depth	Notes
	N		

GROUND INVESTIGATIONS IRELAND

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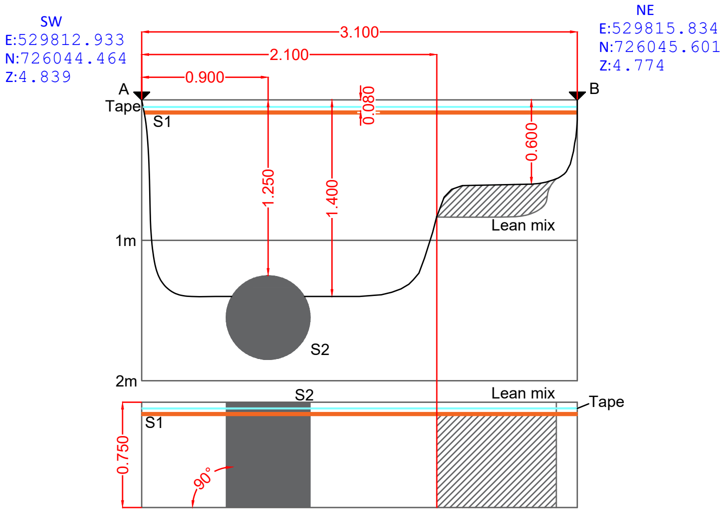
PROJECT:	13614-02-24 - Dyke Road Galway
DRAWING No.:	ST-02
DATE:	11/04/2024
CLIENT:	Aecom
SCALE:	NTS

Version:	Date:	Drawn By:	Checked By:
1	23/04/2024	J.S.	L.B.

ST-03



Service No	ø (m)	Colour - Material	Utility	Angle to trench	Coordinates East	Coordinates North	Level
S1	0.020	Orange - Plastic	Fibre optic	0°	529813.155	726044.790	4.710
S1	0.600?	Concrete	Storm	90°	529813.831	726044.651	3.539

Surface from/to (m)		Surface type
0.00	3.10	TARMACADAM

Sample depth (m)	Sample type
0.5	B

From (m)	To (m)	Description
0.00	0.07	TARMACADAM.
0.07	1.40	MADE GROUND: Grey clayey angular to subrounded fine to coarse Sand and Gravel.

Groundwater	Y/N	Depth	Notes
	N		

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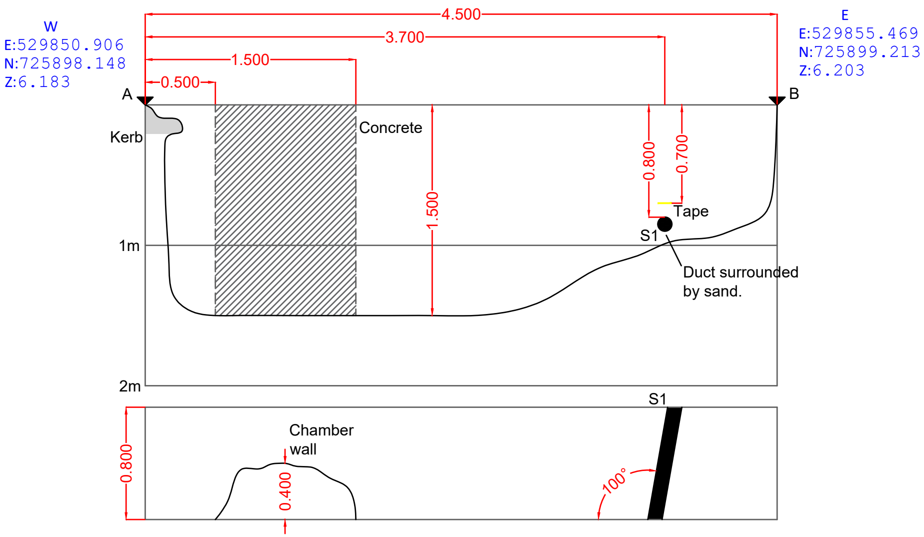
PROJECT:	13614-02-24 - Dyke Road Galway
DRAWING No.:	ST-03
DATE:	12/04/2024
CLIENT:	Aecom
SCALE:	NTS

Version:	Date:	Drawn By:	Checked By:
1	23/04/2024	J.S.	L.B.

ST-04



Service No	ø (m)	Colour - Material	Utility	Angle to trench	Coordinates		Level
					East	North	
S1	0.100	Black - Duct	ESB	100°	529854.585	725898.986	5.482

Surface from/to (m)		Surface type
0.00	4.50	TARMACADAM

Sample depth (m)	Sample type
1.0	B

From (m)	To (m)	Description
0.00	0.08	TARMACADAM.
0.08	0.30	MADE GROUND: Grey sandy angular to subrounded fine to coarse Gravel.
0.30	0.50	MADE GROUND: Brown clayey gravelly fine to coarse Sand.
0.50	1.50	MADE GROUND: Grey sandy angular to subrounded fine to coarse Gravel with some plastic fragments and plastic bags.

Groundwater	Y/N	Depth	Notes
	N		

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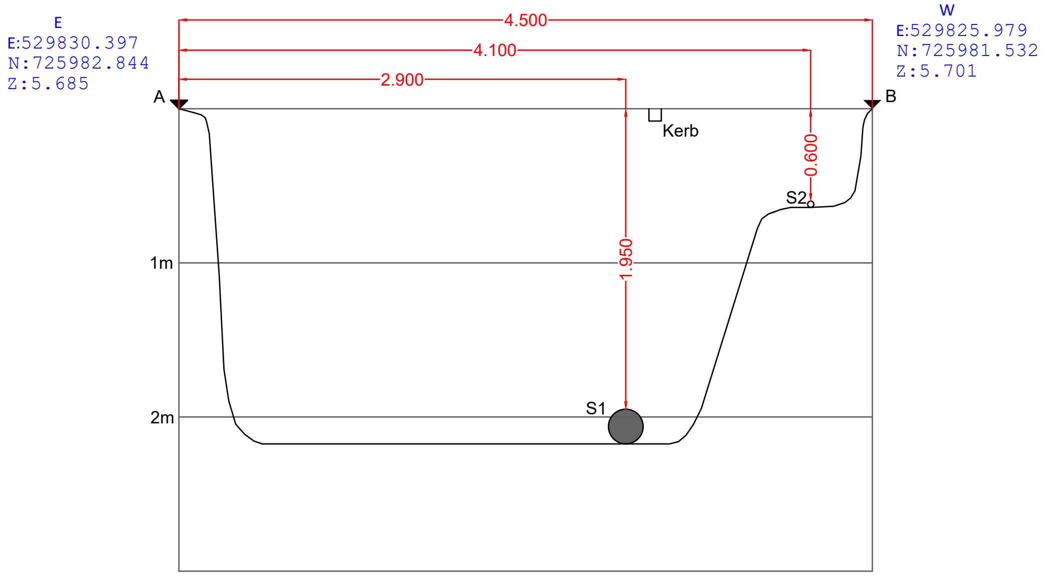
PROJECT:	13614-02-24 - Dyke Road Galway
DRAWING No.:	ST-04
DATE:	17/04/2024
CLIENT:	Aecom
SCALE:	NTS

Version:	Date:	Drawn By:	Checked By:
1	23/06/2024	S.F.	L.B.

ST-05



Service No	ø (m)	Colour - Material	Utility	Angle to trench	Coordinates		Level
					East	North	
S1	0.225	Grey	Foul	100°	529827.542	725981.833	3.884
S2	0.040	Steel crushed	-	85°	529826.391	725981.661	4.869

Surface from/to (m)		Surface type
0.00	3.05	Concrete
3.05	3.13	Kerb
3.15	4.50	Tarmacadam

Sample depth (m)	Sample type

From (m)	To (m)	Description
0.00	0.10	MADE GROUND: Concrete
0.10	0.20	Tarmacadam
0.20	0.90	MADE GROUND: 804
0.90	0.91	MADE GROUND: Membrane
0.20	0.90	Black fibrous PEAT.

Groundwater	Y/N	Depth	Notes
?	Y	1.50	

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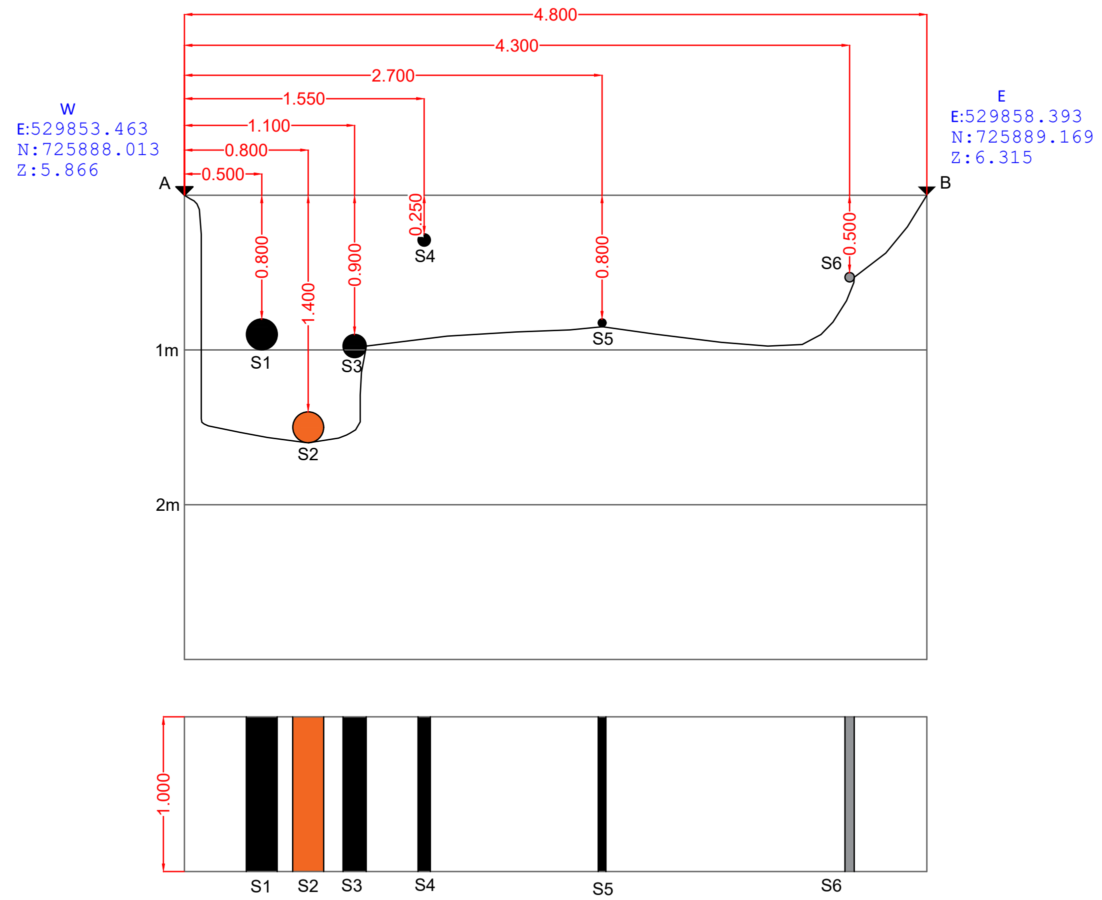
PROJECT:	13614-02-24 - Dyke Road Galway
DRAWING No.:	ST-05
DATE:	13/06/2024
CLIENT:	Aecom
SCALE:	NTS

Version:	Date:	Drawn By:	Checked By:
1	23/04/2024	S.F	?

ST-06



Service No	ø (m)	Colour - Material	Utility	Angle to trench	Coordinates East	Coordinates North	Level
S1	0.200	Black PVC		90°	529853.931	725888.107	5.167
S2	0.200	Orange PVC	Foul?	90°	529854.062	725888.283	4.477
S3	0.150	Black PVC		90°	529854.473	725888.281	4.929
S4	0.080	Black Duct	ESB?	90°	529854.87	725888.265	5.760
S5	0.050	Black PVC		90°	529856.04	725888.724	5.411
S6	0.060	Steel bent	?	90°	529857.489	725889.112	5.844

From (m)	To (m)	Description
0.00	0.30	MADE GROUND: Tarmacadam
0.30	0.60	MADE GROUND: 804
0.60	0.61	MADE GROUND: Membrane
0.61	1.5	MADE GROUND: Grey slightly clayey slightly sandy subangular to subrounded fine to coarse Gravel.

Surface from/to (m)		Surface type
0.00	2.70	TARMACADAM Foot path
2.70	4.80	TARMACADAM Car park

Groundwater	Y/N	Depth	Notes
Slow	Y	0.65	

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PROJECT:	13614-02-24 - Dyke Road Galway
DRAWING No.:	ST-01
DATE:	13/06/2024
CLIENT:	Aecom
SCALE:	NTS

Version:	Date:	Drawn By:	Checked By:
1	16/06/2024	S.F.	?

Dyke Road Galway – Slit Trench Photographs

ST06

ST06

ST06

APPENDIX 4 – Soakaway Records

GROUND INVESTIGATIONS IRELAND
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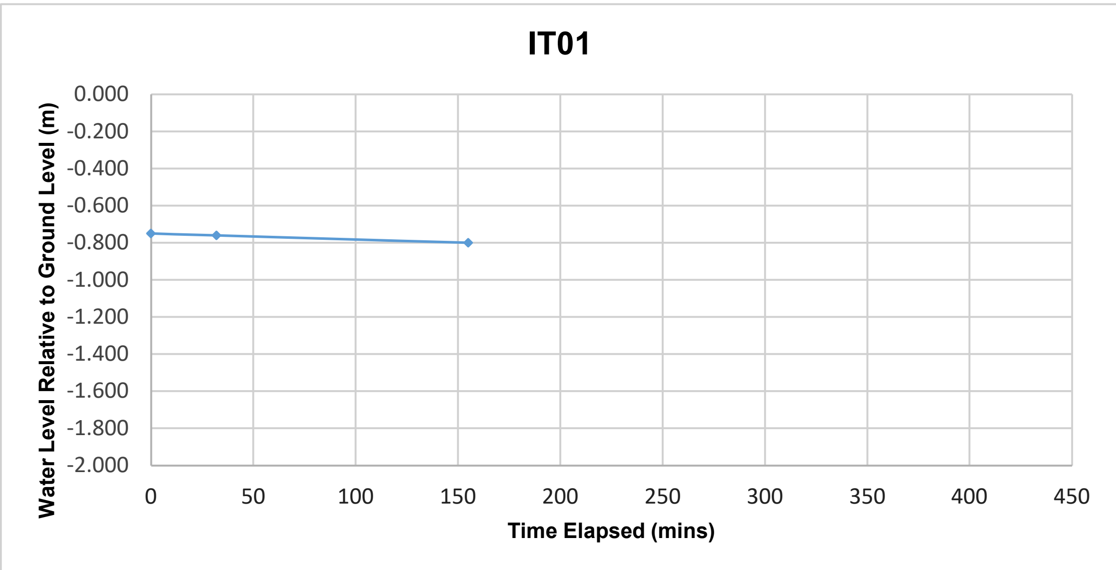
IT01

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.60m x 0.60m x 0.85m (L x W x D)

Date	Time	Water level (m bgl)
15/04/2024	Groundwater at 0.75m BGL	
15/04/2024	0	-0.750
15/04/2024	32	-0.760
15/04/2024	155	-0.800

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.75	0.850	0.100	0.775	0.825



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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Tel: 01 601 5175 / 5176
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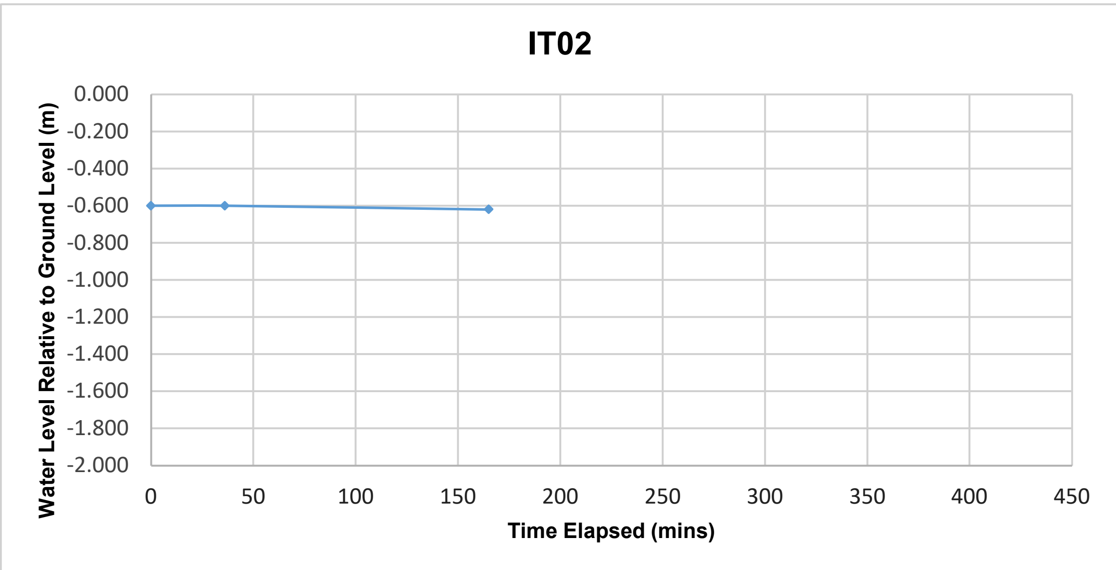
IT02

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.70m x 0.75m x 1.60m (L x W x D)

Date	Time	Water level (m bgl)
15/04/2024	0	-0.600
15/04/2024	36	-0.600
15/04/2024	165	-0.620

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.60	1.600	1.000	0.85	1.35



APPENDIX 5 – Borehole Records

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Borehole Number: BH01

Machine : Dando 2000 & Beretta T-44 Method : Cable Percussion with Rotary follow on	Casing Diameter: 200mm cased to 10.50m 96mm cased to 16.30m	Ground Level (mOD): 4.73	Client: Aecom	Job Number: 13614-02-24
	Location: 529797.4 E 726065.9 N	Dates: 26/04/2024-22/05/2024	Engineer:	Sheet: 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					4.67	0.06	TARMACADAM		
0.25	ES					(0.44)	MADE GROUND: Grey slightly clayey sandy angular to subrounded fine to coarse Gravel		
0.50	ES				4.23	0.50	MADE GROUND: Brownish black slightly clayey slightly sandy gravelly Peat with occasional red brick and ceramic fragments. Gravel is subangular to subrounded fine to coarse		
1.00-1.45 1.00	SPT(C) N=2 B			2,2/1,0,0,1		(1.00)			
1.50	ES				3.23	1.50	MADE GROUND: Brownish black clayey slightly sandy slightly gravelly Peat with occasional ceramic and red brick fragments and rubbish. Gravel is subangular to subrounded fine to coarse		
2.00-2.45 2.00	SPT(C) N=0 B			1,0/0,0,0,0		(1.00)			
2.50	B				2.23	2.50	Very soft beige clayey SILT and brown CLAY with frequent shell fragments		
3.00-3.45	UT 100					(1.00)			
3.50	B				1.23	3.50	Very soft beige clayey SILT with frequent shell fragments		
4.00-4.45	SPT(C) N=0			0,0/0,0,0,0					1
4.50	B					(2.20)			
5.00-5.45	UT 0								
5.70	B				-0.97	5.70	Very soft dark grey silty CLAY with occasional shell fragments		
6.00-6.45	SPT(C) N=2			1,1/1,0,1,0					
6.70	B								
7.50-7.95	SPT(C) N=1			0,1/0,0,0,1		(3.80)			
7.70	B								
8.70	B								
9.00-9.45	SPT(C) N=2			1,0/0,1,1,0					
9.50	B			Water strike(1) at 9.50m, rose to 4.00m in 20 mins.	-4.77	9.50	Grey slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse		1
10.00-10.45	SPT(C) N=1			0,0/0,1,0,0					

Remarks
Cable percussion drilling completed at 10.50m BGL, Rotary drilling completed at 16.30m BGL.
Groundwater encountered at 9.50m BGL
Borehole backfilled upon completion

Scale (approx)	Logged By
1:50	AM

Figure No. 13614-02-24.BH01

Ground Investigations Ireland Ltd www.gii.ie			Site: Dyke Road Galway	Borehole Number: BH01
Machine : Dando 2000 & Beretta T-44 Method : Cable Percussion with Rotary follow on	Casing Diameter: 200mm cased to 10.50m 96mm cased to 16.30m	Ground Level (mOD): 4.73	Client: Aecom	Job Number: 13614-02-24
	Location: 529797.4 E 726065.9 N	Dates: 26/04/2024-22/05/2024	Engineer:	Sheet: 2/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(1.00)			
10.50	74					-5.77	10.50	Very dense grey subangular to subrounded fine to coarse GRAVEL with low cobble content		
11.00-11.16 11.00					1,10/50 SPT(C) 50/5		(0.70)			
11.20	100	87	61			-6.47	11.20	Strong thinly to medium bedded grey finely to medium grained fossiliferous LIMESTONE. Fresh (11.20 - 16.30m BGL) 1 fracture set. 10-30 degrees, closely to medium spaced, undulating, rough with occasional Clay staining		
12.50	100	88	72	6			(5.10)			
14.00	100	87	69							
15.50	100	100	84							
16.30						-11.57	16.30	Complete at 16.30m		

Remarks

Scale (approx)	Logged By
1:50	AM

Figure No. 13614-02-24.BH01

Ground Investigations Ireland Ltd
www.gii.ie

Site Dyke Road Galway	**Borehole Number** BH02			
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 9.70m	**Ground Level (mOD)** 5.08	**Client** Aecom	**Job Number** 13614-02-24
	Location 529838.9 E 726012.6 N	**Dates** 10/04/2024-11/04/2024	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Water
					5.03	0.05	TARMACADAM	
						(0.45)	Light grey slightly sandy subangular to subrounded fine to coarse gravel FILL	
0.50	ES				4.58	0.50	Brownish black mottled light brown slightly clayey slightly sandy slightly gravelly PEAT. Gravel is subangular to subrounded fine to coarse	
						(1.00)		
1.00	B							
1.00	ES							
1.00-1.45	UT 60%			2 blows				
1.50	B				3.58	1.50	Very soft greyish light brown slightly sandy clayey SILT	
2.00-2.45	SPT(C) N=1			0,0/0,0,1,0				
						(1.50)		
2.50	B							1
3.00	B				2.08	3.00	Grey slightly sandy slightly gravelly clayey SILT. Gravel is subangular to subrounded fine to coarse	
3.00-3.45	UT 100%			3 blows		(0.60)		
3.60	B				1.48	3.60	Soft to firm grey slightly sandy slightly gravelly clayey SILT with occasional cobbles. Gravel is subangular to subrounded fine to coarse	
4.00-4.45	SPT(C) N=7			0,1/1,0,2,4				
4.60	B							
						(2.40)		
5.00-5.45	SPT(C) N=12			2,2/1,3,2,6				
5.60	B							
6.00-6.45	SPT(C) N=27			9,6/5,6,8,8	-0.92	6.00	Stiff to very stiff grey slightly sandy slightly gravelly CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse	
6.00	B							
7.00	B							
7.50-7.78	SPT(C) 50/125			9,15/37,13				
						(3.40)		
8.00	B							
9.00-9.45	SPT(C) N=32			14,15/13,3,2,14				
9.00	B							
9.40	B				-4.32	9.40	Grey slightly clayey very sandy subangular to subrounded fine to coarse GRAVEL with occasional cobbles	1
				Water strike(1) at 9.50m, rose to 2.80m in 20 mins.		(0.30)		
					-4.62	9.70	Complete at 9.70m	

Remarks
Cable percussion drilling refused at 9.70m BGL
Groundwater encountered at 9.50m BGL
Borehole backfilled upon completion
Chiselling from 7.50m to 8.00m for 0.5 hours.

Scale (approx)	Logged By
1:50	AM

Figure No. 13614-02-24.BH02

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Borehole Number: BH03

Machine : Dando 2000 / Method : Cable Percussion	Casing Diameter: 200mm cased to 9.10m	Ground Level (mOD): 5.21	Client: Aecom	Job Number: 13614-02-24
	Location: 529849.5 E 725985.6 N	Dates: 12/04/2024-15/04/2024	Engineer:	Sheet: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					5.15	0.06	TARMACADAM		
						(0.94)	Grey sandy angular to subrounded fine to coarse gravel FILL		
1.00 1.00-1.45	B UT 100			2 blows	4.21	1.00 (1.00)	Greyish brown and beige slightly sandy slightly gravelly clayey SILT with pockets of brownish black Peat. Gravel is subangular to subrounded fine to coarse		
2.00-2.45 2.00	SPT(C) N=1 B			0,0/0,0,0,1	3.21	2.00 (1.00)	Very soft greyish beige clayey SILT with occasional shell fragments		
3.00 3.00-3.45	B UT 100			3 blows	2.21	3.00 (0.40)	Brownish grey peaty silty CLAY with frequent organics		
3.40 4.00-4.45 4.40	B SPT(C) N=4 B			 0,1/0,0,1,3	1.81	3.40 (1.60)	Very soft to soft light grey slightly sandy slightly gravelly clayey SILT with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
5.00-5.45 5.40	SPT(C) N=12 B			2,5/4,4,3,1	0.21	5.00 (1.00)	Firm light grey slightly sandy slightly gravelly clayey SILT with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
6.00-6.45 6.00 7.00 7.50-7.95	SPT(C) N=32 B B SPT(C) N=41			3,5/9,7,8,8 2,8/10,8,9,14	-0.79	6.00 (2.00)	Stiff to very stiff light grey slightly sandy slightly gravelly CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
8.00	B				-2.79	8.00 (1.10)	Very stiff light grey sandy gravelly CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
9.00-9.08	SPT(C) 25*/75 50/0			25/50	-3.89	9.10	Complete at 9.10m		

Remarks
Cable percussion drilling refused at 9.10m BGL
No groundwater encountered during drilling
Borehole backfilled upon completion
Chiselling from 9.10m to 9.10m for 1 hour.

Scale (approx)	Logged By
1:50	AM

Figure No. 13614-02-24.BH03

Ground Investigations Ireland Ltd www.gii.ie		Site Dyke Road Galway	Borehole Number BH04
Machine : Dando 2000 Method : Cable Percussion	Casing Diameter 200mm cased to 2.80m	Ground Level (mOD) 6.09	Client Aecom	Job Number 13614-02-24
	Location 529867.4 E 725905.2 N	Dates 19/04/2024	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					6.03	0.06	TARMACADAM		
0.30	B				5.79	(0.24) 0.30	Grey Sand and Gravel FILL. Gravel is subangular to subrounded fine to coarse		
0.50	ES					(0.50)			
0.80	B				5.29	0.80	Brownish black slightly gravelly PEAT. Gravel is subangular to subrounded fine to coarse		
1.00-1.45	SPT(C) N=38			14,11/18,8,5,7		(1.00)	Very stiff greenish grey mottled brown sandy gravelly CLAY with occasional cobbles. Possible residual soil. Gravel is subangular to subrounded fine to coarse		
1.50	ES								
1.80	B				4.29	1.80	Dense greenish grey sandy angular to subrounded fine to coarse GRAVEL. Possible weathered rock		
2.30-2.68	SPT(C) 50/230			5,7/9,10,18,13		(1.00)			
					3.29	2.80	Complete at 2.80m		

Remarks
Cable percussion drilling refused at 2.80m BGL
No groundwater encountered during drillling
Borehole backfilled upon completion
Chiselling from 0.80m to 1.00m for 0.25 hours. Chiselling from 1.00m to 2.30m for 1 hour. Chiselling from 2.80m to 2.80m for 1 hour.

Scale (approx)	Logged By
1:50	AM

Figure No.
13614-02-24.BH04

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Borehole Number: BH05

Machine : Dando 2000 / Method : Cable Percussion	Casing Diameter: 200mm cased to 4.50m	Ground Level (mOD): 7.05	Client: Aecom	Job Number: 13614-02-24
	Location: 529888.8 E 725839.2 N	Dates: 25/04/2024	Engineer:	Sheet: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					6.99	0.06	TARMACADAM		
0.25	ES					(0.34)	Grey Sand and Gravel FILL. Gravel is subangular to subrounded fine to coarse		
0.50	ES				6.65	0.40	MADE GROUND: Greyish light brown slightly sandy slightly gravelly CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
1.00-1.30	SPT(C) 50/145			14,11/24,26		(1.60)			
1.00	B								
1.50	ES								
2.00-2.45	SPT(C) N=7			10,8/3,2,1,1	5.05	2.00	Soft greyish light brown slightly sandy slightly gravelly CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
2.00	B					(0.40)			
2.40	B				4.65	2.40	Soft brownish black slightly clayey slightly gravelly PEAT. Gravel is subangular to subrounded fine to coarse		
						(0.60)			
3.00-3.45	SPT(C) N=43			7,10/6,5,15,17	4.05	3.00	Brownish black slightly clayey slightly gravelly PEAT. Gravel is subangular to subrounded fine to coarse		
						(0.50)			
3.50	B			Water strike(1) at 3.50m.	3.55	3.50	Dense bluish grey very sandy angular to subrounded fine to coarse GRAVEL		1
4.00-4.24	SPT(C) 50/85			17,8/31,19		(1.00)			
4.00	B								
					2.55	4.50	Terminated on possible bedrock or large boulder		
							Complete at 4.50m		

Remarks
Cable percussion drilling refused at 4.50m BGL
Groundwater encountered at 3.50m BGL
Borehole backfilled upon completion
Chiselling from 1.00m to 2.00m for 1 hour. Chiselling from 4.50m to 4.50m for 1 hour.

Scale (approx)	Logged By
1:50	AM

Figure No. 13614-02-24.BH05

Ground Investigations Ireland Ltd
www.gii.ie

Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 5.70m	**Ground Level (mOD)** 6.89	**Site** Dyke Road Galway	**Borehole Number** BH06
	Location 529907.4 E 725874.7 N	**Dates** 24/04/2024	**Client** Aecom	**Job Number** 13614-02-24
			Engineer	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					6.79	0.10	TARMACADAM		
						(0.50)	Grey sandy angular to subrounded fine to coarse Gravel FILL		
					6.29	0.60	MADE GROUND: Grey slightly sandy gravelly Clay with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
1.00-1.09	SPT(C) 25*/75 50/15			25/50					
1.00	B					(1.20)			
1.80	B				5.09	1.80	MADE GROUND: Greyish brown slightly sandy slightly gravelly Clay with occasional cobbles and occasional red brick and charcoal fragments. Gravel is subangular to subrounded fine to coarse		
2.00-2.45	SPT(C) N=9			17,8/2,3,2,2		(0.70)			
2.50	B				4.39	2.50	MADE GROUND: Brownish black slightly gravelly Peat with rare red brick fragments. Gravel is subangular to subrounded fine to coarse		
						(0.20)			
2.70	B				4.19	2.70	Brownish black PEAT		
3.00-3.45	UT 100			1 blows		(0.70)			1
3.40	B				3.49	3.40	Stiff to very stiff light grey slightly sandy slightly gravelly silty CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse		1
				Water strike(1) at 3.50m, rose to 3.00m in 20 mins.					
4.00-4.45	SPT(C) N=32			4,6/8,7,8,9		(1.10)			
4.50	B				2.39	4.50	Very stiff light grey sandy slightly gravelly silty CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
5.00-5.25	SPT(C) 50/95			16,9/33,17		(1.20)			
5.70-5.70	SPT(C) 25*/0 50/0			25/50	1.19	5.70	Complete at 5.70m		

Remarks
Cable percussion drilling refused at 5.70m BGL
Groundwater encountered at 3.50m BGL
Borehole backfilled upon completion
Chiselling from 1.00m to 1.80m for 1 hour. Chiselling from 5.00m to 5.70m for 0.5 hours. Chiselling from 5.70m to 5.70m for 1 hour.

Scale (approx)	Logged By
1:50	AM

Figure No.
13614-02-24.BH06

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Borehole Number: BRC01

Machine : Dando 2000 & Beretta T-44 **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 10.50m 96mm cased to 16.50m	**Ground Level (mOD)** 4.15	**Client** Aecom	**Job Number** 13614-02-24
	Location 529798.3 E 726121.2 N	**Dates** 25/04/2024- 21/05/2024	**Engineer**	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					4.09	0.06	TARMACADAM			
0.25	ES									
0.50	ES					(0.64)	Grey slightly clayey Sand and Gravel FILL with occasional tarmacadam fragments. Gravel is subangular to subrounded fine to coarse			
					3.45	0.70	Very soft brownish black slightly clayey slightly gravelly PEAT. Gravel is subangular to subrounded fine to coarse			
1.00	B									
1.00-1.45	UT 60			6 blows						
1.50	ES					(1.80)				
2.00-2.45	SPT(C) N=0			1,0/0,0,0,0						
2.00	B									
2.50	B				1.65	2.50	Beige clayey SILT and brownish black slightly clayey PEAT with frequent shell fragments			
3.00-3.45	UT 0			2 blows		(1.00)				
3.50	B				0.65	3.50	Very soft beige clayey SILT with occasional shell fragments			
4.00-4.45	SPT(C) N=1			0,0/0,1,0,0						
4.50	B					(2.00)				
5.30-5.75	UT 100			2 blows						
5.50	B				-1.35	5.50	Soft brownish dark grey silty CLAY and beige clayey SILT with occasional shell fragments and occasional pockets of Peat			
6.00-6.45	SPT(C) N=7			2,1/2,1,2,2						
6.50	B					(2.00)				
7.50	B				-3.35	7.50	Very soft greyish brown silty CLAY			
7.50-7.95	UT 100			2 blows						
									1	
						(1.50)				
8.50	B									
									1	
9.00	B			Water strike(1) at 9.00m, rose to 8.00m in 20 mins.	-4.85	9.00	Very soft to soft light grey slightly sandy slightly gravelly silty CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse			
9.00-9.45	SPT(C) N=0			1,0/0,0,0,0						
						(1.50)				
10.00-10.45	SPT(C) N=4			1,0/0,1,2,1						

Remarks
Cable percussion drilling completed at 10.50m BGL, Rotary drilling completed at 16.50m BGL
Groundwater encountered at 9.00m BGL
50mm standpipe installled to 10.00m BGL. Slotted standpipe installed from 10.00 - 1.00m BGL. Solid standpipe installed from 1.00m BGL - GL with gas tap and flush cover

Scale (approx)	Logged By
1:50	AM

Figure No. 13614-02-24.BRC01

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Borehole Number: BRC01

Machine: Dando 2000 & Beretta T-44	Casing Diameter: 200mm cased to 10.50m; 96mm cased to 16.50m	Ground Level (mOD): 4.15	Client: Aecom	Job Number: 13614-02-24
Method: Cable Percussion with Rotary follow on	Location: 529798.3 E 726121.2 N	Dates: 25/04/2024-21/05/2024	Engineer:	Sheet: 2/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
10.50	64					-6.35	10.50 (0.50)	Poor recovery. Recovery consists of grey peaty clayey SILT onto grey clayey silty subangular to subrounded fine to coarse GRAVEL
11.00-11.45					0,0/0,1,4,3 SPT(C) N=8			
11.00	80	50	45			-6.85	11.00 (0.50)	Poor recovery. Recovery consists of slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL.
11.50				9		-7.35	11.50 (1.50)	Strong thinly to medium bedded grey finely to medium grained fossiliferous LIMESTONE. Slightly weathered. (11.50 - 13.00m BGL) 2 fracture sets. FS1: 10-30 degrees, closely to medium spaced, undulating, rough with occasional Clay staining. FS2: 70-80 degrees, widely spaced, undulating, rough with occasional Clay staining
12.50-12.60					C			
12.50	100	97	77					
13.00				7		-8.85	13.00 (3.50)	Strong thinly to medium bedded grey finely to medium grained fossiliferous LIMESTONE. Fresh. (13.00 - 16.50m BGL) 3 fracture sets. FS1: 0-20 degrees, closely to medium spaced, undulating, rough with occasional Clay staining. FS2: 30-40 degrees, medium to widely spaced, undulating, rough. FS3: 70-80 degrees, undulating, rough with occasional Clay staining
14.00	100	97	77					
14.65-14.88					C			
15.50	100	90	70					
16.05-16.15					C			
16.50						-12.35	16.50	Complete at 16.50m

Remarks

Scale (approx)	Logged By
1:50	AM

Figure No. 13614-02-24.BRC01

Ground Investigations Ireland Ltd www.gii.ie			Site Dyke Road Galway	Borehole Number BRC02
Machine : Dando 2000 & Beretta T-44 Method : Cable Percussion with Rotary follow on	Casing Diameter 200mm cased to 10.10m 146mm cased to 12.40m 96mm cased to 18.60m	Ground Level (mOD) 5.08	Client Aecom	Job Number 13614-02-24
	Location 529838.8 E 726050.5 N	Dates 15/04/2024- 15/05/2024	Engineer	Sheet 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					5.02	0.06	TARMACADAM			
0.25	ES						Grey Sand and Gravel FILL with occasional tarmacadam fragments. Gravel is subangular to subrounded fine to coarse			
0.50	ES					(0.94)				
					4.08	1.00	Very soft brownish black slightly gravelly PEAT with occasional pockets of beige clayey SILT. Gravel is subangular to subrounded fine to coarse			
1.00	B									
1.50	ES									
1.60-2.05	UT 60			4 blows		(1.50)				
2.00-2.45	SPT N=0			0,0/0,0,0,0						
2.00	B									
					2.58	2.50	Very soft beige clayey SILT with frequent shell fragments			
2.50	B									
									1	
3.00-3.45	UT 100			3 blows						
3.50	B					(2.20)				
4.00-4.45	SPT N=0			1,0/0,0,0,0						
					0.38	4.70	Brownish dark grey peaty silty CLAY			
4.70	B									
5.00-5.45	UT 100			3 blows						
						(1.30)				
5.70	B									
									1	
6.00	B			Water strike(1) at 6.00m, rose to 3.00m in 20 mins.	-0.92	6.00	Very stiff light grey slightly sandy very gravelly silty CLAY with low cobble content. Gravel is subangular to subrounded fine to coarse.			
6.00-6.45	SPT N=31			2,1/1,10,5,15						
7.00	B									
7.50-7.79	SPT(C) 50/135			21,4/32,18						
8.00	B					(4.10)				
9.00-9.31	SPT(C) 50/160			10,13/20,24,6						
9.00	B									
9.70-9.95	SPT(C) 50/95			25/31,19						

Remarks
Cable percussion drilling completed at 10.10m BGL, Rotary drilling completed at 18.60m BGL
Groundwater encountered at 6.00m BGL
50mm standpipe installed to 6.00m BGL. Slotted standpipe installed from 6.00 - 0.50m BGL. Solid standpipe installed from 0.50m BGL - GL with flush cover
Chiselling from 7.50m to 8.00m for 0.5 hours. Chiselling from 8.30m to 8.70m for 0.5 hours. Chiselling from 9.50m to 9.70m for 0.5 hours.

Scale (approx)	Logged By
1:50	AM

Figure No.
13614-02-24.BRC02

Ground Investigations Ireland Ltd www.gii.ie			Site: Dyke Road Galway	Borehole Number: BRC02
Machine : Dando 2000 & Beretta T-44 Method : Cable Percussion with Rotary follow on	Casing Diameter: 200mm cased to 10.10m 146mm cased to 12.40m 96mm cased to 18.60m	Ground Level (mOD): 5.08	Client: Aecom	Job Number: 13614-02-24
	Location: 529838.8 E 726050.5 N	Dates: 15/04/2024-15/05/2024	Engineer:	Sheet: 2/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.10	11					-5.02	10.10 (0.90)	Poor recovery. Recovery consists of grey slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse.			
11.00	29					-5.92	11.00 (1.40)	Poor recovery. Recovery consists of grey slightly sandy slightly gravelly silty CLAY with medium cobble content. Gravel is subangular to subrounded fine to coarse			
12.40	25					-7.32	12.40 (1.10)	Grey subangular to subrounded fine to coarse GRAVEL			
13.50	100	100	22	6		-8.42	13.50 (2.70)	Strong thinly to medium bedded grey fine to medium grained fossiliferous LIMESTONE with occasional calcite veins. Fresh (13.50 - 16.20m BGL) 3 fracture sets. FS1: 0-20 degrees, closely to medium spaced, undulating, rough with occasional Clay staining. FS2: 40-60 degrees, widely spaced, undulating, rough with occasional Clay staining. FS3: 80-90 degrees, undulating, rough with occasional Clay staining			
14.00	100	91	50								
15.37-15.50					C						
15.50	100	97	86								
16.20				3		-11.12	16.20 (2.40)	Strong thinly to medium bedded grey fine to medium grained fossiliferous LIMESTONE with occasional calcite veins. Fresh (16.20 - 18.60m BGL) 1 fracture set. 0-20 degrees, medium to widely spaced, undulating, rough with occasional Clay staining			
17.00	100	100	97								
18.20-18.35					C						
18.37-18.60					C						
18.60						-13.52	18.60	Complete at 18.60m			

Remarks	Scale (approx): 1:50	Logged By: AM
	Figure No.: 13614-02-24.BRC02	

Ground Investigations Ireland Ltd www.gii.ie		Site Dyke Road Galway	Borehole Number BRC03
Machine : Dando 2000 & Beretta T-44 Method : Cable Percussion with Rotary follow on	Casing Diameter 200mm cased to 10.30m 96mm cased to 20.10m	Ground Level (mOD) 5.37	Client Aecom	Job Number 13614-02-24
	Location 529834.4 E 725993.1 N	Dates 17/04/2024-16/05/2024	Engineer	Sheet 1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					5.31	0.06	TARMACADAM		
0.25	ES						Grey very sandy subangular to subrounded fine to coarse Gravel FILL		
0.50	ES								
						(1.94)			
1.50	ES								
2.00-2.45 2.00	SPT(C) N=0 B			2,0/0,0,0,0	3.37	2.00	Very soft brownish grey slightly sandy slightly gravelly silty CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
						(1.00)			
3.00 3.00-3.45	B U4 100			2 blows	2.37	3.00	Very soft light grey slightly sandy slightly gravelly clayey SILT with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
4.00-4.45 4.00	SPT(C) N=3 B			1,1/2,1,0,0		(2.00)			
5.00-5.45 5.00	SPT(C) N=6 B			1,0/0,2,2,2	0.37	5.00	Soft to firm light grey slightly sandy slightly gravelly silty CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
						(1.00)			
6.00-6.45 6.00	SPT(C) N=16 B			1,1/2,4,5,5	-0.63	6.00	Firm to stiff light grey slightly sandy slightly gravelly silty CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
						(1.50)			
7.50-7.95 7.50	SPT(C) N=49 B			6,8/9,8,9,23	-2.13	7.50	Very stiff grey slightly sandy slightly gravelly CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse		
8.50	B								
						(2.80)			
9.00-9.23	SPT(C) 50/80			15,10/46,4					
9.50	B								
10.00-10.22	SPT(C) 50/70			23,2/50					

Remarks
Cable percussion drilling refused at 10.30m BGL, Rotary drilling completed at 20.10m BGL
No groundwater encountered during drilling
Borehole backfilled upon completion
Chiselling from 8.00m to 8.30m for 0.25 hours. Chiselling from 9.00m to 9.50m for 0.5 hours. Chiselling from 9.50m to 10.00m for 0.5 hours.

Scale (approx)	Logged By
1:50	AM

Figure No.
13614-02-24.BRC03

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Borehole Number: BRC03

Machine : Dando 2000 & Beretta T-44 Method : Cable Percussion with Rotary follow on	Casing Diameter: 200mm cased to 10.30m 96mm cased to 20.10m	Ground Level (mOD): 5.37	Client: Aecom	Job Number: 13614-02-24
	Location: 529834.4 E 725993.1 N	Dates: 17/04/2024-16/05/2024	Engineer:	Sheet: 2/3

Depth (m)	Sample / Tests	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.30							-4.93	10.30	Very stiff to hard brownish grey slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subangular to subrounded fine to coarse		
		100									
11.00-11.08 11.00						25/50 SPT(C) 25*/75 50/0					
		100									
12.50-12.58 12.50						25/50 SPT(C) 25*/75 50/0					
		100						(5.00)			
14.00-14.08 14.00						25/50 SPT(C) 25*/75 50/0					
		100	12	7							
15.30							-9.93	15.30	Strong thinly to medium bedded grey finely to medium grained fossiliferous LIMESTONE with occasional calcite veins. Fresh (15.30 - 17.50m BGL) 1 fracture set. 0-30 degrees, closely spaced, undulating, rough with occasional Clay staining		
15.50											
16.40-16.50		100	90	70	8	C		(2.20)			
17.17-17.45 17.00						C					
17.50		100	97	71			-12.13	17.50	Strong thinly to medium bedded grey finely to medium grained fossiliferous LIMESTONE with occasional calcite veins. Fresh (17.50 - 20.10m BGL) 2 fracture sets. FS1: 0-30 degrees, closely to medium spaced, undulating, rough with occasional Clay staining. FS2: 60-70 degrees, widely spaced, undulating, rough with occasional Clay staining		
18.50					7			(2.60)			
		100	100	84							
19.95-20.05						C					

Remarks

Scale (approx)	Logged By
1:50	AM

Figure No. 13614-02-24.BRC03

Ground Investigations Ireland Ltd www.gii.ie	Site Dyke Road Galway	Borehole Number BRC03

Machine : Dando 2000 & Beretta T-44 Flush : Water Core Dia : 63.5 mm Method : Cable Percussion with Rotary follow on	Casing Diameter 200mm cased to 10.30m 96mm cased to 20.10m	Ground Level (mOD) 5.37	Client Aecom	Job Number 13614-02-24
	Location 529834.4 E 725993.1 N	Dates 17/04/2024-16/05/2024	Engineer	Sheet 3/3

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.10						-14.73	20.10	Complete at 20.10m		

Remarks

Scale (approx)	Logged By
1:50	AM

Figure No.
13614-02-24.BRC03

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Borehole Number: BRC04

Machine : Dando 2000 and Beretta T-44 Method : Cable Percussion with Rotary follow on	Casing Diameter: 200mm cased to 6.50m, 96mm cased to 12.00m	Ground Level (mOD): 6.94	Client: Aecom	Job Number: 13614-02-24
	Location: 529871.1 E 725874.2 N	Dates: 22/04/2024-16/05/2024	Engineer:	Sheet: 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
					6.88	0.06	TARMACADAM
0.25	ES						MADE GROUND: Grey Sand and Gravel. Gravel is angular to subangular fine to coarse
0.50	ES					(0.94)	
1.00-1.45 1.00	SPT(C) N=15 B			5,4/6,4,2,3	5.94	1.00	MADE GROUND: Brownish grey sandy slightly gravelly Clay with occasional glass wire and rubbish fragments and occasional cobbles. Gravel is subangular to subrounded fine to coarse
1.50	ES					(1.60)	
2.00-2.45 2.00	SPT(C) N=11 B			3,2/2,3,3,3			
2.60	B				4.34	2.60 (0.20)	MADE GROUND: Brownish black slightly gravelly Peat. Gravel is subangular to subrounded fine to coarse
2.80	B				4.14	2.80	MADE GROUND: Beige slightly gravelly clayey SILT with pockets of brownish black Peat and wire fragments. Gravel is subangular to subrounded fine to coarse
3.00-3.45	UT 100			14 blows		(0.60)	
3.40	B				3.54	3.40 (0.60)	Light grey slightly sandy gravelly silty CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse.
4.00	B			Water strike(1) at 4.00m, rose to 3.50m in 20 mins.	2.94	4.00	Medium dense to dense greenish grey very sandy subangular to subrounded fine to coarse GRAVEL with occasional cobbles
4.00-4.45	SPT(C) N=17			19,6/5,4,4,4			
5.00-5.38 5.00	SPT(C) 50/226 B			8,12/14,14,21,1		(2.50)	
6.00-6.30	SPT(C) 50/151			10,15/19,29,2			
6.40 6.50	TCR 100	SCR	RQD	FI	0.44	6.50	Dark green angular to subangular fine to coarse GRAVEL. Possible weathered bedrock
6.60	100	93	87		0.34	6.60	Strong to very strong thinly to thickly banded dark green medium to coarsely crystalline METAGABBRO with occasional calcite veins. Fresh (6.60 - 12.00m BGL) 2 fracture sets. FS1: 10-30 degrees, closely to medium spaced, planar to undulating, rough to striated. FS2: 30-40 degrees, widely spaced, planar to undulating, rough
8.00 8.40-8.57	100	93	89	C			
9.50-9.60 9.50			5	C		(5.40)	

Water: ▼1 at 3.40m; ▽1 at 4.00m

Remarks
Cable percussion drilling refused at 6.50m BGL on bedrock, Rotary drilling completed at 12.00m BGL
Groundwater encountered at 4.00m BGL
50mm standpipe installed to 6.00m BGL. Slotted standpipe installed from 6.00 - 0.50m BGL. Solid standpipe installed from 0.5m BGL - GL with flush cover
Chiselling from 4.00m to 4.50m for 0.5 hours. Chiselling from 6.50m to 6.50m for 1 hour.

Scale (approx)	Logged By
1:50	AM

Figure No. 13614-02-24.BRC04

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Borehole Number: BRC04

Machine : Dando 2000 and Beretta T-44 Flush : Water Core Dia : 63.5 mm Method : Cable Percussion with Rotary follow on	Casing Diameter: 200mm cased to 6.50m, 96mm cased to 12.00m	Ground Level (mOD): 6.94	Client: Aecom	Job Number: 13614-02-24
	Location: 529871.1 E 725874.2 N	Dates: 22/04/2024-16/05/2024	Engineer:	Sheet: 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.11-10.30					C						
	100	93	75								
11.00	100	100	83								
12.00						-5.06	12.00	Complete at 12.00m			

Remarks	Scale (approx): 1:50	Logged By: AM
	Figure No.: 13614-02-24.BRC04	

Ground Investigations Ireland Ltd www.gii.ie	Site: Dyke Road Galway	Borehole Number: BRC05
Machine: Dando 2000 & Beretta T-44 Method: Cable Percussion with Rotary follow on	Casing Diameter: 200mm cased to 6.10m; 96mm cased to 11.00m	Ground Level (mOD): 5.53
Client: Aecom	Job Number: 13614-02-24	
Location: 529900.1 E 725923.8 N	Dates: 18/04/2024-20/05/2024	Engineer:
Sheet: 1/2		

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Water
					5.47	0.06	TARMACADAM	
0.50	ES					(0.74)	MADE GROUND: Grey slightly clayey Sand and Gravel. Gravel is subangular to subrounded fine to coarse	
0.80	B				4.73	0.80	Brownish black slightly clayey slightly gravelly PEAT. Gravel is subangular to subrounded fine to coarse	
1.00-1.45	UT 80			3 blows		(0.70)		
1.50	B				4.03	1.50	Very soft beige clayey SILT with occasional shell fragments	
1.50	ES							
2.00-2.45	SPT N=0			0,0/0,0,0,0		(0.90)		
2.40	B				3.13	2.40 (0.20)	Dark brown peaty CLAY	
2.60	B				2.93	2.60	Light grey slightly gravelly clayey SILT with occasional cobbles. Gravel is subangular to subrounded fine to coarse	1
				Water strike(1) at 3.00m, rose to 2.90m in 20 mins.		(0.90)		
3.00-3.45	UT 0			8 blows				
3.50	B				2.03	3.50	Very stiff light grey slightly sandy slightly gravelly silty CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse	
4.00-4.45	SPT(C) N=39			7,8/9,9,11,10				
4.50	B					(2.30)		2
				Water strike(2) at 5.00m, rose to 3.00m in 20 mins.				
5.00-5.45	SPT(C) N=40			6,11/9,14,7,10				
5.80	B							
5.80-6.09	SPT(C) 50/135			8,12/10,40	-0.27	5.80 (0.30)	Dense bluish grey sandy angular to subangular fine to coarse GRAVEL with occasional cobbles. Gravel is subangular to subrounded fine to coarse	
					-0.57	6.10	Strong thinly to medium bedded grey finely to medium grained fossiliferous LIMESTONE with occasional calcite veins. Slightly weathered (6.10 - 7.20m BGL) 1 fracture set. 10-30 degrees, very closely to closely spaced, undulating, rough with occasional Clay staining	
						(1.10)		
					-1.67	7.20	Strong thinly to medium bedded grey finely to medium grained fossiliferous LIMESTONE with occasional calcite veins. Fresh (7.20 - 11.00m BGL) 1 fracture set. 10-30 degrees, closely to medium spaced, undulating, rough with occasional Clay staining	
						(3.80)		

Depth (m)	TCR	SCR	RQD	FI	Field Records
6.10	100	85	27	15	
6.50	100	82	56		
7.20					
7.71-7.80					C
8.00	100	97	38	8	
9.25-9.36					C
9.65-9.88					C
9.50					

Remarks
Cable percussion drilling refused at 6.10m BGL, Rotary drilling completed at 11.00m BGL
Groundwater encountered at 3.00m and 5.00m BGL
50mm standpipe installed to 11.00m BGL. Slotted standpipe installed from 11.00 - 1.00m BGL. Solid standpipe installed from 1.00m BGL - GL with gas tap and flush cover
Chiselling from 5.50m to 5.80m for 0.5 hours. Chiselling from 6.10m to 6.10m for 1 hour.

Scale (approx): 1:50 | Logged By: AM
Figure No.: 13614-02-24.BRC05

Ground Investigations Ireland Ltd www.gii.ie		**Site** Dyke Road Galway	**Borehole Number** BRC05
Machine : Dando 2000 & Beretta T-44 **Flush :** Water **Core Dia:** 63.50 mm **Method :** Cable Percussion with Rotary follow on	**Casing Diameter** 200mm cased to 6.10m 96mm cased to 11.00m	**Ground Level (mOD)** 5.53	**Client** Aecom	**Job Number** 13614-02-24
	Location 529900.1 E 725923.8 N	**Dates** 18/04/2024- 20/05/2024	**Engineer**	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	100	97	73								
11.00						-5.47	11.00	Complete at 11.00m			

Remarks	**Scale (approx)** 1:50	**Logged By** AM
	Figure No. 13614-02-24.BRC05	

Ground Investigations Ireland Ltd
www.gii.ie

Machine : Beretta T-44 **Flush** : Water **Core Dia**: 63.5 mm **Method** : Rotary Cored	**Casing Diameter** 96mm cased to 14.40m	**Ground Level (mOD)** 5.43	**Site** Dyke Road Galway **Client** Aecom	**Borehole Number** BRC06 **Job Number** 13614-02-24
	Location 529845.9 E 725961.5 N	**Dates** 22/05/2024	**Engineer**	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						5.40	0.03	TARMACADAM		
	33						(1.97)	Possible MADEGROUND: Poor recovery. Recovery consists of grey slightly clayey subangular to subrounded fine to coarse GRAVEL		
2.00 2.00-2.45	10				1,0/0,0,0,0 SPT(C) N=0	3.43	2.00	Poor recovery. Recovery consists of grey sandy slightly gravelly silty CLAY with low cobble content. Gravel is subangular to subrounded fine to coarse. Driller notes: Grey silts (Very soft)		
3.50 3.50-3.95	13				0,0/0,0,0,0 SPT(C) N=0		(4.50)			
5.00 5.00-5.45	27				0,0/1,0,0,0 SPT(C) N=1					
6.50 6.50-6.95	100				3,4/4,5,4,7 SPT(C) N=20	-1.07	6.50 (0.90)	Grey clayey sandy subangular to subrounded fine to course GRAVEL with low cobble content. Driller notes: sandy gravelly Cay (Stiff)		
						-1.97	7.40 (0.60)	Grey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium		
8.00 8.00-8.45	37	7	0		0,5/7,8,8,12 SPT(C) N=35	-2.57	8.00 (1.40)	Poor recovery. Recovery consists of grey slightly clayey subangular to rounded fine to coarse GRAVEL with low cobble content (Dense)		
9.40 9.50						-3.97	9.40	Medium strong to strong thinly to medium bedded grey finely to medium grained fossiliferous LIMESTONE with occasional calcite veins. Slightly weathered		

Remarks
Rotary drilling completed at 14.40m BGL
Borehole backfilled upon completion

Scale (approx) 1:50
Logged By AM
Figure No. 13614-02-24.BRC06

Ground Investigations Ireland Ltd
www.gii.ie

Machine : Beretta T-44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 14.40m	**Ground Level (mOD)** 5.43	**Site** Dyke Road Galway	**Borehole Number** BRC06
	Location 529845.9 E 725961.5 N	**Dates** 22/05/2024	**Client** Aecom	**Job Number** 13614-02-24
			Engineer	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	100	83	67	6			(1.30)	(9.40 - 10.70m BGL) 1 fracture set. 10-30 degrees, closely to medium spaced, undulating, rough with occasional Clay staining		
10.70						-5.27	10.70	Medium strong to strong thinly to medium bedded grey and dark grey finely grained argillaceous LIMESTONE with frequent mudstone laminations and occasional calcite veins. Fresh		
11.00 11.00-11.17	100	80	43		C			(10.70 - 14.40m BGL) 3 fracture sets. FS1: 0-20 degrees, closely to medium spaced, planar to undulating, rough with occasional Clay staining. FS2: 40-50 degrees, medium to widely spaced, planar to undulating, rough with occasional Clay staining. FS3: 60-70 degrees, widely spaced, undulating, rough		
12.50				11			(3.70)			
13.34-13.44	100	93	20		C					
14.00	100	100	75							
14.40						-8.97	14.40	Complete at 14.40m		

Remarks

Scale (approx)	Logged By
1:50	AM

Figure No.
13614-02-24.BRC06

APPENDIX 6 – Insitu Plate Bearing Test Records

Applied Load	Gauge settlement
0	**0.000**
34.5	-0.36
69	-1.66
138	-3.97
0	-1.76
69	-3.125
138	-4.255
0	-2.1

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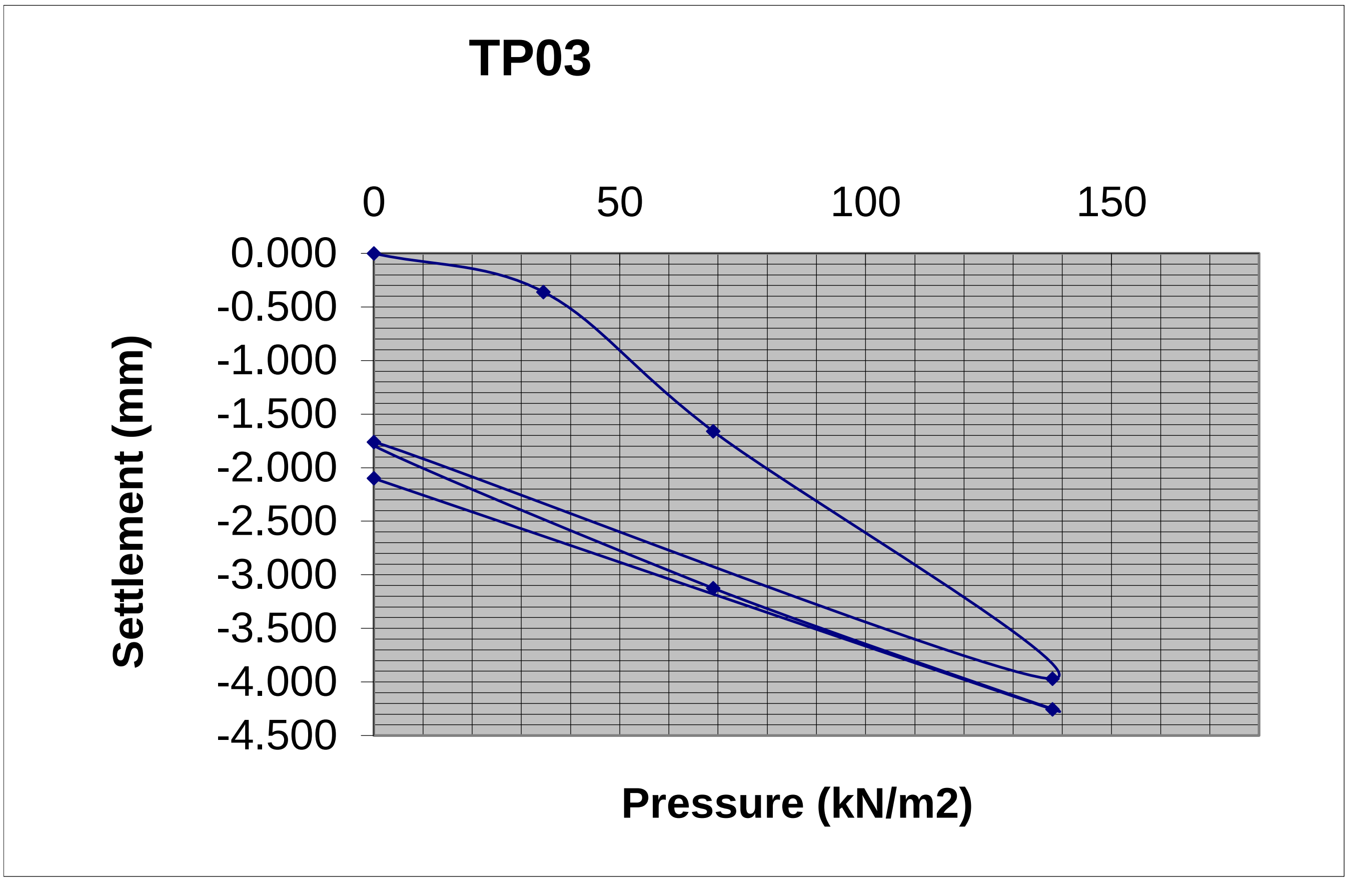
LOCATION	Dyke Road, Galway	**MATERIAL**	MADE GROUND: Grey sandy angular to subrounded fine to coarse Gravel
CONTRACT NO.	13614-02-24		
DATE	15/04/2024		
CLIENT	Aecom	**DEPTH**	0.20m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	TP03	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **28.09 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **34.16 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **3.12 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **4.38 %**

APPENDIX 7 - TRL Dynamic Cone Penetrometer Records

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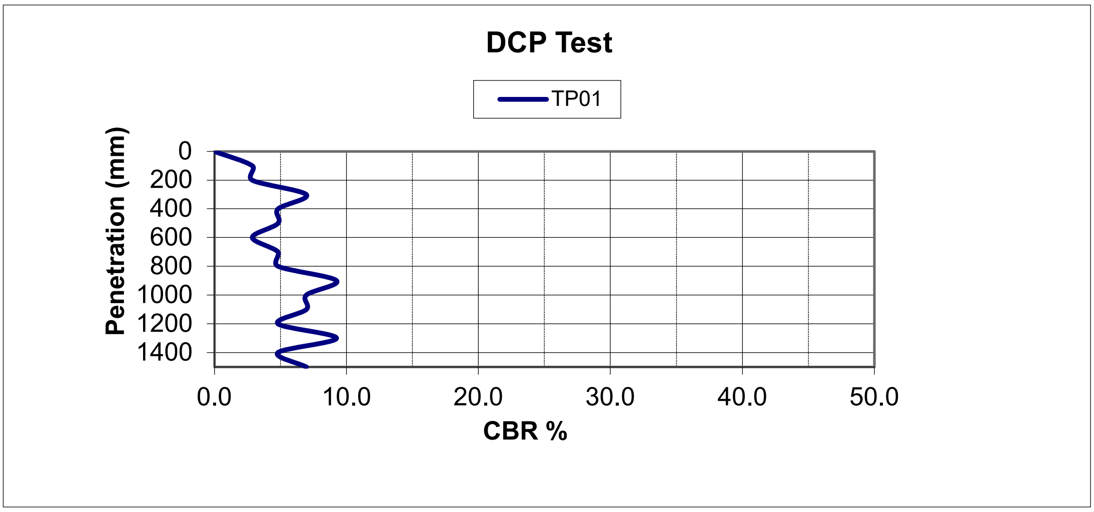
Web: www.gii.ie

Job Name	Dyke Road Galway	**Test Type**	Dynamic Cone Penetration Test
Job No.	13614-02-24	**Test Reference**	TP01
Client	Aecom	**By**	LB
		Date	17/04/2024
Initial Depth	0.8		

Depth below start depth (mm)	No. of Blows per 100mm	Penetration per Blow (mm)	CBR (%)
0	-	-	0.0
100	2	50.0	2.9
200	2	50.0	2.9
300	4	25.0	7.0
400	3	33.3	4.8
500	3	33.3	4.8
600	2	50.0	2.9
700	3	33.3	4.8
800	3	33.3	4.8
900	5	20.0	9.3
1000	4	25.0	7.0
1100	4	25.0	7.0
1200	3	33.3	4.8
1300	5	20.0	9.3
1400	3	33.3	4.8
1500	4	25.0	7.0

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



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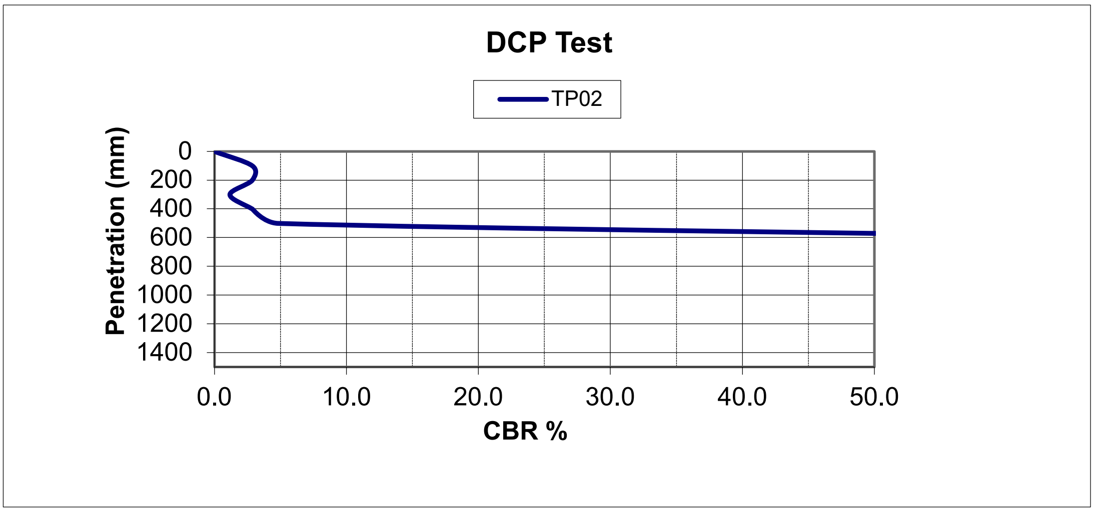
Web: www.gii.ie

Job Name	Dyke Road Galway	**Test Type**	Dynamic Cone Penetration Test
Job No.	13614-02-24	**Test Reference**	TP02
Client	Aecom	**By**	LB
		Date	17/04/2024
Initial Depth	0.7		

Depth below start depth (mm)	No. of Blows per 100mm	Penetration per Blow (mm)	CBR (%)
0	-	-	0.0
100	2	50.0	2.9
200	2	50.0	2.9
300	1	100.0	1.2
400	2	50.0	2.9
500	3	33.3	4.8
600	25	4.0	72.7
700			
800			
900			
1000			
1100			
1200			
1300			
1400			
1500			

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



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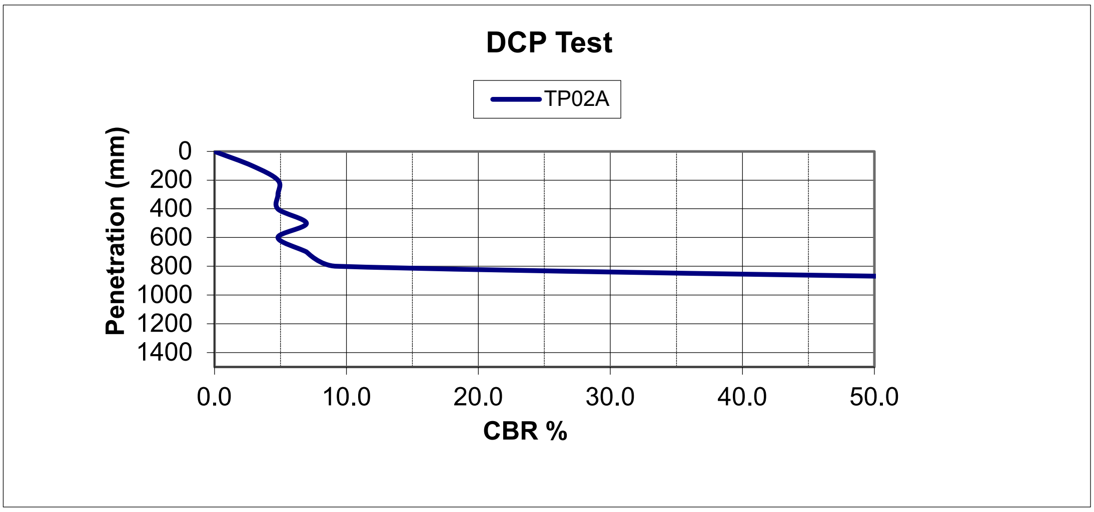
Job Name	Dyke Road Galway	**Test Type**	Dynamic Cone Penetration Test
Job No.	13614-02-24	**Test Reference**	TP02A
Client	Aecom	**By**	LB
		Date	17/04/2024
Initial Depth	0.7		

Depth below start depth (mm)	No. of Blows per 100mm	Penetration per Blow (mm)	CBR (%)
0	-	-	0.0
100	2	50.0	2.9
200	3	33.3	4.8
300	3	33.3	4.8
400	3	33.3	4.8
500	4	25.0	7.0
600	3	33.3	4.8
700	4	25.0	7.0
800	5	20.0	9.3
900	25	4.0	72.7
1000			
1100			
1200			
1300			
1400			
1500			

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



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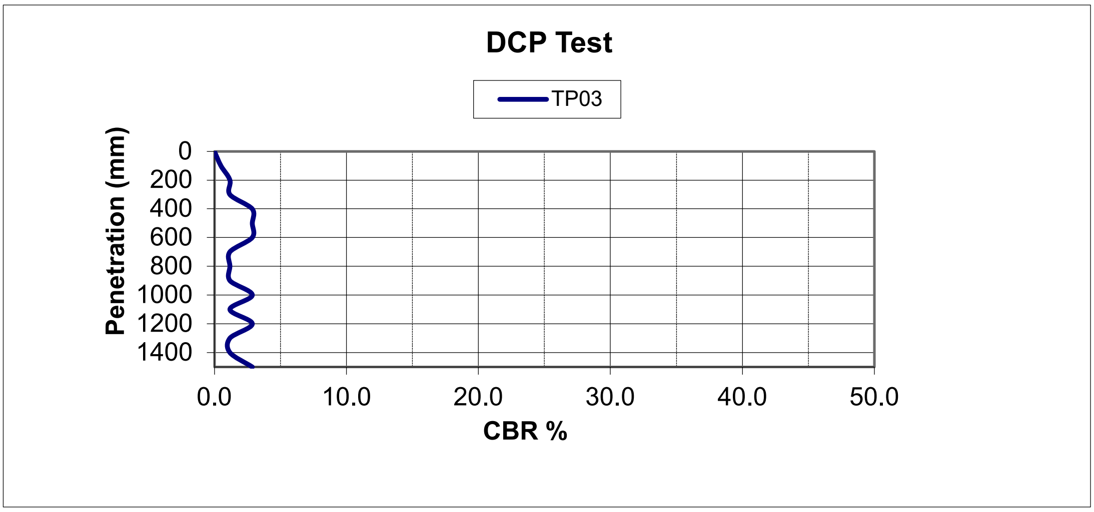
Job Name	Dyke Road Galway	**Test Type**	Dynamic Cone Penetration Test
Job No.	13614-02-24	**Test Reference**	TP03
Client	Aecom	**By**	LB
		Date	15/04/2024
Initial Depth	0.7		

Depth below start depth (mm)	No. of Blows per 100mm	Penetration per Blow (mm)	CBR (%)
0	-	-	0.0
100	0	200.0	0.5
200	1	100.0	1.2
300	1	100.0	1.2
400	2	50.0	2.9
500	2	50.0	2.9
600	2	50.0	2.9
700	1	100.0	1.2
800	1	100.0	1.2
900	1	100.0	1.2
1000	2	50.0	2.9
1100	1	100.0	1.2
1200	2	50.0	2.9
1300	1	100.0	1.2
1400	1	100.0	1.2
1500	2	50.0	2.9

Reference **Kleyn and Van Heerden (60° Cone)**
Formula $\text{Log10 (CBR)} = 2.632 - 1.28\ \text{Log10 (mm/blow)}$



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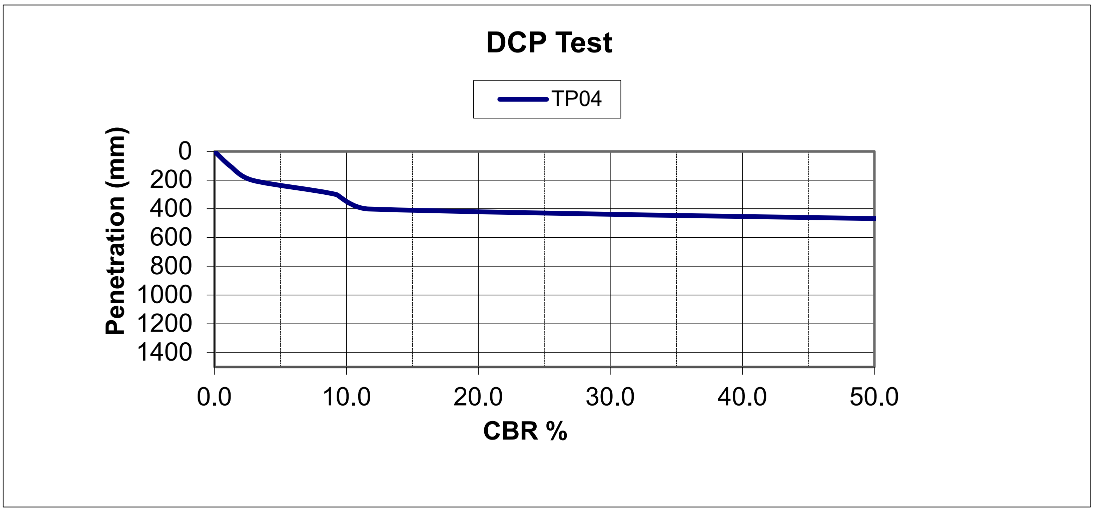
Job Name	Dyke Road Galway	**Test Type**	Dynamic Cone Penetration Test
Job No.	13614-02-24	**Test Reference**	TP04
Client	Aecom	**By**	LB
		Date	15/04/2024
Initial Depth	0.9		

Depth below start depth (mm)	No. of Blows per 100mm	Penetration per Blow (mm)	CBR (%)
0	-	-	0.0
100	4	100.0	1.2
200	2	50.0	2.9
300	5	20.0	9.3
400	6	16.7	11.7
500	25	4.0	72.7
600			
700			
800			
900			
1000			
1100			
1200			
1300			
1400			
1500			

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



APPENDIX 8 – Laboratory Results

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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
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Ireland
D22 K5P8

Attention :	Mike Sutton
Date :	30th April, 2024
Your reference :	13614-02-24
Our reference :	Test Report 24/6265 Batch 1
Location :	Dyke Road Galway
Date samples received :	12th April, 2024
Status :	Final Report
Issue :	202404301446

Two samples were received for analysis on 12th April, 2024 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

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

Scope 1&2 emissions - 9.412 kg of CO2

Scope 1&2&3 emissions - 22.243 kg of CO2

Authorised By:

Phil Sommerton BSc
Senior Project Manager

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road Galway
Contact: Mike Sutton
EMT Job No: 24/6265

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8									LOD/LOR	Units	Method No.
Sample ID	BH02	BH02											
Depth	0.50	1.00											
COC No / misc													
Containers	V J T	V J T											
Sample Date	10/04/2024	10/04/2024											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	12/04/2024	12/04/2024											
Antimony	3	2									<1	mg/kg	TM30/PM15
Arsenic #	13.7	9.6									<0.5	mg/kg	TM30/PM15
Barium #	197	138									<1	mg/kg	TM30/PM15
Cadmium #	1.2	0.8									<0.1	mg/kg	TM30/PM15
Chromium #	40.3	23.7									<0.5	mg/kg	TM30/PM15
Copper #	81	67									<1	mg/kg	TM30/PM15
Lead #	175	106									<5	mg/kg	TM30/PM15
Mercury #	0.7	0.4									<0.1	mg/kg	TM30/PM15
Molybdenum #	3.4	1.9									<0.1	mg/kg	TM30/PM15
Nickel #	21.6	15.3									<0.7	mg/kg	TM30/PM15
Selenium #	3	4									<1	mg/kg	TM30/PM15
Zinc #	250	146									<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
Acenaphthylene	0.06	<0.03									<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05									<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.17	<0.03									<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.44	<0.03									<0.03	mg/kg	TM4/PM8
Pyrene #	0.46	<0.03									<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.34	<0.06									<0.06	mg/kg	TM4/PM8
Chrysene #	0.38	<0.02									<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.63	<0.07									<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.34	<0.04									<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	0.27	<0.04									<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.25	<0.04									<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
PAH 6 Total #	1.93	<0.22									<0.22	mg/kg	TM4/PM8
PAH 17 Total	3.34	<0.64									<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.45	<0.05									<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.18	<0.02									<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1									<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	99	99									<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	<30									<30	mg/kg	TM5/PM8/PM16

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road Galway
Contact: Mike Sutton
EMT Job No: 24/6265

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8									LOD/LOR	Units	Method No.
Sample ID	BH02	BH02											
Depth	0.50	1.00											
COC No / misc													
Containers	V J T	V J T											
Sample Date	10/04/2024	10/04/2024											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	12/04/2024	12/04/2024											
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1[SV]	<0.1[SV]									<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1[SV]	<0.1[SV]									<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1[SV]	<0.1[SV]									<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<0.2									<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4									<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7									<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<7									<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_CU_1D_AL)	<7	<7									<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH_CU+HS_1D_AL)	<26	<26									<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1[SV]	<0.1[SV]									<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_CU_1D_AL)	<10	<10									<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_CU_1D_AL)	<10	<10									<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1[SV]	<0.1[SV]									<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1[SV]	<0.1[SV]									<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1[SV]	<0.1[SV]									<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<0.2									<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	<4									<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	23	<7									<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	369	168									<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_CU_1D_AR)	48	25									<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH_CU+HS_1D_AR)	440	193									<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH_CU+HS_1D_Total)	440	193									<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1[SV]	<0.1[SV]									<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_CU_1D_AR)	67	39									<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_CU_1D_AR)	394	211									<10	mg/kg	TM5/PM8/PM16
MTBE#	<5[SV]	<5[SV]									<5	ug/kg	TM36/PM12
Benzene#	<5[SV]	<5[SV]									<5	ug/kg	TM36/PM12
Toluene#	<5[SV]	<5[SV]									<5	ug/kg	TM36/PM12
Ethylbenzene#	<5[SV]	<5[SV]									<5	ug/kg	TM36/PM12
m/p-Xylene#	<5[SV]	<5[SV]									<5	ug/kg	TM36/PM12
o-Xylene#	<5[SV]	<5[SV]									<5	ug/kg	TM36/PM12
PCB 28#	<5	<5									<5	ug/kg	TM17/PM8
PCB 52#	<5	<5									<5	ug/kg	TM17/PM8
PCB 101#	<5	<5									<5	ug/kg	TM17/PM8
PCB 118#	<5	<5									<5	ug/kg	TM17/PM8
PCB 138#	<5	<5									<5	ug/kg	TM17/PM8
PCB 153#	<5	<5									<5	ug/kg	TM17/PM8
PCB 180#	<5	<5									<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	<35									<35	ug/kg	TM17/PM8

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road Galway
Contact: Mike Sutton
EMT Job No: 24/6265

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8											
Sample ID	BH02	BH02											
Depth	0.50	1.00											
COC No / misc													
Containers	V J T	V J T											
Sample Date	10/04/2024	10/04/2024											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	12/04/2024	12/04/2024									LOD/LOR	Units	Method No.
Natural Moisture Content	109.7	129.7									<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	52.3	56.5									<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3									<0.3	mg/kg	TM38/PM20
Chromium III	40.3	23.7									<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	13.75	13.99									<0.02	%	TM21/PM24
pH #	7.49	7.43									<0.01	pH units	TM73/PM11

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road Galway
Contact: Mike Sutton
EMT Job No: 24/6265

Report : **CEN 10:1 1 Batch**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8									LOD/LOR	Units	Method No.
Sample ID	BH02	BH02											
Depth	0.50	1.00											
COC No / misc													
Containers	V J T	V J T											
Sample Date	10/04/2024	10/04/2024											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	12/04/2024	12/04/2024											
Dissolved Antimony #	0.010	0.005									<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	0.10	0.05									<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	0.0039	0.0055									<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	0.039	0.055									<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.035	0.020									<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.35	0.20									<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005									<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005									<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015									<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015									<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007									<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07									<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005									<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05									<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.009	0.010									<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.09	0.10									<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002									<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02									<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003									<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03									<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	0.007	0.004									<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.07	0.04									<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001									<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001									<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01									<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1									<0.1	mg/kg	TM26/PM0
Fluoride	<0.3	0.3									<0.3	mg/l	TM173/PM0
Fluoride	<3	<3									<3	mg/kg	TM173/PM0
Sulphate as SO4 #	37.6	9.5									<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	376	95									<5	mg/kg	TM38/PM0
Mass of raw test portion	0.1295	0.1342										kg	NONE/PM17
Chloride #	2.9	3.1									<0.3	mg/l	TM38/PM0
Chloride #	29	31									<3	mg/kg	TM38/PM0
Mass of dried test portion	0.09	0.09										kg	NONE/PM17
Dissolved Organic Carbon	8	13									<2	mg/l	TM60/PM0
Dissolved Organic Carbon	80	130									<20	mg/kg	TM60/PM0
pH	8.26	8.34									<0.01	pH units	TM73/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road Galway
Contact: Mike Sutton
EMT Job No: 24/6265

Report : **CEN 10:1 1 Batch**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8									LOD/LOR	Units	Method No.
Sample ID	BH02	BH02											
Depth	0.50	1.00											
COC No / misc													
Containers	V J T	V J T											
Sample Date	10/04/2024	10/04/2024											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	12/04/2024	12/04/2024											
Total Dissolved Solids #	200	147									<35	mg/l	TM20/PM0
Total Dissolved Solids #	2000	1469									<350	mg/kg	TM20/PM0

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road Galway
Contact: Mike Sutton
EMT Job No: 24/6265

Report : **EN12457_2**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	BH02	BH02						
Depth	0.50	1.00						
COC No / misc								
Containers	V J T	V J T						
Sample Date	10/04/2024	10/04/2024						
Sample Type	Soil	Soil						
Batch Number	1	1						
Date of Receipt	12/04/2024	12/04/2024						
Solid Waste Analysis								
Total Organic Carbon #	13.75	13.99	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025 SV	<0.025 SV	6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs #	<0.035	<0.035	1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	1.93	<0.22	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	3.34	<0.64	100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate								
Arsenic #	0.039	0.055	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.35	0.20	20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.09	0.10	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	0.10	0.05	0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	0.07	0.04	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	2000	1469	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	80	130	500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1295	0.1342	-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	69.3	66.9	-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.86	0.855	-	-	-		l	NONE/PM17
Moisture Content 105C (% Dry Weight)	44.4	49.5	-	-	-	<0.1	%	PM4/PM0
pH #	7.49	7.43	-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	<3	10	150	500	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	376	95	1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	29	31	800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland

Reference: 13614-02-24

Location: Dyke Road Galway

Contact: Mike Sutton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
24/6265	1	BH02	0.50	1-4	Trace of PAHs & Naturally occurring compounds
24/6265	1	BH02	1.00	5-8	Trace of PAHs & Naturally occurring compounds

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road Galway
Contact: Mike Sutton

Note:

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

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

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

Where trace asbestos is reported the amount of asbestos will be <0.1%.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
24/6265	1	BH02	0.50	4	Catherine Coles	22/04/2024	**General Description (Bulk Analysis)**	brown soil
					Catherine Coles	22/04/2024	**Asbestos Fibres**	NAD
					Catherine Coles	22/04/2024	**Asbestos ACM**	NAD
					Catherine Coles	22/04/2024	**Asbestos Type**	NAD
24/6265	1	BH02	1.00	8	Catherine Coles	22/04/2024	**General Description (Bulk Analysis)**	chalk,peat, vegitation
					Catherine Coles	22/04/2024	**Asbestos Fibres**	NAD
					Catherine Coles	22/04/2024	**Asbestos ACM**	NAD
					Catherine Coles	22/04/2024	**Asbestos Type**	NAD

EMT Job No.: 24/6265

SOILS and ASH

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

STACK EMISSIONS

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

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

HWOL ACRONYMS AND OPERATORS USED

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

EMT Job No: 24/6265

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.	Yes		AD	Yes

EMT Job No: 24/6265

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

EMT Job No: 24/6265

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

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Ground Investigations Ireland
Catherinestown House
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Attention :	Mike Sutton
Date :	30th April, 2024
Your reference :	13614-02-24
Our reference :	Test Report 24/6663 Batch 1
Location :	Dyke Road Galway
Date samples received :	18th April, 2024
Status :	Final Report
Issue :	202404301121

Two samples were received for analysis on 18th April, 2024 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

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

Scope 1&2 emissions - 6.371 kg of CO2

Scope 1&2&3 emissions - 15.057 kg of CO2

Authorised By:

Bruce Leslie
Project Manager

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road Galway
Contact: Mike Sutton
EMT Job No: 24/6663

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	LOD/LOR	Units	Method No.
Sample ID	BRC-02	BRC-02			
Depth	0.25	1.50			
COC No / misc					
Containers	V J T	V J T			
Sample Date	16/04/2024	16/04/2024			
Sample Type	Soil	Soil			
Batch Number	1	1			
Date of Receipt	18/04/2024	18/04/2024			
Arsenic#	1.6	1.6	<0.5	mg/kg	TM30/PM15
Cadmium#	0.4	0.4	<0.1	mg/kg	TM30/PM15
Chromium#	13.0	11.6	<0.5	mg/kg	TM30/PM15
Copper#	6	6	<1	mg/kg	TM30/PM15
Lead#	<5	<5	<5	mg/kg	TM30/PM15
Mercury#	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Nickel#	8.5	7.7	<0.7	mg/kg	TM30/PM15
Selenium#	<1	<1	<1	mg/kg	TM30/PM15
Water Soluble Boron#	0.3	0.3	<0.1	mg/kg	TM74/PM32
Zinc#	11	10	<5	mg/kg	TM30/PM15
PAH MS					
Naphthalene#	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene#	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene#	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene#	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene#	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene#	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene#	0.05	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene#	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene#	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene#	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene#	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene#	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene#	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene#	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	90	89	<0	%	TM4/PM8
EPH (C8-C40) (EH_1D_Total)#	877	1033	<30	mg/kg	TM5/PM8
Phenol#	<0.01	<0.01	<0.01	mg/kg	TM26/PM21B
Natural Moisture Content	3.9	187.8	<0.1	%	PM4/PM0
Sulphate as SO4 (2:1 Ext)#	0.0158	0.0387	<0.0015	g/l	TM38/PM20
Total Cyanide#	<0.5	<0.5	<0.5	mg/kg	TM89/PM45
Organic Matter	0.8	1.1	<0.2	%	TM21/PM24

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road Galway
Contact: Mike Sutton
EMT Job No: 24/6663

Report : Solid

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

EMT Sample No.	1-4	5-8											
Sample ID	BRC-02	BRC-02											
Depth	0.25	1.50									Please see attached notes for all abbreviations and acronyms		
COC No / misc													
Containers	V J T	V J T											
Sample Date	16/04/2024	16/04/2024											
Sample Type	Soil	Soil											
Batch Number	1	1									LOD/LOR	Units	Method No.
Date of Receipt	18/04/2024	18/04/2024											
pH #	9.16	7.97									<0.01	pH units	TM73/PM11

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road Galway
Contact: Mike Sutton

Note:

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

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

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

Where trace asbestos is reported the amount of asbestos will be <0.1%.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
24/6663	1	BRC-02	0.25	4	Bart Kuznicki	26/04/2024	**General Description (Bulk Analysis)**	Brown soil with stones
					Bart Kuznicki	26/04/2024	**Asbestos Fibres**	NAD
					Bart Kuznicki	26/04/2024	**Asbestos ACM**	NAD
					Bart Kuznicki	26/04/2024	**Asbestos Type**	NAD
24/6663	1	BRC-02	1.50	8	Kieran Hunt	26/04/2024	**General Description (Bulk Analysis)**	Brown soil / debris
					Kieran Hunt	26/04/2024	**Asbestos Fibres**	NAD
					Kieran Hunt	26/04/2024	**Asbestos ACM**	NAD
					Kieran Hunt	26/04/2024	**Asbestos Type**	NAD

EMT Job No.: 24/6663

SOILS and ASH

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

STACK EMISSIONS

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

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

HWOL ACRONYMS AND OPERATORS USED

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

EMT Job No: 24/6663

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.			AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.	Yes		AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

EMT Job No: 24/6663

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes

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Attention :	Mike Sutton
Date :	16th May, 2024
Your reference :	13614-02-24
Our reference :	Test Report 24/6996 Batch 1
Location :	Dyke Road, Galway
Date samples received :	24th April, 2024
Status :	Final Report
Issue :	202405161600

Twenty samples were received for analysis on 24th April, 2024 of which nine were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

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

Scope 1&2 emissions - 43.223 kg of CO_2

Scope 1&2&3 emissions - 102.147 kg of CO_2

Authorised By:

Bruce Leslie
Project Manager

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road, Galway
Contact: Mike Sutton
EMT Job No: 24/6996

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	33-36	37-40	41-44	45-48	49-52	57-60				
Sample ID	ST01	ST02	ST03	TP03	TP03	TP03	TP04	TP04	TP05				
Depth	0.20-0.80	0.15-0.80	0.07-1.40	0.10-0.60	0.61-1.10	1.10-2.30	0.07-1.00	1.00-1.20	0.55-1.35				
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T				
Sample Date	11/04/2024	11/04/2024	12/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1		LOD/LOR	Units	Method No.
Date of Receipt	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024				
Antimony	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	mg/kg	TM30/PM15
Arsenic #	<0.5	2.4	1.6	1.3	7.7	1.3	1.7	2.6	1.7		<0.5	mg/kg	TM30/PM15
Barium #	8	12	7	7	34	99	13	12	10		<1	mg/kg	TM30/PM15
Cadmium #	0.2	0.4	0.4	0.3	0.6	0.2	0.4	0.4	0.9		<0.1	mg/kg	TM30/PM15
Chromium #	13.3	16.2	11.7	4.1	11.6	17.9	23.0	10.2	24.5		<0.5	mg/kg	TM30/PM15
Copper #	4	9	5	3	26	6	5	6	5		<1	mg/kg	TM30/PM15
Lead #	<5	9	<5	<5	30	<5	<5	7	<5		<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM30/PM15
Molybdenum #	0.7	1.5	0.9	0.4	1.0	1.3	1.4	0.9	1.5		<0.1	mg/kg	TM30/PM15
Nickel #	3.4	9.4	7.2	2.8	8.7	3.0	6.3	7.6	7.0		<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1	<1	<1	3	<1	<1	<1	<1		<1	mg/kg	TM30/PM15
Sulphur as S	-	-	-	-	0.52	0.13	-	0.07	-		<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	-	-	-	-	0.58	0.10	-	0.03	-		<0.01	%	TM50/PM29
Zinc #	6	16	11	<5	29	6	11	10	16		<5	mg/kg	TM30/PM15
Magnesium	-	-	-	-	0.0106	0.0035	-	0.0019	-		<0.0001	g/l	TM30/PM20
PAH MS													
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	<0.03	<0.03	0.12	<0.03	<0.03	<0.03	<0.03		<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	0.21	<0.03	<0.03	0.05	0.07		<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	0.18	<0.03	<0.03	0.04	0.08		<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	0.21	<0.06	<0.06	<0.06	0.08		<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	<0.02	0.15	<0.02	<0.02	<0.02	0.07		<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	0.15		<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	0.12	<0.04	<0.04	<0.04	0.10		<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.06		<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.06		<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22	<0.22	<0.22	0.33	<0.22	<0.22	<0.22	0.44		<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	0.99	<0.64	<0.64	<0.64	0.67		<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11		<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04		<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	95	94	97	97	94	96	95	94	96		<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	<30	69	<30	124	173	<30	<30	<30		<30	mg/kg	TM5/PM8/PM16

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road, Galway
Contact: Mike Sutton
EMT Job No: 24/6996

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	33-36	37-40	41-44	45-48	49-52	57-60		LOD/LOR	Units	Method No.
Sample ID	ST01	ST02	ST03	TP03	TP03	TP03	TP04	TP04	TP05				
Depth	0.20-0.80	0.15-0.80	0.07-1.40	0.10-0.60	0.61-1.10	1.10-2.30	0.07-1.00	1.00-1.20	0.55-1.35				
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T				
Sample Date	11/04/2024	11/04/2024	12/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1				
Date of Receipt	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024				
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1[SV]	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1[SV]	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1[SV]	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4	<4	<4	<4	<4	<4	<4	<4		<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7	<7	<7	21	71	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<7	69	<7	103	102	19	<7	<7		<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_CU_1D_AL)	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH_CU+HS_1D_AL)	<26	<26	69	<26	124	173	<26	<26	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1[SV]	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_CU_1D_AL)	<10	<10	<10	<10	35	112	<10	<10	<10		<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_CU_1D_AL)	<10	<10	56	<10	73	61	19	<10	<10		<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1[SV]	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1[SV]	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1[SV]	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	<4	<4	<4	<4	<4	<4	<4	<4		<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	<7	<7	68	<7	237	156	56	<7	<7		<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_CU_1D_AR)	<7	<7	9	<7	21	<7	13	<7	<7		<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH_CU+HS_1D_AR)	<26	<26	77	<26	258	156	69	<26	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH_CU+HS_1D_Total)	<52	<52	146	<52	382	329	69	<52	<52		<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1[SV]	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_CU_1D_AR)	<10	<10	<10	<10	53	54	<10	<10	<10		<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_CU_1D_AR)	<10	<10	68	<10	176	115	56	<10	<10		<10	mg/kg	TM5/PM8/PM16
MTBE#	<5	<5	<5	<5	<5[SV]	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Benzene#	<5	<5	<5	<5	<5[SV]	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Toluene#	<5	7	<5	<5	<5[SV]	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	<5	<5	<5	<5[SV]	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
m/p-Xylene#	<5	7	<5	<5	<5[SV]	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
o-Xylene#	<5	<5	<5	<5	<5[SV]	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
PCB 28#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 52#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 101#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 118#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 138#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 153#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 180#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	<35	<35	<35	<35	<35	<35	<35	<35		<35	ug/kg	TM17/PM8

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

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road, Galway
Contact: Mike Sutton
EMT Job No: 24/6996

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	33-36	37-40	41-44	45-48	49-52	57-60				
Sample ID	ST01	ST02	ST03	TP03	TP03	TP03	TP04	TP04	TP05				
Depth	0.20-0.80	0.15-0.80	0.07-1.40	0.10-0.60	0.61-1.10	1.10-2.30	0.07-1.00	1.00-1.20	0.55-1.35				
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T				
Sample Date	11/04/2024	11/04/2024	12/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1		LOD/LOR	Units	Method No.
Date of Receipt	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024				
Natural Moisture Content	2.0	5.7	3.6	1.8	193.1	239.1	4.8	4.0	5.7		<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	1.9	5.4	3.5	1.8	65.9	70.5	4.6	3.8	5.4		<0.1	%	PM4/PM0
Chloride (2:1 Ext BRE) #	-	-	-	-	0.060	0.027	-	0.007	-		<0.002	g/l	TM38/PM20
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3		<0.3	mg/kg	TM38/PM20
Nitrate as NO3 (2:1 Ext BRE)	-	-	-	-	0.0064	<0.0025	-	<0.0025	-		<0.0025	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	-	-	-	-	0.4223	0.0352	-	0.0235	-		<0.0015	g/l	TM38/PM20
Chromium III	13.3	16.2	11.7	4.1	11.6	17.9	23.0	10.2	24.5		<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.05	0.57	0.11	0.18	27.30	3.80	0.17	0.20	0.13		<0.02	%	TM21/PM24
pH #	9.43	8.81	8.92	8.19	7.14	8.41	9.59	8.82	8.82		<0.01	pH units	TM73/PM11
Asbestos Type*	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD			None	Subcontracted

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

Client Name:	Ground Investigations Ireland	**Report :**	**CEN 10:1 1 Batch**
Reference:	13614-02-24		
Location:	Dyke Road, Galway	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Mike Sutton		
EMT Job No:	24/6996		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	33-36	37-40	41-44	45-48	49-52	57-60				
Sample ID	ST01	ST02	ST03	TP03	TP03	TP03	TP04	TP04	TP05				
Depth	0.20-0.80	0.15-0.80	0.07-1.40	0.10-0.60	0.61-1.10	1.10-2.30	0.07-1.00	1.00-1.20	0.55-1.35				
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T				
Sample Date	11/04/2024	11/04/2024	12/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1		LOD/LOR	Units	Method No.
Date of Receipt	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024				
Dissolved Antimony #	<0.002	<0.002	<0.002	<0.002	0.007	0.002	<0.002	<0.002	<0.002		<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	<0.02	0.07	<0.02	<0.02	<0.02	<0.02		<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025	0.0068	0.0039	<0.0025	<0.0025	<0.0025		<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	<0.025	0.068	0.039	<0.025	<0.025	<0.025		<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	<0.003	<0.003	<0.003	0.021	0.008	<0.003	<0.003	<0.003		<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	<0.03	<0.03	<0.03	0.21	0.08	<0.03	<0.03	<0.03		<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	0.0036	<0.0015	<0.0015		<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.036	<0.015	<0.015		<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007		<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07		<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	<0.002	0.004	<0.002	<0.002	0.005	0.005	<0.002	<0.002	<0.002		<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	<0.02	0.04	<0.02	<0.02	0.05	0.05	<0.02	<0.02	<0.02		<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003		<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	0.003	<0.003	<0.003	<0.003	0.006	0.004	<0.003	0.003	0.003		<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.03	<0.03	<0.03	<0.03	0.06	0.04	<0.03	<0.03	0.03		<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001		<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001		<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM26/PM0
Fluoride	<0.3	0.3	<0.3	0.4	0.4	<0.3	<0.3	<0.3	<0.3		<0.3	mg/l	TM173/PM0
Fluoride	<3	3	<3	4	4	<3	<3	<3	<3		<3	mg/kg	TM173/PM0
Sulphate as SO4 #	0.7	3.4	1.6	203.0	63.6	<0.5	11.6	0.9	<0.5		<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	7	34	16	2031	636	<5	116	9	<5		<5	mg/kg	TM38/PM0
Mass of raw test portion	0.0914	0.0954	0.0942	0.0923	0.369	0.1394	0.0961	0.0922	0.096			kg	NONE/PM17
Chloride #	<0.3	<0.3	0.4	0.7	17.8	2.4	0.8	<0.3	0.3		<0.3	mg/l	TM38/PM0
Chloride #	<3	<3	4	7	178	24	8	<3	3		<3	mg/kg	TM38/PM0
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09			kg	NONE/PM17
Dissolved Organic Carbon	<2	<2	<2	<2	35	9	<2	<2	<2		<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	<20	<20	<20	350	90	<20	<20	<20		<20	mg/kg	TM60/PM0
pH	7.88	7.93	7.50	8.23	8.21	8.17	10.43	8.13	8.09		<0.01	pH units	TM73/PM0

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road, Galway
Contact: Mike Sutton
EMT Job No: 24/6996

Report : CEN 10:1 1 Batch

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	33-36	37-40	41-44	45-48	49-52	57-60				
Sample ID	ST01	ST02	ST03	TP03	TP03	TP03	TP04	TP04	TP05				
Depth	0.20-0.80	0.15-0.80	0.07-1.40	0.10-0.60	0.61-1.10	1.10-2.30	0.07-1.00	1.00-1.20	0.55-1.35				
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T				
Sample Date	11/04/2024	11/04/2024	12/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1		LOD/LOR	Units	Method No.
Date of Receipt	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024				
Total Dissolved Solids #	<35	<35	<35	356	276	103	79	37	44		<35	mg/l	TM20/PM0
Total Dissolved Solids #	<350	<350	<350	3562	2761	1030	790	370	440		<350	mg/kg	TM20/PM0

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road, Galway
Contact: Mike Sutton
EMT Job No: 24/6996

Report : EN12457_2

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	33-36	37-40	41-44	45-48	49-52	57-60							
Sample ID	ST01	ST02	ST03	TP03	TP03	TP03	TP04	TP04	TP05							
Depth	0.20-0.80	0.15-0.80	0.07-1.40	0.10-0.60	0.61-1.10	1.10-2.30	0.07-1.00	1.00-1.20	0.55-1.35							
COC No / misc																
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	11/04/2024	11/04/2024	12/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024	15/04/2024							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1	1	1	1		Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024							
Solid Waste Analysis																
Total Organic Carbon #	0.05	0.57	0.11	0.18	27.30	3.80	0.17	0.20	0.13		3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	<0.025	<0.025 SV	<0.025	<0.025	<0.025	<0.025		6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs #	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035		1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	69	<30	124	173	<30	<30	<30		500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	<0.22	<0.22	0.33	<0.22	<0.22	<0.22	0.44		-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64	0.99	<0.64	<0.64	<0.64	0.67		100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	<0.025	<0.025	<0.025	0.068	0.039	<0.025	<0.025	<0.025		0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	<0.03	<0.03	<0.03	0.21	0.08	<0.03	<0.03	<0.03		20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.036	<0.015	<0.015		0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07		2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001		0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	<0.02	0.04	<0.02	<0.02	0.05	0.05	<0.02	<0.02	<0.02		0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	<0.02	<0.02	0.07	<0.02	<0.02	<0.02	<0.02		0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	0.03	<0.03	<0.03	<0.03	0.06	0.04	<0.03	<0.03	0.03		4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	<350	<350	<350	3562	2761	1030	790	370	440		4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	<20	<20	<20	350	90	<20	<20	<20		500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.0914	0.0954	0.0942	0.0923	0.369	0.1394	0.0961	0.0922	0.096		-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	98.6	94.4	95.6	97.4	24.4	64.4	93.7	97.3	93.4		-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.899	0.895	0.896	0.898	0.622	0.85	0.894	0.897	0.894		-	-	-		l	NONE/PM17
Moisture Content 105C (% Dry Weight)	1.4	5.9	4.6	2.7	309.2	55.4	6.8	2.8	7.0		-	-	-	<0.1	%	PM4/PM0
pH #	9.43	8.81	8.92	8.19	7.14	8.41	9.59	8.82	8.82		-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	3	<3	4	4	<3	<3	<3	<3		10	150	500	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	7	34	16	2031	636	<5	116	9	<5		1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	<3	4	7	178	24	8	<3	3		800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland

Reference: 13614-02-24

Location: Dyke Road, Galway

Contact: Mike Sutton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
24/6996	1	ST01	0.20-0.80	1-4	No interpretation possible
24/6996	1	ST02	0.15-0.80	5-8	No interpretation possible
24/6996	1	ST03	0.07-1.40	9-12	Trace of lubricating oil
24/6996	1	TP03	0.10-0.60	33-36	No interpretation possible
24/6996	1	TP03	0.61-1.10	37-40	Trace of possible PAHs & Naturally occurring compounds
24/6996	1	TP03	1.10-2.30	41-44	Trace of possible PAHs, Possible fatty acids & Trace of naturally occurring compounds
24/6996	1	TP04	0.07-1.00	45-48	Trace of naturally occurring compounds
24/6996	1	TP04	1.00-1.20	49-52	No interpretation possible
24/6996	1	TP05	0.55-1.35	57-60	No interpretation possible

Element Materials Technology

Notification of Deviating Samples

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dyke Road, Galway
Contact: Mike Sutton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
24/6996	1	ST01	0.20-0.80	1-4	EPH	Sample holding time exceeded
24/6996	1	ST02	0.15-0.80	5-8	EPH, GRO	Sample holding time exceeded
24/6996	1	ST03	0.07-1.40	9-12	EPH	Sample holding time exceeded
24/6996	1	TP03	1.10-2.30	41-44	TOC	Sample holding time exceeded

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.
It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

SOILS and ASH

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

STACK EMISSIONS

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

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

HWOL ACRONYMS AND OPERATORS USED

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

EMT Job No: 24/6996

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.	Yes		AD	Yes

EMT Job No: 24/6996

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes

EMT Job No: 24/6996

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

EMT Job No: 24/6996

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
Subcontracted	See attached subcontractor report for accreditation status and provider.					AR	

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Attention :	Mike Sutton
Date :	21st May, 2024
Your reference :	13614-02-24
Our reference :	Test Report 24/7795 Batch 1
Location :	Dykes Road Galway
Date samples received :	8th May, 2024
Status :	Final Report
Issue :	202405211146

Fifteen samples were received for analysis on 8th May, 2024 of which fifteen were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

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

Scope 1&2 emissions - 69.721 kg of CO2

Scope 1&2&3 emissions - 164.769 kg of CO2

Authorised By:

Bruce Leslie
Project Manager

Element Materials Technology Environmental UK Limited
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Registered Office: 3rd Floor Davidson Building, 5 Southampton Street, London WC2E 7HA
Company Registration No: 11371415

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	13614-02-24		
Location:	Dykes Road Galway	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Mike Sutton		
EMT Job No:	24/7795		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40	LOD/LOR	Units	Method No.
Sample ID	BH01	BH01	BH04	BH05	BH05	BH05	BRC01	BRC01	BRC01	BRC02			
Depth	0.50	1.50	1.50	0.25	0.50	1.50	0.50	1.50	3.50	0.50			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024			
Antimony	2	4	3	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	TM30/PM15
Arsenic #	8.5	15.0	1.4	1.6	2.2	2.3	1.2	2.9	1.2	1.8	<0.5	mg/kg	TM30/PM15
Barium #	96	209	69	8	28	25	8	21	103	8	<1	mg/kg	TM30/PM15
Cadmium #	0.9	0.5	<0.1	0.2	0.6	0.5	0.2	0.5	0.2	0.4	<0.1	mg/kg	TM30/PM15
Chromium #	28.1	42.9	172.7	11.6	19.2	22.6	15.5	23.2	19.0	9.5	<0.5	mg/kg	TM30/PM15
Copper #	43	77	4	4	8	8	4	13	8	5	<1	mg/kg	TM30/PM15
Lead #	97	184	<5	<5	9	8	<5	14	<5	<5	<5	mg/kg	TM30/PM15
Mercury #	0.2	0.5	<0.1	<0.1	0.1	0.1	<0.1	0.3	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	3.0	4.3	2.1	1.0	1.0	1.2	2.1	1.7	1.2	0.8	<0.1	mg/kg	TM30/PM15
Nickel #	15.1	31.3	75.3	5.9	8.3	8.3	6.9	9.9	5.3	8.7	<0.7	mg/kg	TM30/PM15
Selenium #	3	<1	2	<1	<1	<1	<1	1	<1	<1	<1	mg/kg	TM30/PM15
Zinc #	152	232	90	<5	21	19	6	20	12	9	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	0.27	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.55	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	0.21	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.15	1.43	<0.03	0.08	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	0.78	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.57	5.19	<0.03	<0.03	<0.03	<0.03	<0.03	0.18	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	0.64	4.73	<0.03	0.05	<0.03	<0.03	<0.03	0.14	<0.03	0.05	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.35	2.82	<0.06	<0.06	<0.06	<0.06	<0.06	0.14	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	0.38	3.01	<0.02	0.15	<0.02	<0.02	0.05	0.11	<0.02	0.08	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.92	5.80	<0.07	<0.07	<0.07	<0.07	<0.07	0.20	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.60	3.70	<0.04	<0.04	<0.04	<0.04	<0.04	0.11	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	0.46	2.50	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	0.08	0.60	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.49	2.49	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	0.10	0.39	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	3.04	19.68	<0.22	<0.22	<0.22	<0.22	<0.22	0.49	<0.22	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	4.74	34.54	<0.64	<0.64	<0.64	<0.64	<0.64	0.88	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.66	4.18	<0.05	<0.05	<0.05	<0.05	<0.05	0.14	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.26	1.62	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	100	97	99	99	95	99	99	99	98	100	<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	88	344	<30	1047	<30	<30	129	52	<30	296	<30	mg/kg	TM5/PM8/PM16

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	13614-02-24		
Location:	Dykes Road Galway	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Mike Sutton		
EMT Job No:	24/7795		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40			
Sample ID	BH01	BH01	BH04	BH05	BH05	BH05	BRC01	BRC01	BRC01	BRC02			
Depth	0.50	1.50	1.50	0.25	0.50	1.50	0.50	1.50	3.50	0.50			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024			
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1^{SV}	<0.1^{SV}	<0.1	0.2^{SV}	<0.1	<0.1	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	22	<7	61	<7	<7	<7	<7	16	21	<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	88	300	<7	887	19	29	118	52	<7	246	<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_CU_1D_AL)	<7	22	<7	99	<7	<7	11	<7	<7	29	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH_CU+HS_1D_AL)	88	344	<26	1047	<26	29	129	52	<26	296	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1^{SV}	<0.1^{SV}	<0.1	0.2^{SV}	<0.1	<0.1	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_CU_1D_AL)	<10	76	<10	198	<10	<10	10	<10	23	58	<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_CU_1D_AL)	76	246	<10	753	19	24	108	45	<10	209	<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	64	<7	91	<7	<7	<7	<7	<7	28	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	256	917	<7	1788	<7	86	238	141	<7	562	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_CU_1D_AR)	43	122	<7	266	<7	<7	39	20	<7	100	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH_CU+HS_1D_AR)	299	1103	<26	2145	<26	86	277	161	<26	690	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH_CU+HS_1D_Total)	387	1447	<52	3192	<52	115	406	213	<52	986	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1^{SV}	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_CU_1D_AR)	40	224	<10	369	<10	24	36	<10	<10	115	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_CU_1D_AR)	224	757	<10	1512	<10	68	208	131	<10	477	<10	mg/kg	TM5/PM8/PM16
MTBE#	<5^{SV}	<5^{SV}	<5	<5^{SV}	<5	<5	<5^{SV}	<5^{SV}	<5	<5	<5	ug/kg	TM36/PM12
Benzene#	<5^{SV}	<5^{SV}	<5	<5^{SV}	<5	<5	<5^{SV}	<5^{SV}	<5	<5	<5	ug/kg	TM36/PM12
Toluene#	<5^{SV}	<5^{SV}	<5	<5^{SV}	<5	<5	<5^{SV}	<5^{SV}	<5	<5	<5	ug/kg	TM36/PM12
Ethylbenzene#	<5^{SV}	<5^{SV}	<5	<5^{SV}	<5	<5	<5^{SV}	<5^{SV}	<5	<5	<5	ug/kg	TM36/PM12
m/p-Xylene#	<5^{SV}	<5^{SV}	<5	7^{SV}	<5	<5	<5^{SV}	<5^{SV}	<5	<5	<5	ug/kg	TM36/PM12
o-Xylene#	<5^{SV}	<5^{SV}	<5	<5^{SV}	<5	<5	<5^{SV}	<5^{SV}	<5	<5	<5	ug/kg	TM36/PM12
PCB 28#	<5	<50$_{AA}$	<5	<50$_{AA}$	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 52#	<5	<50$_{AA}$	<5	<50$_{AA}$	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 101#	<5	<50$_{AA}$	<5	<50$_{AA}$	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 118#	<5	<50$_{AA}$	<5	<50$_{AA}$	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 138#	<5	<50$_{AA}$	<5	<50$_{AA}$	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 153#	<5	<50$_{AA}$	<5	<50$_{AA}$	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 180#	<5	<50$_{AA}$	<5	<50$_{AA}$	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	<350$_{AA}$	<35	<350$_{AA}$	<35	<35	<35	<35	<35	<35	<35	ug/kg	TM17/PM8

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

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dykes Road Galway
Contact: Mike Sutton
EMT Job No: 24/7795

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40	LOD/LOR	Units	Method No.
Sample ID	BH01	BH01	BH04	BH05	BH05	BH05	BRC01	BRC01	BRC01	BRC02			
Depth	0.50	1.50	1.50	0.25	0.50	1.50	0.50	1.50	3.50	0.50			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024			
Natural Moisture Content	39.0	49.1	0.9	3.6	12.4	14.6	3.8	78.9	131.0	3.5	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	28.1	33.0	0.9	3.4	11.1	12.7	3.7	44.1	56.7	3.4	<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<6.0$_{AB}$	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Chromium III	28.1	42.9	172.7	11.6	19.2	22.6	15.5	23.2	19.0	9.5	<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	3.64	8.97	0.47	0.62	0.28	0.63	0.65	6.69	4.84	0.37	<0.02	%	TM21/PM24
pH #	7.66	7.71	8.78	9.09	8.67	8.51	9.03	7.83	8.17	9.11	<0.01	pH units	TM73/PM11
Asbestos Type*	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD		None	Subcontracted

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dykes Road Galway
Contact: Mike Sutton
EMT Job No: 24/7795

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	41-44	45-48	49-52	53-56	57-60	LOD/LOR	Units	Method No.
Sample ID	BRC02	BRC04	BRC04	BRC05	BRC05			
Depth	1.50	0.50	1.50	0.50	3.50			
COC No / misc								
Containers	V J T	V J T	V J T	V J T	V J T			
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1			
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024			
Antimony	<1	<1	<1	<1	<1	<1	mg/kg	TM30/PM15
Arsenic #	3.5	1.0	3.3	2.2	1.8	<0.5	mg/kg	TM30/PM15
Barium #	39	6	68	12	45	<1	mg/kg	TM30/PM15
Cadmium #	0.6	0.2	0.6	0.2	0.4	<0.1	mg/kg	TM30/PM15
Chromium #	23.4	8.7	29.7	13.2	34.2	<0.5	mg/kg	TM30/PM15
Copper #	17	3	11	4	13	<1	mg/kg	TM30/PM15
Lead #	28	<5	38	<5	8	<5	mg/kg	TM30/PM15
Mercury #	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	2.1	0.6	1.8	1.2	1.5	<0.1	mg/kg	TM30/PM15
Nickel #	11.7	4.1	8.9	6.4	10.0	<0.7	mg/kg	TM30/PM15
Selenium #	2	<1	<1	<1	<1	<1	mg/kg	TM30/PM15
Zinc #	34	<5	106	<5	28	<5	mg/kg	TM30/PM15
PAH MS								
Naphthalene #	<0.04	<0.40$_{AA}$	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.30$_{AA}$	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.50$_{AA}$	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.40$_{AA}$	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.30$_{AA}$	0.28	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.40$_{AA}$	0.11	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.30$_{AA}$	0.70	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.30$_{AA}$	0.59	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.60$_{AA}$	0.41	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.20$_{AA}$	0.38	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.70$_{AA}$	0.70	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.40$_{AA}$	0.44	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.40$_{AA}$	0.26	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.40$_{AA}$	0.06	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.40$_{AA}$	0.24	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.40$_{AA}$	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<2.20$_{AA}$	2.34	<0.22	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<6.40$_{AA}$	4.17	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.50$_{AA}$	0.50	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.20$_{AA}$	0.20	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<10$_{AA}$	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	99	98$_{AA}$	100	99	94	<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	117	613	<30	137	<30	<30	mg/kg	TM5/PM8/PM16

Element Materials Technology

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	13614-02-24		
Location:	Dykes Road Galway	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Mike Sutton		
EMT Job No:	24/7795		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	41-44	45-48	49-52	53-56	57-60						LOD/LOR	Units	Method No.
Sample ID	BRC02	BRC04	BRC04	BRC05	BRC05								
Depth	1.50	0.50	1.50	0.50	3.50								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024								
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1SV	<0.1SV	<0.1	<0.1SV	<0.1						<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1SV	<0.1SV	<0.1	<0.1SV	<0.1						<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1SV	<0.1SV	<0.1	0.5SV	1.0						<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<0.2	<0.2	<0.2	<0.2						<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4	<4	<4	<4						<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	22	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	117	521	<7	123	<7						<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_CU_1D_AL)	<7	70	<7	14	<7						<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH_CU+HS_1D_AL)	117	613	<26	138	<26						<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1SV	<0.1SV	<0.1	0.5SV	1.0						<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_CU_1D_AL)	31	92	<10	14	<10						<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_CU_1D_AL)	90	450	<10	110	<10						<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1SV	<0.1SV	<0.1	<0.1SV	<0.1						<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1SV	<0.1SV	<0.1	<0.1SV	<0.1						<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1SV	<0.1SV	<0.1	<0.1SV	<0.1						<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<0.2	<0.2	<0.2	<0.2						<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	5	<4	<4	<4						<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	65	8	<7	<7						<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	263	1271	9	266	<7						<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_CU_1D_AR)	34	230	<7	47	<7						<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH_CU+HS_1D_AR)	297	1571	<26	313	<26						<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH_CU+HS_1D_Total)	414	2184	<52	451	<52						<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1SV	<0.1SV	<0.1	<0.1SV	<0.1						<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_CU_1D_AR)	56	254	<10	42	<10						<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_CU_1D_AR)	222	1087	<10	231	<10						<10	mg/kg	TM5/PM8/PM16
MTBE#	<5SV	<5SV	<5	<5SV	<5						<5	ug/kg	TM36/PM12
Benzene#	<5SV	<5SV	<5	<5SV	<5						<5	ug/kg	TM36/PM12
Toluene#	<5SV	<5SV	<5	<5SV	<5						<5	ug/kg	TM36/PM12
Ethylbenzene#	<5SV	<5SV	<5	<5SV	<5						<5	ug/kg	TM36/PM12
m/p-Xylene#	<5SV	<5SV	<5	<5SV	<5						<5	ug/kg	TM36/PM12
o-Xylene#	<5SV	<5SV	<5	<5SV	19						<5	ug/kg	TM36/PM12
PCB 28#	<5	<50AA	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 52#	<5	<50AA	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 101#	<5	<50AA	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 118#	<5	<50AA	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 138#	<5	<50AA	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 153#	<5	<50AA	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 180#	<5	<50AA	<5	<5	<5						<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	<350AA	<35	<35	<35						<35	ug/kg	TM17/PM8

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dykes Road Galway
Contact: Mike Sutton
EMT Job No: 24/7795

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	41-44	45-48	49-52	53-56	57-60								
Sample ID	BRC02	BRC04	BRC04	BRC05	BRC05								
Depth	1.50	0.50	1.50	0.50	3.50								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1						LOD/LOR	Units	Method No.
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024								
Natural Moisture Content	124.5	1.5	8.1	4.5	11.8						<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	55.5	1.5	7.5	4.3	10.5						<0.1	%	PM4/PM0
Hexavalent Chromium #	<6.0 AB	<0.3	<0.3	<0.3	<0.3						<0.3	mg/kg	TM38/PM20
Chromium III	23.4	8.7	29.7	13.2	34.2						<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	7.30	0.73	0.43	0.16	0.13						<0.02	%	TM21/PM24
pH #	7.91	9.09	8.67	8.27	8.55						<0.01	pH units	TM73/PM11
Asbestos Type*	NAD	NAD	NAD	NAD	NAD							None	Subcontracted

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

Client Name:	Ground Investigations Ireland	**Report :**	**CEN 10:1 1 Batch**
Reference:	13614-02-24		
Location:	Dykes Road Galway	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Mike Sutton		
EMT Job No:	24/7795		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40			
Sample ID	BH01	BH01	BH04	BH05	BH05	BH05	BRC01	BRC01	BRC01	BRC02			
Depth	0.50	1.50	1.50	0.25	0.50	1.50	0.50	1.50	3.50	0.50			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024			
Dissolved Antimony #	0.009	0.013	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	0.09	0.13	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	0.0026	0.0051	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.0071	0.0035	<0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	0.026	0.051	<0.025	<0.025	<0.025	<0.025	<0.025	0.071	0.035	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.055	0.068	0.010	<0.003	<0.003	<0.003	<0.003	0.011	0.021	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.55	0.68	0.10	<0.03	<0.03	<0.03	<0.03	0.11	0.21	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.015	0.023	<0.002	<0.002	<0.002	<0.002	0.004	0.005	0.003	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.15	0.23	<0.02	<0.02	<0.02	<0.02	0.04	0.05	0.03	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	0.005	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM26/PM0
Fluoride	<0.3	<0.3	<0.3	0.3	0.6	0.6	0.5	<0.3	<0.3	<0.3	<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	6	6	5	<3	<3	<3	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	93.2	83.4	1.1	4.4	3.4	3.1	2.4	12.6	<0.5	2.5	<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	933	834	11	44	34	31	24	126	<5	25	<5	mg/kg	TM38/PM0
Mass of raw test portion	0.1038	0.0984	0.0972	0.094	0.0974	0.0967	0.095	0.1067	0.1052	0.0943		kg	NONE/PM17
Chloride #	3.1	9.2	0.4	0.6	0.6	0.7	0.5	2.0	1.8	0.5	<0.3	mg/l	TM38/PM0
Chloride #	31	92	4	6	6	7	5	20	18	5	<3	mg/kg	TM38/PM0
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		kg	NONE/PM17
Dissolved Organic Carbon	4	6	5	<2	<2	<2	<2	15	8	<2	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	40	60	50	<20	<20	<20	<20	150	80	<20	<20	mg/kg	TM60/PM0
pH	8.09	8.22	8.17	8.06	7.93	8.02	8.03	8.34	8.19	8.10	<0.01	pH units	TM73/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dykes Road Galway
Contact: Mike Sutton
EMT Job No: 24/7795

Report : **CEN 10:1 1 Batch**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40			
Sample ID	BH01	BH01	BH04	BH05	BH05	BH05	BRC01	BRC01	BRC01	BRC02			
Depth	0.50	1.50	1.50	0.25	0.50	1.50	0.50	1.50	3.50	0.50			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024			
Total Dissolved Solids #	244	252	54	<35	43	45	<35	196	102	<35	<35	mg/l	TM20/PM0
Total Dissolved Solids #	2441	2519	540	<350	430	450	<350	1959	1020	<350	<350	mg/kg	TM20/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dykes Road Galway
Contact: Mike Sutton
EMT Job No: 24/7795

Report : CEN 10:1 1 Batch

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	41-44	45-48	49-52	53-56	57-60						LOD/LOR	Units	Method No.
Sample ID	BRC02	BRC04	BRC04	BRC05	BRC05								
Depth	1.50	0.50	1.50	0.50	3.50								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024								
Dissolved Antimony #	<0.002	<0.002	<0.002	<0.002	<0.002						<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02						<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	0.0051	<0.0025	<0.0025	<0.0025	<0.0025						<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	0.051	<0.025	<0.025	<0.025	<0.025						<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.015	<0.003	0.014	0.009	0.016						<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.15	<0.03	0.14	0.09	0.16						<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005						<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005						<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015						<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015						<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007						<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07						<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005						<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05						<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.008	<0.002	<0.002	<0.002	<0.002						<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.08	<0.02	<0.02	<0.02	<0.02						<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002						<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02						<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	<0.003	<0.003						<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03						<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	0.003	<0.003	<0.003	<0.003	<0.003						<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03						<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001						<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001						<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01						<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM26/PM0
Fluoride	0.4	<0.3	0.4	0.7	0.4						<0.3	mg/l	TM173/PM0
Fluoride	4	<3	4	7	4						<3	mg/kg	TM173/PM0
Sulphate as SO4 #	21.0	4.5	6.1	149.4	4.5						<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	210	45	61	1493	45						<5	mg/kg	TM38/PM0
Mass of raw test portion	0.1029	0.0936	0.0968	0.0958	0.0983							kg	NONE/PM17
Chloride #	1.7	0.8	0.6	0.9	0.7						<0.3	mg/l	TM38/PM0
Chloride #	17	8	6	9	7						<3	mg/kg	TM38/PM0
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09							kg	NONE/PM17
Dissolved Organic Carbon	10	<2	3	<2	<2						<2	mg/l	TM60/PM0
Dissolved Organic Carbon	100	<20	30	<20	<20						<20	mg/kg	TM60/PM0
pH	8.21	8.00	8.34	7.74	8.03						<0.01	pH units	TM73/PM0

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

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dykes Road Galway
Contact: Mike Sutton
EMT Job No: 24/7795

Report : **CEN 10:1 1 Batch**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	41-44	45-48	49-52	53-56	57-60						LOD/LOR	Units	Method No.
Sample ID	BRC02	BRC04	BRC04	BRC05	BRC05								
Depth	1.50	0.50	1.50	0.50	3.50								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024								
Total Dissolved Solids #	140	43	77	330	60						<35	mg/l	TM20/PM0
Total Dissolved Solids #	1400	430	770	3299	600						<350	mg/kg	TM20/PM0

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dykes Road Galway
Contact: Mike Sutton
EMT Job No: 24/7795

Report : **EN12457_2**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40						
Sample ID	BH01	BH01	BH04	BH05	BH05	BH05	BRC01	BRC01	BRC01	BRC02						
Depth	0.50	1.50	1.50	0.25	0.50	1.50	0.50	1.50	3.50	0.50						
COC No / misc																
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1	1	1	1	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024						
Solid Waste Analysis																
Total Organic Carbon #	3.64	8.97	0.47	0.62	0.28	0.63	0.65	6.69	4.84	0.37	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025SV	<0.025SV	<0.025	<0.025SV	<0.025	<0.025	<0.025SV	<0.025SV	<0.025	<0.025	6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs #	<0.035	<0.350BA	<0.035	<0.350BA	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	88	344	<30	1047	<30	<30	129	52	<30	296	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	3.04	19.68	<0.22	<0.22	<0.22	<0.22	<0.22	0.49	<0.22	<0.22	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	4.74	34.54	<0.64	<0.64	<0.64	<0.64	<0.64	0.88	<0.64	<0.64	100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	0.026	0.051	<0.025	<0.025	<0.025	<0.025	<0.025	0.071	0.035	<0.025	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.55	0.68	0.10	<0.03	<0.03	<0.03	<0.03	0.11	0.21	<0.03	20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.15	0.23	<0.02	<0.02	<0.02	<0.02	0.04	0.05	0.03	<0.02	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	0.09	0.13	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	2441	2519	540	<350	430	450	<350	1959	1020	<350	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	40	60	50	<20	<20	<20	<20	150	80	<20	500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1038	0.0984	0.0972	0.094	0.0974	0.0967	0.095	0.1067	0.1052	0.0943	-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	86.9	91.3	92.7	95.8	92.5	93.0	95.1	84.3	85.6	95.9	-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.887	0.891	0.893	0.896	0.893	0.893	0.895	0.883	0.885	0.896	-	-	-		l	NONE/PM17
Moisture Content 105C (% Dry Weight)	15.0	9.5	7.9	4.4	8.1	7.5	5.2	18.6	16.8	4.2	-	-	-	<0.1	%	PM4/PM0
pH #	7.66	7.71	8.78	9.09	8.67	8.51	9.03	7.83	8.17	9.11	-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	<3	<3	<3	6	6	5	<3	<3	<3	10	150	500	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	933	834	11	44	34	31	24	126	<5	25	1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	31	92	4	6	6	7	5	20	18	5	800	15000	25000	<3	mg/kg	TM38/PM0

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13614-02-24
Location: Dykes Road Galway
Contact: Mike Sutton
EMT Job No: 24/7795

Report : **EN12457_2**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	41-44	45-48	49-52	53-56	57-60	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	BRC02	BRC04	BRC04	BRC05	BRC05						
Depth	1.50	0.50	1.50	0.50	3.50						
COC No / misc											
Containers	V J T	V J T	V J T	V J T	V J T						
Sample Date	06/05/2024	06/05/2024	06/05/2024	06/05/2024	06/05/2024						
Sample Type	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1						
Date of Receipt	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024						
Solid Waste Analysis											
Total Organic Carbon #	7.30	0.73	0.43	0.16	0.13	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	$<0.025^{SV}$	$<0.025^{SV}$	<0.025	$<0.025^{SV}$	<0.025	6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs #	<0.035	$<0.350_{BA}$	<0.035	<0.035	<0.035	1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	117	613	<30	137	<30	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	$<2.20_{BA}$	2.34	<0.22	<0.22	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	$<6.40_{BA}$	4.17	<0.64	<0.64	100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate											
Arsenic #	0.051	<0.025	<0.025	<0.025	<0.025	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.15	<0.03	0.14	0.09	0.16	20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	<0.07	<0.07	2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.08	<0.02	<0.02	<0.02	<0.02	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03	0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	<0.03	<0.03	<0.03	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	1400	430	770	3299	600	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	100	<20	30	<20	<20	500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1029	0.0936	0.0968	0.0958	0.0983	-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	87.6	96.6	93.2	94.1	92.0	-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.887	0.897	0.893	0.894	0.892	-	-	-		l	NONE/PM17
Moisture Content 105C (% Dry Weight)	14.2	3.5	7.3	6.3	8.6	-	-	-	<0.1	%	PM4/PM0
pH #	7.91	9.09	8.67	8.27	8.55	-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	4	<3	4	7	4	10	150	500	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	210	45	61	1493	45	1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	17	8	6	9	7	800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland

Reference: 13614-02-24

Location: Dykes Road Galway

Contact: Mike Sutton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
24/7795	1	BH01	0.50	1-4	possible Lubricating Oil, trace of possible PAHs, possible Naturally Occurring Compounds
24/7795	1	BH01	1.50	5-8	possible Lubricating Oil, trace of possible PAHs, possible Naturally Occurring Compounds
24/7795	1	BH04	1.50	9-12	No interpretation possible
24/7795	1	BH05	0.25	13-16	possible Lubricating Oil, trace of possible PAHs, possible Tarmac/Bitumen
24/7795	1	BH05	0.50	17-20	trace of possible Lubricating Oil
24/7795	1	BH05	1.50	21-24	trace of possible Lubricating Oil, trace of possible PAHs, possible Naturally Occurring Compounds
24/7795	1	BRC01	0.50	25-28	possible Lubricating Oil, trace of possible PAHs, possible Tarmac/Bitumen, possible Naturally Occurring Compounds
24/7795	1	BRC01	1.50	29-32	trace of possible Lubricating Oil, possible Naturally Occurring Compounds
24/7795	1	BRC01	3.50	33-36	trace of possible PAHs & Unknown Aliphatic Hydrocarbon Peaks at 6.5 mins
24/7795	1	BRC02	0.50	37-40	possible Lubricating Oil, trace of possible PAHs, possible Tarmac/Bitumen, possible Naturally Occurring Compounds
24/7795	1	BRC02	1.50	41-44	trace of PAHs, Trace of possible Lubricating Oil & Unknown Aliphatic Hydrocarbon Peaks at 6.5 mins
24/7795	1	BRC04	0.50	45-48	possible Lubricating Oil, trace of possible PAHs, possible Tarmac/Bitumen, possible Naturally Occurring Compounds
24/7795	1	BRC04	1.50	49-52	trace of possible PAHs
24/7795	1	BRC05	0.50	53-56	possible Lubricating Oil, trace of possible PAHs, possible Tarmac/Bitumen, possible Naturally Occurring Compounds
24/7795	1	BRC05	3.50	57-60	No interpretation possible

SOILS and ASH

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

STACK EMISSIONS

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x10 Dilution
AB	x20 Dilution
BA	x10 Dilution

HWOL ACRONYMS AND OPERATORS USED

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

EMT Job No: 24/7795

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.	Yes		AD	Yes

EMT Job No: 24/7795

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

EMT Job No: 24/7795

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	
Subcontracted	See attached subcontractor report for accreditation status and provider.					AR	

LABORATORY REPORT

Contract Number: PSL24/3965

Report Date:	28 June 2024
Client's Reference:	13614-02-24
Client Name:	Ground Investigations Ireland Ltd Catherinestown House Hazelhatch Road Newcastle Co Dublin D22 YD52
For the attention of:	**Mike Sutton**
Contract Title:	Dyke Road Galway
Date Received:	5/6/2024
Date Commenced:	5/6/2024
Date Completed:	28/6/2024
Notes:	**Opinions and Interpretations are outside the UKAS Accreditation**

Checked and Approved Signatories:

A Watkins (Managing Director)	R Berriman (Associate Director)	S Royle (Laboratory Manager)
L Knight (Assistant Laboratory Manager)	S Eyre (Senior Technical Coordinator)	T Watkins (Senior Technician)

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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH01		UT	3.00	3.45	Very soft brown organic CLAY.
BH01		B	3.50		Brown slightly sandy slightly gravelly organic CLAY.
BH01		B	6.70		Brown slightly sandy slightly gravelly organic CLAY.
BH02		UT	1.00	1.27	Dark brown fibrous PEAT.
BH02		B	3.00		Grey slightly sandy gravelly CLAY with some organic material.
BH02		UT	3.00	3.45	Very soft dark grey organic CLAY.
BH03		UT	1.00	1.45	Dark brown organic CLAY.
BH03		UT	3.00	3.45	Brown organic CLAY.
BH05		B	4.00		Grey slightly silty sandy GRAVEL with many cobbles.
BH06		UT	3.00	3.45	Brown slightly sandy organic CLAY.
BRC01		UT	5.30	5.75	Very soft brown organic CLAY.
BRC01		B	5.50		Brown slightly sandy slightly gravelly organic CLAY.
BRC01		B	7.50		Brown slightly sandy slightly gravelly organic CLAY.
BRC01		UT	7.50	7.95	Very soft brown organic CLAY.
BRC02		UT	1.60	1.87	Dark brown PEAT.
BRC02		B	2.00		Dark brown slightly sandy gravelly organic CLAY.
BRC02		UT	3.00	3.45	Very soft light brown organic CLAY.
BRC02		B	3.50		Brown slightly sandy organic CLAY.
BRC02		UT	5.00	5.45	Very soft brown organic CLAY.

UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	Contract No: PSL24/3965 Client Ref: 13614-02-24

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BRC02		B	7.00		Grey silty sandy GRAVEL with many cobbles.
BRC03		UT	3.00	3.45	Very soft brown slightly gravelly organic CLAY.
BRC03		B	4.00		Brown slightly sandy slightly gravelly CLAY with many cobbles.
BRC03		B	7.50		Brown slightly sandy slightly gravelly CLAY.
BRC03		B	8.50		Grey sandy slightly gravelly CLAY.
BRC03		B	9.50		Grey slightly sandy slightly gravelly CLAY.
BRC04		B	4.00		Grey slightly silty sandy GRAVEL with many cobbles.
BRC05		B	2.60		Grey slightly sandy slightly gravelly CLAY with many cobbles.
BRC05		B	3.50		Grey slightly sandy slightly gravelly CLAY with many cobbles.
BRC05		B	4.50		Grey slightly sandy gravelly SILT.
TP01		B	0.50		Grey clayey sandy GRAVEL.
TP01		B	1.00		Dark brown fibrous PEAT.
TP02		B	2.00		Brown peaty SILT.
TP03		B	2.00		Brown peaty SILT.
TP05		B	1.00		Grey very sandy very silty GRAVEL.

UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	Contract No: PSL24/3965
		Client Ref: 13614-02-24

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
BH01		UT	3.00	3.45	136			150	55	95	100	Extremely High Plasticity CE
BH01		B	3.50		145			141	45	96	96	Extremely High Plasticity CE
BH01		B	6.70		123			151	55	96	88	Extremely High Plasticity CE
BH02		UT	1.00	1.27	80				NP			
BH02		B	3.00		27			56	26	30	55	High Plasticity CH
BH02		UT	3.00	3.45	133			161	58	103	100	Extremely High Plasticity CE
BH06		UT	3.00	3.45	159			258	84	174	100	Extremely High Plasticity CE
BRC01		UT	5.30	5.75	141			237	78	159	100	Extremely High Plasticity CE
BRC01		B	5.50		160			243	80	163	94	Extremely High Plasticity CE
BRC01		B	7.50		197			274	88	186	51	Extremely High Plasticity CE
BRC01		UT	7.50	7.95	192			233	77	156	100	Extremely High Plasticity CE
BRC02		UT	1.60	1.87	92			302	135	167	92	Extremely High Plasticity ME
BRC02		B	2.00		88			321	101	220	38	Extremely High Plasticity CE
BRC02		UT	3.00	3.45	115			135	51	84	100	Extremely High Plasticity CE
BRC02		B	3.50		121			124	48	76	100	Extremely High Plasticity CE
BRC02		B	7.00		1.2				NP			
BRC03		UT	3.00	3.45	113			256	83	173	100	Extremely High Plasticity CE
BRC03		B	4.00		8.2			20	12	8	41	Low Plasticity CL
BRC03		B	7.50		8.2			24	13	11	65	Low Plasticity CL

SYMBOLS : NP : Non Plastic * : Liquid Limit and Plastic Limit Wet Sieved.

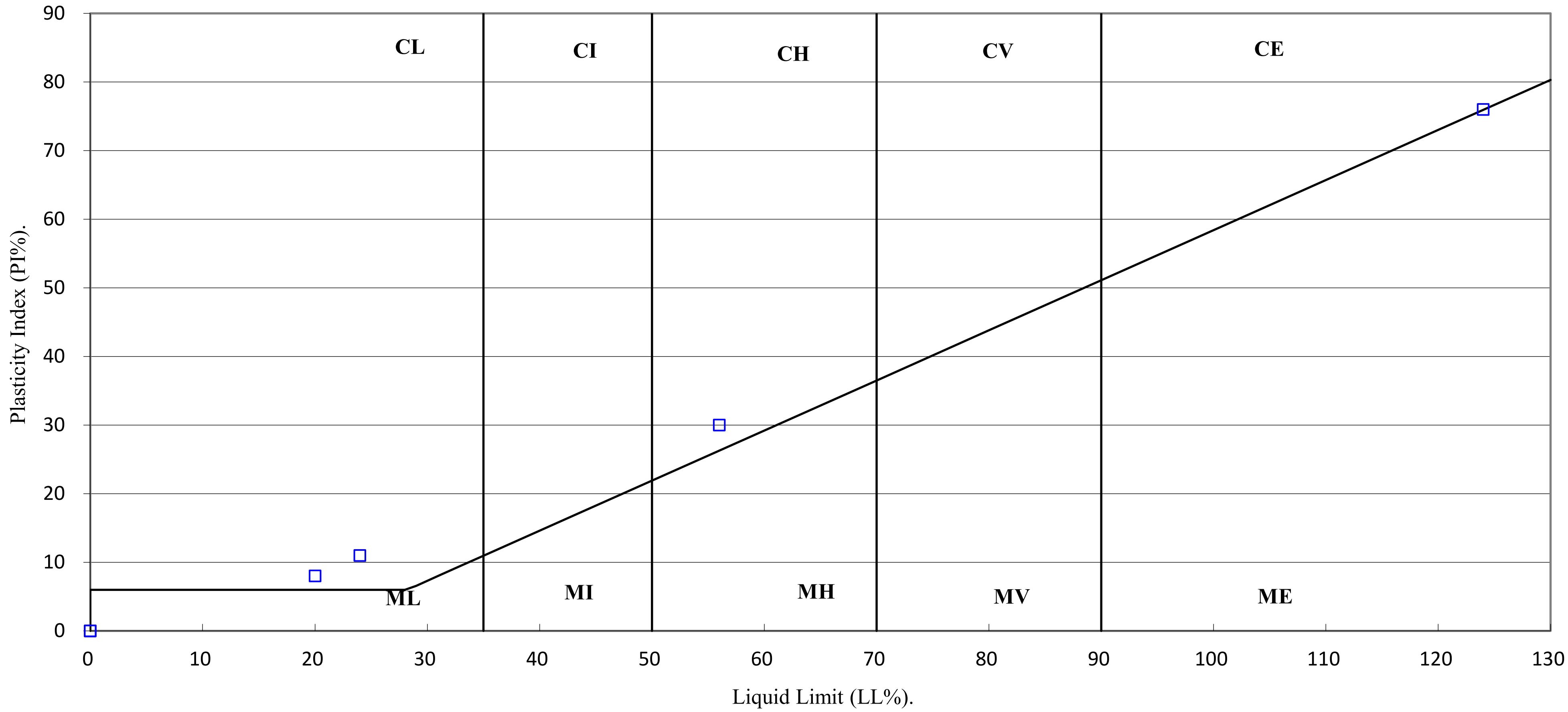
UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Dyke Road Galway

Contract No:
PSL24/3965
Client Ref:
13614-02-24

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Dyke Road Galway**	**Contract No:**
		PSL24/3965
		Client Ref:
		13614-02-24

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
BRC03		B	9.50		9.0			20	12	8	63	Low Plasticity CL
BRC05		B	2.60		57			70	31	39	57	Very High Plasticity CV
BRC05		B	3.50		9.3			23	13	10	46	Low Plasticity CL
TP01		B	0.50		3.7							
TP01		B	1.00		614				NP			
TP02		B	2.00		147			177	95	82	96	Extremely High Plasticity ME
TP03		B	2.00		137			140	97	43	99	Extremely High Plasticity ME
TP05		B	1.00		8.1							

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.

UKAS TESTING 4043

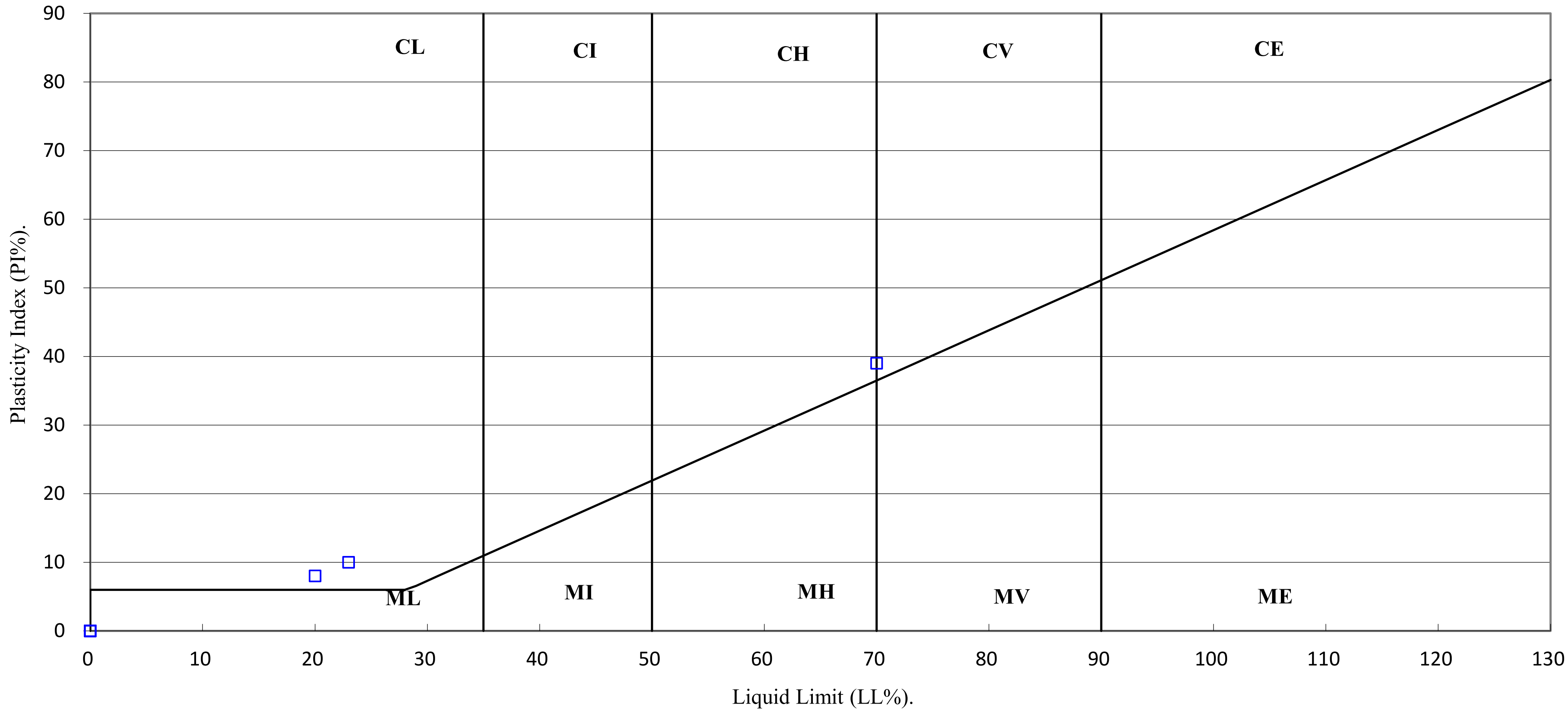
PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Dyke Road Galway

Contract No: PSL24/3965

Client Ref: 13614-02-24

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	Dyke Road Galway	**Contract No:**
		PSL24/3965
		Client Ref:
		13614-02-24

PARTICLE SIZE DISTRIBUTION TEST

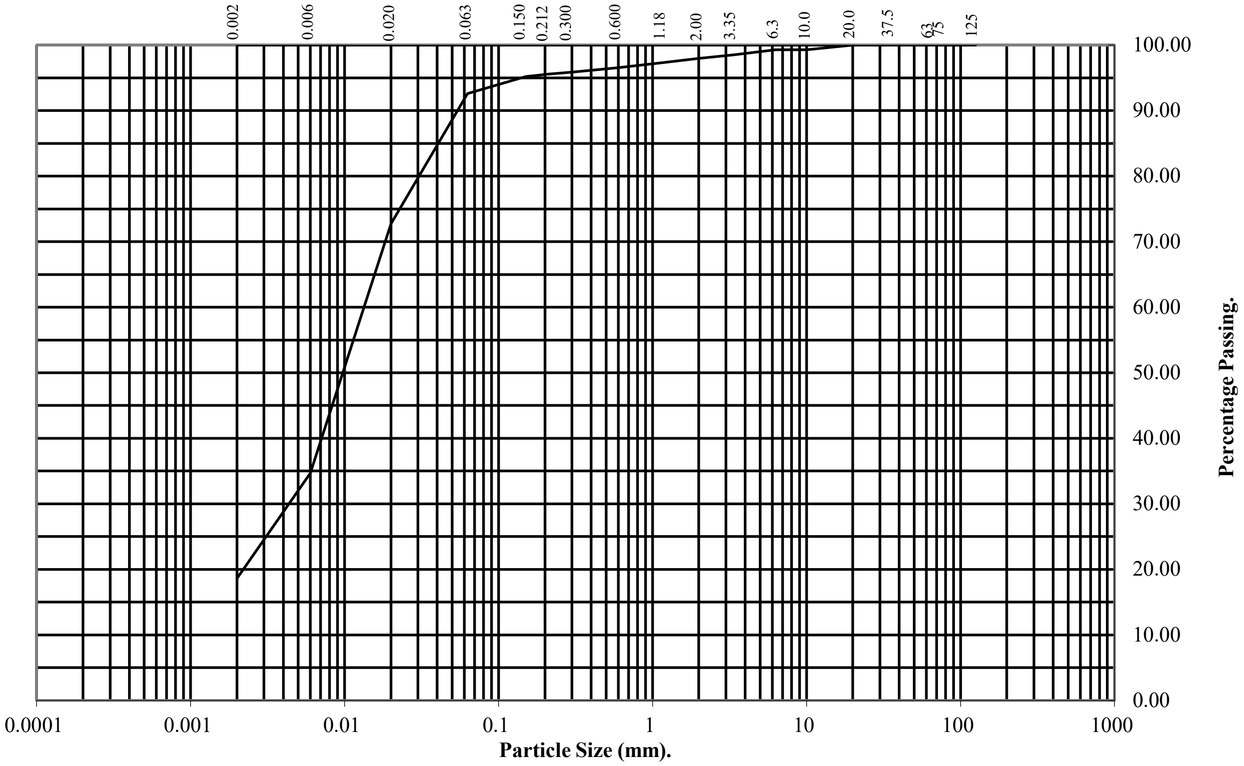
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BH01 **Top Depth (m):** 3.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	99
3.35	99
2	98
1.18	97
0.6	97
0.3	96
0.212	96
0.15	95
0.063	93

Particle Diameter	Percentage Passing
0.02	73
0.006	35
0.002	19

Soil Fraction	Total Percentage
Cobbles	0
Gravel	2
Sand	5
Silt	74
Clay	19

Remarks:

See Summary of Soil Descriptions

4043 PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

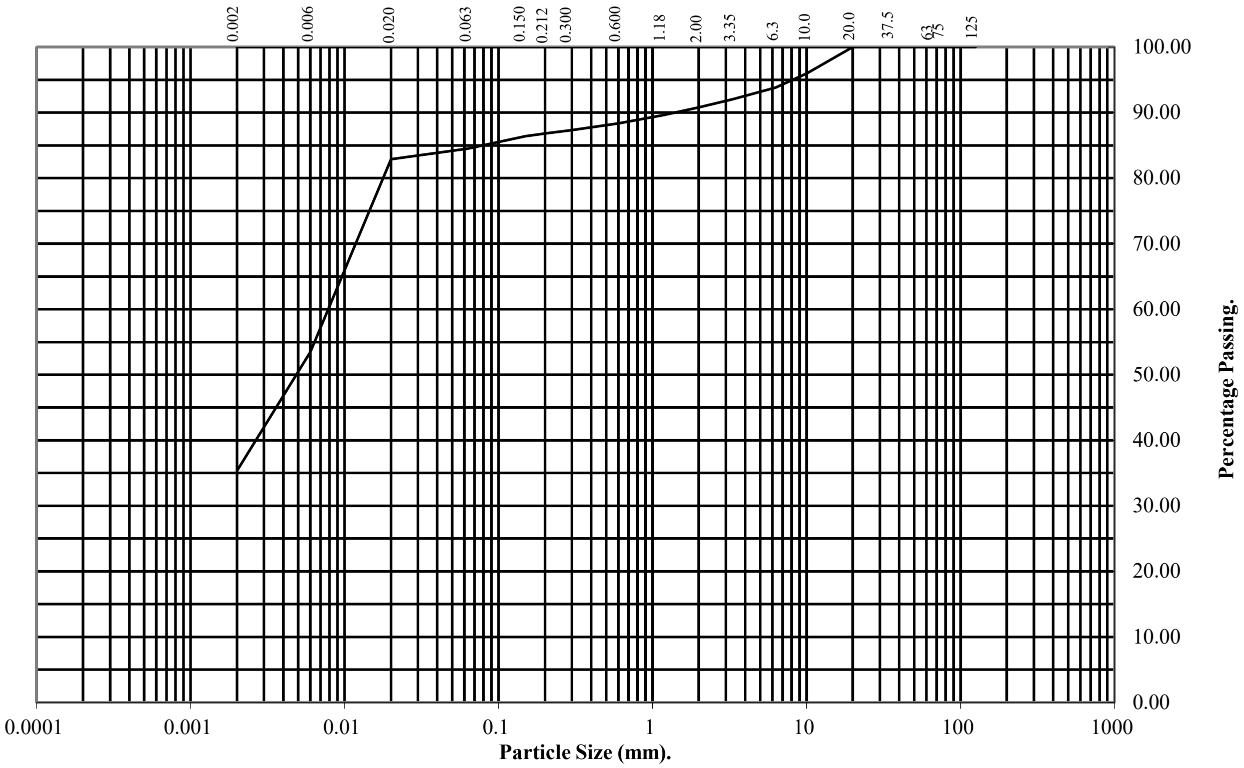
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BH01 **Top Depth (m):** 6.70

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	96
6.3	94
3.35	92
2	91
1.18	90
0.6	88
0.3	87
0.212	87
0.15	86
0.063	85

Particle Diameter	Percentage Passing
0.02	83
0.006	53
0.002	35

Soil Fraction	Total Percentage
Cobbles	0
Gravel	9
Sand	6
Silt	50
Clay	35

Remarks:
See Summary of Soil Descriptions

4043 PROFESSIONAL SOILS LABORATORY

Dyke Road Galway

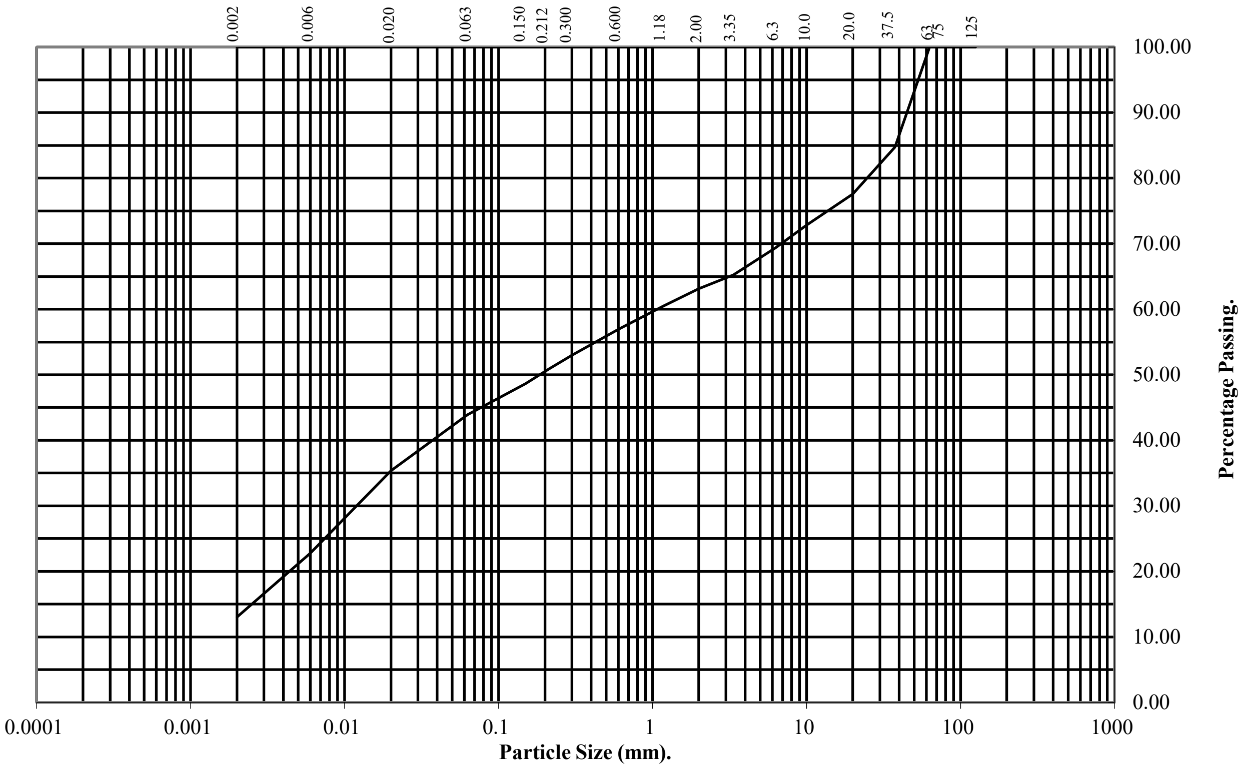
Contract No:	**PSL24/3965**
Client Ref:	**13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BH02**	**Top Depth (m):**	**3.00**
Sample Number:		**Base Depth(m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	85
20	78
10	73
6.3	69
3.35	65
2	63
1.18	60
0.6	57
0.3	53
0.212	51
0.15	49
0.063	44

Particle Diameter	Percentage Passing
0.02	35
0.006	23
0.002	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	37
Sand	19
Silt	31
Clay	13

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY

Dyke Road Galway

Contract No:	**PSL24/3965**
Client Ref:	**13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

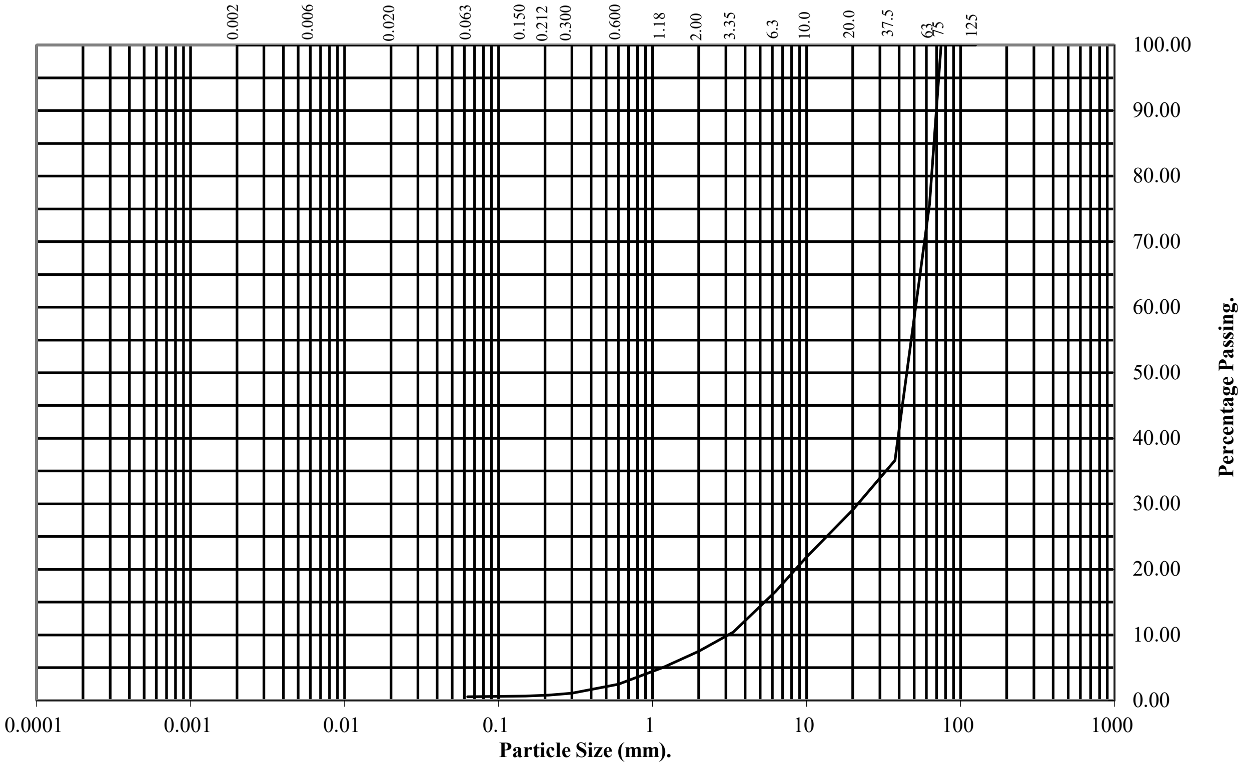
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: BH05 **Top Depth (m):** 4.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	76
37.5	37
20	29
10	22
6.3	17
3.35	10
2	8
1.18	5
0.6	2
0.3	1
0.212	1
0.15	1
0.063	1

Soil Fraction	Total Percentage
Cobbles	24
Gravel	68
Sand	7
Silt/Clay	1

Remarks:
See Summary of Soil Descriptions

UKAS 4043 PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

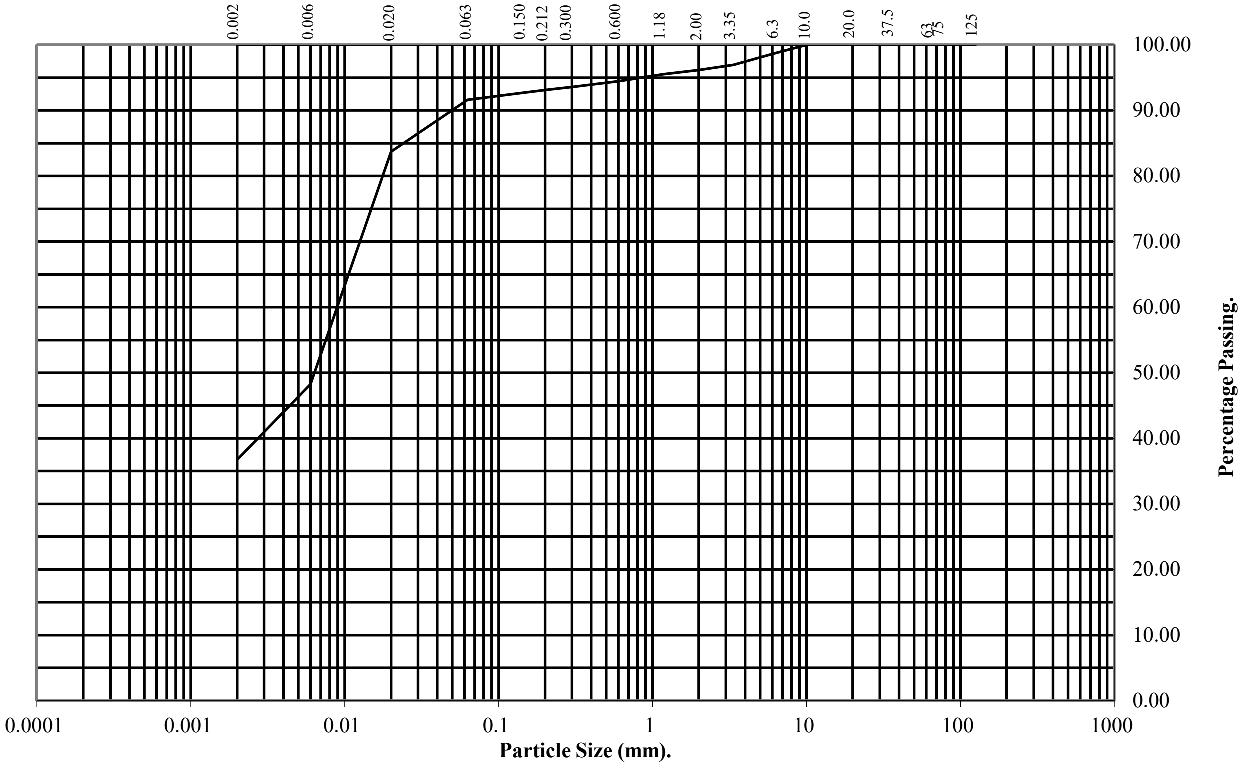
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BRC01 **Top Depth (m):** 5.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	99
3.35	97
2	96
1.18	96
0.6	94
0.3	94
0.212	93
0.15	93
0.063	92

Particle Diameter	Percentage Passing
0.02	84
0.006	48
0.002	37

Soil Fraction	Total Percentage
Cobbles	0
Gravel	4
Sand	4
Silt	55
Clay	37

Remarks:
See Summary of Soil Descriptions

UKAS 4043 / PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** PSL24/3965 **Client Ref:** 13614-02-24

PARTICLE SIZE DISTRIBUTION TEST

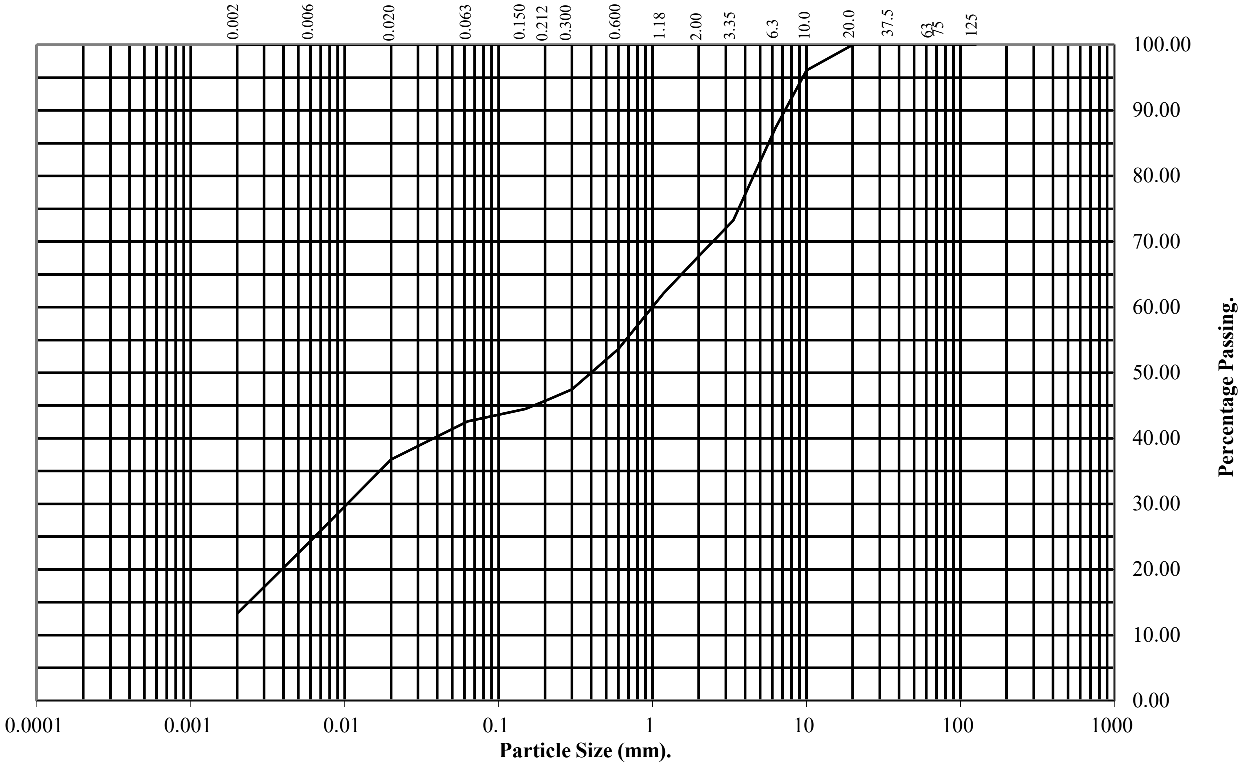
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BRC01 **Top Depth (m):** 7.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	96
6.3	87
3.35	73
2	68
1.18	62
0.6	54
0.3	47
0.212	46
0.15	44
0.063	43

Particle Diameter	Percentage Passing
0.02	37
0.006	24
0.002	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	32
Sand	25
Silt	30
Clay	13

Remarks:
See Summary of Soil Descriptions

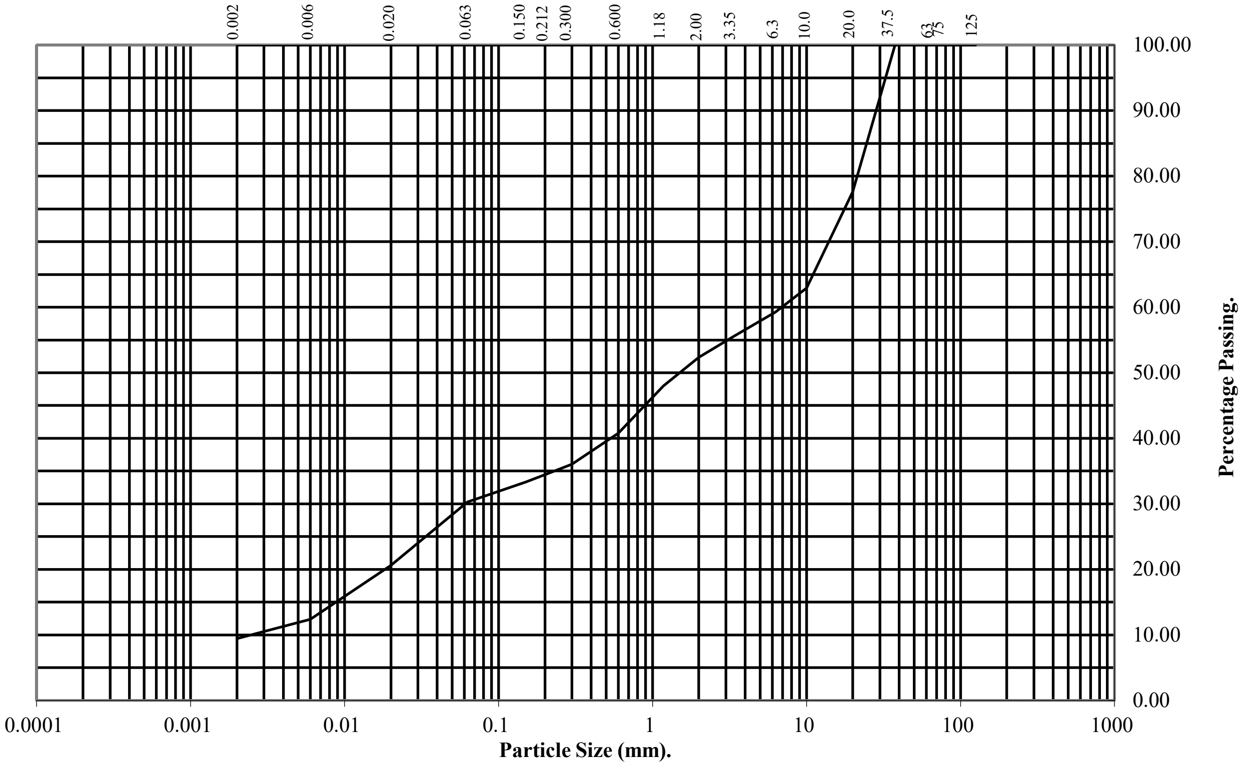
UKAS 4043 / PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	**Contract No:** PSL24/3965 **Client Ref:** 13614-02-24

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**BRC02**	**Top Depth (m):**	**2.00**
Sample Number:		**Base Depth(m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	78
10	63
6.3	59
3.35	56
2	52
1.18	48
0.6	41
0.3	36
0.212	35
0.15	33
0.063	30

Particle Diameter	Percentage Passing
0.02	21
0.006	12
0.002	9

Soil Fraction	Total Percentage
Cobbles	0
Gravel	48
Sand	22
Silt	21
Clay	9

Remarks:
See Summary of Soil Descriptions

PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

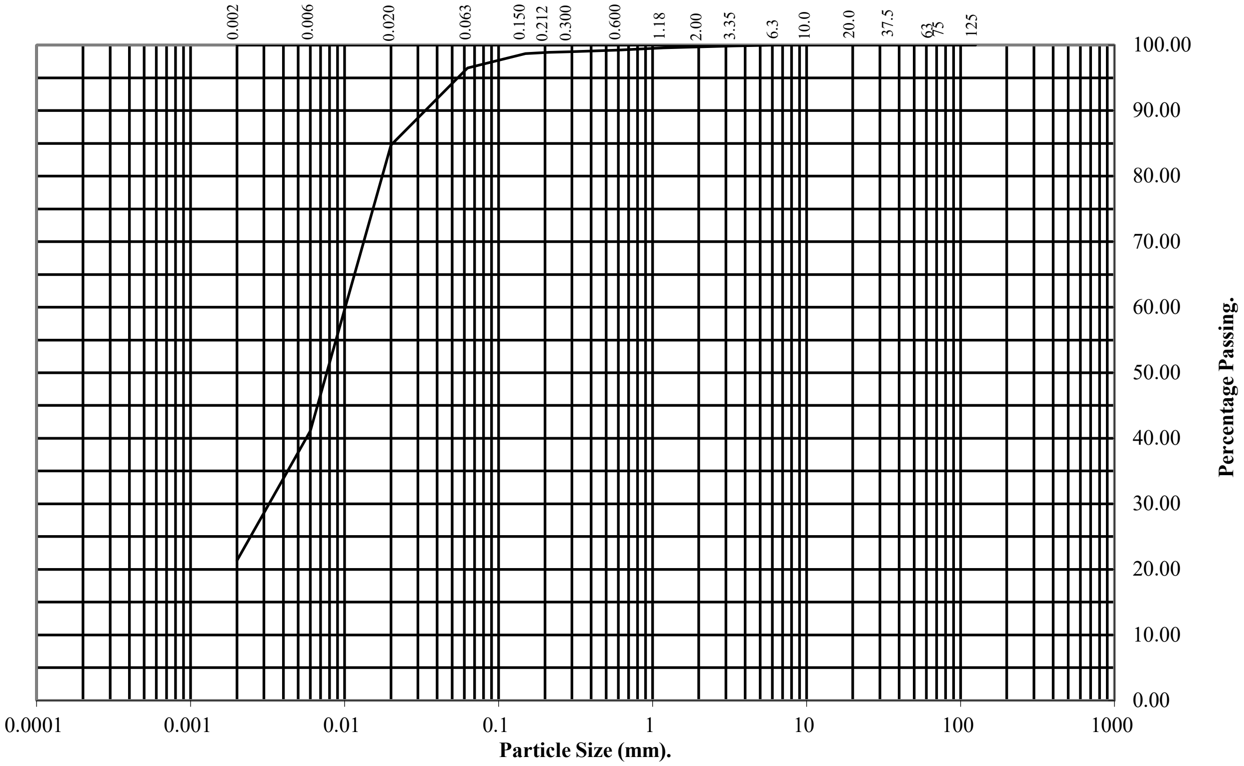
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BRC02 **Top Depth (m):** 3.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	99
0.3	99
0.212	99
0.15	99
0.063	97

Particle Diameter	Percentage Passing
0.02	85
0.006	41
0.002	21

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	3
Silt	76
Clay	21

Remarks:

See Summary of Soil Descriptions

PSL PROFESSIONAL SOILS LABORATORY

Dyke Road Galway

Contract No:
PSL24/3965
Client Ref:
13614-02-24

PARTICLE SIZE DISTRIBUTION TEST

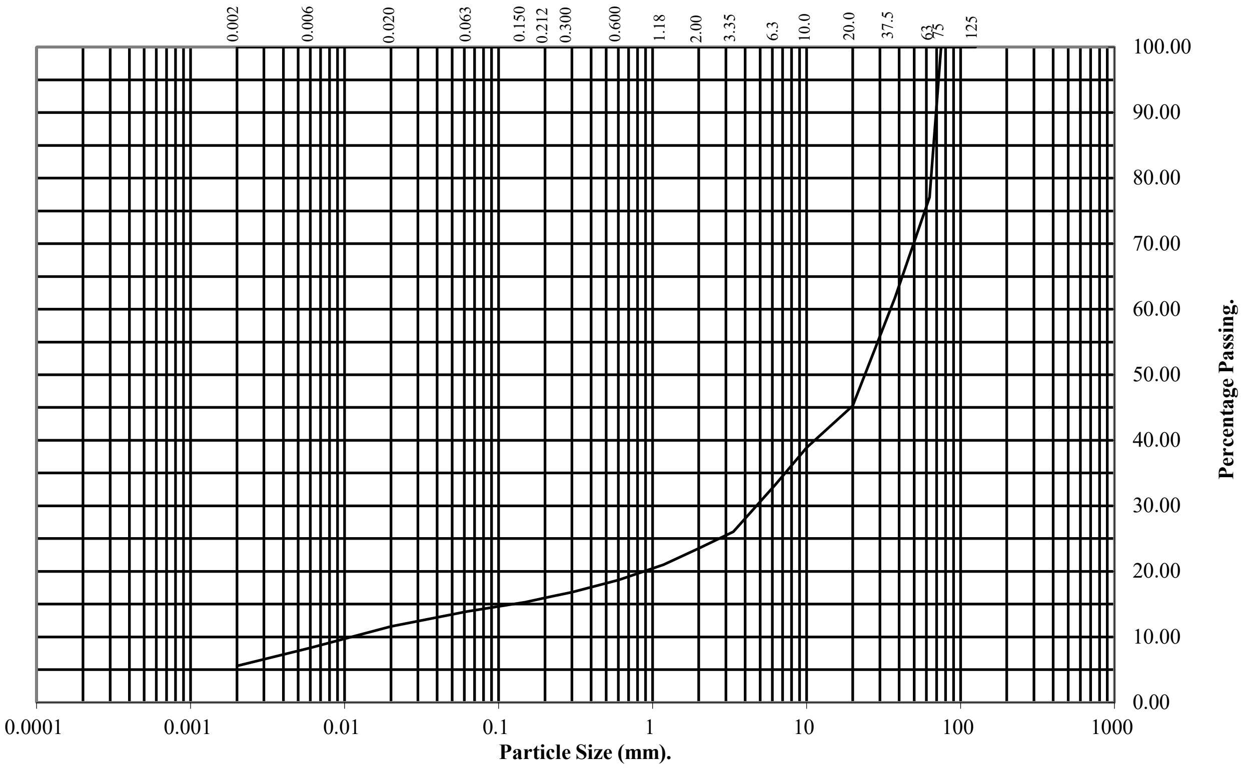
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BRC02 **Top Depth (m):** 7.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	77
37.5	62
20	45
10	39
6.3	33
3.35	26
2	24
1.18	21
0.6	19
0.3	17
0.212	16
0.15	15
0.063	14

Particle Diameter	Percentage Passing
0.02	12
0.006	8
0.002	6

Soil Fraction	Total Percentage
Cobbles	23
Gravel	53
Sand	10
Silt	8
Clay	6

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

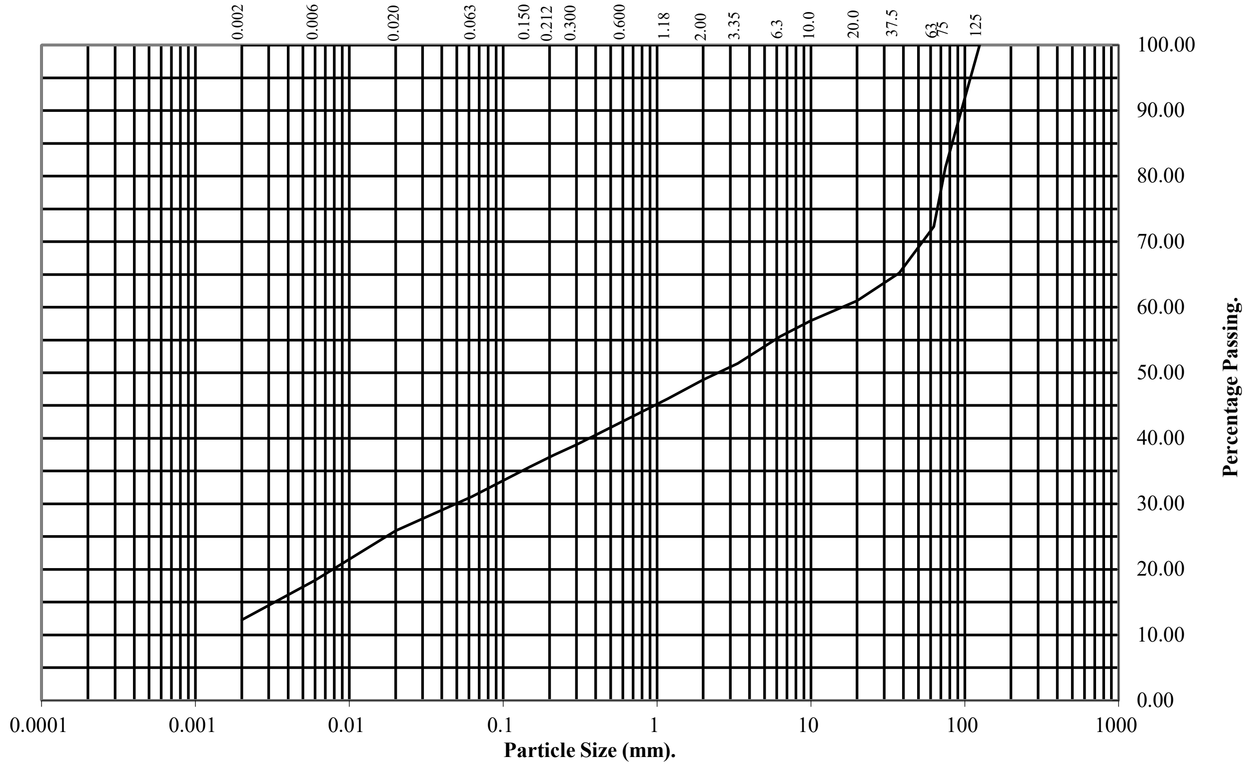
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BRC03 **Top Depth (m):** 4.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	81
63	72
37.5	65
20	61
10	58
6.3	56
3.35	51
2	49
1.18	46
0.6	43
0.3	39
0.212	37
0.15	36
0.063	31

Particle Diameter	Percentage Passing
0.02	26
0.006	18
0.002	12

Soil Fraction	Total Percentage
Cobbles	28
Gravel	23
Sand	18
Silt	19
Clay	12

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043 — PSL PROFESSIONAL SOILS LABORATORY

Dyke Road Galway

Contract No:	**PSL24/3965**
Client Ref:	**13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

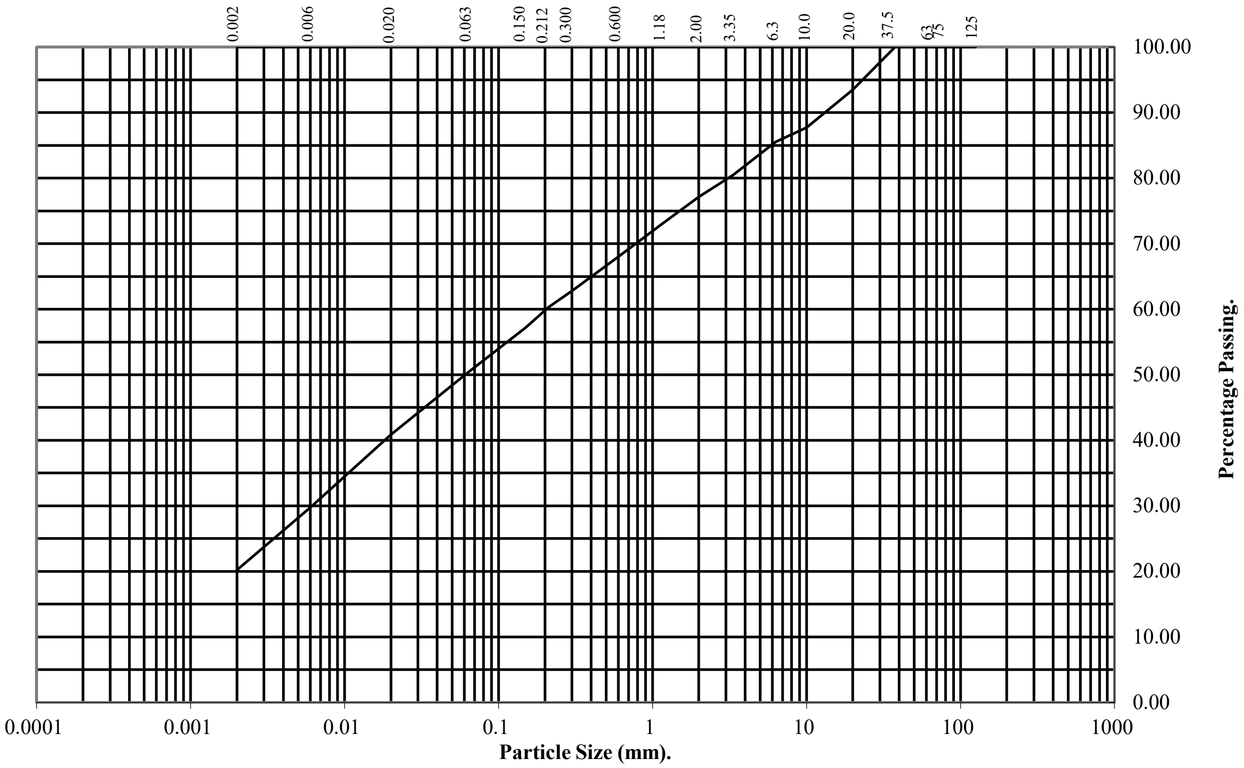
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BRC03 **Top Depth (m):** 7.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	93
10	88
6.3	86
3.35	80
2	77
1.18	73
0.6	68
0.3	63
0.212	60
0.15	57
0.063	50

Particle Diameter	Percentage Passing
0.02	41
0.006	30
0.002	20

Soil Fraction	Total Percentage
Cobbles	0
Gravel	23
Sand	27
Silt	30
Clay	20

Remarks:
See Summary of Soil Descriptions

UKAS 4043 / PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** PSL24/3965 **Client Ref:** 13614-02-24

PARTICLE SIZE DISTRIBUTION TEST

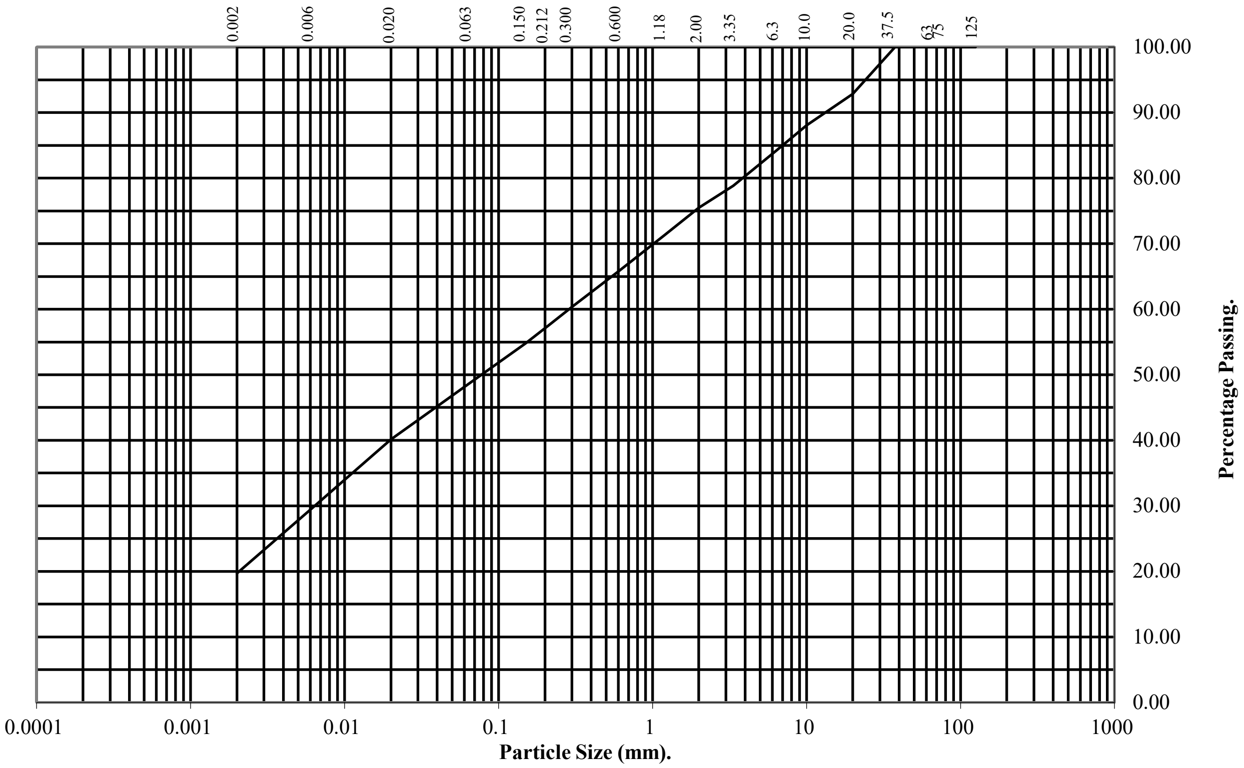
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BRC03 **Top Depth (m):** 9.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	93
10	88
6.3	84
3.35	79
2	75
1.18	71
0.6	66
0.3	60
0.212	58
0.15	55
0.063	48

Particle Diameter	Percentage Passing
0.02	40
0.006	29
0.002	20

Soil Fraction	Total Percentage
Cobbles	0
Gravel	25
Sand	27
Silt	28
Clay	20

Remarks:
See Summary of Soil Descriptions

PSL PROFESSIONAL SOILS LABORATORY

Dyke Road Galway

Contract No:	**PSL24/3965**
Client Ref:	**13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

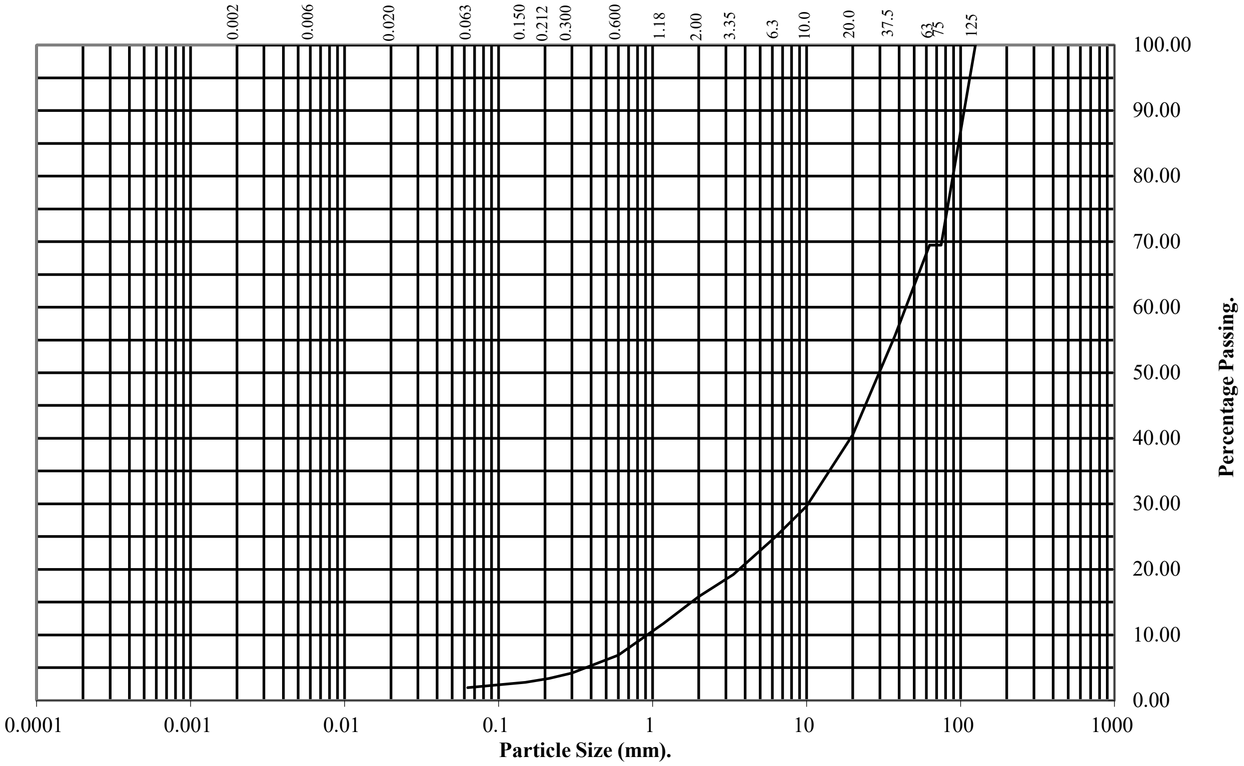
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: BRC04 **Top Depth (m):** 4.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	69
63	69
37.5	56
20	41
10	30
6.3	25
3.35	19
2	16
1.18	12
0.6	7
0.3	4
0.212	3
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	31
Gravel	53
Sand	14
Silt/Clay	2

Remarks:
See Summary of Soil Descriptions

PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	Contract No: PSL24/3965 Client Ref: 13614-02-24

PARTICLE SIZE DISTRIBUTION TEST

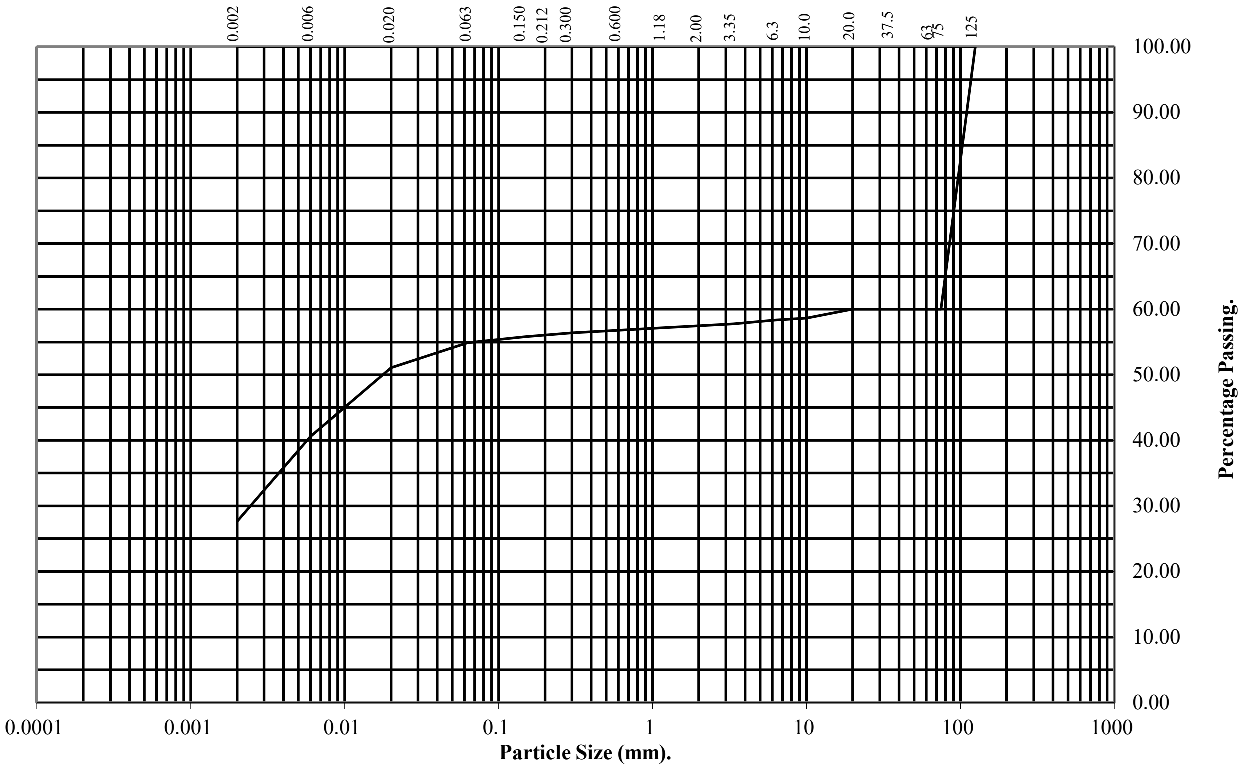
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BRC05 **Top Depth (m):** 2.60

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	60
63	60
37.5	60
20	60
10	59
6.3	58
3.35	58
2	57
1.18	57
0.6	57
0.3	56
0.212	56
0.15	56
0.063	55

Particle Diameter	Percentage Passing
0.02	51
0.006	41
0.002	28

Soil Fraction	Total Percentage
Cobbles	40
Gravel	3
Sand	2
Silt	27
Clay	28

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

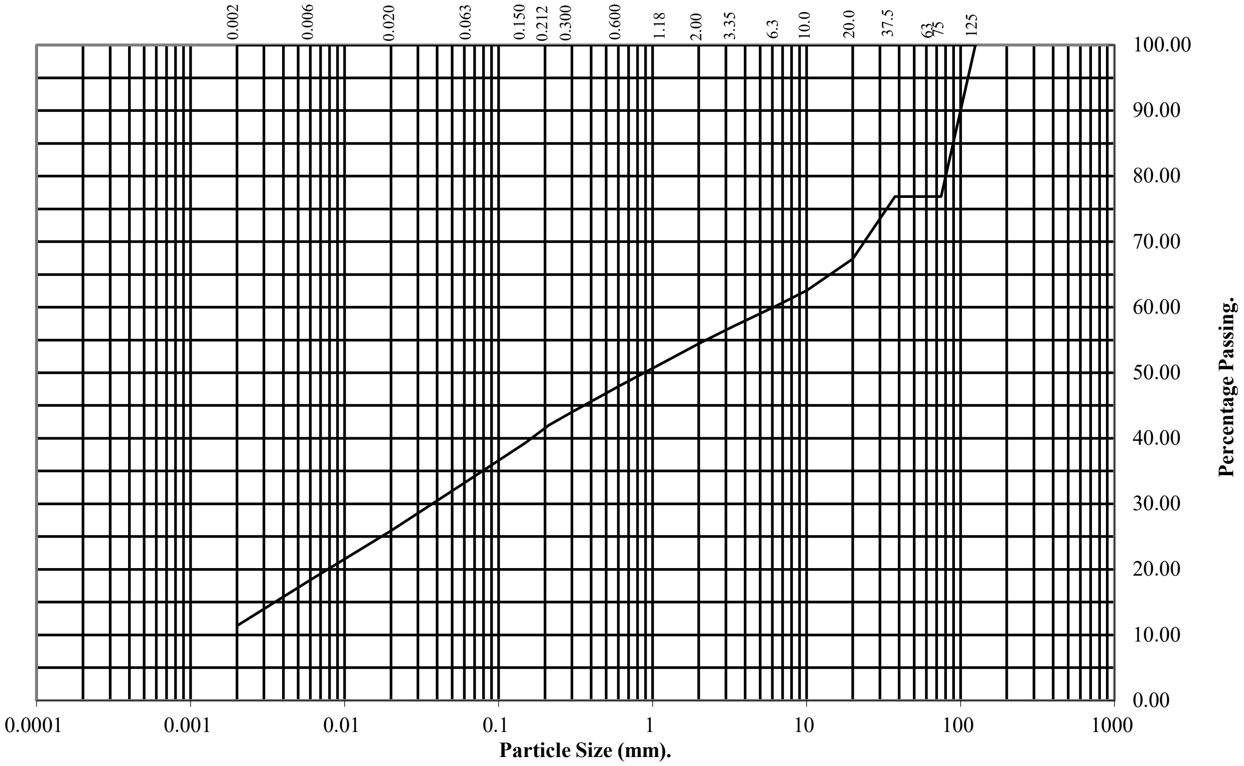
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BRC05 **Top Depth (m):** 3.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	77
63	77
37.5	77
20	67
10	63
6.3	60
3.35	57
2	54
1.18	52
0.6	48
0.3	44
0.212	42
0.15	39
0.063	33

Particle Diameter	Percentage Passing
0.02	26
0.006	18
0.002	11

Soil Fraction	Total Percentage
Cobbles	23
Gravel	23
Sand	21
Silt	22
Clay	11

Remarks:
See Summary of Soil Descriptions

UKAS 4043 PSL PROFESSIONAL SOILS LABORATORY

Dyke Road Galway

Contract No:	PSL24/3965
Client Ref:	13614-02-24

PARTICLE SIZE DISTRIBUTION TEST

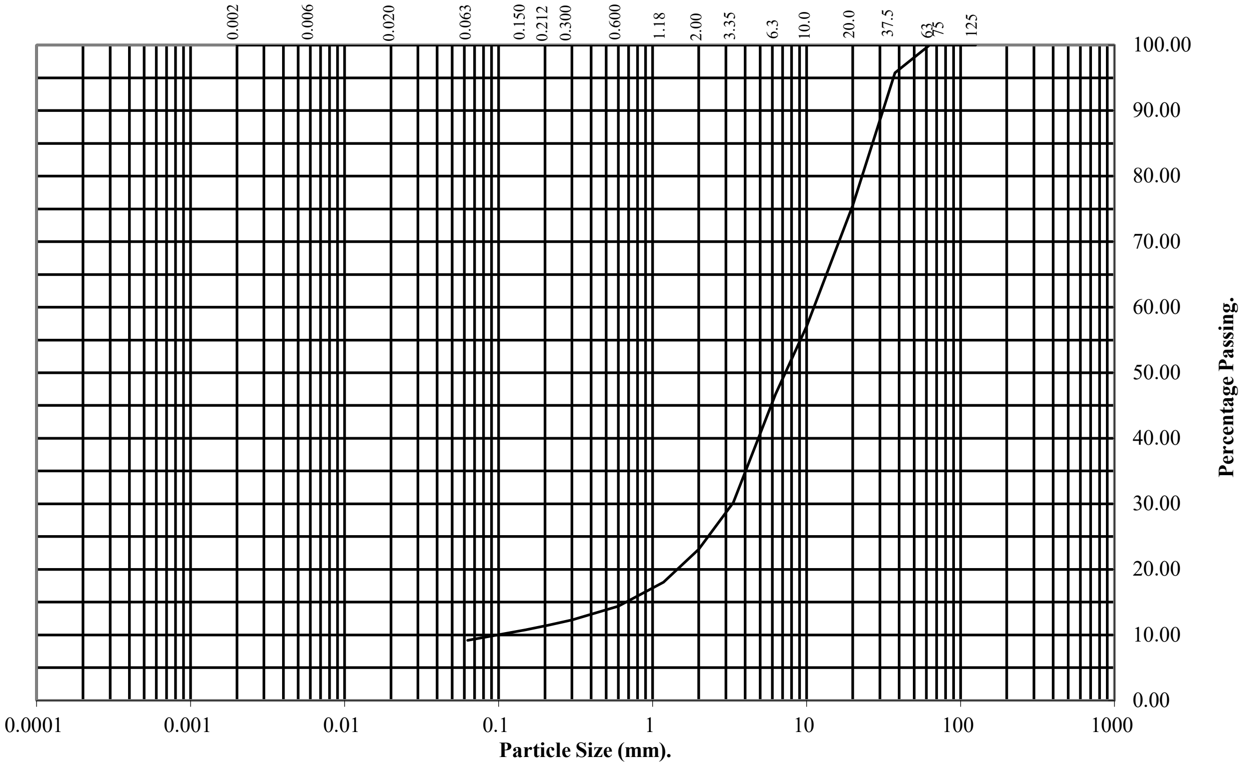
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP01 **Top Depth (m):** 0.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	96
20	76
10	57
6.3	47
3.35	30
2	23
1.18	18
0.6	14
0.3	12
0.212	12
0.15	11
0.063	9

Soil Fraction	Total Percentage
Cobbles	0
Gravel	77
Sand	14
Silt/Clay	9

Remarks:
See Summary of Soil Descriptions

UKAS 4043 / PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** PSL24/3965 **Client Ref:** 13614-02-24

PARTICLE SIZE DISTRIBUTION TEST

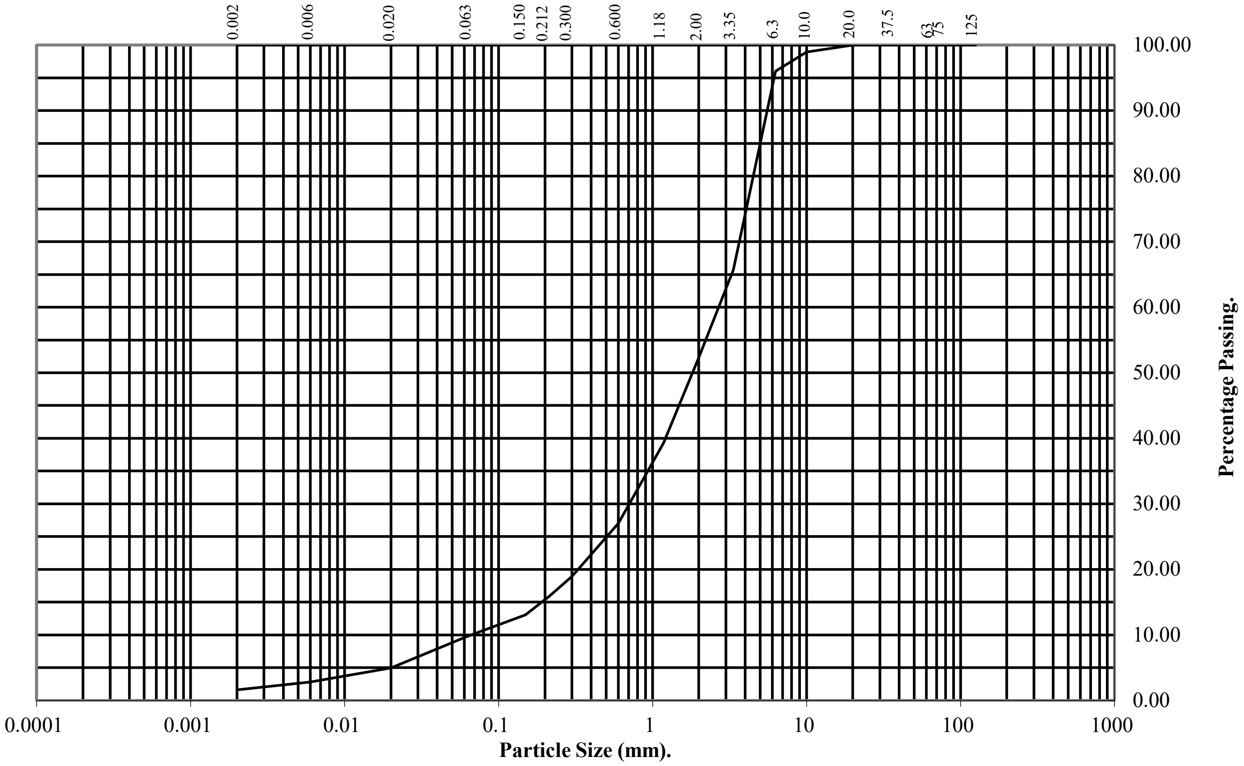
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP01 **Top Depth (m):** 1.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	96
3.35	66
2	52
1.18	39
0.6	27
0.3	19
0.212	16
0.15	13
0.063	10

Particle Diameter	Percentage Passing
0.02	5
0.006	3
0.002	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	48
Sand	42
Silt	8
Clay	2

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043 — PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** PSL24/3965 **Client Ref:** 13614-02-24

PARTICLE SIZE DISTRIBUTION TEST

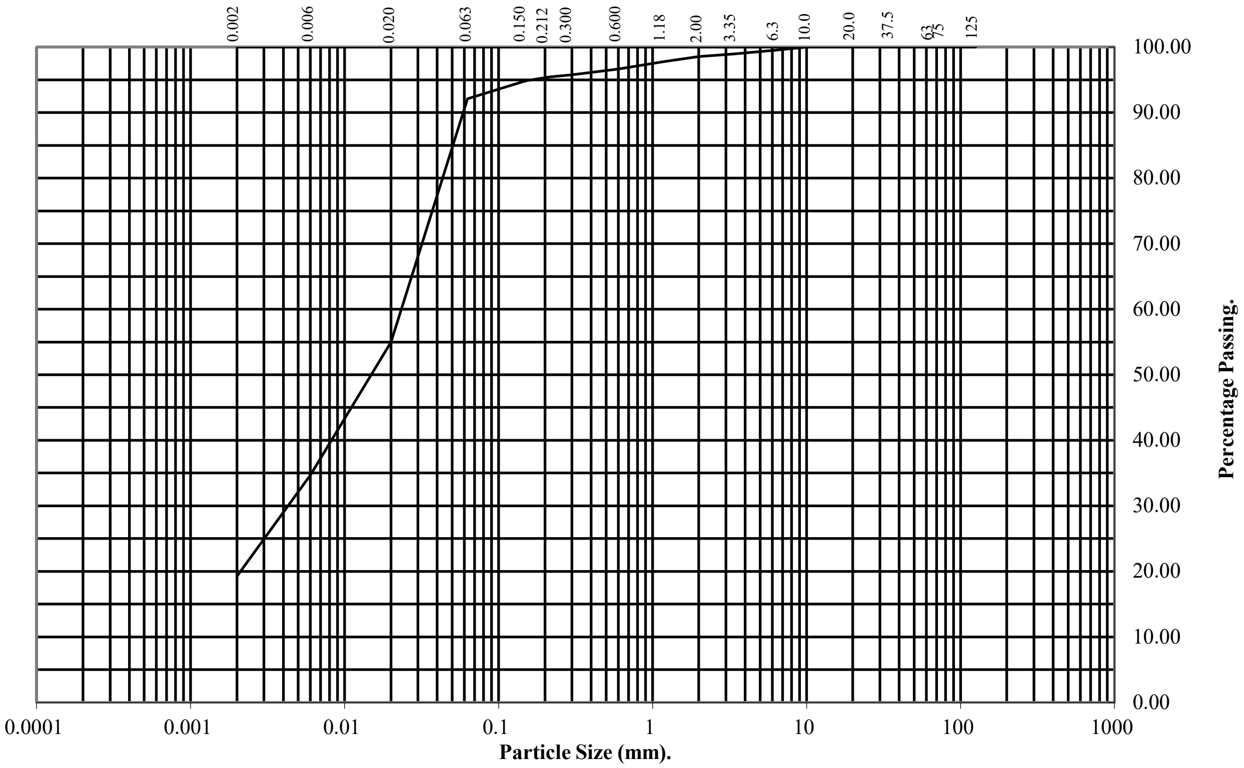
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP02 **Top Depth (m):** 2.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	99
1.18	98
0.6	97
0.3	96
0.212	95
0.15	95
0.063	92

Particle Diameter	Percentage Passing
0.02	55
0.006	35
0.002	19

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	7
Silt	73
Clay	19

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY

Dyke Road Galway

Contract No: **PSL24/3965**
Client Ref: **13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

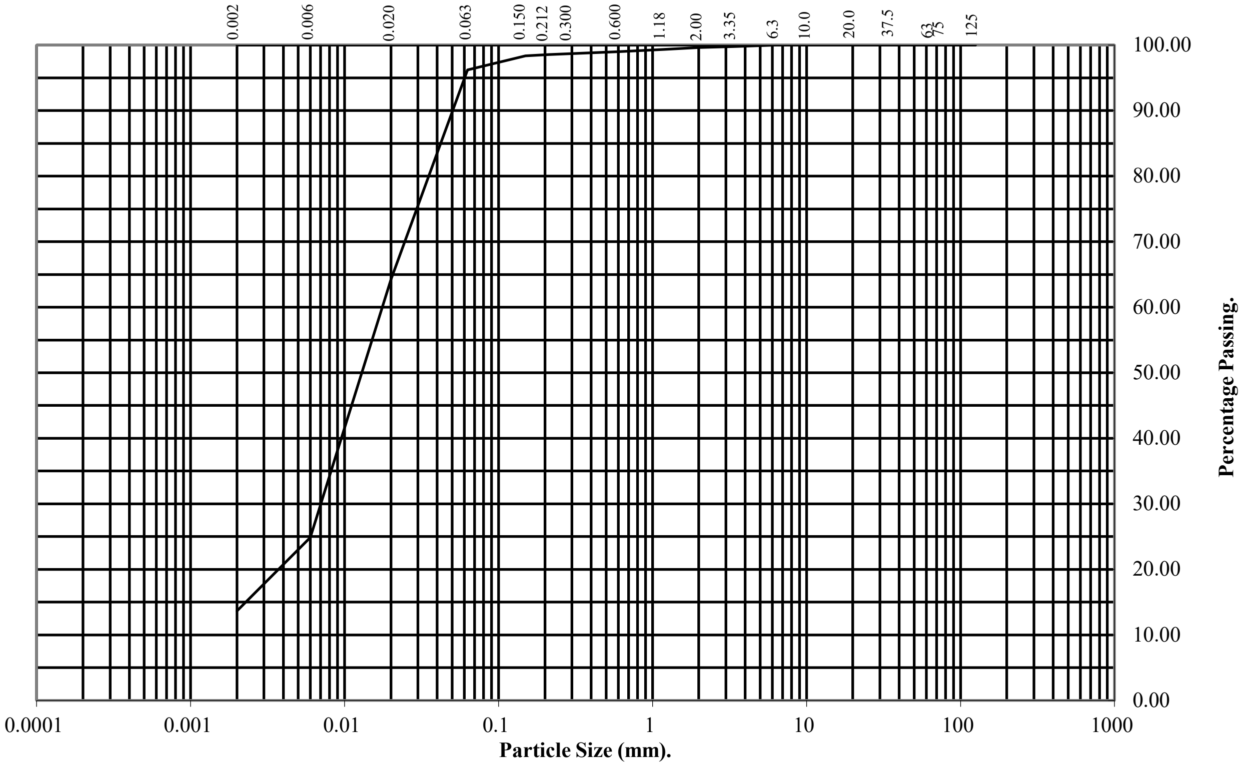
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP03 **Top Depth (m):** 2.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	99
0.6	99
0.3	99
0.212	99
0.15	98
0.063	96

Particle Diameter	Percentage Passing
0.02	64
0.006	25
0.002	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	4
Silt	82
Clay	14

Remarks:
See Summary of Soil Descriptions

PROFESSIONAL SOILS LABORATORY

Dyke Road Galway

Contract No:	**PSL24/3965**
Client Ref:	**13614-02-24**

PARTICLE SIZE DISTRIBUTION TEST

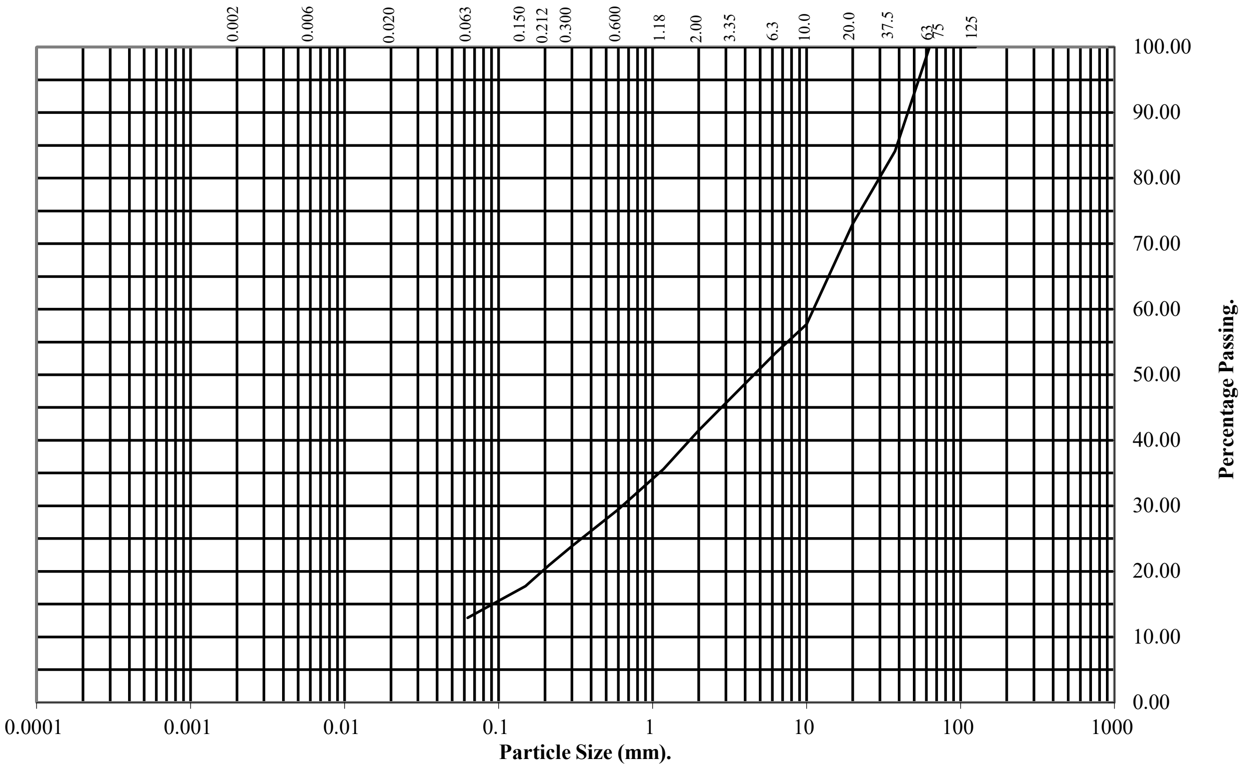
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP05 **Top Depth (m):** 1.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	84
20	73
10	58
6.3	53
3.35	47
2	42
1.18	36
0.6	29
0.3	24
0.212	21
0.15	18
0.063	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	58
Sand	29
Silt/Clay	13

Remarks:
See Summary of Soil Descriptions

PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	**Contract No:** PSL24/3965 **Client Ref:** 13614-02-24

MOISTURE CONDITION VALUE

BS1377 : Part 4 : 1990 Clause 5.4

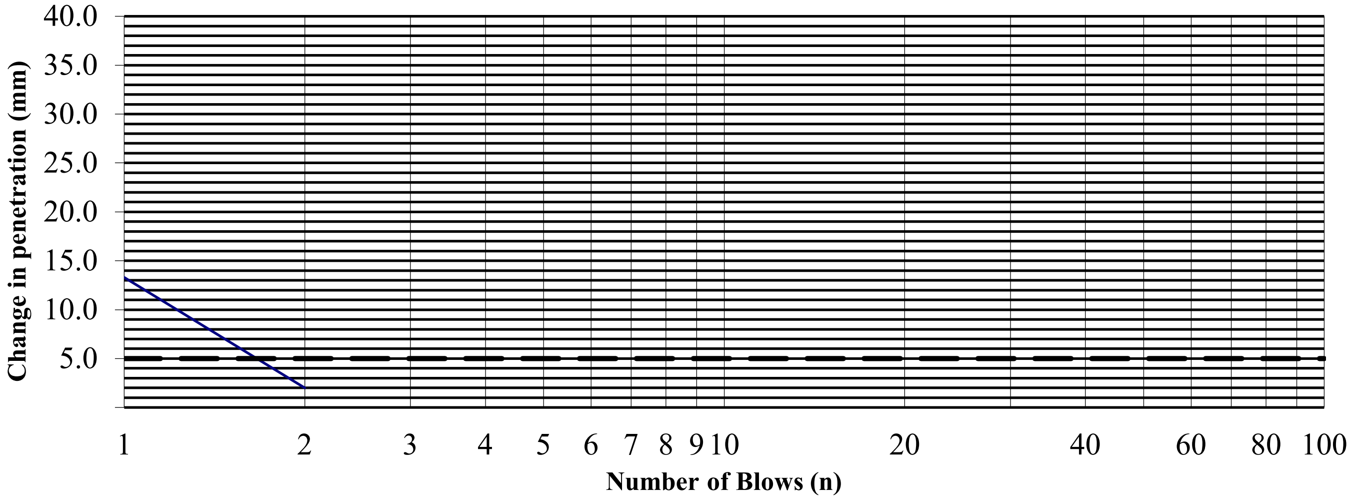
Hole Number: **BRC03** **Top Depth (m):** **8.50**

Sample Number: **Base Depth (m):**

Sample Type: **B**

Material Retained on the 20mm BS Test Sieve (%):	12
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	44.3	13.3
2	32.7	2.0
3	31.1	
4	31.0	
6	30.8	
8	30.7	
12		
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Moisture Content (%)	14
MCV	2.2

PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	Contract No:
		PSL24/3965
		Client Ref:
		13614-02-24

MOISTURE CONDITION VALUE

BS1377 : Part 4 : 1990 Clause 5.4

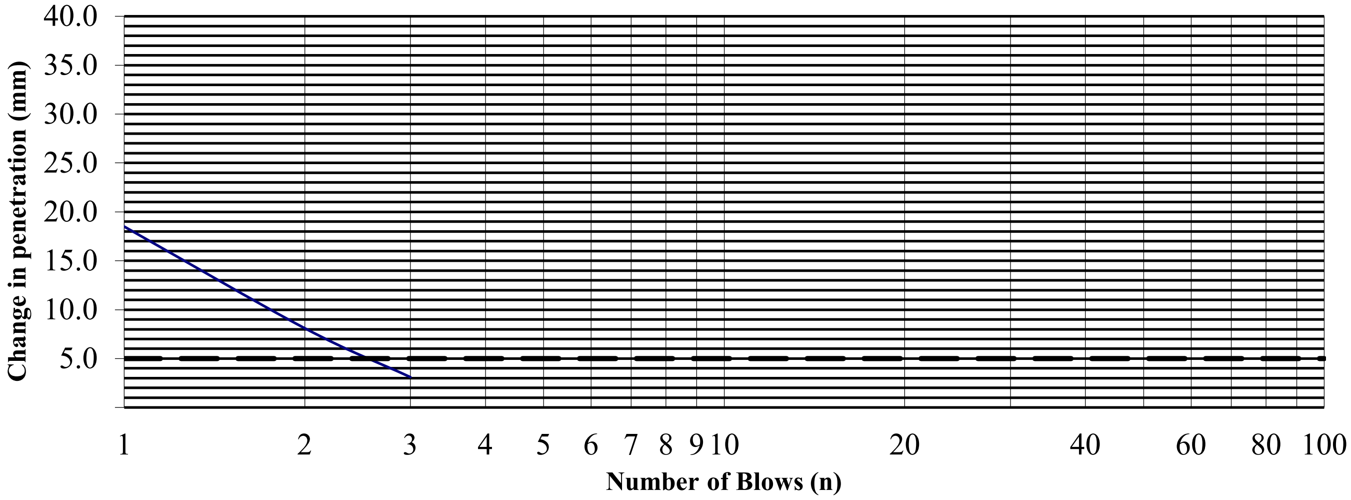
Hole Number: **BRC05** **Top Depth (m):** **4.50**

Sample Number: **Base Depth (m):**

Sample Type: **B**

Material Retained on the 20mm BS Test Sieve (%):	49
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	50.9	18.5
2	39.9	8.1
3	34.6	3.1
4	32.4	
6	32.0	
8	31.8	
12	31.5	
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Moisture Content (%)	10
MCV	4.1

MOISTURE CONDITION VALUE

BS1377 : Part 4 : 1990 Clause 5.4

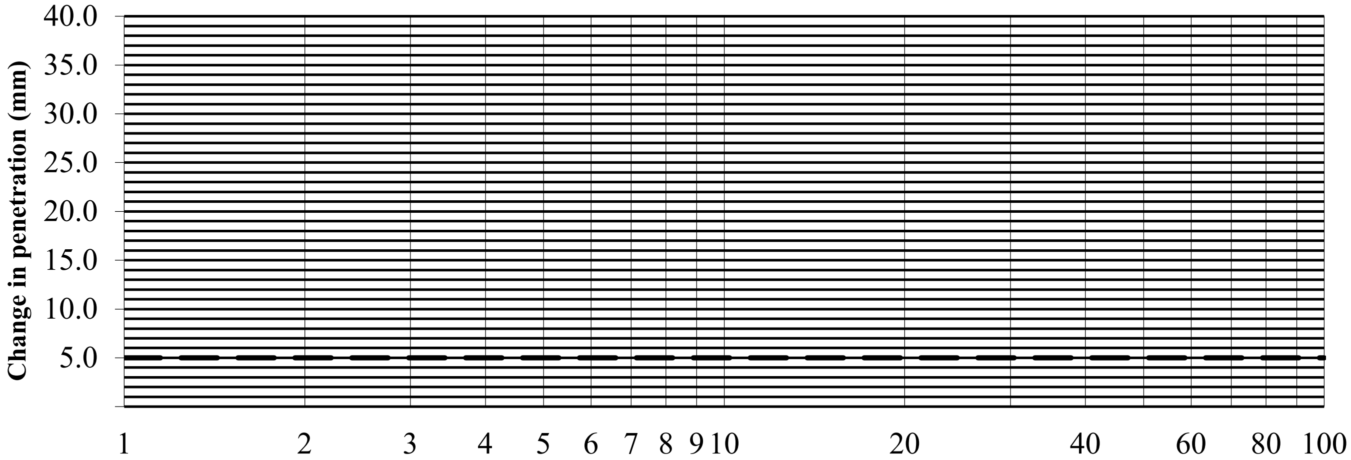
Hole Number: TP01 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	136.8	2.6
2	135.1	
3	134.6	
4	134.2	
6		
8		
12		
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Moisture Content (%)	614
MCV	<1

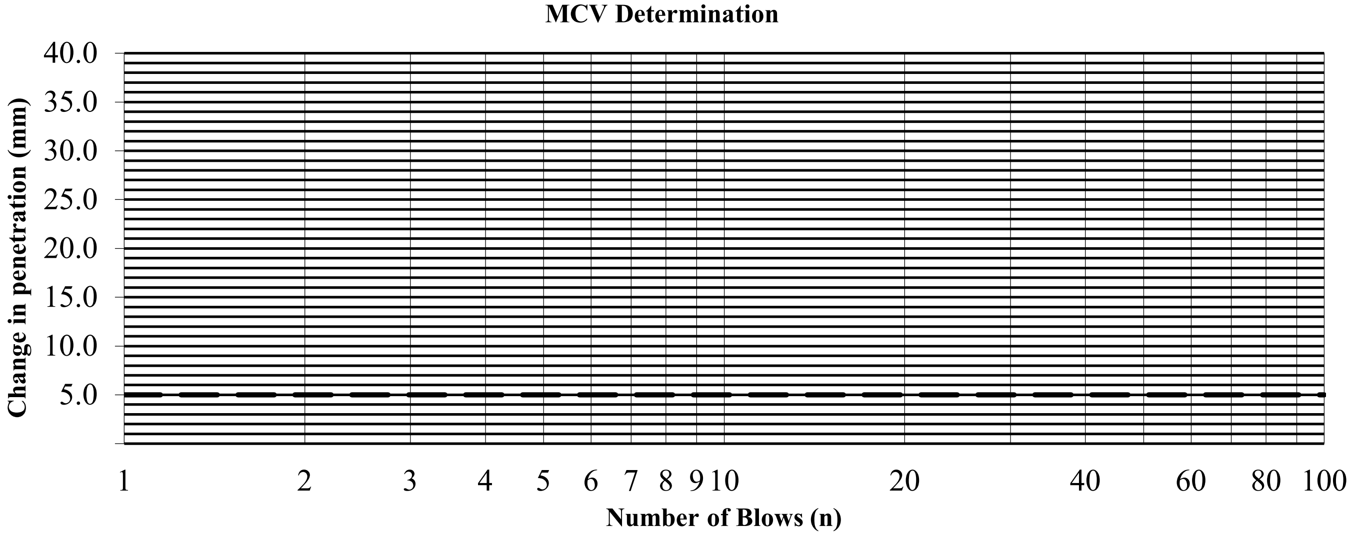
UKAS 4043 / PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	**Contract No:** PSL24/3965 **Client Ref:** 13614-02-24

MOISTURE CONDITION VALUE

BS1377 : Part 4 : 1990 Clause 5.4

Hole Number:	**TP02**	**Top Depth (m):**	**2.00**
Sample Number:		**Base Depth (m):**	
Sample Type:	**B**		

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	



Blows (N)	Penetration (mm)	n to 4n (mm)
1	97.3	3.2
2	95.0	
3	94.4	
4	94.1	
6		
8		
12		
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Moisture Content (%)	131
MCV	<1

UKAS 4043 PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	**Contract No:** PSL24/3965
		Client Ref: 13614-02-24

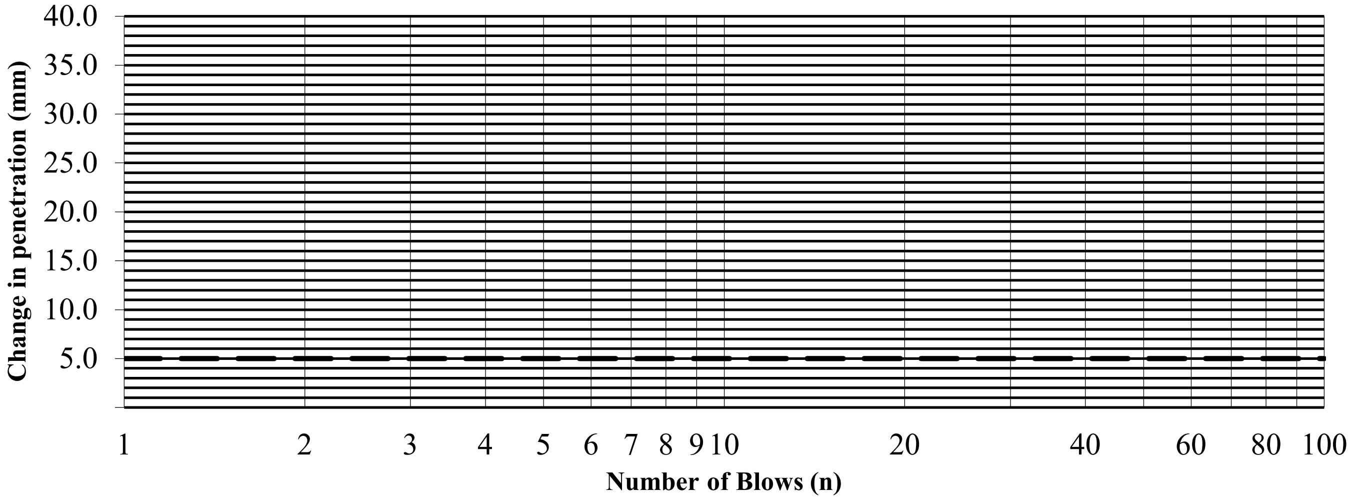
MOISTURE CONDITION VALUE

BS1377 : Part 4 : 1990 Clause 5.4

Hole Number:	**TP03**	**Top Depth (m):**	**2.00**
Sample Number:		**Base Depth (m):**	
Sample Type:	**B**		

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	94.1	2.2
2	92.9	
3	92.3	
4	91.9	
6		
8		
12		
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Moisture Content (%)	145
MCV	<1

UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:**
		PSL24/3965
		Client Ref:
		13614-02-24

MOISTURE CONDITION VALUE

BS1377 : Part 4 : 1990 Clause 5.4

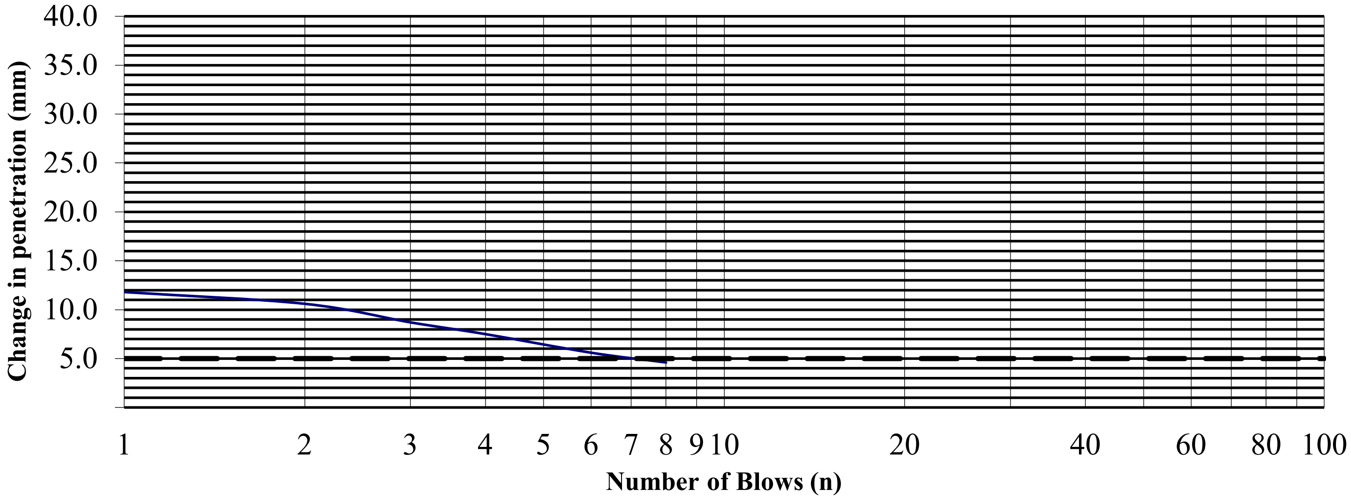
Hole Number: **TP05** **Top Depth (m):** **1.00**

Sample Number: **Base Depth (m):**

Sample Type: **B**

Material Retained on the 20mm BS Test Sieve (%):	27
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	50.0	11.8
2	44.8	10.6
3	40.5	8.7
4	38.2	7.5
6	35.6	5.6
8	34.2	4.6
12	31.8	
16	30.7	
24	30.0	
32	29.6	
48		
64		
96		
128		
192		
256		

Test Results.

Moisture Content (%)	8.1
MCV	8.5

UKAS 4043 PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	Contract No: PSL24/3965 Client Ref: 13614-02-24

SUMMARY OF LABORATORY HAND VANES

(BS1377 : PART 7 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Peak Shear Strength kPa	Residual Shear Strength kPa	Remarks
BH01		UT	3.00	3.45	79	10		
BH02		UT	3.00	3.45	104	23		
BH03		UT	3.00	3.45	151	8		
BH06		UT	3.00	3.45	167	27		
BRC01		UT	5.30	5.75	123	13		
BRC01		UT	7.50	7.95	160	6		
BRC02		UT	3.00	3.45	86	6		
BRC02		UT	5.00	5.45	131	12		
BRC03		UT	3.00	3.45	87	18		

* This test is out of our UKAS scope

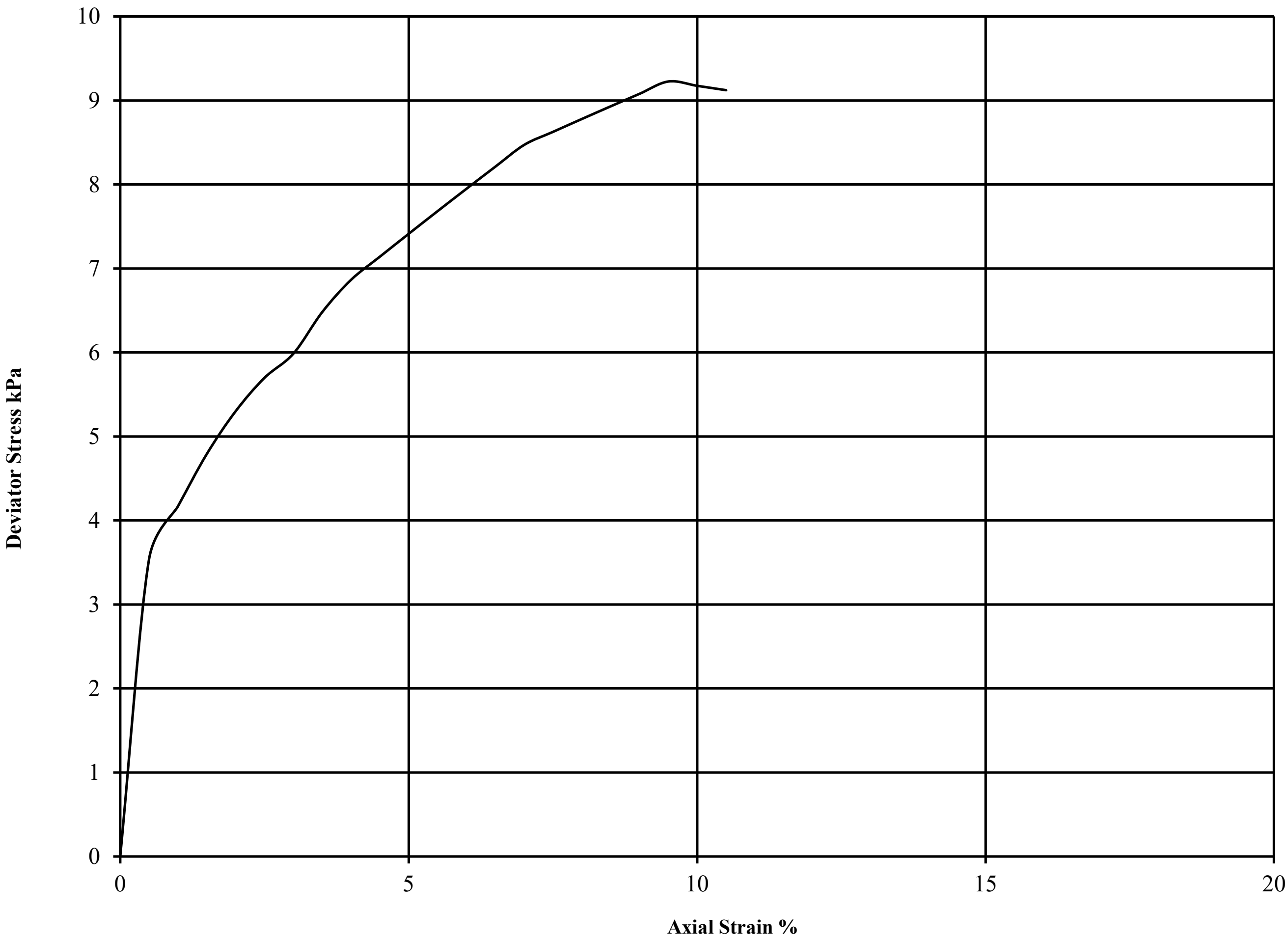
PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	Dyke Road Galway	Contract No: PSL24/3965 Client Ref: 13614-02-24

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**BH01**	**Top Depth (m):**	**3.00**
Sample Number:		**Base Depth (m):**	**3.45**
Sample Type	**UT**		



Diameter (mm):		102	Height (mm):		204	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35
1	79	1.33	0.74	60	9	5	9.5	Intermediate	See summary of soil descriptions

PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

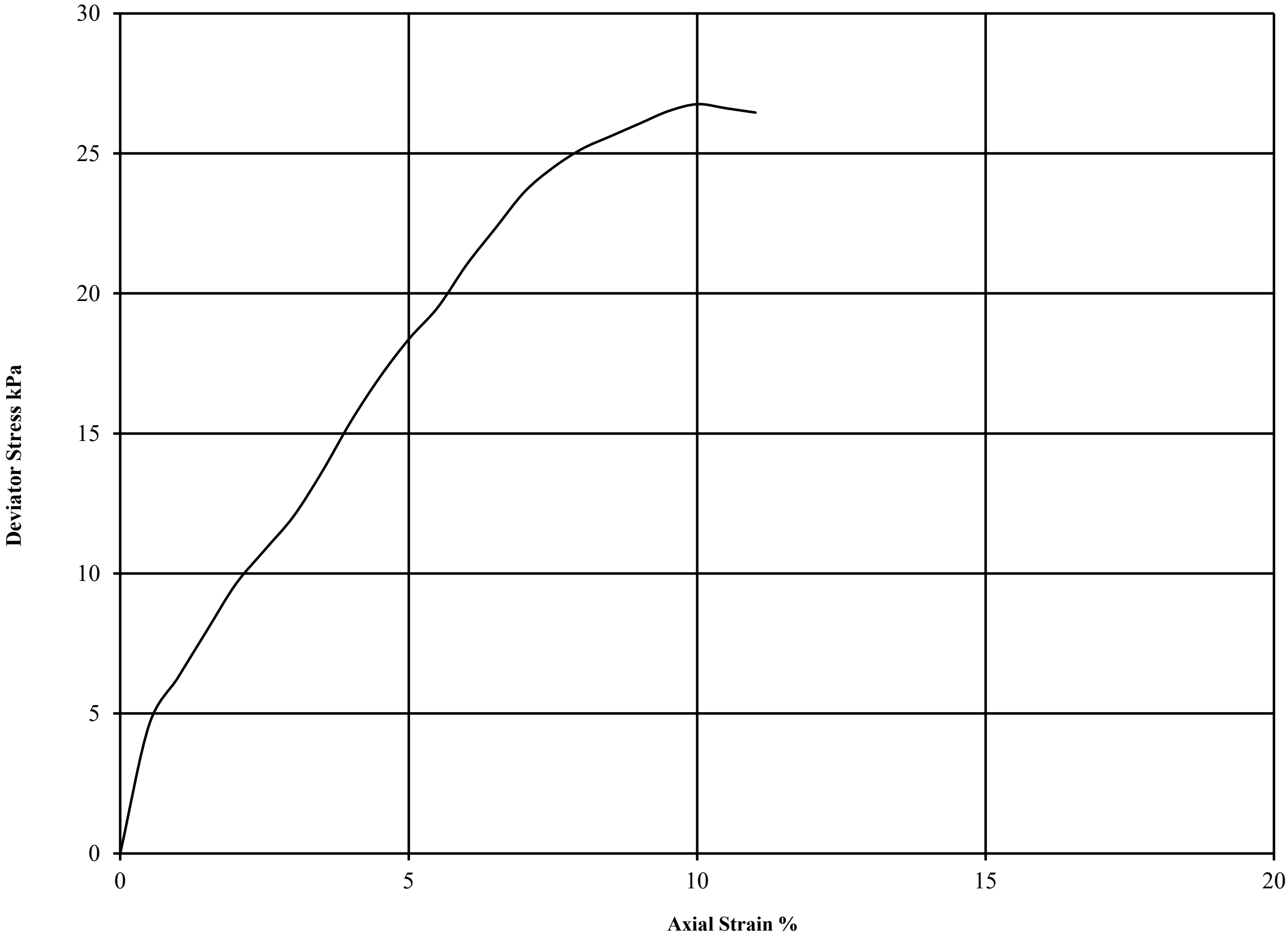
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **BH02** **Top Depth (m):** **3.00**

Sample Number: **Base Depth (m):** **3.45**

Sample Type **UT**



Diameter (mm):		102	Height (mm):		204	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35
1	96	1.33	0.68	60	27	13	10.0	Intermediate	See summary of soil descriptions

UKAS TESTING 4043 PSL PROFESSIONAL SOILS LABORATORY a Tetra Tech Group company	**Dyke Road Galway**	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

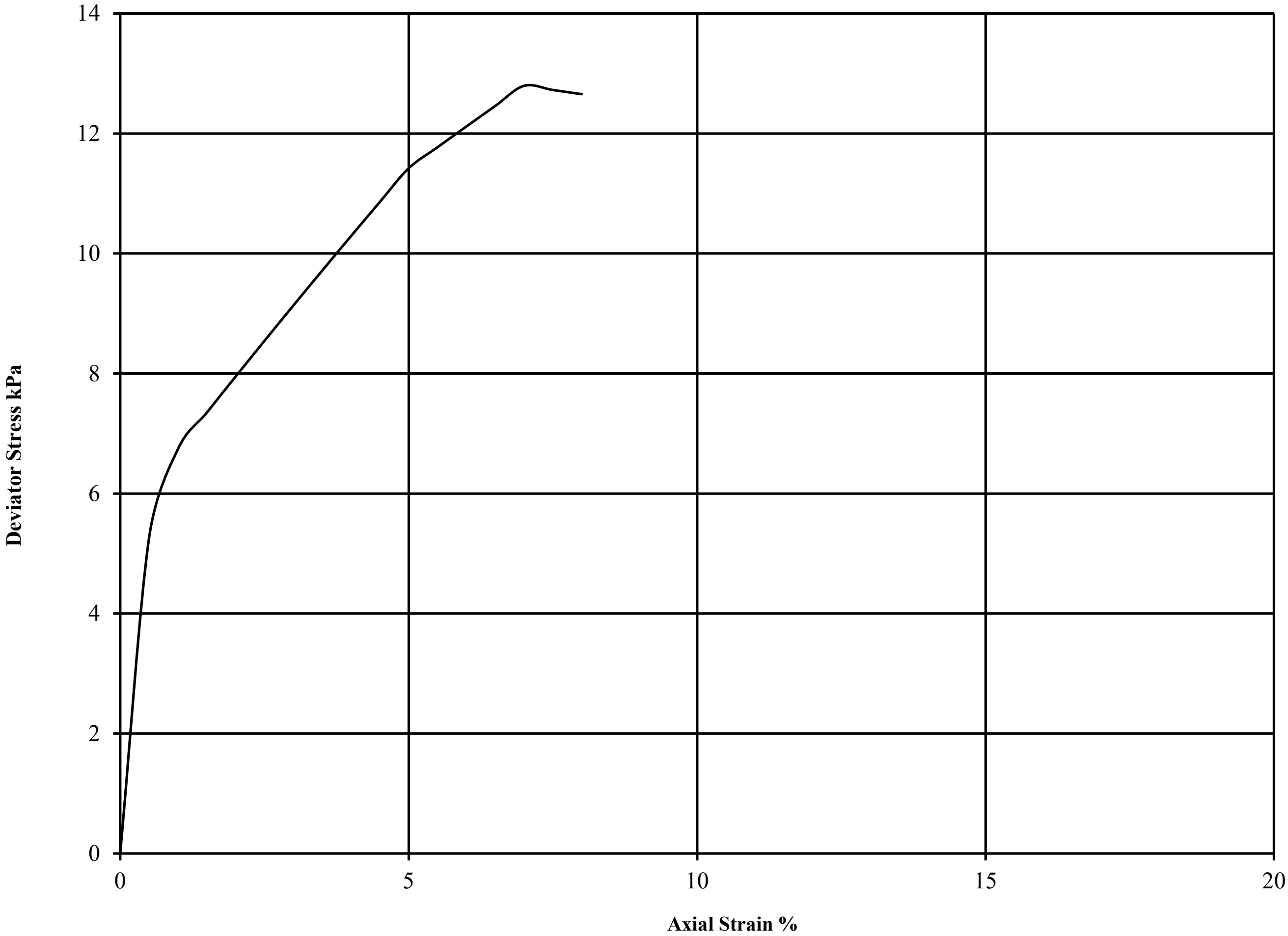
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **BRC01** **Top Depth (m):** **5.30**

Sample Number: **Base Depth (m):** **5.75**

Sample Type **UT**



Diameter (mm):		102	Height (mm):		204	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.36
1	123	1.27	0.57	110	13	6	7.0	Intermediate	See summary of soil descriptions

UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

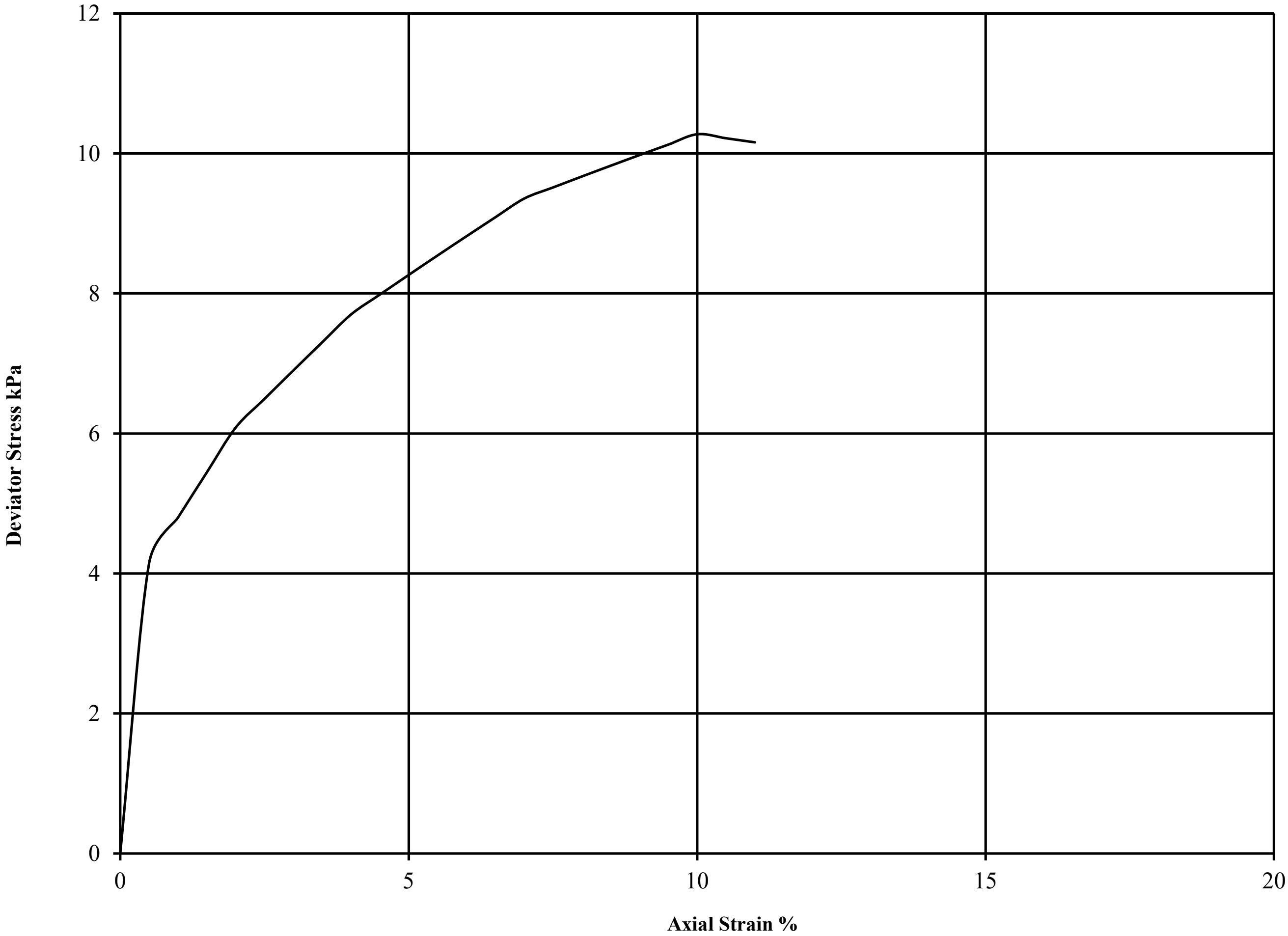
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: BRC01 **Top Depth (m):** 7.50

Sample Number: **Base Depth (m):** 7.95

Sample Type UT



Diameter (mm):		100	Height (mm):		200	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $\frac{1}{2}(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.36
1	160	1.26	0.48	150	10	5	10.0	Intermediate	See summary of soil descriptions

		Contract No:
UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	PSL24/3965
		Client Ref:
		13614-02-24

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

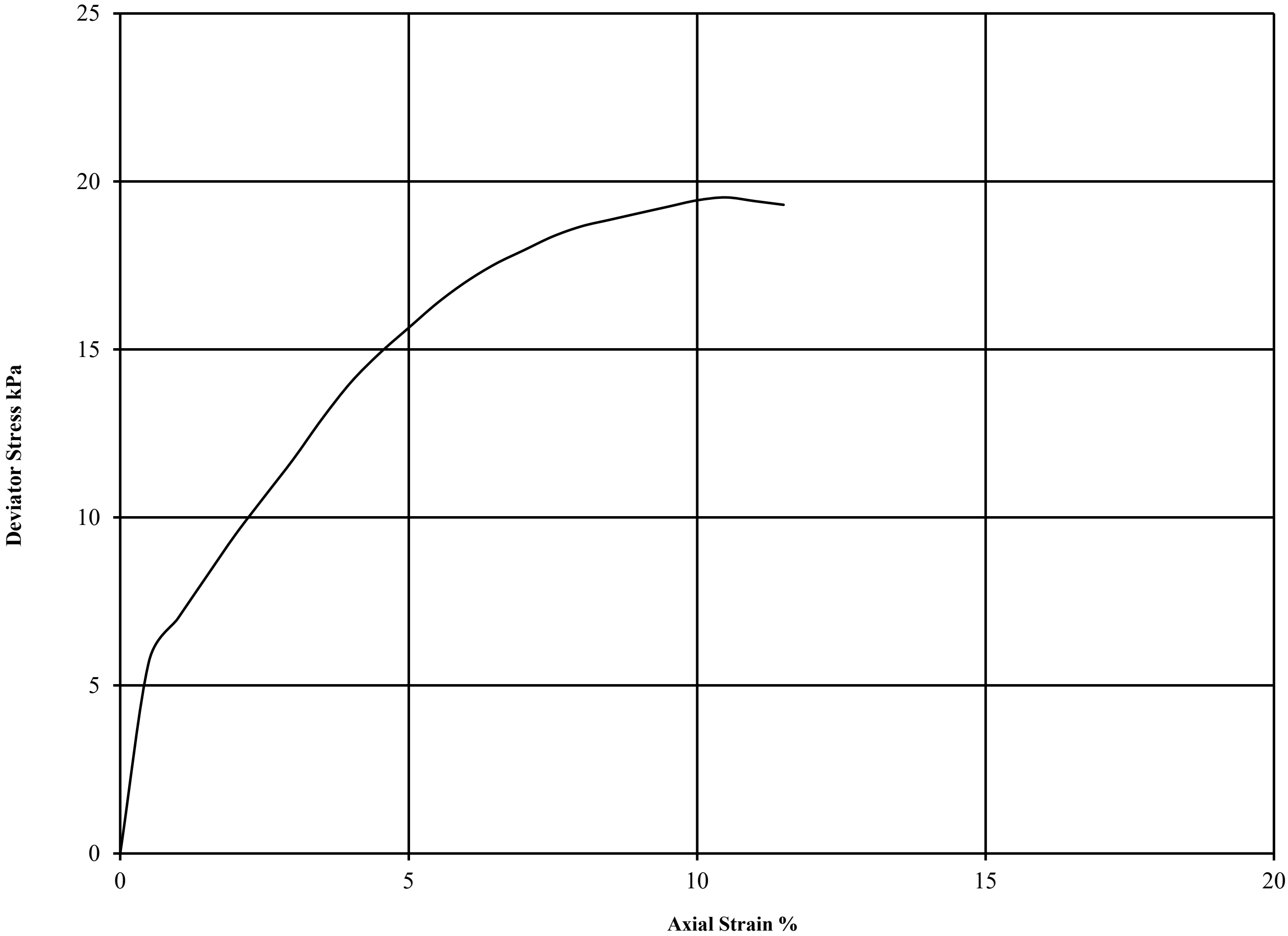
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **BRC02** **Top Depth (m):** **3.00**

Sample Number: **Base Depth (m):** **3.45**

Sample Type **UT**



Diameter (mm):		102	Height (mm):		204	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35
1	86	1.30	0.70	60	20	10	10.5	Intermediate	See summary of soil descriptions

UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

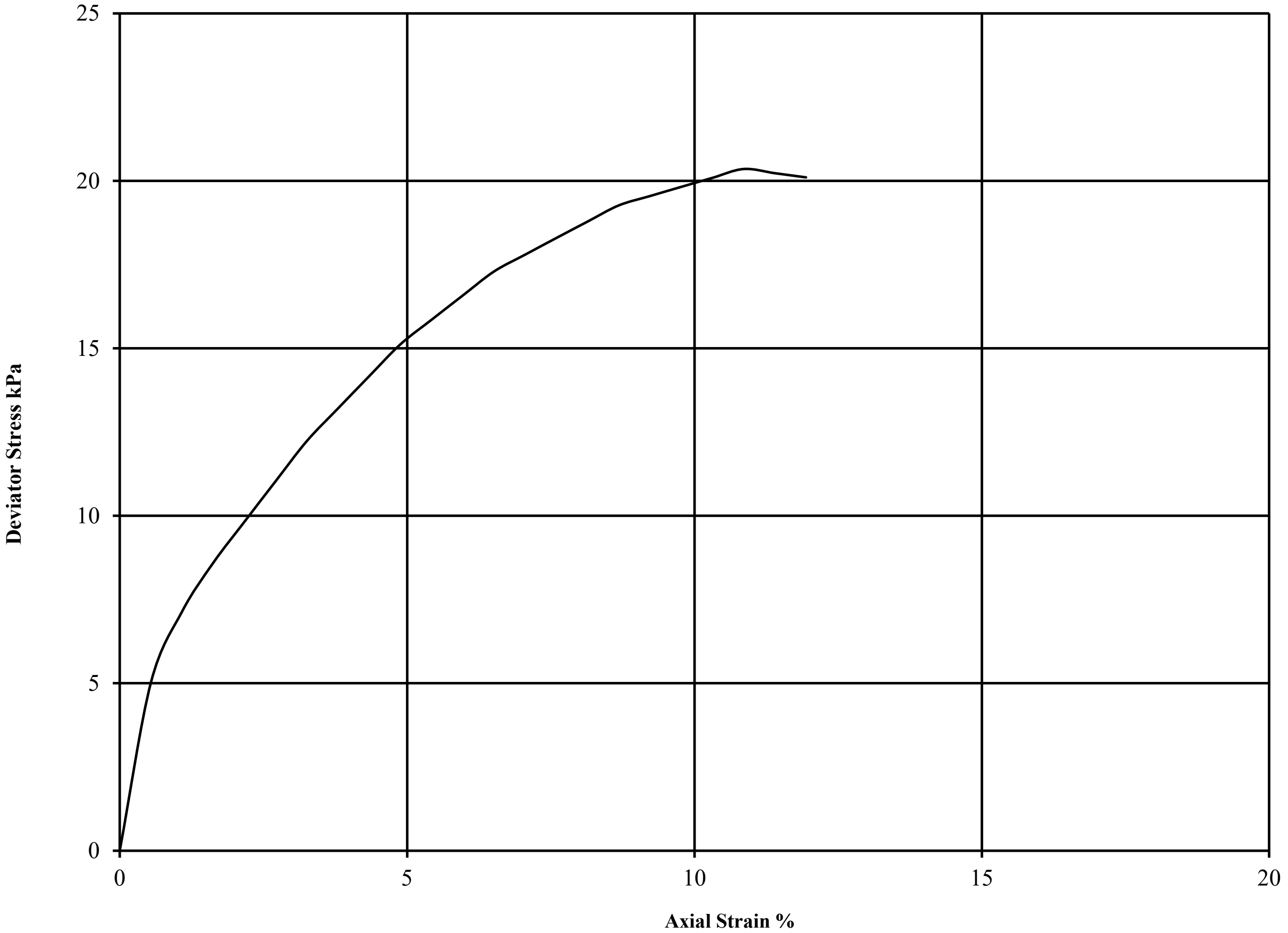
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: **BRC02** **Top Depth (m):** **5.00**

Sample Number: **Base Depth (m):** **5.45**

Sample Type **UT**



Diameter (mm):		102	Height (mm):		188	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $\frac{1}{2}(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35
1	131	1.27	0.55	100	20	10	10.9	Intermediate	See summary of soil descriptions

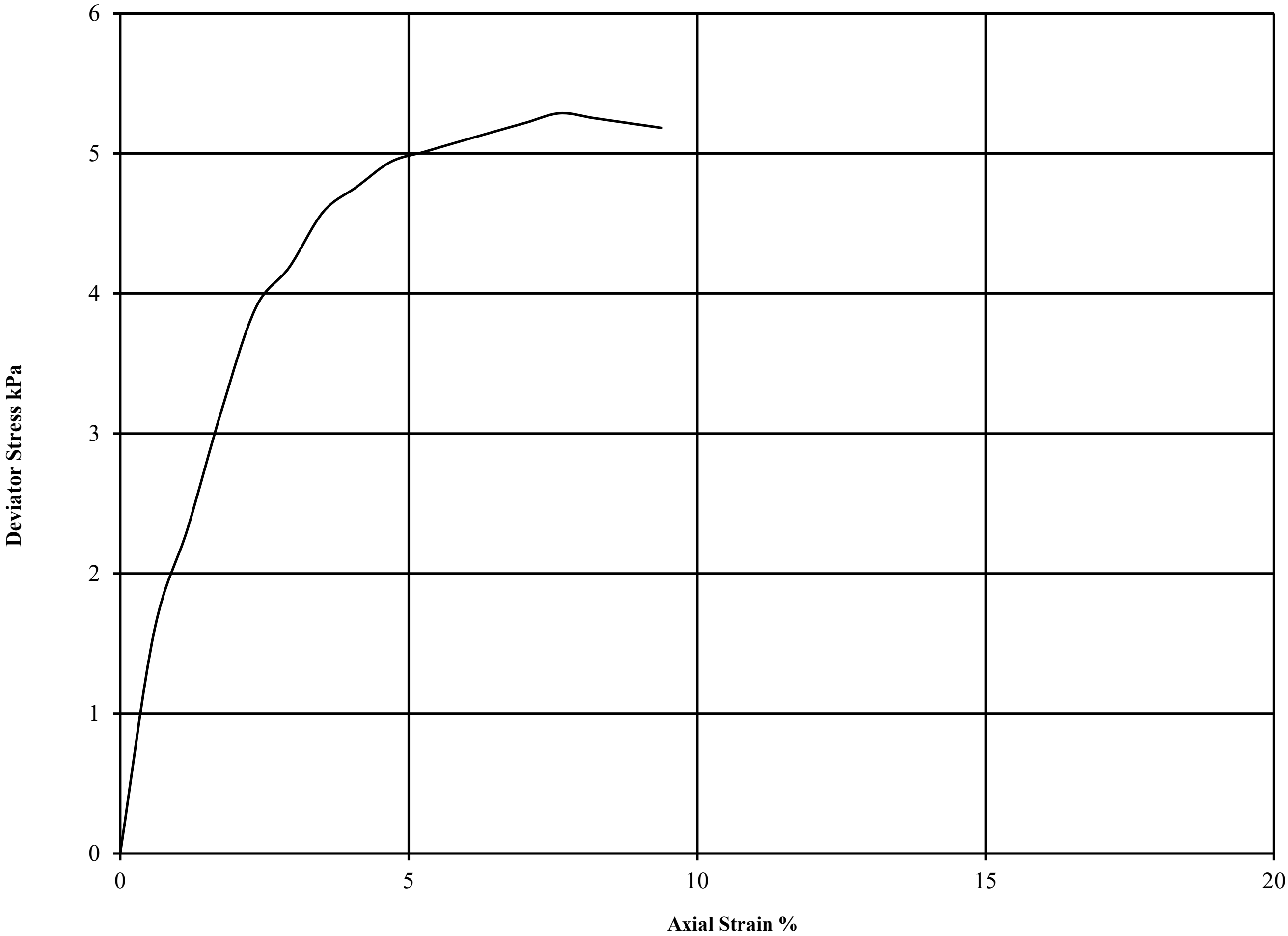
	Dyke Road Galway	**Contract No:** PSL24/3965 **Client Ref:** 13614-02-24

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:	**BRC03**	**Top Depth (m):**	**3.00**
Sample Number:		**Base Depth (m):**	**3.45**
Sample Type	**UT**		



Diameter (mm):		102	Height (mm):		174	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.36
1	87	1.44	0.77	60	5	3	7.6	Intermediate	See summary of soil descriptions

PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

ONE DIMENSIONAL CONSOLIDATION TEST

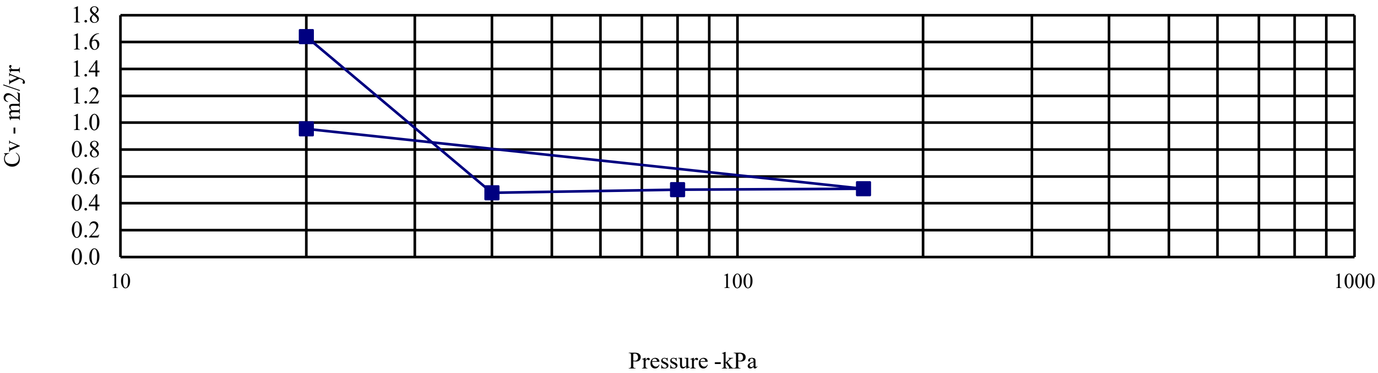
BS 1377: Part 5: 1990: Clause 3

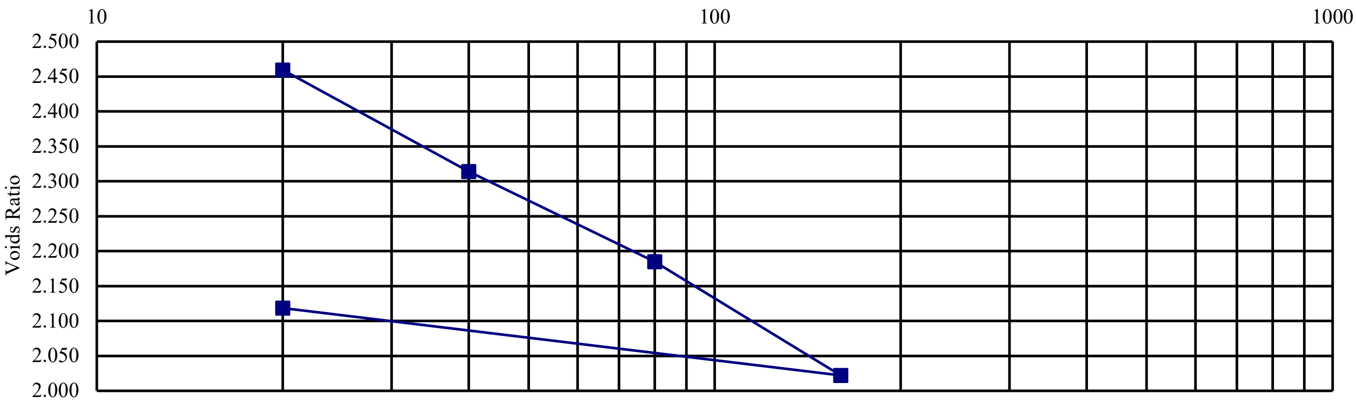
Hole Number: **BH02** **Top Depth (m):** **1.00**

Sample Number: **Base Depth (m) :** **1.27**

Sample Type: **UT**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	80						
Bulk Density (Mg/m3):	1.31	0	20	2.298	1.641	Method used to determine CV:	T90
Dry Density (Mg/m3):	0.73	20	40	2.103	0.478		
Voids Ratio:	2.626	40	80	0.975	0.502	Nominal temperature during test ' C:	20
Degree of saturation:	80.4	80	160	0.639	0.509		
Height (mm):	20.014	160	20	0.228	0.953	Remarks: See summary of soil descriptions	
Diameter (mm)	75.008						
Particle Density (Mg/m3): Assumed	2.65						





UKAS TESTING 4043 PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No: PSL24/3965 Client Ref: 13614-02-24**

ONE DIMENSIONAL CONSOLIDATION TEST

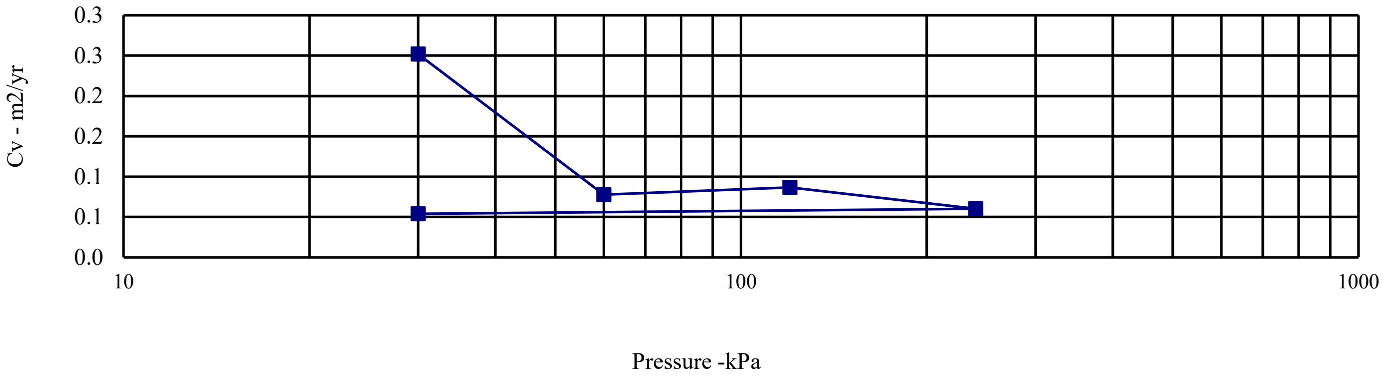
BS 1377: Part 5: 1990: Clause 3

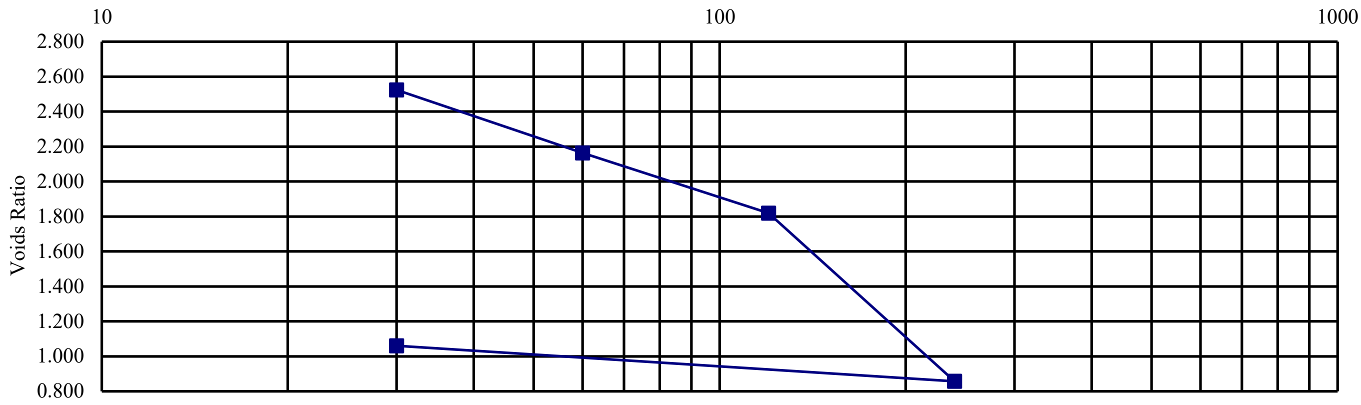
Hole Number: **BH02** **Top Depth (m):** **3.00**

Sample Number: **Base Depth (m) :** **3.45**

Sample Type: **UT**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	104						
Bulk Density (Mg/m3):	1.35	0	30	3.883	0.252	Method used to determine CV:	T90
Dry Density (Mg/m3):	0.66	30	60	3.400	0.078		
Voids Ratio:	2.989	60	120	1.820	0.087	Nominal temperature during test ' C:	20
Degree of saturation:	92.2	120	240	2.843	0.060		
Height (mm):	20.01	240	30	0.522	0.054	Remarks: See summary of soil descriptions	
Diameter (mm)	75.01						
Particle Density (Mg/m3): Assumed	2.65						





UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No:** **PSL24/3965** **Client Ref:** **13614-02-24**

ONE DIMENSIONAL CONSOLIDATION TEST

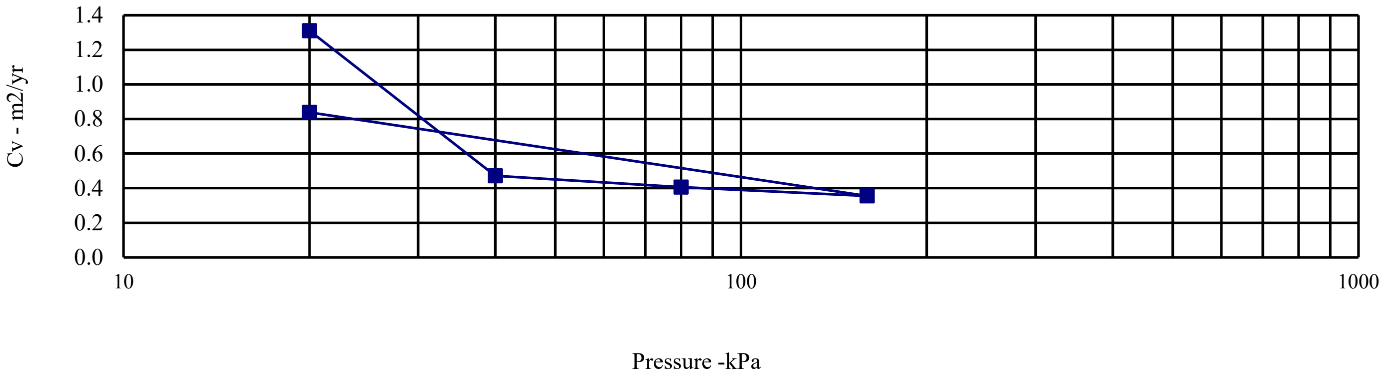
BS 1377: Part 5: 1990: Clause 3

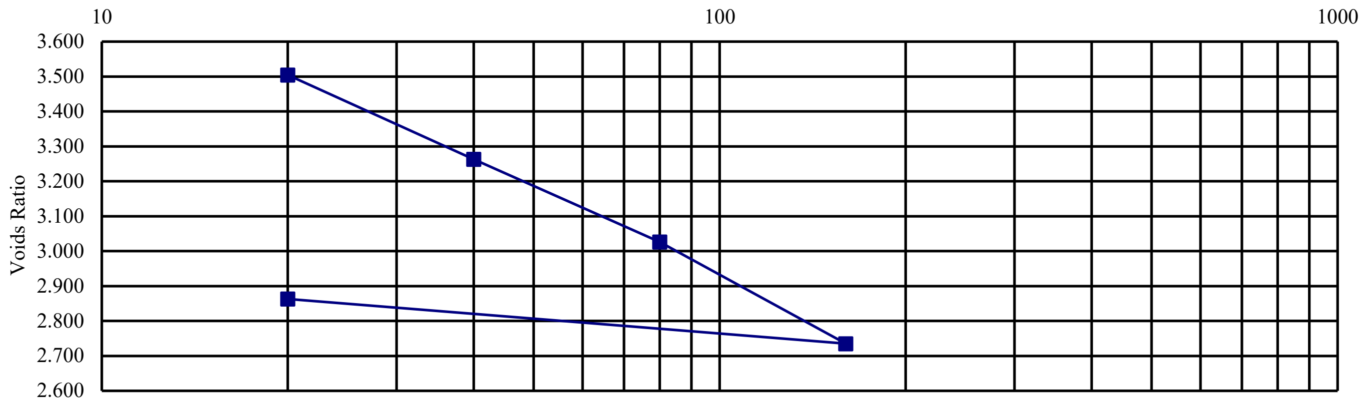
Hole Number: BH03 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m) :** 1.45

Sample Type: UT

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	147						
Bulk Density (Mg/m3):	1.31	0	20	4.867	1.311	Method used to determine CV:	T90
Dry Density (Mg/m3):	0.53	20	40	2.677	0.471		
Voids Ratio:	3.990	40	80	1.388	0.406	Nominal temperature during test ' C:	20
Degree of saturation:	97.7	80	160	0.905	0.355		
Height (mm):	20.032	160	20	0.244	0.838	Remarks: See summary of soil descriptions	
Diameter (mm)	74.955						
Particle Density (Mg/m3): Assumed	2.65						





UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	Contract No: PSL24/3965 Client Ref: 13614-02-24

ONE DIMENSIONAL CONSOLIDATION TEST

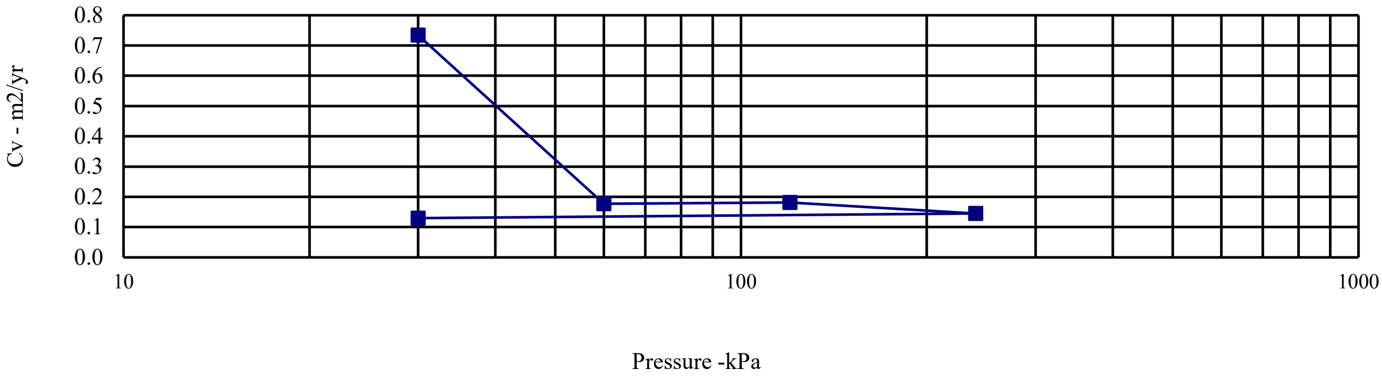
BS 1377: Part 5: 1990: Clause 3

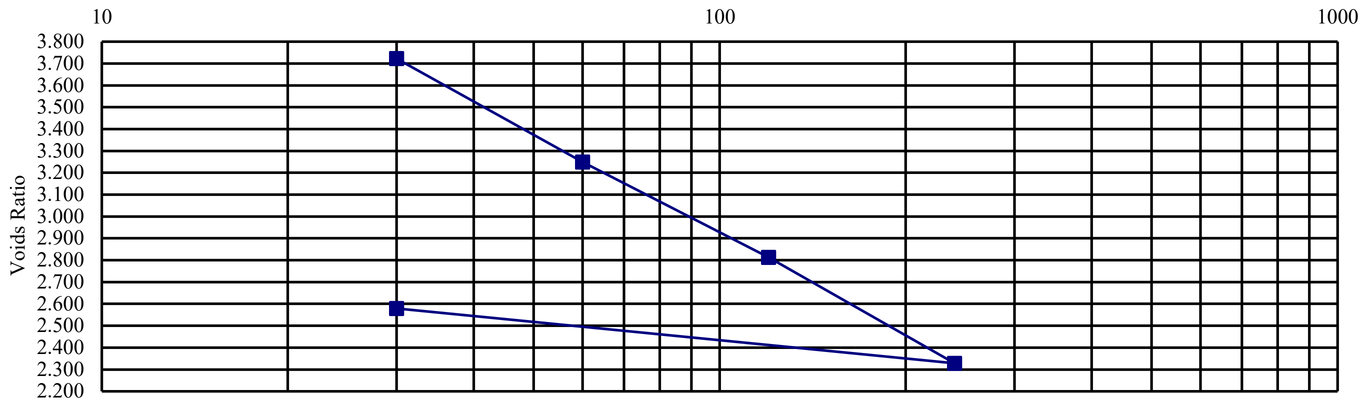
Hole Number: **BH03** **Top Depth (m):** **3.00**

Sample Number: **Base Depth (m) :** **3.45**

Sample Type: **UT**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	151						
Bulk Density (Mg/m3):	1.17	0	30	5.672	0.734	Method used to determine CV:	T90
Dry Density (Mg/m3):	0.47	30	60	3.341	0.177		
Voids Ratio:	4.691	60	120	1.710	0.181	Nominal temperature during test ' C:	20
Degree of saturation:	85.5	120	240	1.059	0.145		
Height (mm):	20.016	240	30	0.359	0.130	Remarks: See summary of soil descriptions	
Diameter (mm)	75.028						
Particle Density (Mg/m3): Assumed	2.65						





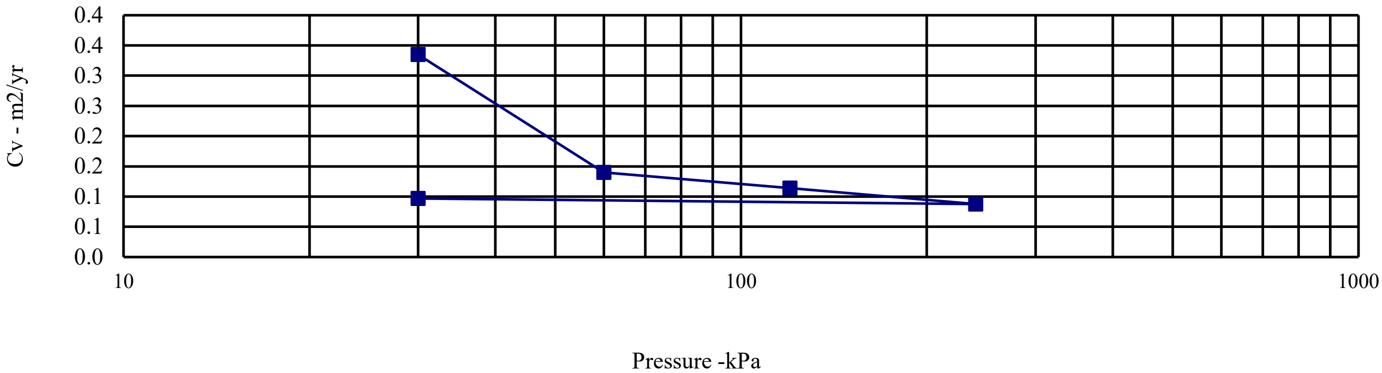
UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	Dyke Road Galway	**Contract No: PSL24/3965** **Client Ref: 13614-02-24**

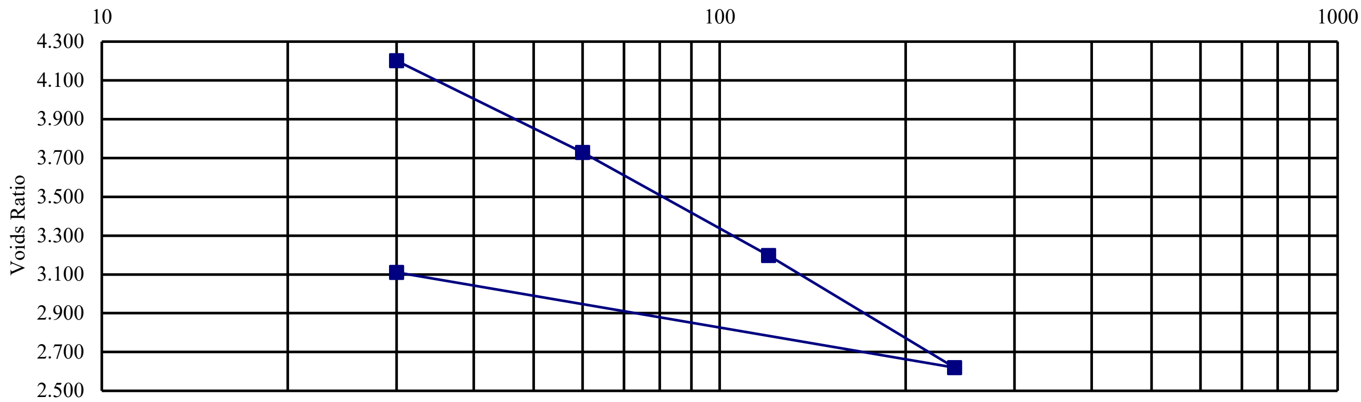
ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number:	**BH06**	**Top Depth (m):**	**3.00**
Sample Number:		**Base Depth (m) :**	**3.45**
Sample Type:	**UT**		

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	167						
Bulk Density (Mg/m3):	1.25	0	30	2.584	0.335	Method used to determine CV:	T90
Dry Density (Mg/m3):	0.47	30	60	3.028	0.140		
Voids Ratio:	4.638	60	120	1.871	0.114	Nominal temperature during test ' C:	20
Degree of saturation:	95.2	120	240	1.148	0.088		
Height (mm):	20.024	240	30	0.645	0.097	Remarks: See summary of soil descriptions	
Diameter (mm)	75.02						
Particle Density (Mg/m3): Assumed	2.65						





UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY	**Dyke Road Galway**	**Contract No: PSL24/3965** **Client Ref: 13614-02-24**

7 - 11 Harding Street
Leicester
LE1 4DH

Professional Soils Laboratory
5/7 Hexthorpe Road
Hexthorpe
Doncaster
DN4 0AR

Analytical Test Report:	**L24/05476/PSL - 24-46441**

Your Project Reference:	**PSL24/3965 Dyke Road Galway**		
Your Order Number:	PSL24/3965	Samples Received / Instructed:	18/06/2024 / 18/06/2024
Report Issue Number:	1	Sample Tested:	18/06 to 24/06/2024
Samples Analysed:	10 soil samples	Report issued:	24/06/2024

Signed

James Gane
Analytical Services Manager
CTS Group

Notes:

General

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30˚C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Stone Content was determined in accordance with CTS method statement MS - CL - Sample Prep and refers to the percentage of stones retained on a 10mm BS test sieve.

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited, subUKAS - Subcontracted to a laboratory UKAS accredited for this test, subMCERTS - Subcontracted to a laboratory MCERTS accredited for this test

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Date of Issue: 29.05.2024
Issued by: J. Gane
Issue No: 4
Rev No: 10

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Leicester
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L24/05476/PSL - 24-46441

Project Reference - PSL24/3965 Dyke Road Galway

Analytical Test Results - Solid

Lab Reference			372762	372763	372765	372766	372767	372768
Client Sample ID			-	-	-	-	-	-
Client Sample Location			BH01	BH01	BRC02	BRC02	BRC02	BRC03
Client Sample Type			B	B	B	B	B	B
Client Sample Number			-	-	-	-	-	-
Depth - Top (m)			3.50	6.70	2.00	3.50	7.00	4.00
Depth - Bottom (m)			3.50	6.70	2.00	3.50	7.00	4.00
Date of Sampling			-	-	-	-	-	-
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Clay	Loam	Loam	Clay	Other	Clay
Determinant	**Units**	**Accreditation**						
SOM (via TOC)	(%)	UKAS	2.9	5.1	20	2.6	< 0.9	< 0.9

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L24/05476/PSL - 24-46441

Project Reference - PSL24/3965 Dyke Road Galway

Analytical Test Results - Solid

Lab Reference			**372769**	**372770**	**372771**
Client Sample ID			-	-	-
Client Sample Location			BRC03	BRC04	BRC05
Client Sample Type			B	B	B
Client Sample Number			-	-	-
Depth - Top (m)			7.50	4.00	3.50
Depth - Bottom (m)			7.50	4.00	3.50
Date of Sampling			-	-	-
Time of Sampling			-	-	-
Sample Matrix			Clay	Other	Clay
Determinant	**Units**	**Accreditation**			
SOM (via TOC)	(%)	UKAS	< 0.9	< 0.9	< 0.9

CTS Group
7 - 11 Harding Street
Leicester
LE1 4DH

L24/05476/PSL - 24-46441

Project Reference - PSL24/3965 Dyke Road Galway

Analytical Test Results - Chemical Analysis

Lab Reference			**372762**	**372763**	**372764**	**372765**	**372766**	**372767**
Client Sample ID			-	-	-	-	-	-
Client Sample Location			BH01	BH01	BH05	BRC02	BRC02	BRC02
Client Sample Type			B	B	B	B	B	B
Client Sample Number			-	-	-	-	-	-
Depth - Top (m)			3.50	6.70	4.00	2.00	3.50	7.00
Depth - Bottom (m)			3.50	6.70	4.00	2.00	3.50	7.00
Date of Sampling			-	-	-	-	-	-
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Clay	Loam	Other	Loam	Clay	Other
Determinant	**Units**	**Accreditation**						
Water soluble sulphate (as SO_4)	(mg/l)	u	1400	1500	1500	820	74	230
pH Value	pH Units	MCERTS	8.1	7.7	9.2	7.8	8.3	8.8
Water Soluble Chloride	(mg/l)	u	27	24	12	44	23	11

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L24/05476/PSL - 24-46441

Project Reference - PSL24/3965 Dyke Road Galway

Analytical Test Results - Chemical Analysis

Lab Reference			**372768**	**372769**	**372770**	**372771**
Client Sample ID			-	-	-	-
Client Sample Location			BRC03	BRC03	BRC04	BRC05
Client Sample Type			B	B	B	B
Client Sample Number			-	-	-	-
Depth - Top (m)			4.00	7.50	4.00	3.50
Depth - Bottom (m)			4.00	7.50	4.00	3.50
Date of Sampling			-	-	-	-
Time of Sampling			-	-	-	-
Sample Matrix			Clay	Clay	Other	Clay
Determinant	**Units**	**Accreditation**				
Water soluble sulphate (as SO_4)	(mg/l)	u	100	76	89	71
pH Value	pH Units	MCERTS	8.7	9.0	9.3	8.7
Water Soluble Chloride	(mg/l)	u	4.9	7.8	4.6	7.6

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L24/05476/PSL - 24-46441

Project Reference - PSL24/3965 Dyke Road Galway

Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
372762	-	BH01	B	-	Greyish light brown sandy silty clay	130	< 0.1	79
372763	-	BH01	B	-	Brownish grey clayey loam with rare rootlets	110	< 0.1	87
372764	-	BH05	B	-	Grey sandy crushed rock	-	-	100
372765	-	BRC02	B	-	Dark brown slightly gravelly slightly clayey silty loam with rare rootlets	75	49	37
372766	-	BRC02	B	-	Greyish light brown sandy silty clay	100	< 0.1	100
372767	-	BRC02	B	-	Light grey silty crushed rock	3.9	30	21
372768	-	BRC03	B	-	Light grey slightly gravelly slightly sandy silty clay	9.4	9.4	56
372769	-	BRC03	B	-	Light grey slightly gravelly slightly sandy silty clay	10	2.7	57
372770	-	BRC04	B	-	Greenish grey sandy gravel	4.4	29	26
372771	-	BRC05	B	-	Light grey slightly gravelly slightly sandy silty clay	7.7	24	66

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L24/05476/PSL - 24-46441

Project Reference - PSL24/3965 Dyke Road Galway

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
372762	-	BH01	B	-	
372763	-	BH01	B	-	
372764	-	BH05	B	-	
372765	-	BRC02	B	-	
372766	-	BRC02	B	-	
372767	-	BRC02	B	-	
372768	-	BRC03	B	-	
372769	-	BRC03	B	-	
372770	-	BRC04	B	-	
372771	-	BRC05	B	-	

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L24/05476/PSL - 24-46441

Project Reference - PSL24/3965 Dyke Road Galway

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preperation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
TOCS	MS - CL - TOC Eltra	Air Dried	Passing 10mm test sieve	Determination of Total Organic Carbon in soils
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis

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L24/05476/PSL - 24-46441

Project Reference - PSL24/3965 Dyke Road Galway

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided

C - Received in inappropriate container

H - Contains headspace

T - Temperature on receipt exceeds storage temperature

R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
372762	-	BH01	B	-		A
372763	-	BH01	B	-		A
372764	-	BH05	B	-		A
372765	-	BRC02	B	-		A
372766	-	BRC02	B	-		A
372767	-	BRC02	B	-		A
372768	-	BRC03	B	-		A
372769	-	BRC03	B	-		A
372770	-	BRC04	B	-		A
372771	-	BRC05	B	-		A

CMTL Ireland Limited
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois R32 W30Y
Tel: 057 8664885

Laboratory Test Report
Uniaxial Compressive Strength

Project:	Dyke Road Galway	**Job Number**	13614-02-24
Client:	Ground Investigations Ireland	**Lab Ref No**	ST 28878
	Catherinestown House, Hazelhatch Road	**Date Received**	20/06/2024
	Newcastle. Co. Dublin	**Date Tested**	27/06/2024
Originator:	Mike Sutton	**Date Reported**	01/07/2024

Sample Reference	Moisture Content	Density (Mg/m^3)	Uniaxial Compressive Strength (N/mm^2)
BRC01 14.65-14.88	0.2	2659	116.4
BRC02 18.37-18.60	0.7	2691	140.3
BRC03 17.17-17.45	0.2	2692	100.2
BRC04 10.11-10.30	0.8	2888	88.1
BRC05 9.65-9.88	0.4	2709	112.7

Remarks: Core BRC01 14.65-14.88 Visible Cracks

Approved Signature
James Ward, Operations Manager
CMTL Ireland Limited

CMTL Ireland Limited
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois R32 W30Y
Tel: 057 8664885

Laboratory Test Report
Point Load Strength Index

Project :	Dyke Road Galway	**Job Number**	13614-02-24
Client :	Ground Investigations Ireland	**Lab Ref No**	ST 28879
	Catherinestown House, Hazelhatch Road	**Date Received**	20/06/2024
	Newcastle, Co. Dublin	**Date Tested**	26/06/2024
Originator :	Mike Sutton	**Date Reported**	01/07/2024

Point Load Strength Index

Sample No:-	Depth (m)	Description	Type	Orientation	W (mm)	D (mm)	P (kN)	A	De (mm)	I_s	F	$I_{s(50)}$MN/m²
BRC01	12.50-12.60	1	D	⊥	63.0	64.0	25.00	4032	64.0	6.104	1.12	6.82
BRC01	16.05-16.15	1,2	D	⊥	63.0	63.0	28.00	3969	63.0	7.055	1.11	7.83
BRC02	15.37-15.50	1	D	⊥	63.0	65.0	33.00	4095	65.0	7.811	1.13	8.79
BRC02	18.20-18.35	1,3	D	⊥	63.0	63.0	14.00	3969	63.0	3.527	1.11	3.91
BRC03	16.40-16.50	1,2	D	⊥	63.0	63.0	29.00	3969	63.0	7.307	1.11	8.11
BRC03	19.95-20.05	1,2	D	⊥	63.0	64.0	24.00	4032	64.0	5.859	1.12	6.55
BRC04	8.40-8.57	1,2	D	⊥	63.0	65.0	10.00	4095	65.0	2.367	1.13	2.66
BRC04	9.50-9.60	1,2	D	⊥	63.0	63.0	25.00	3969	63.0	6.299	1.11	6.99
BRC05	7.71-7.80	1,2,3	D	⊥	63.0	64.0	22.00	4032	64.0	5.371	1.12	6.00
BRC05	9.25-9.36	1,2	D	⊥	63.0	64.0	35.00	4032	64.0	8.545	1.12	9.55
BRC06	11.00-11.17	1,2	D	⊥	63.0	65.0	11.00	4095	65.0	2.604	1.13	2.93
BRC06	13.34-13.44	1,2	D	⊥	63.0	63.0	14.00	3969	63.0	3.527	1.11	3.91

Description 1 : Blue/ Grey
Description 2 : White Veins
Description 2 : Cracks

$I_{s(50)}$MN/m² for	Description 1,2,3	
Min	2.66	
Mean	6.68	
Max	9.55	

Test
A = axial
D = diametrical

Relationship to planes of weakness
IL = irregular lump
II = parallel
⊥ = perpendicular

Mean Value

	$I_{s(50)}$MN/m²	U.C.S. MN/m²
Extremely Weak	<0.05	0.6-1.0
Very Weak	0.05-0.20	1.0-5.0
Weak	0.20-0.50	5.0-25.0
Medium Strong	0.50-2.00	25-50
Strong	2.00-4.50	50-100
Very Strong	4.50-9.00	100-250
Extremely Strong	9.00 +	>250

Approved Signature
James Ward, Operations Manager
CMTL Ireland Limited

APPENDIX 9 – Groundwater Monitoring Records

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

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

GROUNDWATER MONITORING

Dyke Road

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
BRC01	26/06/2024	11:10	0.17	
BRC02	26/06/2024	10:32	0.87	
BRC04	26/06/2024	09:25	2.25	
BRC05	26/06/2024	09:55	1.30	

LDA Dyke Road
Galway

Geophysical Survey

Report Status: Final

MGX Project Number: 6756

MGX File Reference: 6756f-005.doc

1st July 2024

Confidential Report To:

Land Development Agency
2nd Floor, Ashford House
Tara Street
Dublin 2
D02 VX67

AECOM
4th Floor, Adelphi Plaza
George's Street Upper
Dun Laoghaire
A96 T927

Report submitted by:
Minerex Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare, W23X7Y5
Ireland
Tel.: 01-6510030
Email: info@mgx.ie

Issued by:

Author: John Connaughton (Geophysicist)

Reviewer: Hartmut Krahn (Senior Geophysicist)

Minerex Geophysics Limited

Subsurface Geophysical Investigations

EXECUTIVE SUMMARY

1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of 2D-Resistivity (ERT), seismic refraction (p-wave) and MASW (s-wave) surveying for the ground investigation for the proposed LDA development at Dyke Road, County Galway.
2. The main objectives of the survey were to determine the ground conditions under the site, to determine the depth to rock and the overburden thickness, and to detect possible karstified rock in order to help guide the locations of direct ground investigations.
3. The recommended locations were drilled and the results are a zone of Metagabbro (BRC04) within the limestone and a deeper pocket of very stiff to hard clay within the good limestone (BRC03).
4. The clean limestone present is liable to karstification, but it does not have to be karstified.
5. The three different methods allowed for correlations to be identified between them and to improve the interpretation.
6. The urban nature of the site has negative effects on all the surveying methods.
7. The seismic refraction data was interpreted with four layers.
8. Layer 1 is interpreted as road construction material underlain by urban made ground and peat.
9. Layer 2 is described as soft to firm clay and silt or urban made ground or peat and extends to depths of 4 – 8m below ground level (bgl).
10. Layer 3 is only present in the NW of the site and is interpreted as very stiff or very dense overburden but may contain some very weathered rock.
11. Rock is indicated by Layer 4. The depth to the top of this layer ranges from 4 – 9m bgl across most of the site but is 11 to 12m bgl in the NW in BRC01 and BH01.
12. Peat present in layer 1 or 2 would be compressed because of the urban layers.
13. Map 2 indicates three zones reviewed as ‘Deep Rock’, ‘very stiff to hard Clay’ and ‘Metagabbro/anomalous Rock’. These were interpreted after targeted drilling.
14. The MASW data gives results for 3.6m to 4.5m of soft to firm material across much of the site and to deeper levels in the NW.
15. This report was reviewed and finalised after the complete direct ground investigation data had been received.

CONTENTS

List of Tables, Maps and Figures:

1. INTRODUCTION

1.1 Background

Minerex Geophysics Ltd. (MGX) carried out a geophysical survey for an LDA site on the Dyke Road, Galway. The survey consisted of 2D-Resistivity (ERT), seismic refraction (p-wave) and MASW (s-wave) measurements. The survey was commissioned by the LDA.

This survey utilized various complementary geophysical methods to improve final interpretations. The role of geophysics as a non-destructive fast method is to provide a geological interpretation over a wide area to complement direct ground investigations at specific locations. The direct ground investigation results can be used to improve the initial geophysical results and interpretation.

The survey was aimed at investigating the ground conditions under the site, the depth to rock and identifying possible karstified rock.

During the tender stage, MGX indicated to the client limitations of the survey in this urban setting and improved the methodology and choice of geophysical methods.

The main purpose of a geophysical survey in this setting is to guide the locations for boreholes, rather than creating a ground model with an accuracy like on a greenfield site. The geophysics will rather have an outcome in a relative scale, like the rock is deeper here than there, and there is rather karst here than there. Then such comparisons can be use to target boreholes.

1.2 Objectives

The main objectives of the geophysical survey were:

- To determine the ground conditions under the site
- To determine the depth to rock and the overburden thickness
- To estimate the strength or stiffness or compaction of overburden materials and the rock quality
- To determine the type of overburden and rock
- To detect lateral changes within the geological layers
- To detect possible karstified zones within the rock or karst features
- To determine the s-wave velocity and to calculate the small strain shear modulus G_{max}

1.3 Site Description

The site is located in a number of carparks along the Dyke Road just east of the Corrib River in Galway City. The site is bordered by roads to the west, south and southeast, a Retail Park to the east and a greenfield site to the north. The Black Box Theatre is in the north of the site. Access was from the Dyke Road in the west.

The whole site is underlain by tarmac. The total survey area covered an area of approx. 18,000m^2.

1.4 Geology

Online geological maps of Ireland (GSI, 2024) give the following information:

The quaternary sediments are described as urban while there is fen peat noted on the opposite side of the road to the west.

In terms of rock, the survey area is underlain by Visean Limestones, described as undifferentiated limestones.

Visean Limestones are karstifiable and there are many karst features noted in the Galway area, however the nearest features noted to this site are over 2km to the east.

There is an unconformity approx. 200m to the west with metamorphic rock to the west of it.

1.5 Report

This report includes the results and interpretation of the geophysical survey. Maps, figures and tables are included to illustrate the results of the survey. More detailed descriptions of geophysical methods and measurements can be found in GSEG (2002), Milsom (1989) and Reynolds (1997).

The description of soil, rock and the use of geotechnical terms (soft, stiff, dense etc) follows Eurocode (2007) and BSI (2020) standards. The terms are defined in the standards and the physical parameters are related from experience. This geophysical survey has been acquired, processed, interpreted and reported in accordance with these guidelines.

The client provided maps of the site and the digital version was used as the background map in this report. Elevations were surveyed on site and are used in the vertical sections.

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Minerex Geophysics Limited, while using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface.

2. GEOPHYSICAL SURVEY

2.1 Methodology

The methodology consisted of using 2D-Resistivity (ERT), Seismic Refraction and MASW (Multi-Channel Analysis of Surface Waves) surveying.

The 2D-Resistivity survey was carried out first, the data was analysed on site and additional surveying was carried out targeting certain features and ensuring a good spread of lines across the site.

The survey locations are indicated on Map 1. The lines and parameters are tabulated in Table 1.

2.2 2D-Resistivity (ERT)

2D-Resistivity lines were surveyed with electrode spacing of 3m, up to 64 electrodes per set-up and a maximum length of 189m per set-up. The readings were taken with a Tigre Resistivity Meter, Imager Cables, stainless steel electrodes and a laptop with ImagerPro acquisition software.

Lines R2 and R3 were surveyed using the roll-along mode to lengths longer than 189m to achieve continuous coverage to a depth of 15m along the ends of the lines.

The electrodes were placed inside small drilled holes (12mm), and saline water was added to make a good electrical connection. The holes were subsequently re-sealed upon completion of the lines.

During 2D-Resistivity surveying, data is acquired in the form of linear arrays using a suite of metal electrodes. A current is induced into the ground via a pair of electrodes whilst a potential difference is measured across a second pair of electrodes. This allows for the recording of the apparent resistivity in a two-dimensional arrangement below the line. The data is inverted after the survey to obtain a model of subsurface resistivities. The generated model resistivity values and their spatial distribution can then be related to typical values for different geological materials.

The penetration depth of a resistivity set-up increases towards the centre where it reaches an approx. depth of 15m below ground level (bgl).

The presence of metal underground services like water pipes may influence the results of the survey. There are large diameter metal water mains along the dyke road and the resistivity lines were kept away from these in as much as possible.

2D-Resistivity has previously proven zones of anomalous or karstified rock with lateral extents of 10m and more.

2.3 Seismic Refraction

Seismic refraction lines were surveyed with geophone spacing of 3m and 24 geophones per set-up resulting in a 69m length per set-up. The recording equipment consisted of a 24 Channel GEOMETRICS ES-3000 engineering seismograph with 4.5Hz vertical geophones. The seismic energy source consisted of a hammer and plate. A zero-delay trigger was used to start the recording. Normally 7 shot points per p-wave set-up were used.

The seismic refraction survey method focuses on propagating p-waves travelling through the subsurface, which are generated by a seismic source. As the wave propagates through the subsurface, its velocity varies as it travels through overburden, rock with different elastic properties, and along geological boundaries. Velocity data is recorded via the surveying equipment, which is then processed, allowing geological layer thicknesses and boundaries to be established.

Seismic Refraction generally determines the depth to horizontal or near horizontal layers where the compaction or strength or rock quality changes with an accuracy of around 20% of the depth to that layer. Where the layers are shallower than the geophone spacing depth deviations of +- 1m to top of layers can occur. Where low velocity layers or shadow zones are present (e.g., below solid ground surface) or where layers dip with more than 20 degree angle the accuracy becomes much less. This lower accuracy is the case here on this project.

A low velocity layer exists for the seismic waves below the solid surface layer. This makes it less certain or impossible to pick first breaks from geophones near the source and therefore no velocity determination for the shallow subsurface is possible. This results in larger deviations in the modelling and borehole results are required for a final calibration of the results.

The seismic refraction set-ups with 69m individual length have a reasonable penetration depth of around 15m. An internationally accepted maximum depth estimate for a seismic refraction set-up is 1/6 of the set-up length including offshots. The depth penetration varies according to the velocity structure of the subsurface. In this report we used a depth of 15m bgl. where the seismic modelling was ended as deeper modelling becomes less meaningful.

2.4 MASW (Multichannel Analysis of Surface Waves)

The seismic shear wave velocity was determined by active MASW surveying. MASW (Multi-Channel Analysis of Surface Waves) determines the bulk seismic shear wave velocity versus depth. The velocities are used to determine the small strain shear modulus.

The MASW method was acquired along with the seismic refraction survey though the shots were done individually with a larger time window. The recording equipment consisted of a 24 Channel GEOMETRICS ES-3000 engineering seismograph with 4.5Hz vertical geophones. The seismic energy source consisted of a hammer and plate. A zero-delay trigger was used to start the recording. The shot points were located at the ends of the set-ups.

Many constraints exist for the MASW method and the main factors on this site that affect the methods are strong vertical velocity gradients, particularly between the overburden and rock, and changing velocity structure and layer thicknesses along the lines.

2.5 Site Work

The data acquisition was carried out on the nights of the 28th and 29th of March 2024. The weather conditions were fair throughout the acquisition period. Health and safety standards were adhered to at all times. A traffic management system was in place, clearly highlighted by the use of warning signs and cones.

The locations and elevations were surveyed with a Carlson NR3 RTK-GPS to accuracy < 0.05m.

3. RESULTS AND INTERPRETATION

The interpretation of geophysical data was executed utilizing the known response of geophysical measurements, typical physical parameters for subsurface features that may underlay the site, and the experience of the authors.

Ground investigation results were available after the survey and the abbreviated borehole logs are indicated on the sections. The overburden was abbreviated as clay, silt, sand and gravel. The rock was generally divided into weathered limestone (based on RQD value < 50%) and limestone or metagabbro rock (> 50%). This can be done only to a certain extend as the rock can be very variable. RQD values, fracture indices and non-intact zones often change rapidly with depth. The small size of a borehole only represents a very small volume of ground while the geophysical survey on the other end of the scale averages over a large volume of ground.

3.1 2D-Resistivity (ERT)

The 2D-Resistivity data was positioned and inverted with the RES2DINV inversion package. Lines using the roll-along method were concatenated for a joint inversion. The programme uses a smoothness constrained least-squares inversion method to produce a 2D model of the subsurface resistivities from the recorded apparent resistivity values. Three variations of the least squares method are available and for this project the Jacobian Matrix was recalculated for the first three iterations, then a Quasi-Newton approximation was used for subsequent iterations. Each dataset was inverted using seven iterations resulting in a typical RMS error of <3.0%. The resulting models were colour contoured with the same resistivity scale for all lines and they are displayed as cross sections (Figures 1a – 1b).

The data shows interference from urban ground and conditions. High resistivities near the surface are likely due to road construction material while rapid changes along some lines may be due to interference from surrounding metal.

Resistivities are characteristic for certain overburden and rock types. If there is a high content of clay minerals (which are electrically conductive) then the overburden resistivity will be lower than as if there is a high content of clastic grains like sand or gravel. The purer the clay and the lower the sand and gravel content, the lower the resistivity. Water content in overburden layers can influence the resistivities, but generally clay content has a more dominating effect.

Karstified rock is defined in this report as a formerly intact clean limestone rock, liable to karstification, that has been partially dissolved by water over long geological time scales and where the cavities and voids have either remained empty (filled by air) or became filled by overburden sediment (clay, silt, sand), weathering product of the broken rock itself or water. This process would lead to a reduction of the resistivity of the overall rock and therefore karstified rock has a lower resistivity than intact clean limestone rock. This is generally indicated by lower resistivities embedded within high resistivity at depth.

High resistivities near the surface are likely an effect of the material used for the construction of the carparks. The low resistivities underlying this are interpreted as peat or clay and silts. High resistivities at depth are interpreted as clean limestone while lower resistivities within the rock layer are described as possible karst features. Due to the built-up nature of the site, the data may be disturbed by non-geological features and any possible karst features would require direct ground investigations in order to determine the rock quality in these areas. Between 130 – 160m along line R4, the high resistivities near the surface are likely caused by some disturbance.

Some features within the 2D-Resistivity models may indicate possible karst zones, though disturbance from metal can never be ruled out. Three deeper areas with different resistivities are indicated Map 2. A linear feature within relatively shallow rock in the SE of the site stretching SW to NE is indicated on all four resistivity lines and in comparison with the rotary core logs was interpreted as Metagabbro or anomalous rock. In the NW of the site at the black box theatre the results indicate deeper rock and the modelling was only working to a depth of around 10m bgl. A third area in the central site area relates to a low resistivity feature within the rock layer along line R2 which was found in the drilling to be very stiff to hard Clay.

3.2 Seismic Refraction

The seismic refraction data was positioned and processed with the SEISIMAGER software package to give a layered model of the subsurface. The number of layers has been determined by analysing the seismic traces and a total of 4 layers were used in the models. All seismic lines were subject to a standardised processing sequence which consisted of a topographic correction which was based on integrated elevation data, first break picking, tomographic inversion, travel-time computation via ray-tracing and velocity modelling. Residual deviations of typically 0.4 to 1.8 msec RMS have been obtained for each line. Following each processing stage QC procedures were adhered to. The resulting layer boundaries are shown as thick lines overlaid on the 2D-Resistivity cross sections (Figure 1a – 1b). The average seismic velocities obtained within the layers are annotated on the sections as bold black numbers.

The p-wave seismic velocity is closely linked to the density of subsurface materials and to parameters like compaction, stiffness, strength and rock quality. The higher the density of the subsurface materials the higher the seismic velocity. More compacted, stiffer, denser and stronger material will have a higher seismic velocity. For rock, the seismic velocity is higher when the rock is stronger, less weathered and has a higher quality. If the rock is more weathered, broken, fractured, fissured or karstified then the seismic velocity will be reduced compared to that of intact fresh rock.

Because of the above relationship, the seismic refraction method and seismic velocities are suitable to investigate ground where the layers get denser, more compacted and stronger with depth. A disadvantage is that some materials may have the same seismic velocity: Stiff to very stiff highly consolidated overburden and a weathered rock can have the same seismic velocity range (as could be the case in the layer 3 below).

The modelled seismic data has created the following layered ground model:

Layer 1 has seismic velocities of 500m/s. The velocity is a mix of the tarmac and underlying material that represents a 'shadow zone' as described in Ch2.3.

Layer 2 was modelled with a velocity of 1200m/s and is interpreted as overburden material with soft to firm strength or compaction. This depth of the layer extends to elevation 0mOD across much of the site but is deeper to the NW where the deep rock is interpreted.

Layer 3 velocities of 2000m/s indicate a very stiff or very dense overburden. This layer is only present in the NW of the site. This layer may also contain some very weathered limestone.

Good Rock (Layer 4) is indicated by seismic velocities of 3500 - 4000m/s. The depth to the top of the good rock ranges from 4 – 9m below ground level (bgl) across much of the site but falls to 11 to 12m bgl in the NW in RC BRC01 and BH01. There is a pocket of very stiff to hard clay included in this layer, as drilled in BRC03.

3.3 Interpretation of Resistivity and Seismic Refraction

Table 2 summarises the interpretation. The stiffness or compaction of overburden and the rock strength or quality have been estimated from the seismic velocity. The estimation of the excavatability for the bedrock has been made according to the caterpillar chart published in Reynolds (1997). The geotechnical assessment for rippability will have to take factors like rock type and jointing into account and the estimation in this report is solely based on the seismic velocities.

Interpreted cross sections are shown in Figure 2a – 2b as well as areas highlighted as containing possible karstified limestone or deep rock. Possible Karst zones or deep rock are shown on Map 2. The interpretation has been made from all available information. For overburden layers and the top of the rock the seismic refraction data has been used as seismic refraction is the best method to delineate layer boundaries. The resistivity model values have been used in a general sense to determine overburden materials and rock type as well as identifying possible karst zones within the rock.

Resistivity data is better suited to show overburden material, rock types and features within the rock while seismic refraction velocities are indicating the change of compaction, stiffness or rock quality with depth. Along short sections where only one data type is available an interpolation for the interpreted layers was made.

Table 2: Summary of Interpretation

Layer	General Seismic Velocity Range (m/sec)	General Resistivity Range (Ohmm)	Interpretation	Estimated Excavation Method
1	500	Any	Road Construction Material over urban Made Ground or Peat	Diggable

2	1200	<125	Soft to firm Clay and Silt or urban Made Ground or Peat	Diggable
3	2000	<250	Very stiff or very dense Overburden	Diggable
4a	N/A	< 125	Very stiff to hard Clay	Digging and ripping
4b	3500 - 4000	Any	Limestone	Breaking & Blasting
4c	3500 - 4000	Any	Metagrabbro/anomalous Rock	Breaking & Blasting

3.4 MASW (Multichannel Analysis of Surface Waves)

The MASW lines were positioned, processed, analysed and modelled with the SEISIMAGER/SW and the SURFSEIS6 software packages. The objective is to obtain a model of shear wave velocity versus depth.

All shot points were analysed in order to extract the best possible dispersion curve for the modelling stage.

Following processing steps are done to achieve this:

1. Edit the shot point geometry and display the shot points for each array
2. Edit traces and/or apply filters to improve the shot record for the next step
3. A dispersion curve (phase velocity versus frequency plot or dispersion image) is computed
4. For each shot the maximum amplitude at each frequency of the dispersion image is selected and the picks for the dispersion curve are truncated (frequency gate), smoothed and brought forward into the modelling process
5. An initial model of shear-wave velocity, $V_{s,}$ versus depth is computed
6. An inversion is carried out to create the final V_s curve (Shear wave versus depth). The valid useful depth range is noted and the data saved in a file
7. For stable repeatable results the shear wave velocity versus depth is extracted and the depth range covered by the real survey data is then listed in Table 3
8. The results for the two opposed shot points at the end of each array are compared and an average shear wave velocity is computed
9. The small strain shear modulus (also named G_{max}) for each shot point and depth is computed by using a density of 1800 kg/m^3 typical for consolidated overburden (Eq. 1)

   (Eq. 1) $$G = V_s^2 * \rho * 10^{-6}$$

where G = Shear Modulus (MPa)

V_s = Seismic Shear Wave Velocity (m/s)

ρ = Density (kg/m^3)

The results are displayed in tabular format in Table 3. The results show the seismic shear wave velocity and the small strain shear modulus vs. depth. S-Wave Velocities across all the lines range from 74 – 292m/s and the small strain shear moduli from 10 – 153MPa.

The relationship between shear wave velocities and material stiffness is summarised below:

Table 4: Shear Wave Velocity to Stiffness Relationship

Shear Wave Velocity Vs Range in m/s	Material Stiffness
< 150	Soft
150 to 300	Firm
300 to 500	Stiff
> 500 m/s	Very Stiff

Intensive efforts have been made to extract the best dispersion curves by time gating, selecting and test processing various source versus receiver trace distances and trace ranges and by directional selection of traces.

The depth of surveying was generally restricted by the strong vertical velocity gradient in particular between the overburden and rock layers. The MASW data can survey the softer layers below the construction material which is not possible by the seismic refraction method. The data shows soft to firm material across the site. The depth of the survey ranges from 3.6m to 4.5m across much of the site but increases to 7.2 – 9m in the NW which also indicating a change in the depth to rock.

4. CONCLUSIONS

The following conclusions are made:

- The geophysical surveys carried out at the LDA Dyke Road site consisted of 2D-Resistivity (ERT), seismic refraction and MASW surveying.
- The purpose of this survey was to provide some guidance for borehole locations by indicating general geological changes across the site and highlighting possible areas of karstified limestone.
- The recommended locations were drilled and the results are incorporated into this interpretation.
- The drilling found a zone of Metagabbro (BRC04) within the limestone and a deeper pocket of very stiff to hard clay within the good limestone (BRC03).
- The urban environment has interfered with the data, namely the tarmac and low velocity layer for the seismic refraction and underground metal for the resistivity.
- At all locations there was a correlation between all three geophysical survey methods, high resistivities generally match with increases in seismic refraction velocities while the depth of the MASW survey showing soft to firm materials ties in with layers 1 and 2 from the seismic refraction survey and extends to greater depths in the NW where these layers are thicker.
- Some high resistivities at depth indicate that there is clean limestone present that is liable to karstification, but it does not have to be karstified.
- The seismic refraction survey was modelled with a total of four layers.
- Layer 1 is mainly affected by the road construction. High resistivities near the surface indicate road construction material such as gravel and tarmac. This layer would also contain urban made ground and peat.
- Layer 2 is interpreted as soft to firm clay and silt or urban made ground or peat. This layer extends down to an elevation of approx. 0mOD across much of the site but extends deeper in the NW.
- Layer 3 is described as very stiff or very dense overburden. This layer is only present in the NW of the site. It may contain some very weathered rock.
- Layer 4 is interpreted as rock. The depth to the top of this layer is between 4 – 9m bgl across most of the site but 11 to 12m bgl in the NW in RC BRC01 and BH01. Due to the interference the seismic modelling depth was limited here to around 10m.
- Resistivities and rotary coring lead to a subdivision of Layer 4 into 3 zones with 4a as very stiff to hard clay, 4b limestone and 4c metagabbro/anomalous rock. These are indicated in Figures 2a and 2b.

- The resistivities give general indications of overburden types and possible features within the rock but the built-up nature of the site can have a non-geological effect on the data as well and care must be taken when using the interpretation.
- There are generally high resistivities near the surface. This would be typical for road construction materials such as tarmac and gravel fill.
- Peat present in layer 1 or 2 would be compressed because of the urban layers.
- Map 2 indicates three zones reviewed as ‘Deep Rock’ in the NW, very stiff to hard Clay and Metagabbro/anomalous Rock. These were interpreted after targeted drilling.
- Table 3 gives the results from the MASW survey and shows shear wave velocities of 74 – 292m/s across the site which indicates soft to firm material. The small strain shear moduli range from 10 to 153MPa. The depth of these layers is shown to increase towards the NW.
- The interpretation presented here was reviewed after the geotechnical data became available.

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Table 1: Geophysical Survey Locations and Acquisition Parameters

2D-Resistivity (ERT) Survey					
Site	**Line**	**Electrode Spacing (m)**	**Length (m)**	**Display direction**	**Survey Type/Mode**
Car Park	R1	3	189	NW-SE	Traverse
Car Park	R2	3	333	N-S	Roll Along
Car Park	R3	3	237	NW-SE	Roll Along
Car Park	R4	3	189	NW-SE	Traverse
		SUM	**948**		
Seismic Refraction Survey					
Site	**Line**	**Geophone Spacing (m)**	**Length (m)**	**Display direction**	**Survey Type/Mode**
Car Park	S1	3	69	NW-SE	Single Setup
Car Park	S2	3	69	N-S	Single Setup
Car Park	S3	3	69	N-S	Single Setup
Car Park	S4	3	69	N-S	Single Setup
Car Park	S5	3	69	N-S	Single Setup
Car Park	S6	3	69	N-S	Single Setup
Car Park	S7	3	69	NW-SE	Single Setup
Car Park	S8	3	69	NW-SE	Single Setup
Car Park	S9	3	69	NW-SE	Single Setup
Car Park	S10	3	69	NW-SE	Single Setup
		SUM	**690**		
MASW Survey					
Site	**Line**	**Geophone Spacing (m)**	**Length (m)**	**Display direction**	**Survey Type/Mode**
Car Park	M1	3	69	NW-SE	1D-MASW
Car Park	M2	3	69	N-S	1D-MASW
Car Park	M3	3	69	N-S	1D-MASW
Car Park	M4	3	69	N-S	1D-MASW
Car Park	M5	3	69	N-S	1D-MASW
Car Park	M6	3	69	N-S	1D-MASW
Car Park	M7	3	69	NW-SE	1D-MASW
Car Park	M8	3	69	NW-SE	1D-MASW
Car Park	M9	3	69	NW-SE	1D-MASW
Car Park	M10	3	69	NW-SE	1D-MASW
		SUM	**690**		

Table 3: MASW S-Wave Velocities and Gmax

Line	Depth (m)	Left S-Wave Velocity (m/s)	Right S-Wave Velocity (m/s)	Average S-Wave Velocity (m/s)	Average Gmax - Shear Modulus (Mpa)
S1					
	0.8	160	147	153	42
	1.6	178	165	171	53
	2.4	122	117	119	26
	3.2	107	53	80	11
	4.0	151	129	140	35
	4.8	143	192	168	51
	5.6	146	96	121	26
	6.4	141	92	117	25
	7.2	181	92	136	33
S2					
	0.4	66	82	74	10
	0.8	131	111	121	27
	1.2	168	138	153	42
	1.6	147	114	130	31
	2.0	103	114	109	21
	2.4	66	113	90	14
	2.8	80	116	98	17
	3.2	120	106	113	23
	3.6	112	105	108	21
S3					
	1.0	247	217	232	97
	2.0	234	278	256	118
	3.0	269	232	250	113
	4.0	108	147	128	29

Table 3: MASW S-Wave Velocities and Gmax

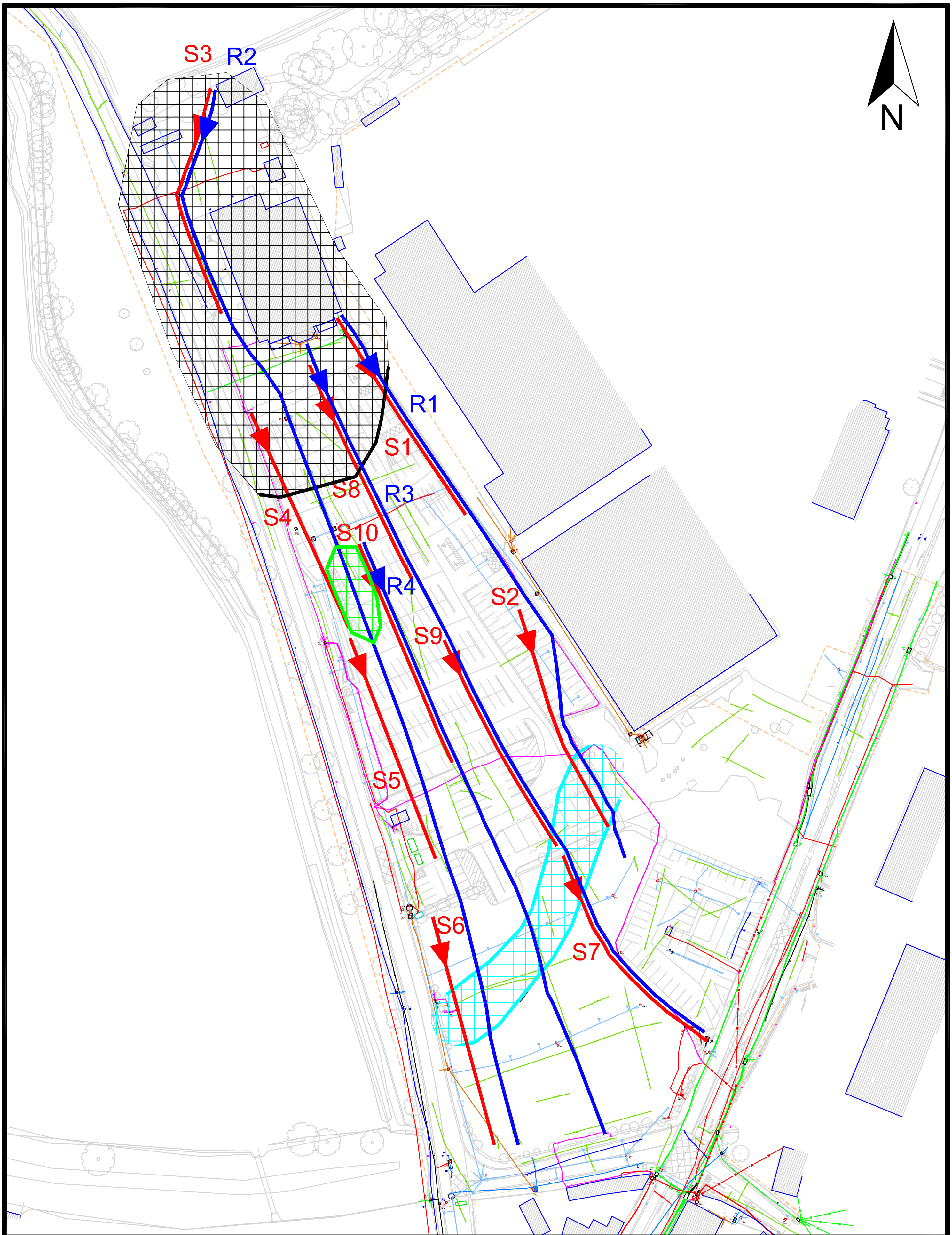
Line	Depth (m)	Left S-Wave Velocity (m/s)	Right S-Wave Velocity (m/s)	Average S-Wave Velocity (m/s)	Average Gmax - Shear Modulus (Mpa)
	5.0	79	110	95	16
	6.0	145	173	159	46
	7.0	279	247	263	124
	8.0	293	259	276	137
	9.0	135	189	162	47
S4					
	1.0	213	240	226	92
	2.0	286	248	267	129
	3.0	263	133	198	71
	4.0	173	98	135	33
	5.0	124	170	147	39
	6.0	180	219	200	72
	7.0	240	228	234	99
	8.0	304	208	256	118
	9.0	300	186	243	106
S5					
	0.4	101	152	126	29
	0.8	81	161	121	26
	1.2	111	166	139	35
	1.6	157	159	158	45
	2.0	175	144	159	46
	2.4	162	128	145	38
	2.8	138	116	127	29
	3.2	115	110	113	23
	3.6	104	107	105	20

Table 3: MASW S-Wave Velocities and Gmax

Line	Depth (m)	Left S-Wave Velocity (m/s)	Right S-Wave Velocity (m/s)	Average S-Wave Velocity (m/s)	Average Gmax - Shear Modulus (Mpa)
S6					
	0.4	210	227	219	86
	0.8	234	253	244	107
	1.2	248	288	268	129
	1.6	231	311	271	132
	2.0	190	316	253	115
	2.4	135	300	217	85
	2.8	108	257	183	60
	3.2	86	216	151	41
	3.6	77	120	99	18
S7					
	0.5	214	242	228	94
	1.0	281	250	266	127
	1.5	319	265	292	153
	2.0	289	256	273	134
	2.5	215	242	229	94
	3.0	139	217	178	57
	3.5	117	204	161	46
	4.0	142	198	170	52
	4.5	164	193	178	57
S8					
	1.0	118	136	127	29
	2.0	192	171	182	59
	3.0	157	125	141	36
	4.0	86	94	90	15

Table 3: MASW S-Wave Velocities and Gmax

Line	Depth (m)	Left S-Wave Velocity (m/s)	Right S-Wave Velocity (m/s)	Average S-Wave Velocity (m/s)	Average Gmax - Shear Modulus (Mpa)
	5.0	61	153	107	21
	6.0	80	126	103	19
	7.0	122	124	123	27
	8.0	149	179	164	49
	9.0	136	156	146	38
S9					
	0.4	110	126	118	25
	0.8	154	187	171	52
	1.2	192	233	212	81
	1.6	215	232	223	90
	2.0	221	184	203	74
	2.4	220	117	168	51
	2.8	197	80	138	34
	3.2	140	65	102	19
	3.6	92	59	75	10
S10					
	0.5	80	88	84	13
	1.0	180	173	176	56
	1.5	266	235	250	113
	2.0	235	215	225	91
	2.5	158	165	161	47
	3.0	199	154	177	56
	3.5	245	166	206	76
	4.0	190	182	186	62
	4.5	169	169	169	51



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CLIENT	Land Development Agency Aecom
PROJECT	Dyke Road, Galway City Geophysical Survey
TITLE	Map 2: Geophysical Survey Interpretation Map

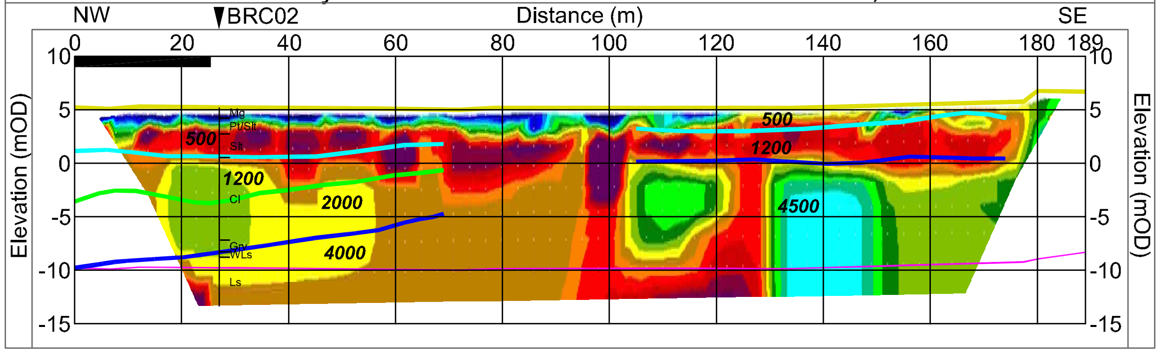
SCALE:	1:1000 @ A3
PROJECT:	6756
DRAWN:	JS
DATE:	01/07/2024
MGX FILE:	6756f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

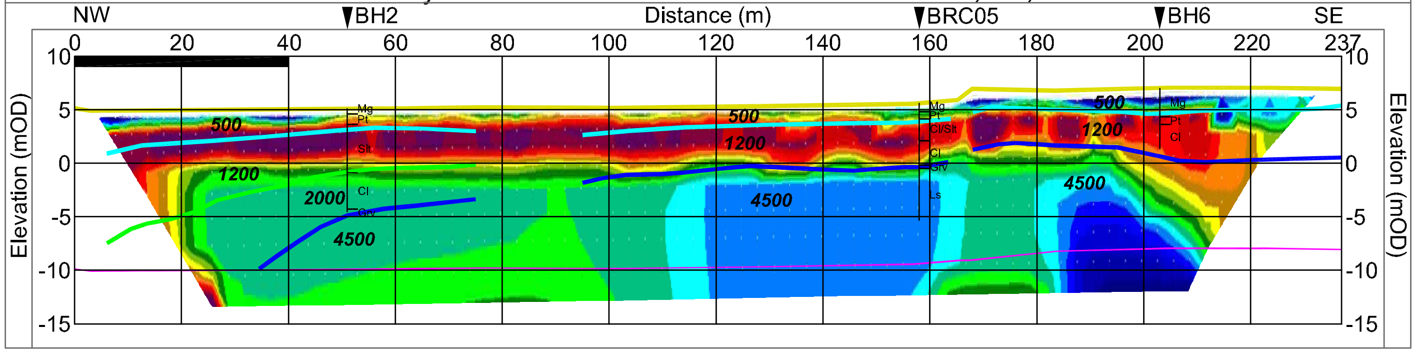
R2	2D-Resistivity Line
S1	Seismic Refraction and MASW Line
	Deep Rock
	Very stiff to hard Clay
	Metagabbro/anomalous Rock

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

2D-Resistivity Line R1 and Seismic Refraction Line S1, S2 Model



2D-Resistivity Line R3 and Seismic Refraction Line S8, S9, S7 Model



Abbreviated GI Logs:

BRC06 — Borehole Name and Location

Pt	Peat	Mg	Made Ground
Cl	Clay	Slt	Silt
Grv	Gravel	WLs	Weathered Limestone
Sd	Sand	Ls	Limestone

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CLIENT	Land Development Agency AECOM
PROJECT	LDA Dyke Road, Galway Geophysical Survey
TITLE	Figure 1a: Models of Geophysical Survey

SCALE:	1:1000 @ A3, VE x 2
PROJECT:	6756
DRAWN:	JS
DATE:	01/07/2024
MGX FILE:	6756f_Drawings.dwg
STATUS:	Final

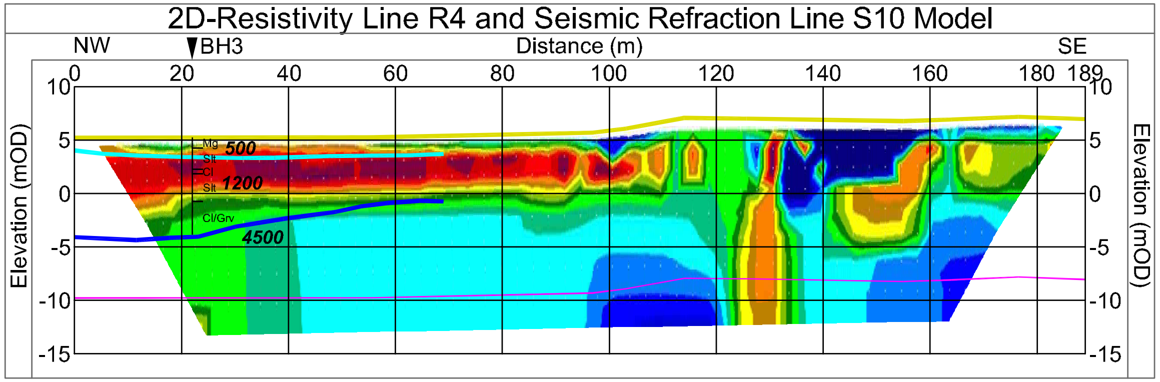
2D-Resistivity Model Values:

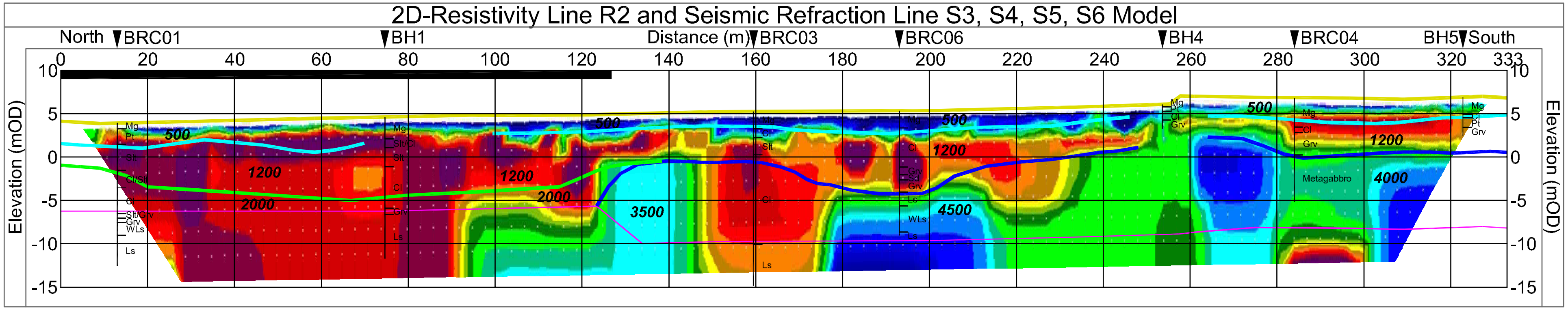
Resistivities (Ohmm)

Zone of deep Rock

Layers from Seismic Refraction Model:

- Ground Surface/Top of Layer 1 (500 m/s)
- Top of Layer 2 (1200 m/s)
- Top of Layer 3 (2000 m/s)
- Top of Layer 4 (3500 - 4500 m/s)
- Seismic Modelling Depth
- **1800** Seismic Velocity in m/s





Abbreviated GI Logs:

BRC06 Borehole Name and Location

Pt	Peat	Mg	Made Ground
Cl	Clay	Slt	Silt
Grv	Gravel	WLs	Weathered Limestone
Sd	Sand	Ls	Limestone

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CLIENT	Land Development Agency AECOM
PROJECT	LDA Dyke Road, Galway Geophysical Survey
TITLE	Figure 1b: Models of Geophysical Survey

SCALE:	1:1000 @ A3, VE x 2
PROJECT:	6756
DRAWN:	JS
DATE:	01/07/2024
MGX FILE:	6756f_Drawings.dwg
STATUS:	Final

2D-Resistivity Model Values:

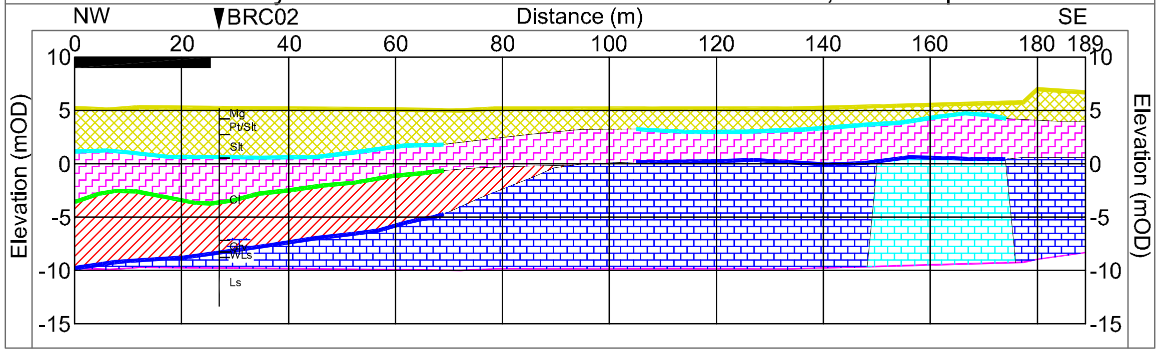
Resistivities (Ohmm)

Zone of deep Rock

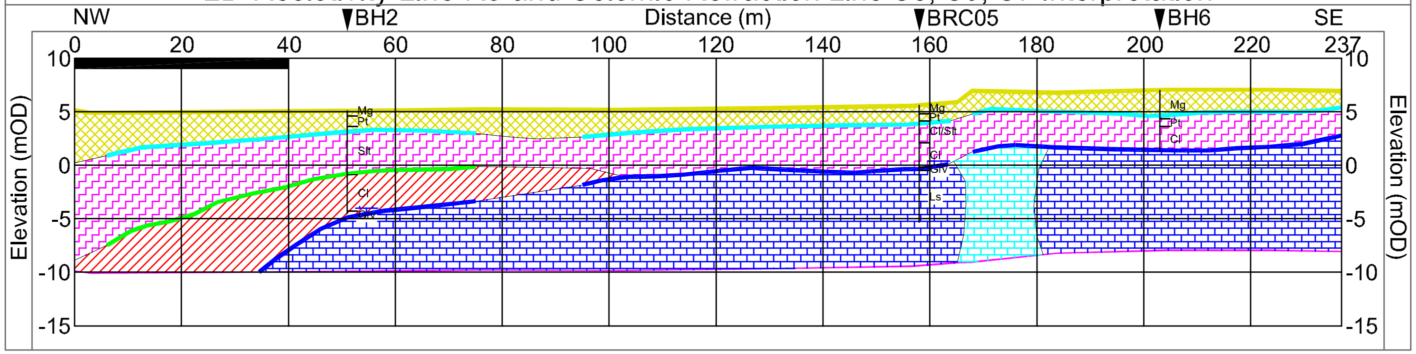
Layers from Seismic Refraction Model:

- Ground Surface/Top of Layer 1 (500 m/s)
- Top of Layer 2 (1200 m/s)
- Top of Layer 3 (2000 m/s)
- Top of Layer 4 (3500 - 4500 m/s)
- Seismic Modelling Depth
- **1800** Seismic Velocity in m/s

2D-Resistivity Line R1 and Seismic Refraction Line S1, S2 Interpretation



2D-Resistivity Line R3 and Seismic Refraction Line S8, S9, S7 Interpretation



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CLIENT	Land Development Agency AECOM
PROJECT	LDA Dyke Road, Galway Geophysical Survey
TITLE	Figure 2a: Interpretation of Geophysical Survey

SCALE:	1:1000 @ A3, VE x 2
PROJECT:	6756
DRAWN:	JS
DATE:	01/07/2024
MGX FILE:	6756f_Drawings.dwg
STATUS:	Final

Interpretation:

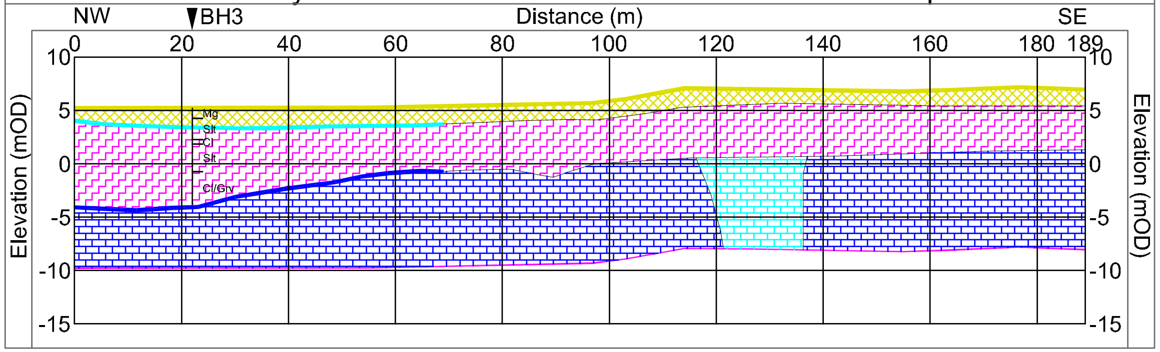
- 1 Road Construction Material over Urban Made Ground or Peat
- 2 Soft to firm Clay and Silt or urban Made Ground or Peat
- 3 Very stiff or very dense Overburden
- 4a Very stiff to hard Clay
- 4b Limestone
- 4c Metagabbro/anomalous Rock
- Zone of deep Rock

Abbreviated GI Logs:

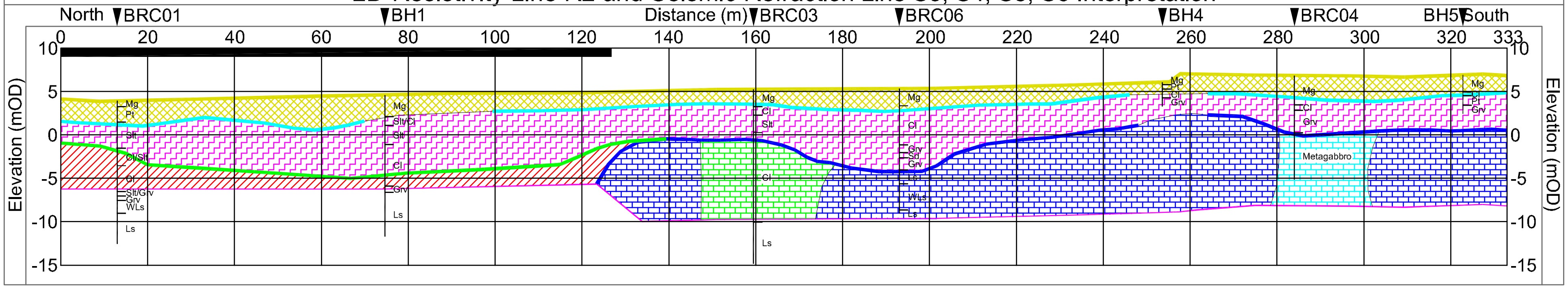
BRC06 Borehole Name and Location

Pt	Peat	Mg	Made Ground
Cl	Clay	Slt	Silt
Grv	Gravel	WLs	Weathered Limestone
Sd	Sand	Ls	Limestone

2D-Resistivity Line R4 and Seismic Refraction Line S10 Interpretation



2D-Resistivity Line R2 and Seismic Refraction Line S3, S4, S5, S6 Interpretation



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CLIENT	Land Development Agency AECOM
PROJECT	LDA Dyke Road, Galway Geophysical Survey
TITLE	Figure 2b: Interpretation of Geophysical Survey

SCALE:	1:1000 @ A3, VE x 2
PROJECT:	6756
DRAWN:	JS
DATE:	01/07/2024
MGX FILE:	6756f_Drawings.dwg
STATUS:	Final

Interpretation:

- 1 Road Construction Material over Urban Made Ground or Peat
- 2 Soft to firm Clay and Silt or urban Made Ground or Peat
- 3 Very stiff or very dense Overburden
- 4a Very stiff to hard Clay
- 4b Limestone
- 4c Metagabbro/anomalous Rock
- Zone of deep Rock

Abbreviated GI Logs:

BRC06 Borehole Name and Location

Pt	Peat	Mg	Made Ground
Cl	Clay	Slt	Silt
Grv	Gravel	WLs	Weathered Limestone
Sd	Sand	Ls	Limestone

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