Volume III – Appendices to Environmental Impact Assessment Report

MIXED USE BUILD-TO-RENT & COMMERCIAL DEVELOPMENT

Former Chadwick's Builders Merchant development, South of Greenhills Road, North of the existing access road serving Greenhills Industrial Estate, Greenhills Industrial Estate, Walkinstown, Dublin 12 (Eircode's D12 HD51, D12 N523, D12 C602)

MARCH 2022

HUGHES PLANNING
& DEVELOPMENT CONSULTANTS

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APPENDIX 5

Bat Survey Report

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Bat Survey Report

Greenhills Rd, Walkinstown, Dublin

ASH Ecology & Environmental

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1. INTRODUCTION

1.1 Purpose of the Report

Ash Ecology and Environmental Ltd (AEE) was commissioned by Enviroguide Consulting to carry out a bat emergence survey (21/04/2021), and follow up building inspection for bat signs (01/03/2022) at a site located along Greenhills Rd, Walkinstown, Co. Dublin; see Figure 1. There are currently a number of vacant buildings on the site which be demolished and in that regard a bat survey was required to assess any bat usage on the site.

The Proposed Development will consist of the following:

(i) The demolition of the former Chadwick's Builders Merchant development comprising 1 no. two storey office building and 9 no. storage/warehouse buildings ranging in height from 3 m – 9.9 m as follows: Building A (8,764 sq.m.), Building B (1,293 sq.m.), Building C (two-storey office building) (527 sq.m.), Building D (47 sq.m.), Building E (29 sq.m.), Building F (207 sq.m.), Building G (101 sq.m.), Building H (80 sq.m.), Building I (28 sq.m.), and Building J (44 sq.m.), in total comprising 11,120 sq.m.;

(ii) the construction of a mixed-use Build-to-Rent residential and commercial development comprising 633 no. build-to-rent apartment units (292 no. one-beds, 280 no. two-beds and 61 no. three-beds), 1 no. childcare facility and 10 no. commercial units in 4 no. blocks (A-D) ranging in height from 5 to 12 storeys as follows:

(a) Block A comprises 209 no. apartments (102 no. 1 bed-units, 106 no. 2 bed-units and 1 no. 3-bed units) measuring 5 - 10 storeys in height. (b) Block B comprises 121 no. apartments (53 no. 1 bed-units, 45 no. 2 bed-units and 23 no. 3 bed-units) measuring 8 - 10 storeys in height. (c) Block C comprises 130 no. apartments (38 no. 1-bed units, 71 no. 2-bed units and 21 no. 3-bed units) measuring 8 - 12 storeys in height. (d) Block D comprises 173 no. apartments (99 no. 1 bed-units, 58 no. 2 bed-units and 16 no. 3 bed-units) measuring 6 - 10 storeys in height. All apartments will be provided with private balconies/terraces;

(iii) provision of indoor communal residential amenity/management facilities including a co-working space, communal meeting room/ work space, foyer, toilets at ground floor of Block A; gym, changing rooms, toilets, resident's lounge, studio, laundry room, communal meeting room/ work space, multi-function space with kitchen at ground floor of Block B; games room with kitchenette, media room, co-working space, resident's lounge, communal meeting room/ work space, reception area, management office with ancillary staff room and toilets, toilets, parcel room at ground floor of Block C;

(iv) the construction of 1 no. childcare facility with dedicated outdoor play area located at ground floor of Block A;

(v) the construction of 8 no. commercial units at ground floor level of Blocks A, B and D, and 2 no. commercial units at second floor level (fronting Greenhills Road) of Block C as follows: Block A has 3 no. units at ground floor comprising 79.46 sq.m., 90.23 sq.m., and 121.39 sq.m., Block B has 1 no. unit at ground floor comprising 127.03 sq.m., Block C has two units at second floor comprising 120.85 sq.m. and 125.45 sq.m., and Block D has 4 no. units at ground floor comprising 84.45 sq.m., 149.77 sq.m., 155.48 sq.m. and 275.59 sq.m.;

(vi) the construction of 3 no. vehicular entrances; a primary entrance via vehicular ramp from the north (access from Greenhills Road) and 2 no. secondary entrances from the south for emergency access and services (access from existing road to the south of the site) with additional pedestrian accesses proposed along Greenhills Road;

(vii) provision of 424 no. car parking spaces comprising 398 no. standard spaces, 21 no. mobility spaces and 5 no. car club spaces located at ground floor level car park located within Block A and accessed via the proposed entrance at Greenhills Road, a two-storey car park located within Blocks C and D also accessed from the proposed entrance at Greenhills Road and on-street parking at ground floor level adjacent to Blocks A and C. Provision of an additional 15 no. commercial/ unloading/ drop-off on-street parking spaces at ground floor level (providing for an overall total of 439 car parking spaces).

Provision of 4 no. dedicated motorcycle spaces at ground floor level parking area within Blocks C and D;

(viii) provision of 1363 no. bicycle parking spaces comprising 1035 no. residents' bicycle spaces, 5 no. accessible bicycle spaces and 7 no. cargo bicycle spaces in 9 no. bicycle storerooms in ground and first floor parking areas within Blocks A, C and D, and 316 no. visitors' bicycle spaces located externally at ground floor level throughout the development;

(ix) provision of outdoor communal amenity space (5,020 sq.m.) comprising landscaped courtyards that include play areas, seating areas, grass areas, planting, and scented gardens located on podiums at first and second floor levels; provision of a communal amenity roof garden in Block C with seating area and planting (176 sq.m.); and inclusion of centrally located public open space (3,380 sq.m.) adjacent to Blocks B and C comprising grassed areas, planting, seating areas, play areas, water feature, flexible use space; and incidental open space/public realm;

(x) development also includes landscaping and infrastructural works, foul and surface water drainage, bin storage, ESB substations, plant rooms, boundary treatments, internal roads, cycle paths and footpaths and all associated site works to facilitate the development.

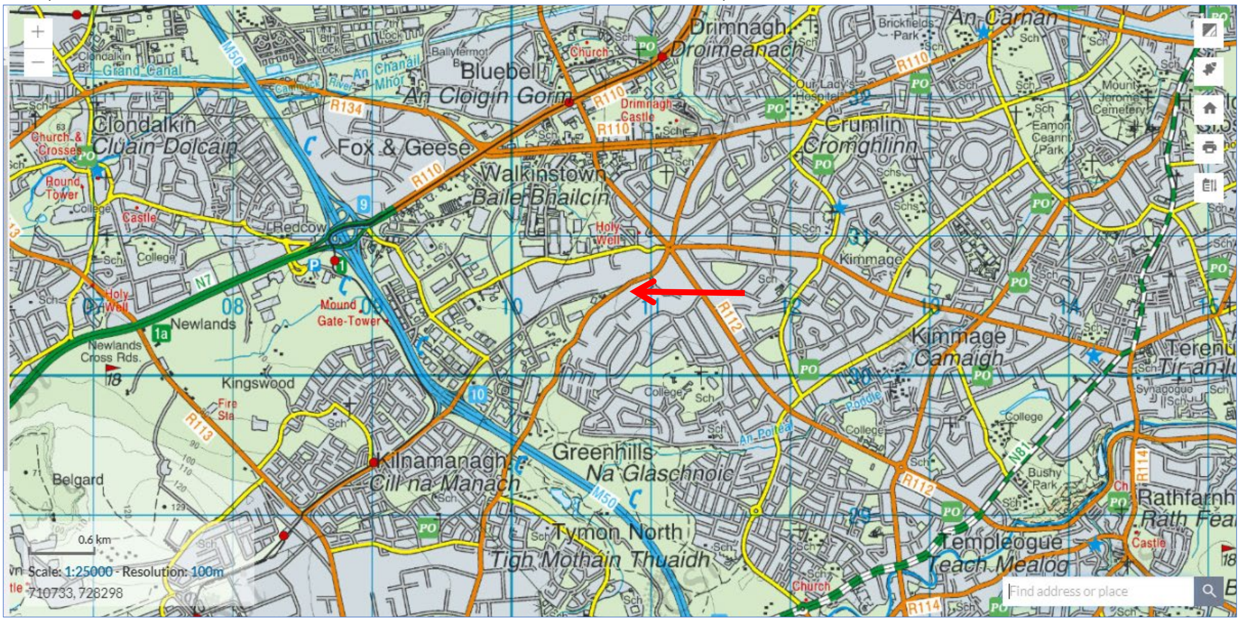

Figure 1 Site Location Map, red arrow.

Figure 2 Aerial Photo of the Site.

1.2 Competency of Assessor

This report has been prepared by Ash Ecology & Environmental Ltd (AEE) whose managing director and leading ecologist is Aisling Walsh who is a full member of the Chartered Institute of Ecological & Environmental Management (CIEEM) and whose qualifications include M.Sc. (Dist) in Biodiversity and Conservation (TCD) and B.Sc. (Hons) Zoology (NUIG). Aisling has over 15 years of experience providing environmental consultancy and environmental assessment services. Aisling has written numerous Ecological Impact Assessments (EcIA), Screening for Appropriate Assessment Stage I and Stage II Natura Impact Statement, Environmental Impact Assessments/Statements, Badger Surveys, Bat Surveys, Habitat Surveys. AEE is listed as a Registered Practice by the CIEEM and a member of Bat Conservation Ireland. Aisling Walsh is a licenced bat ecologist (examples of recent: DER/BAT 2020 – 46 EUROPEAN, DER/BAT 2020 – 48 EUROPEAN, EUROPEAN, DER/BAT 2021 – 89, DER/BAT 2022 – 12).

1.3 Bat Legislation

In view of their sensitive status across Europe, all species of bat have been listed on Annex IV of the EC 'Habitats and Species Directive' and some, such as the lesser horseshoe bat, are given further protection and listed on Annex II of this Directive. This Directive was transposed into Irish law as the European Communities (Natural Habitats) Regulations, 1997, as consolidated and updated in the European Communities) Birds and Natural Habitats) Regulations 2011 (S.I. No.477 of 2011), and combined with the Wildlife Acts (1976 to 2018), ensures that individual bats and their breeding sites and resting places are fully protected. This has important implications for those who own or manage sites where bats occur.

All bat species are protected under the Wildlife Acts 1976-2018 which make it an offence to wilfully interfere with or destroy the breeding or resting place of these species; however, the Acts permit limited exemptions for certain kinds of development.

All species of bats in Ireland are listed on Schedule 5 of the 1976 Act, and are therefore subject to the provisions of Section 23, which make it an offence to:

1. *Intentionally kill, injure or take a bat,*
2. *Possess or control any live or dead specimen or anything derived from a bat,*
3. *Wilfully interfere with any structure or place used for breeding or resting by a bat,*
4. *Wilfully interfere with a bat while it is occupying a structure or place which it uses for that purpose.*

1.4 Derogation licences

In order to obtain a licence to allow the destruction of bat roosts etc., in advance of any otherwise legitimate development which may impact on the favourable conservation status of bats, Section 25 of the Habitats Regulations must be satisfied along with Regulation 54 of S.I. 477 (2011):

A derogation licence may only be granted:

(a) Where there is no satisfactory alternative and

(b) the derogation is not detrimental to the maintenance of the populations of the species to which the Habitats Directive relates at a favourable conservation status in their natural range.

Where both conditions are satisfied, the derogation licence may only be granted where it is—

(a) in the interests of protecting wild fauna and flora and conserving natural habitats,

(b) to prevent serious damage, in particular to crops, livestock, forests, fisheries and water and other types of property,

(c) in the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment,

(d) for the purpose of research and education, of repopulating and reintroducing these species and for the breeding operations necessary for these purposes, including the artificial propagation of plants, or

(e) to allow, under strictly supervised conditions, on a selective basis and to a limited extent, the taking or keeping of certain specimens of the species to the extent specified therein, which are referred to in the First Schedule.

The first aim of the developer, working with professional advice, should be to entirely avoid or minimise the potential impact of a proposed development on bats and their breeding and resting places.

Current NPWS advice is that there should be no net loss in local bat population status, taking into account factors such as population size, viability and connectivity.[1] Hence, when it is unavoidable that a development will affect a bat population, the mitigation should aim to maintain a population of equivalent status in the area.

One of the key aims of the Habitats Directive is to encourage member states to maintain at, or restore to, favourable conservation status those species of community interest (Article 2(2)). 'Favourable conservation status' is defined in the Habitats and Species Directive (Article 1(i)). Conservation status is defined as "the sum of the influences acting on the species concerned that may affect the long term distribution and abundance of its population within the territory." It is assessed

[1] Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

as favourable when: "population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitats, and the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and there is, or will probably continue to be, a sufficiently large habitat to maintain its populations on a long term basis." Note that even though there is apparent overlap between the Wildlife Acts and the Habitats Regulations, they run concurrently. No action in relation to bats that would not be permitted under the Habitats Regulations may be licensed under the Wildlife Acts.

Derogation licences granted under the Regulations include reference to the relevant provisions of the Wildlife Acts to ensure that all requirements for licensing are covered in the one document. It should also be noted that a licence only allows what is permitted within its terms and conditions; it does not legitimise all actions related to bats at a given site.[2]

2. METHODOLOGY

2.1 Information Sources

A desk-based review of information sources was completed. Information contained on the websites of the National Parks and Wildlife Service (NPWS)[3] and the National Biodiversity Data Centre (NBDC)[4] was reviewed.

In addition, the following publications and websites were also reviewed and consulted:

- Ordnance Survey of Ireland mapping and aerial photography available from www.heritagemaps.ie;
- Online data available on European sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie;
- Information on the status of EU protected habitats and species in Ireland (National Parks & Wildlife Service, 2013a and 2013b)[5]
- Clare County Development Plan 2017-2023
- McAney, K & Hanniffy, R (2015) The Vincent Wildlife Trust's Irish bat box schemes
- Bat Conservation Ireland https://www.batconservationireland.org/
- Bat Roosts in Trees: A Guide to Identification and Assessment for Tree-Care and Ecology Professionals (2018)
- Andrews H & Gardener M 2016. Bat Tree Habitat Key – Database Report 2016. AEcol, Bridgwater.

[2] Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

[3] The National Parks and Wildlife Services map viewer http://webgis.npws.ie/npwsviewer/

[4] The National Biodiversity Data Centre www.NBDC.ie

[5] NPWS (2013a). The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 2, Version 1.1. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

NPWS (2013b). The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 3, Version 1.0. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

- Bat Conservation Trust (2018) Bats and artificial lighting in the UK Bats and the Built Environment series
- Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Mitchell-Jones, A.J, & McLeish, A.P. (eds). 2004., 3rd Edition Bat Workers' Manual, JNCC, Peterborough, ISBN 1 86107 558 8
- Bat Conservation Trust (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd edition
- Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes (National Roads Authority, 2005).
- Guidelines for the Treatment of Bats during the Construction of National Road Schemes (National Roads Authority, 2005).
- Aughney, T., Kelleher, C. & Mullen, D. (2008) Bat Survey Guidelines: Traditional Farm Buildings Scheme. The Heritage Council, Áras na hOidhreachta, Church Lane, Kilkenny.
- Bat Conservation Ireland https://www.batconservationireland.org/
- Bat Conservation Trust (2018) Bats and artificial lighting in the UK Bats and the Built Environment series[6]
- Bat Conservation Ireland (2012) Bats and Appropriate Assessment Guidelines, Version 1, December 2012. Bat Conservation Ireland, www.batconservationireland.org[7]
- Bat Conservation Ireland (2010) Bats & Lighting Guidance Notes for: Planners, engineers, architects and developers[8]
- Bats and Lighting in the UK – Bats and the Built Environment Series (Institute of Lighting Professionals, September 2011
- Guidance Notes for the Reduction of Obtrusive Light GN01 (Institute of Lighting Professionals, 2011.
- Bats and Lighting – Guidance Notes for Planners, Engineers, Architects and Developers (Bat Conservation Ireland);
- The Eurobats Mitigation of Lighting Document
- Homan O'Brien Engineering (April 2021) Chadwicks Greenhills SHD Site Lighting Report

[6] https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/

[7] https://www.batconservationireland.org/wp-content/uploads/2013/09/BCIreland-AA-Guidelines_Version1.pdf

[8] https://www.batconservationireland.org/wp-content/uploads/2013/09/BCIrelandGuidelines_Lighting.pdf

2.2 Desk Study

2.2.1 Previous Records

A desktop review was carried out to identify the previous records of Bat species within the Proposed Development Site and its environs. The study area occurs in 10km² Grid Square 013. The website the NBDC (www.nbdc.ie) was accessed on 22/04/2021 to establish any previous bat records and shown below in Table 1.

Table 1 Historical Bat Records in 10km² Grid Square O13 (NBDC website www.nbdc.ie accessed 22/04/2021)

Species Name - Common	*Species Name - Latin*	Last Documented Record O13
Brown Long-eared Bat	*Plecotus auritus*	25/07/2013
Daubenton's Bat	*Myotis daubentonii*	11/08/2014
Lesser Noctule	*Nyctalus leisleri*	28/05/2016
Nathusius's Pipistrelle	Pipistrellus nathusii	15/09/2010
Natterer's Bat	Myotis nattereri	30/09/2016
Common Pipistrelle	*Pipistrellus pipistrellus*	03/08/2013
Soprano Pipistrelle	*Pipistrellus pygmaeus*	30/09/2016
Whiskered Bat	Myotis mystacinus	13/08/2007

2.2.2 Species Background

Ireland had ten known bat species until February 2013, when a single live greater horseshoe bat (*Rhinolophus ferrumequinum)* was found roosting in Co. Wexford[9]. On 8th June 2020, a single audio recording was confirmed in the Glendaough area, Co. Wicklow. It was found on two more occasions in the same area in early July 2020 (Bat Conservation Ireland, July 2020).

The ten species (excluding the greater horseshoe) are briefly described overleaf. For a more comprehensive overview see McAney, 2006.[10]

The dependence of Irish bat species on insect prey has left them vulnerable to habitat destruction, land drainage, agricultural intensification and increase use of pesticides. Also, their reliance on buildings as roosting sites has made them particularly vulnerable to renovation works and the use of timber chemical treatment. Buildings are highly important as roosting sites for bats and all Irish bat species use buildings for all roost types. Most significant in terms of roosts in houses are maternity roosts, but cellars and even attics may serve as hibernation sites for bats. Roosts within buildings can far exceed the numbers encountered in trees, bridges, caves or cliffs and roosts of over 1,000 bats have been recorded in buildings.[11]

[9] National Biodiversity Data Centre http://www.biodiversityireland.ie/new-bat-species-found-in-ireland/

[10] McAney, K. (2006) *A Conservation Plan for Irish Vesper Bats.* Irish Wildlife Manual No.20. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government.

[11] NRA (2005) Guidelines for the Treatment of Bats Prior to the Construction of National Road Schemes. National Roads Authority, Dublin

2.2.2.1 Family Vespertilionidae:

Common pipistrelle *Pipistrellus pipistrellus*

This species was only recently separated from its sibling, the soprano or brown pipistrelle P. pygmaeus[12], which is detailed below. The common pipistrelle's echolocation calls peak at 45 kHz. The species forages along linear landscape features such as hedgerows and treelines as well as within woodland.

Soprano pipistrelle *Pipistrellus pygmaeus*

The soprano pipistrelle's echolocation calls peak at 55 kHz, which distinguishes it readily from the common pipistrelle on detector. The pipistrelles are the smallest and most often seen of our bats, flying at head height and taking small prey such as midges and small moths. Summer roost sites are usually in buildings, but tree holes and heavy ivy are also used. Roost numbers can exceed 1,500 animals in mid-summer.

Nathusius' pipistrelle *Pipistrellus nathusii*

Nathusius' pipistrelle is a recent addition to the Irish fauna and has mainly been recorded from the north-east of the island in Counties Antrim and Down[13] and also in Fermanagh, Longford and Cavan. It has also recently been recorded in Counties Cork and Kerry.[14] However, the known resident population is enhanced in the autumn months by an influx of animals from Scandinavian countries. The status of the species has not yet been determined.

Leisler's bat *Nyctalus leisleri*

This species is Ireland's largest bat, with a wingspan of up to 320mm; it is also the third most common bat, preferring to roost in buildings, although it is sometimes found in trees and bat boxes. It is the earliest bat to emerge in the evening, flying fast and high with occasional steep dives to ground level, feeding on moths, caddisflies and beetles. The echolocation calls are sometimes audible to the human ear being around 15 kHz at their lowest. The audible chatter from their roost on hot summer days is sometimes an aid to location. This species is uncommon in Europe and as Ireland holds the largest national population the species is considered as Near Threatened here.

Brown long-eared bat *Plecotus auritus*

This species of bat is a 'gleaner', hunting amongst the foliage of trees and shrubs, and hovering briefly to pick a moth or spider off a leaf, which it then takes to a sheltered perch to consume. They often land on the ground to capture their prey. Using its nose to emit its echolocation, the long-eared bat 'whispers' its calls so that the insects, upon which it preys, cannot hear its approach (and hence, it needs oversize ears to hear the returning echoes). As this is a whispering species, it is extremely difficult to monitor in the field as it is seldom heard on a bat detector.

[12] Barratt, E. M., Deauville, R., Burland, T. M., Bruford, M. W., Jones, G., Racey, P. A., & Wayne, R. K. (1997) *DNA Answers the Call of Pipistrelle Bat Species. Nature* 387: 138 - 139.

[13] Richardson, P. (2000) *Distribution Atlas of Bats in Britain and Ireland 1980 - 1999*. The Bat Conservation Trust, London, England.

[14] Kelleher, C. (2005) *International Bat Fieldcraft Workshop, Killarney, Co. Kerry.* National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government.

Furthermore, keeping within the foliage, as it does, it is easily overlooked. It prefers to roost in old buildings.

Natterer's bat *Myotis nattereri*
This species has a slow to medium flight, usually over trees but sometimes over water. It usually follows hedges and treelines to its feeding sites, consuming flies, moths, caddisflies and spiders. Known roosts are usually in old stone buildings but they have been found in trees and bat boxes. The Natterer's bat is one of our least studied species and further work is required to establish its status in Ireland.

Daubenton's bat *Myotis daubentonii*
This bat species feeds close to the surface of water, either over rivers, canals, ponds, lakes or reservoirs but it can also be found foraging in woodlands. Flying at 15 kilometres per hour, it gaffs insects with its over-sized feet as they emerge from the surface of the water - feeding on caddis flies, moths, mosquitoes, midges etc. It is often found roosting beneath bridges or in tunnels and also makes use of hollows in trees.

Whiskered bat *Myotis mystacinus*
This species, although widely distributed, has been rarely recorded in Ireland. It is often found in woodland, frequently near water. Flying high, near the canopy, it maintains a steady beat and sometimes glides as it hunts. It also gleans spiders from the foliage of trees. Whiskered bats prefer to roost in buildings, under slates, lead flashing or exposed beneath the ridge beam within attics. However, they also use cracks and holes in trees and sometimes bat boxes. The whiskered bat is one of our least studied species and further work is required to establish its status in Ireland.

Brandt's bat *Myotis brandtii*
This species is known from five specimens found in Counties Wicklow (Mullen, 2007), Cavan, and Clare in 2003, a specimen in Kerry in 2005[15] and another in Tipperary in 2006.[16] No maternity roosts have yet been found. It is very similar to the whiskered bat and cannot be separated by the use of detectors. Its habits are similar to its sibling.

2.2.2.2 Family Rhinolophidae:

Lesser horseshoe bat *Rhinolophus hipposideros*

This species is the only representative of the Rhinolophidae or horseshoe bat family in Ireland. It differs from our other species in both habits and looks, having a unique nose leaf with which it projects its echolocation calls. It is also quite small and, at rest, wraps its wings around its body. Lesser horseshoe bats feed close to the ground, gleaning their prey from branches and stones. It often carries its prey to a perch to consume, leaving the remains beneath as an indication of its presence.

The echolocation call of this species is of constant frequency and, on a heterodyne bat detector, sounds like a melodious warble. The species is confined to six counties

[15] Kelleher, C. 2006a Nathusius pipistrelle Pipistrellus nathusii and Brandt's Bat Myotis brandtii - New Bat Species to Co. Kerry – Irish Naturalists' Journal 28: 258.

[16] Kelleher, C. 2006b Brandt's Bat Myotis brandtii, New Bat Species to Co. Tipperary. Irish Naturalists' Journal 28: 345.

along the Atlantic seaboard: Mayo, Galway, Clare, Limerick, Kerry and Cork. The current Irish national population is estimated at 12,500 animals. This species is listed on Annex II of the EC Habitats Directive and 41 Special Areas of Conservation have been designated in Ireland for its protection. Where it occurs, it is often found roosting within farm buildings.

2.2.3 *Landscape Suitability*

The National Biodiversity Data Centre (NBDC) maps landscape suitability bats based on Lundy *et al.* (2011). The maps are a visualisation of the results of the analyses based on a 'habitat suitability' index. The index ranges from 0 to 100 with 0 being least favourable and 100 most favourable for bats. The average overall for the higher suitability is 36.4-58.6. The average assessment of bat habitats in the current study area is 23.67– low. Table 2 gives the suitability of the study area for the bat species found in the study area (based on NBDC) along with their Irish Red List Status (from Marnell *et al.,* 2019).[17]

Table 2 Suitability of the study area for the bat species found in the Walkinstown area (based on the NBDC data) with Irish Red list status indicated.

Common name	Scientific name	Suitability index	Irish red list status
All bats	-	23.67	Least Concern
Soprano pipistrelle	*Pipistrellus pygmaeus*	35	Least Concern
Brown long-eared bat	*Plecotus auritus*	28	Least Concern
Common pipistrelle	*Pipistrellus pipistrellus*	39	Least Concern
Lesser-horseshoe bat	*Rhinolophus hipposideros*	0	Least Concern
Leisler's bat	*Nyctalus leisleri*	42	Least Concern
Whiskered bat	*Myotis mystacinus*	20	Least Concern
Daubenton's bat	*Myotis daubentonii*	18	Least Concern
Nathusius' pipistrelle	*Pipistrellus nathusii*	15	Least Concern
Natterer's bat	*Myotis nattereri*	16	Least Concern

2.2.4 *Bat Roosts*

Bats were originally cave and tree dwelling animals but many now find buildings just as suitable for their needs. Bats are social animals and most species congregate in large colonies during summer. These colonies consist mostly of females of every reproductive class, with some juvenile males from the previous year. Male bats normally roost individually or in small groups meeting up with the females in the late autumn-early winter, when it is time to mate. In summer, bats seek warm dry buildings in which they can give birth and suckle their young. In winter, they seek out places with a constant low temperature and high humidity where they can become torpid and hibernate during adverse weather conditions. However, bats do not hibernate continuously during winter and will awake and hunt during mild nights when there are insects available, and it is energetically advantageous to forage.

[17] Marnell, F., Looney, D. & Lawton, C. (2019) Ireland Red List No. 12: Terrestrial Mammals. National Parks and Wildlife Service, Department of the Culture, Heritage and the Gaeltacht, Dublin, Ireland.

2.2.4.1 Maternity Roosts

Maternity roosts are the most significant roosts and they are predominantly all-female aggregations that are formed from late May onwards and remain as a relatively cohesive unit until mid to late August. Not all female bats give birth annually. These females that do bear young in a given year avail of a suitable building, tree and sometimes cave (or equivalent). The young are flightless for several weeks and hence are vulnerable to dangers such as tree felling and restoration, reinforcement or demolition of structures such as buildings and bridges.

2.2.4.2 Mating Roosts

Most bat species mate in autumn but pregnancy does not occur until the following spring. During this time males will take possession of a cavity in a building, tree, bridge, cave or mine and attract females to these sites to establish a harem. Male bats call both from a perch and in flight in much the same manner that male birds sing.

2.2.4.3 Hibernation Roosts

Bats have a high metabolic rate and in temperate countries, such as Ireland, flying insects are not available in sufficient numbers during winter to sustain bats. Therefore, bats hibernate during winter. In hibernation sites, bats are often completely inactive for several days and are extremely vulnerable to disturbance by human activities due to the time taken for them to become sufficiently active to allow escape. Hibernation may extend from November to the end of March, during which time bat activity will take place sporadically.

2.2.4.4 Night Roosts

These are roosts which are used as resting places for bats between foraging bouts. They also provide retreats for bats from predators or during inclement weather conditions. They also function as feeding perches and may be important for socialising.

2.3 General Activity Survey

A general bat activity survey was undertaken on the 21st April 2021 from 20.00 to 22.00 (sunset was 20.38) by walking the Site boundary and around all structures onsite. The weather was optimal for a bat survey with temperatures on the night 12°C in calm conditions. Bat activity surveys are best carried out mid-March to end of September in suitable weather conditions[18] which this survey was. The equipment used for the bat activity surveys included a Elekon Bat Logger M detector. Visual observations were taken with the aid of a powerful L.E.D. torch (AP Pros-Series 220 Lumens High Performance Spotlight).

2.4 Buildings Assessment Methodology

A bat potential assessment of the buildings onsite using a Seek Thermal Reveal Pro High-Resolution Thermal Imaging Camera along with a RIDGID 36848 Micro CA-150 Hand-Held Borescope for inspection of any crevices (where accessible) was carried out. This piece of equipment is fitted with a camera and allows visibility of confined spaces and narrow passages potentially used by hibernating/roosting bats. It allows spaces up to 3m from ground level to be inspected. The BCT guidelines were followed.[19] All buildings were assessed externally and internally, where accessible, during April 2021 and a follow-up external and internal inspection was again carried out March 1st 2022. The buildings onsite were grouped into 17 areas to facilitate the interpretation of results, see Figure 3 and Plates in Appendix A. Buildings were classified using Table 4.1 of the BCT guidelines (2016) and shown overleaf as Table 3. The buildings were all accessed internally on March 1st 2022 and assessed for the presence of bat droppings and insect feeding remains e.g. butterfly wings.

[18] Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

[19] *Bat Surveys for Professional Ecologists, Good Practice Guidelines (2016)*

Figure 3 Buildings grouped and numbered 1 to 17. Plates in Appendix A show the groupings.

Table 3 Guidelines for assessing the potential suitability of proposed development sites for bats, based on the presence of roost features within the landscape, to be applied using professional judgement.

Suitability	Description Roosting habitats	Commuting and foraging habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions[a] and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation[b]). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.[c]	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions[a] and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions[a] and surrounding habitat.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

[a] For example, in terms of temperature, humidity, height above ground level, light levels or levels of disturbance.
[b] Evidence from the Netherlands shows mass swarming events of common pipistrelle bats in the autumn followed by mass hibernation in a diverse range of building types in urban environments (Korsten *et al.*, 2015). This phenomenon requires some research in the UK but ecologists should be aware of the potential for larger numbers of this species to be present during the autumn and winter in large buildings in highly urbanised environments.
[c] This system of categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

2.5 Bat Potential Tree Assessment

The scrub and young trees present onsite will be removed to facilitate the development. Trees onsite were assessed to determine the presence of the Potential Roost Features listed below and, to assess whether the trees may be used as important commuting and foraging routes.

- Natural holes (e.g., knot holes) arising from naturally shed branches or branches previously pruned back to a branch collar.
- Man-made holes (e.g., cavities that have developed from flush cuts or cavities created by branches tearing out from parent stems).
- Cracks/splits in stems or braches (horizontal and vertical).
- Partially detached or loose bark plates.
- Cankers (caused by localised bark death) in which cavities have developed.
- Other hollows or cavities, including butt rots.
- Compression of forks with included bark, forming potential cavities.
- Crossing stems or branches with suitable roosting space between.

- Ivy stems with diameters in excess of 50mm with suitable roosting space behind (or where roosting space can be seen where a mat of thinner stems has left a gap between the mat and the trunk).
- Bat or bird boxes.
- Other suitable places of rest or shelter.

Certain factors such as orientation of the feature, height from the ground, the direct surroundings and its location in respect to other features may enhance or reduce the potential value.

Trees were then classified into general bat roost potential groups based upon the presence of these features. An evaluation table is shown as Table 4.

Table 4 Classification and Survey Requirements for Bats in Trees[20]

Classification of Tree	Description of Category and Associated Features (based on Potential Roosting Features listed above)	Likely Further Survey Work / Actions
Confirmed Roost	Evidence of roosting bats in the form of live / dead bats, droppings, urine staining, mammalian fur oil staining, etc.	A National Parks and Wildlife (NPWS) derogation licence application will be required if the tree or roost site is affected by the development or proposed arboricultural works. This will require a combination of aerial assessment by roped access bat workers (where possible, health and safety constraints allowing) and nocturnal survey during appropriate periods (e.g. nocturnal survey - May to August) to inform on the licence. Works to tree undertaken under supervision in accordance with the approved good practice method statement provided within the licence. However, where confirmed roost site(s) are not affected by works, work under a precautionary good practice method statement may be possible.

[20] Bat Surveys for Professional Ecologists: Good Practice Guidelines (J., Collins (Bat Conservation Trust), 2016[20]).

Classification of Tree	Description of Category and Associated Features (based on Potential Roosting Features listed above)	Likely Further Survey Work / Actions
High Potential	A tree with one or more Potential Roosting Features that are obviously suitable for larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter protection, conditions (height above ground level, light levels, etc.) and surrounding habitat. Examples include (but are not limited to); woodpecker holes, larger cavities, hollow trunks, hazard beams, etc.	Aerial assessment by roped access bat workers (if appropriate) and / or nocturnal survey during appropriate period (May to August). Following additional assessments, tree may be upgraded or downgraded based on findings. If roost sites are confirmed and the tree or roost is to be affected by proposals a licence from the NPWS will be required. After completion of survey work (and the presence of a bat roost is discounted), a precautionary working method statement may still be appropriate.
Moderate Potential	A tree with Potential Roosting Features which could support one or more potential roost sites due to their size, shelter protection, conditions (height above ground level, light levels, etc.) and surrounding habitat but unlikely to support a roost of high conservation status (i.e., larger roost, irrespective of wider conservation status). Examples include (but are not limited to); woodpecker holes, rot cavities, branch socket cavities, etc.	A combination of aerial assessment by roped access bat workers and / or nocturnal survey during appropriate period (May to August). Following additional assessments, tree may be upgraded or downgraded based on findings. After completion of survey work (and the presence of a bat roost is discounted), a precautionary working method statement may still be appropriate. If a roost site/s is confirmed a licence from the NPWS will be required.
Low Potential	A tree of sufficient size and age to	No further survey required

Classification of Tree	Description of Category and Associated Features (based on Potential Roosting Features listed above)	Likely Further Survey Work / Actions
	contain Potential Roosting Features but with none seen from ground or features seen only very limited potential. Examples include (but are not limited to); loose/lifted bark, shallow splits exposed to elements or upward facing holes.	but a precautionary working method statement may be appropriate.
Negligible/No potential	Negligible/no habitat features likely to be used by roosting bats	None.

2.6 Landscape Evaluation

Ecological survey results were evaluated to determine the significance of identified features located in the study area on an importance scale ranging from international-national-county-local (from NRA, 2009) The local scale is approximately equivalent to one 10km square but can be operationally defined to reflect the character of the area of interest. Because most sites will fall within the local scale, this is sub-divided into two categories: local importance (higher value) and local importance (lower value).

3. RESULTS

3.1 General Activity Survey

The results of bat survey carried out April 21st 2021 using the Elekon Batlogger M detector yielded no results i.e. no bats were detected during the survey despite ambient weather and the appropriate time of year.

The lack of Bat activity within the site boundary during April 2021 may be due to the site location within a heavily urbanised/industrialised area with high levels of traffic, lighting and anthropogenic disturbance which would discourage bats.

The site lacks commuting and foraging routes (with no mature trees) to more suitable habitat and is relatively well illuminated due to the surrounding urban landscape. This is further implied via the low bat suitability score given to the general environment surrounding the Site, see Section 3.4. The follow-up internal buildings inspection for bat signs during the March 1st 2022 survey did not identify further bat activity within subject buildings since April 21st 2021 (see Section 3.2 below).

3.2 Buildings Assessment Survey

The buildings onsite were grouped into 17 sections (see Figure 3) and inspected as per the methodology set out in Section 2.4. All buildings were assessed externally and internally, where accessible, during April 2021 and a follow-up external and internal inspection was again carried out March 1st 2022. The March survey was outside the window for emergence surveys however all accessible spaces, including attic space of Building 17, that could potentially allow bats access the buildings were visually examined in detail for bats, signs of bats, or evidence of bat activity, using a torch where necessary. Cracks, crevices etc. were investigated for ingress / egress points and evidence of bat habitation, such as smearing lines, droppings, and staining. The majority were of corrugated steel and lacked bat roost potential inside including attic spaces.

No bat emergence was detected or observed from any buildings onsite during the survey April 21st 2021. No signs of bats e.g. piles of bat droppings, feeding remains etc were uncovered in the follow-up survey on March 1st 2022. Table 5 below shows the suitability assigned (as per Table 3). The majority of buildings, and space occupied by same, were 'Negligible' which a small number were 'Low' (No. 1, 2, 3, 6, 7, 8 & 17). There were no buildings classified as 'Moderate' or 'High' suitability.

Table 5 Building Suitability for Bats on Site (see Figure 3 for locations within site)

No. Assigned on Figure 3	Suitability	Recommendation
1	Low	Pre-demolition Survey
2	Low	Pre-demolition Survey
3	Low	Pre-demolition Survey
4	Negligible	No further action
5	Negligible	No further action
6	Low	Pre-demolition Survey
7	Low	Pre-demolition Survey
8	Low	Pre-demolition Survey
9	Negligible	No further action
10	Negligible	No further action
11	Negligible	No further action
12	Negligible	No further action
13	Negligible	No further action
14	Negligible	No further action
15	Negligible	No further action
16	Negligible	No further action
17	Low	Pre-demolition Survey

3.3 Bat Potential Tree Assessment

All trees and scrub onsite are to be felled to facilitate the development. The trees onsite had no/negligible potential for roosting bats; see Table 4, Section 2.5 assessment classification.

3.4 Landscape Evaluation

As stated the landscape is considered of local importance (Lower value) for bats due to the site location within a heavily urbanised/industrialised area with high levels of traffic, lighting and anthropogenic disturbance which would discourage bats. It has been assigned a low landscape suitability score for bats, see Section 2.2.3. There is negligible commuting and foraging routes for bats in and around the site that would connect it to more suitable habitats.

The follow-up internal buildings inspection for bat signs during the March 1st 2022 survey did not identify further bat activity within subject buildings since April 21st 2021 where no bat activity was detected.

4. RECOMMENDATIONS

4.1 Tree Assessment

No bat potential trees (being used as roosts) were found during survey as the site is mostly *Buddleia* scrub and willow trees, however in the unlikely event bats be noted as present during felling/scrub clearance then works should cease immediately and a derogation licence from the National Parks and Wildlife Services (NPWS) acquired.

4.2 Lighting for Bats

The proposed lighting plan[21] for the site includes the following mitigation for bats:

- A photo-electric cell (PEC) is proposed for automatic switch-on at dusk and off with time control. Presence detection may also be incorporated for safety purposes & bat consideration, e.g. when nobody is outside, after a set interval time, lighting reduces to a pre-determined level, e.g. 50%, but as soon as human or vehicular movement is detected, full illumination is restored.
- Lighting has only been installed where necessary for public safety. These lights have been designed and selected with specific shutters and filters to minimise any potential for back spills into the sensitive locations while still providing the primary function of safely lighting the pedestrian routes.
- Reflectance's – Downward lighting can be reflected from bright surfaces. To minimize bat disturbance, the design avoids the use of bright surfaces and incorporates darker colour lamp heads and poles to reduce reflectance.
- Shielding of Luminaires & Light - To minimize bat disturbance, the design avoids the use of upward lighting by shielding or by downward directional focus.
- Type of Light – To minimize bat disturbance, the design avoids the use of strong UV lighting. The lighting design is based on the use of LED lighting which has minimal or no UV output of significance.

4.3 Demolition Works

The majority of the buildings on the site were deemed Negligible for bat roost suitability; however, a small number (No. 1, 2, 3, 6, 7, 8 & 17) see Figure 3 and Plates in Appendix A) had 'Low' potential, i.e. "*a structure with one or more potential roost sites that could be used by individual bats opportunistically*." A cautionary pre-demolition bat survey of buildings onsite should be carried out as a precautionary measure during the appropriate time of year in suitable weather conditions.

A series of 5 No. bat boxes will be erected on trees around the Site to provide future roosting opportunities for bats. The type recommended is the 2F Schwegler Bat Box.[22]

[21] Homan O'Brien Engineering (April 2021) Chadwicks Greenhills SHD Site Lighting Report

[22] Available here: https://www.nhbs.com/search?q=bat+boxes&qtview=158629

5. CONCLUSION

The bat activity onsite during the April 21st 2021 survey was absent despite the ambient weather conditions on the night. The follow-up inspection of all buildings onsite on March 1st 2022 revealed no bat signs such as bat droppings or insect feeding remains in attic spaces or ground of buildings for demolition.

The Site itself is considered to be of Lower Importance for bats for the following reasons:

- No bats were recorded during a bat survey carried out April 21st 2021 which was carried out in ambient weather conditions during the appropriate time of year.
- No signs of bats were uncovered during an internal and external inspection of all 17 buildings and/or groups of buildings, within the site on March 1st 2022.
- The site is illuminated due to the urban setting (which may deter bats).
- The site lacks mature trees and therefore commuting and foraging routes to other more suitable habitats.
- The majority of buildings occupying most of the building space onsite was constructed with corrugated steel and lacked roosting suitability for bats. Any attic spaces e.g. Building 17, did not reveal signs of bats.

On the basis of the findings of the survey works completed in April 2021 it is concluded that the overall impact on bats, arising from the Proposed Development, will be most likely negligible if the general recommendations and specific lighting mitigation measures are implemented from Section 4.0, namely a pre-demolition bat survey of Buildings 1, 2, 3, 6, 7, 8 and 17 along with lighting mitigation for bats and future roosting opportunities e.g. bat boxes integrated into the final design.

In summary the Site also lies in a heavily urbanised/industrialised area with high levels of traffic, lighting and anthropogenic disturbance that would give the general environment surrounding the Site a low bat suitability score and potentially deter bats from using the site. The unsuitability of the Site for bats is further supported by the initial activity and emergence survey on April 21st 2021 which did not detect any activity or emergence of bats on Site despite it being a calm, mild evening within the bat survey season. The follow-up survey which inspected all buildings for signs of bat, on March 1st 2022 endorses these conclusions.

APPENDICES

APPENDIX A

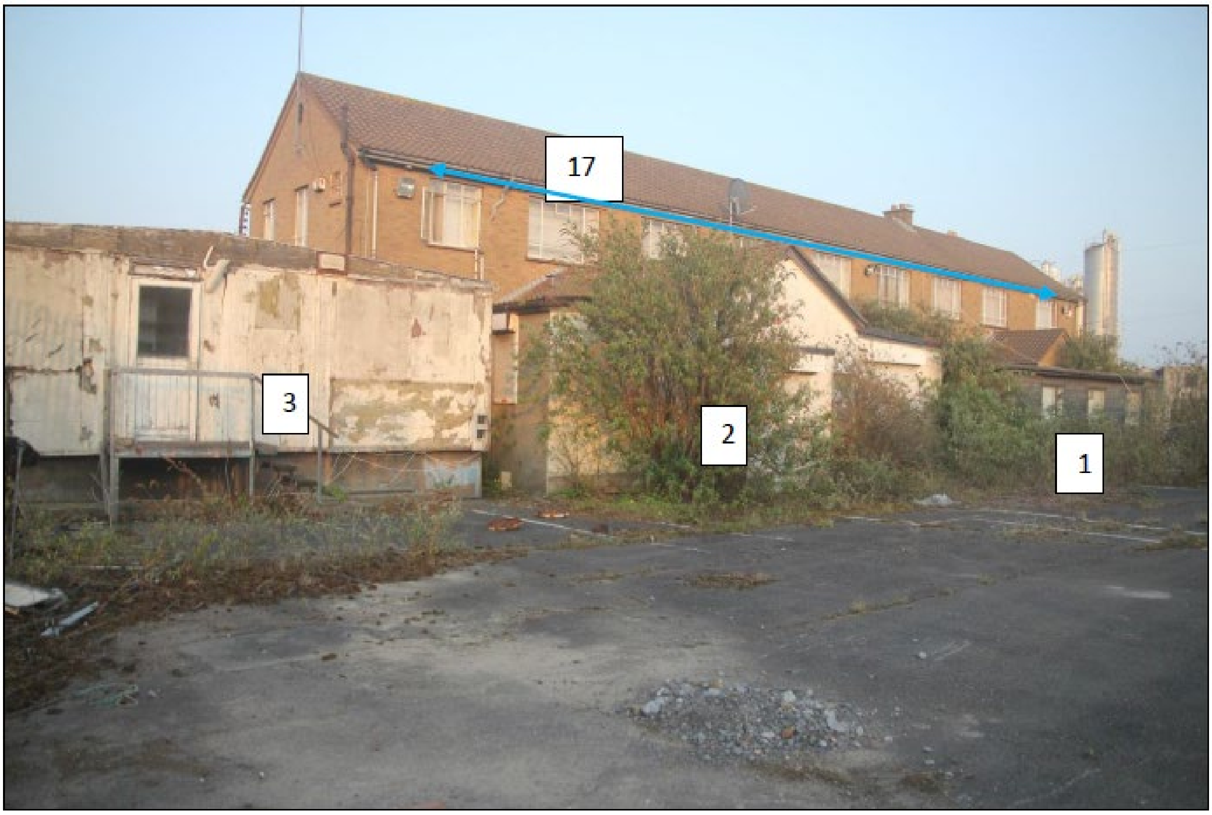

Plate 1 From left to Right Buildings 3, 2 and 1 - Low Bat Potential. Building 17 to the rear, also of Low Bat Potential

Plate 2 Attic space of Building 17 reveals no signs of bats – inspected March 1st 2022

Plate 3 All tables and floors of Building 17 were checked for bat signs in March 2022, none were found.

Plate 4 Building 4 – Negligible Bat Potential.

Plate 5 Building 5 - Negligible Bat Potential.

Plate 6 Building 6 - Low Bat Potential.

Plate 7 Building 7 - Low Bat Potential.

Plate 8 Building 8 - Low Bat Potential.

Plate 9 Building 9 – Low Bat Potential.

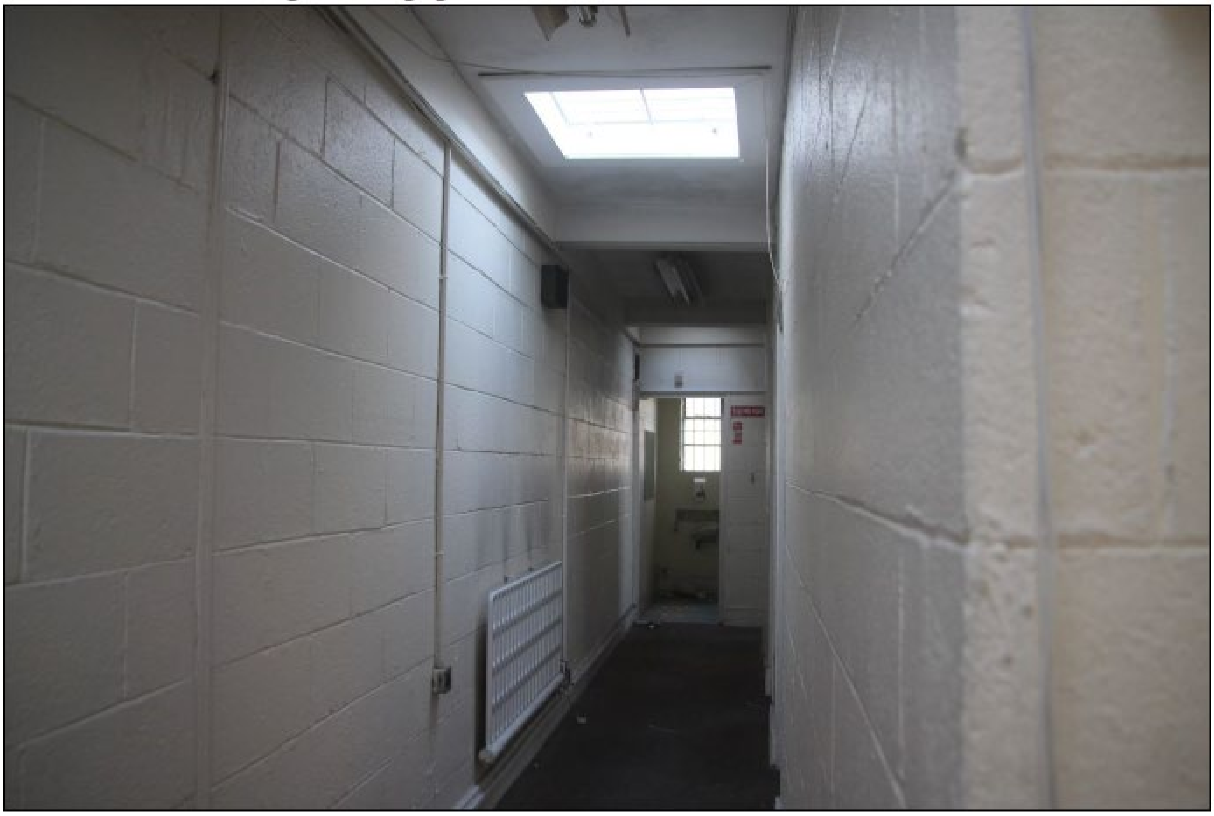

Plate 10 Building 9 – Negligible Bat Potential. Interior of flat roof building, March 2022

Plate 11 Building 10 - Negligible Bat Potential.

Plate 12 Building 10 - Negligible Bat Potential.

Plate 13 Building 11 - Negligible Bat Potential.

Plate 14 Building 11 - Negligible Bat Potential.

Plate 15 Building 12 - Negligible Bat Potential.

Plate 16 Building 12 - Negligible Bat Potential.

Plate 17 Building 13 - Negligible Bat Potential.

Plate 18 Building 13 - Negligible Bat Potential.

Plate 19 Building 14 - Negligible Bat Potential.

Plate 20 Building 15 - Negligible Bat Potential.

Plate 21 Building 15 - Negligible Bat Potential. Interior, March 2022.

Plate 22 Building 16 - Negligible Bat Potential.

APPENDIX 6

6.1 NRA/TII Criteria for Rating the Magnitude and Significance of Impacts at EIA Stage

6.2 Ground Investigations Report

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Table 1 Criteria for Rating Site Attributes – Estimation of Importance of Soil and Geology Attributes (NRA)

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

Table 2 Criteria for Rating Site Attributes – Estimation of Importance of Hydrogeological Attributes (NRA)

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

Table 3 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Soil/ Geology Attribute (NRA)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves. Irreversible loss of high proportion of local high fertility soils. Removal of entirety of geological heritage feature. Requirement to excavate/remediate entire waste site. Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Loss of moderate proportion of future quarry or pit reserves. Removal of part of geological heritage feature. Irreversible loss of moderate proportion of local high fertility soils. Requirement to excavate/remediate significant proportion of waste site. Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves. Removal of small part of geological heritage feature. Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils. Requirement to excavate/remediate small proportion of waste site. Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

Table 4 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Hydrogeological Attribute (NRA)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer. Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >1% annually.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually.

Table 5 Rating of Significant Environmental Impacts at EIS Stage (NRA)

Importance of Attribute	**Magnitude of Importance**			
	Negligible	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

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Ground Investigations Ireland

Greenhills Road

Lohan & Donnelly

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DOCUMENT CONTROL SHEET

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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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CONTENTS

APPENDICES

1.0 Preamble

On the instructions of Lohan & Donnelly Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd. in January 2021 at the site of the proposed residential development on the Greenhills Road, Dublin 12.

2.0 Overview

2.1. Background

It is proposed to construct new residential development with associated services, access roads and car parking at the proposed site. The site was historically used as a gravel quarry, with a large retaining wall structure marking the southwestern boundary of the site. The site is currently occupied by several derelict industrial/commercial buildings and is situated near the Walkinstown Roundabout, on the southern side of Greenhills Road (R918), Dublin 12. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant.

2.2. Purpose and Scope

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

- Visit project site to observe existing conditions
- Carry out 14 No. Window Sample Boreholes to recover soil samples
- Carry out 10 No. Cable Percussion boreholes to a maximum depth of 4.50m BGL
- Installation of 3 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. Window Sampling

The window sampling was carried out at the locations shown in Figure 2 in Appendix 1 using a Tecopsa SPT Tec 10 percussion drilling rig. The window sampling consists of a 1m long steel tube with a cutting edge and an internal plastic liner which is mechanically driven into the ground utilising a 50kg weight falling a height of 500mm. Upon completion of the 1m sample, the tube is withdrawn and the plastic liner removed and sealed for logging and sub sampling by a Geotechnical Engineer/Engineering Geologist. The tube is replaced in the borehole and a subsequent 1m sample can be recovered. Occasionally outer casing or a reduced diameter tube is utilised to enable the window sample to progress in difficult drilling conditions. Geotechnical or environmental soil samples can be recovered from each of the liners following logging. The window sample records are provided in Appendix 2 of this Report.

3.3. Cable Percussion Boreholes

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

The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata.

Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 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 3 of this Report.

3.4. Surveying

The exploratory hole locations have been recorded using a Trimble R10 GNSS System which records the coordinates and elevation of the locations to ITM, as required by the project specification. In areas where the Trimble R10 GNSS System was unable to record the data due to building interference, observation

methods were used to estimate the exploratory hole location. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.5. 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 on soil samples, as required by the specification, including the Rilta Suite, pH and sulphate testing was carried out by Element Materials Technology Laboratory in the UK. The Rilta Suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria. A number of groundwater samples were also tested by Element, using an indicator parameter suite.
Geotechnical testing consisting of moisture content, Atterberg limits and, Particle Size Distribution (PSD), tests were carried out in NMTL's Geotechnical Laboratory in Carlow.
The results of the completed laboratory are included in Appendix 4 of this Report.

4.0 Ground Conditions

4.1. General

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

The sequence of strata encountered were variable across the site but generally comprised;

- Surfacing
- Made Ground
- Cohesive Deposits
- Granular Deposits

SURFACING: Tarmacadam or Concrete surfacing was present in all exploratory holes and was present to a maximum depth of 0.30m BGL.

MADE GROUND: Made Ground and suspected Made Ground deposits were encountered beneath the surfacing and were present to a depth of between 0.40m and 2.40m BGL, with the full extent of these deposits not determined at BH02, BH02A, BH03, WS02, WS02A, WS02B, WS08, and WS08A. These deposits varied across the site but were generally were described as either a *brown clayey sandy subangular to subrounded fine to coarse Gravel* or a *greyish brown sandy gravelly Clay* and contained *rare fragments of red brick.*

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the made ground and/or surfacing at BH03A, BH04, BH05, BH06, WS03, WS04, WS05, WS09, WS10, and WS11. These deposits were described typically as *dark brown/grey slightly sandy gravelly CLAY with occasional cobbles.* The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had occasional, some or many cobble and boulder content were noted on the exploratory hole logs.

GRANULAR DEPOSITS: Granular deposits were encountered beneath the made ground and/or cohesive deposits at BH01, BH04, BH05, BH06, BH07, BH08, WS01, WS06, and WS07. These deposits were generally described as *grey/brown clayey subangular to subrounded fine to coarse GRAVEL with occasional cobbl*es and *brown clayey gravelly fine to coarse SAND*. The secondary sand/gravel and silt/clay constituents varied across the site and with depth while occasional, some or many cobble and boulder content also present where noted on the exploratory hole logs.
Based on the SPT N values the deposits are typically medium dense and become dense with depth.

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 BH04, BH06 and BH08 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 5 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 low to intermediate plasticity.
The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 19% and 46.2% generally with fines contents of 25.5% to 45%.
The Particle Size Distribution tests confirm that generally the granular deposits are well-graded with percentages of sands and silt/clay typically between 0.3% and 32.7% with a gravel content of typically 46% to 81.2%.

4.3.2. Chemical Laboratory Testing

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water-soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

4.3.3. 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 environmental assessment report is included under the cover of a sperate report by Ground Investigations Ireland.

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

5.0 Recommendations & Conclusions

5.1. General

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

5.2. Foundations

An allowable bearing capacity of 125 kN/m^2 is recommended for conventional strip or pad foundations on the stiff cohesive deposits and medium dense granular deposits at a depth of 2.20m BGL. If a higher bearing capacity is required, an allowable bearing capacity of 250 kN/m^2 is recommended for conventional strip or pad foundations on the very stiff cohesive deposits and dense granular deposits at a depth of 3.00m BGL. For each unit, where granular and cohesive deposits are encountered at foundation level, we recommend that all foundations of the unit in question be lowered to the same stratum to avoid differential settlement. The possibility for variation in the depth of the made ground in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete.

A ground bearing floor slab is recommended to be based on the stiff cohesive deposits or medium dense granular deposits with an appropriate depth of compacted hardcore specified by the consulting engineer and in accordance with the limits and guidelines in SR21:2014+A1:2016 and/or NRA SRW CL808 Type E granular stone fill. Where the depth of Made Ground/Soft deposits exceeds 0.90m then suspended floor slabs should be considered.

The pH and sulphate testing completed on samples recovered from the exploratory holes indicates the pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. No special precautions are required for concrete foundations to prevent sulphate attack. The samples tested were below the limits of DS1 in the BRE Special Digest 1:2005.

Due to the high loading anticipated, piled foundations may be more economically advantageous for the proposed buildings. 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.

5.3. Excavations

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

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

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.

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 Environmental Assessment Report.

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 - Figures

Site Location

Indicative Site Boundary

Client:

L&D

Project Code:

10299-12-20

Project Title:

Greenhills Road

Drawing Title:

Figure 1 Site Location

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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

0 15 30 45 60 75 m

Drawn By:	Date:
BS	14-01-2021

Indicative Site Boundary

Borehole

Window Sample

Client:

L&D

Project Code:

10299-12-20

Project Title:

Greenhills Road

Drawing Title:

Figure 5 SI Points

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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

0 15 30 45 60 75 m

Drawn By:	Date:
SG	21-01-2021

APPENDIX 2 – Window Sample Records

Ground Investigations Ireland Ltd
www.gii.ie

Site: Greenhills Road				**Number**: WS01
Excavation Method: Drive-in Windowless Sampler	**Dimensions**: 85mm to 2.00m 65mm to 3.00m	**Ground Level (mOD)**: 58.28	**Client**: Lohan and Donnelly	**Job Number**: 10299-12-20
	Location: 710701.7 E 730493.4 N	**Dates**: 18/01/2021	**Project Contractor**: GII	**Sheet**: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				58.16	(0.12) 0.12	TARMACADAM		
				58.08	(0.08) 0.20	MADE GROUND: Grey silty sandy subangular to subrounded fine to coarse Gravel		
				57.88	(0.20) 0.40	MADE GROUND: Brown slightly clayey sandy subangular fine to coarse Gravel		
0.50	ES01			57.48	(0.40) 0.80	MADE GROUND: Brown slightly gravelly clayey fine to coarse Sand with rare fragments of red brick		
1.50	ES02			55.88	(1.60) 2.40	Possible MADE GROUND: Brown slightly sandy slightly gravelly Clay with occasional cobbles		
2.80	ES03			55.28	(0.60) 3.00	Brown gravelly very clayey fine to coarse SAND. Gravel is subrounded fine to coarse		
						Complete at 3.00m		

Remarks: Borehole backfilled upon completion	**Scale (approx)**: 1:25	**Logged By**: SG
	Figure No.: 10299-12-20.WS01	

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Number: **WS02**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	85mm to 0.40m	57.98	Lohan and Donnelly	10299-12-20
	Location	**Dates**	**Project Contractor**	**Sheet**
	710696.6 E 730528.8 N	18/01/2021	GII	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				57.86	(0.12) 0.12	TARMACADAM		
				57.68	(0.18) 0.30	TARMACADAM		
				57.58	(0.10) 0.40	MADE GROUND: Grey silty sandy Subangular fine to coarse Gravel		
						Complete at 0.40m		

Remarks	Scale (approx)	Logged By
Unable to advance borehole due to possible boulder	1:25	SG
	Figure No. 10299-12-20.WS02	

Ground Investigations Ireland Ltd
www.gii.ie

Site	Greenhills Road		**Number**	**WS02A**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 0.40m	**Ground Level (mOD)** 57.94	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710700.6 E 730527.3 N	**Dates** 18/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.12)	TARMACADAM		
				57.82	0.12			
					(0.18)	TARMACADAM		
				57.64	0.30			
					(0.10)	MADE GROUND: Grey silty sandy Subangular fine to coarse Gravel		
				57.54	0.40			
						Complete at 0.40m		

Remarks
Unable to advance borehole due to possible boulder

Scale (approx)	**Logged By**
1:25	SG

Figure No.
10299-12-20.WS02a

Ground Investigations Ireland Ltd www.gii.ie	Site Greenhills Road	Number **WS02B**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	85mm to 0.40m	57.98	Lohan and Donnelly	10299-12-20
	Location	**Dates**	**Project Contractor**	**Sheet**
	710691.4 E 730524.3 N	20/01/2021	GII	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				57.86	(0.12) 0.12	TARMACADAM		
				57.68	(0.18) 0.30	TARMACADAM		
				57.58	(0.10) 0.40	MADE GROUND: Grey silty sandy Subangular fine to coarse Gravel		
						Complete at 0.40m		

Remarks	Scale (approx)	Logged By
Unable to advance borehole due to possible boulder	1:25	SG
	Figure No. 10299-12-20.WS02b	

Ground Investigations Ireland Ltd
www.gii.ie

Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m 65mm to 3.00m	**Ground Level (mOD)**	**Site** Greenhills Road	**Number** **WS03**
	Location 710717.6 E 730562.5 N	**Dates** 18/01/2021	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
			Project Contractor GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.23) 0.23	CONCRETE		
0.50	ES04				(0.47) 0.70	Possible MADE GROUND: Brown very clayey very sandy subangular to subrounded fine to coarse Gravel		
					(0.50) 1.20	Possible MADE GROUND: Dark brown slightly sandy slightly gravelly Clay		
1.50	ES05				(1.30) 2.50	Grey slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse Moderate hydrocarbon odour		
					(0.50) 3.00	Brown clayey sandy subangular to subrounded fine to coarse GRAVEL		
3.00	ES06					Complete at 3.00m		

Remarks
Borehole backfilled upon completion

Scale (approx)	**Logged By**
1:25	SG

Figure No.
10299-12-20.WS03

Ground Investigations Ireland Ltd
www.gii.ie

Site	Number
Greenhills Road	WS04

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	85mm to 2.00m 65mm to 3.00m		Lohan and Donnelly	10299-12-20
	Location	**Dates**	**Project Contractor**	**Sheet**
	710707.6 E 730590.2 N	18/01/2021	GII	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.22) 0.22	CONCRETE		
0.30	ES07					Possible MADE GROUND: Brown clayey very sandy subangular fine to coarse Gravel with occassional cobbles Mild hydrocarbon odour		
1.30	ES08				(1.28) 1.50			
					(0.50) 2.00	Dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse		
					(0.80) 2.80	Light brown slightly clayey very sandy subangular to subrounded fine to coarse GRAVEL		
					(0.20) 3.00	Light brown slightly clayey very sandy subrounded fine to coarse GRAVEL		
						Complete at 3.00m		

Remarks
Borehole backfilled upon completion

Scale (approx)	Logged By
1:25	SG

Figure No.
10299-12-20.WS04

Ground Investigations Ireland Ltd
www.gii.ie

Site Greenhills Road				**Number** **WS05**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m 65mm to 2.80m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710747.7 E 730588.6 N	**Dates** 18/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.22) 0.22	CONCRETE		
					(0.28) 0.50	Possible MADE GROUND: Brown clayey sandy subangular fine to coarse Gravel		
1.50	ES09				(1.50) 2.00	Possible MADE GROUND: Dark brown clayey very sandy subangular fine to coarse Gravel		
2.10	ES10				(0.40) 2.40	Brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse		
					(0.40) 2.80	Black slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse		
						Complete at 2.80m		

Remarks
Refusal at 2.80m BGL
Borehole backfilled upon completion

Scale (approx) 1:25	**Logged By** SG
Figure No. 10299-12-20.WS05	

Ground Investigations Ireland Ltd
www.gii.ie

Site	Number
Greenhills Road	WS06

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	85mm to 2.00m		Lohan and Donnelly	10299-12-20
	Location	**Dates**	**Project Contractor**	**Sheet**
	710784.5 E 730591.2 N	19/01/2021	GII	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	TARMACADAM		
					(0.25) 0.30	MADE GROUND: Red clayey very sandy subangular to subrounded fine to coarse Gravel		
					(0.15) 0.45	Possible MADE GROUND: Brown slightly sandy slightly gravelly Clay		
					(0.55) 1.00	Possible MADE GROUND: Brown clayey very gravelly fine to coarse Sand		
1.00	ES12				(1.00) 2.00	Dark brown clayey very gravelly fine to coarse SAND. Gravel is aubangular to subrounded fine to coarse		
2.00	ES13					Complete at 2.00m		

Remarks
Refusal at 2.00m BGL
Borehole backfilled upon completion

Scale (approx)	Logged By
1:25	SG

Figure No.
10299-12-20.WS06

Ground Investigations Ireland Ltd www.gii.ie			Site Greenhills Road	Number **WS07**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m 65mm to 2.30m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710772.3 E 730620.9 N	**Dates** 19/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	CONCRETE		
0.20-1.00	ES11				(1.80) 2.00	Recovered as; MADE GROUND: Brown sandy gravelly Clay with rare fragments of red brick		
					(0.30) 2.30	Recovered as; Dark brown clayey sandy subangular to subrounded fine to coarse GRAVEL		
						Complete at 2.30m		

Remarks	Scale (approx)	Logged By
Refusal at 2.30 Borehole backfilled upon completion	1:25	SG
	Figure No. 10299-12-20.WS07	

Ground Investigations Ireland Ltd www.gii.ie			Site Greenhills Road	Number **WS08**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 1.00m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710801.2 E 730635.6 N	**Dates** 20/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.18) 0.18	CONCRETE		
					(0.42) 0.60	MADE GROUND: Brown slightly sandy slightly gravelly Clay with rare fragments of red brick		
					(0.40) 1.00	Possible MADE GROUND: Grey clayey sandy subangular to subrounded fine to coarse Gravel with occasional cobbles		
						Complete at 1.00m		

Remarks	Scale (approx)	Logged By
Refusal at 1.00m BGL Borehole backfilled upon completion	1:25	SG
	Figure No. 10299-12-20.WS08	

Ground Investigations Ireland Ltd www.gii.ie			Site Greenhills Road	Number **WS08A**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 1.40m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710806.2 E 730632.5 N	**Dates** 20/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	CONCRETE		
					0.20	MADE GROUND: Brown slightly sandy slightly gravelly Clay with rare fragments of red brick		
					(0.55)			
					0.75	MADE GROUND: Grey clayey very sandy subrounded fine to coarse Gravel with rare fragments of red brick		
1.00	ES21				(0.65)			
					1.40	Complete at 1.40m		

Remarks
Refusal at 1.40m BGL
Borehole backfilled upon completion

Scale (approx)	Logged By
1:25	SG

Figure No.
10299-12-20.WS08a

Ground Investigations Ireland Ltd www.gii.ie			Site Greenhills Road	Number **WS09**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m 65mm to 3.00m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710829.4 E 730651.4 N	**Dates** 19/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	CONCRETE		
					(0.55) 0.75	Possible MADE GROUND: Brown slightly sandy gravelly Clay		
					(0.25) 1.00	Possible MADE GROUND: Greyish brown slightly clayey sandy subrounded fine to coarse Gravel		
					(0.70) 1.70	Possible MADE GROUND: Brown slightly sandy gravelly Clay		
1.70	ES14				(0.50) 2.20	Possible MADE GROUND: Dark brown clayey gravelly fine to coarse Sand		
2.50	ES15				(0.50) 2.70	Brown slightly gravelly very sandy SILT. Gravel is subrounded fine to coarse		
					(0.30) 3.00	Brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse		
						Complete at 3.00m		

Remarks Borehole backfilled upon completion	**Scale (approx)** 1:25	**Logged By** SG
	Figure No. 10299-12-20.WS09	

Ground Investigations Ireland Ltd www.gii.ie			Site: Greenhills Road	Number: **WS10**
Excavation Method: Drive-in Windowless Sampler	**Dimensions**: 85mm to 2.00m, 65mm to 2.60m	**Ground Level (mOD)**:	**Client**: Lohan and Donnelly	**Job Number**: 10299-12-20
	Location: 710808 E 730604.9 N	**Dates**: 19/01/2021	**Project Contractor**: GII	**Sheet**: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	TARMACADAM		
0.50	ES16				(1.05)	MADE GROUND: Dark brown slightly sandy slightly gravelly Clay with rare fragments of red brick		
					1.10			
2.00	ES17				(1.50)	Dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse		
					2.60	Complete at 2.60m		

Remarks	Scale (approx)	Logged By
Refusal at 2.60m BGL Borehole backfilled upon completion	1:25	SG
	Figure No. 10299-12-20.WS10	

Ground Investigations Ireland Ltd www.gii.ie			Site: Greenhills Road	Number: **WS11**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m 65mm to 2.80m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710835.1 E 730616.7 N	**Dates** 20/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	TARMACADAM		
					(0.45)	MADE GROUND: Brown clayey sandy subangular to subrounded fine to coarse Gravel		
					0.50 (0.30)	Possible MADE GROUND: Brown slightly sandy slightly gravelly Clay		
0.80	ES18				0.80 (0.40)	Possible MADE GROUND: Brown gravelly very clayey fine to coarse Sand		
					1.20 (0.10)	Brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse		
1.50	ES19				1.30 (0.35)	Greyish brown slightly gravelly silty fine to coarse SAND. Gravel subrounded fine to medium		
					1.65 (0.35)	Brown slightly gravelly silty sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium		
2.50	ES20				2.00 (0.80)	Brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse Moderate hydrocarbon odour		
					2.80	Complete at 2.80m		

Remarks
Refusal at 2.80m BGL
Borehole backfilled upon completion

Scale (approx)	Logged By
1:25	SG

Figure No. 10299-12-20.WS11

Greenhills Road – Window Sample Core Photographs

WS01

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 3.00m BGL)

WS03

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 3.00m BGL)

Greenhills Road – Window Sample Core Photographs

WS04

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 3.00m BGL)

WS05

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 2.80m BGL)

Greenhills Road – Window Sample Core Photographs

WS06

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

WS07

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 2.30m BGL)

Greenhills Road – Window Sample Core Photographs

WS08

(0.00 – 1.00m BGL)

WS08a

(0.00 – 1.00m BGL)

(1.00 – 1.40m BGL)

WS09

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

Greenhills Road – Window Sample Core Photographs

(2.00 – 3.00m BGL)

WS10

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 2.60m BGL)

WS11

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 2.80m BGL)

APPENDIX 3 – Cable Percussion Borehole Records

Ground Investigations Ireland Ltd www.gii.ie	Site Greenhills Road	Borehole Number BH-01

Machine : Dando 2000 Method : Cable Percussion	Casing Diameter 200mm cased to 4.50m	Ground Level (mOD) 58.84	Client Lohan and Donnelly	Job Number 10299-12-20
	Location (dGPS) 710668.2 E 730490.5 N	Dates 20/01/2021- 25/01/2021	Project Contractor GII	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	B01				58.74	0.10	TARMACADAM		
0.20	ES01				58.64	0.20	MADE GROUND: Brown slightly silty slightly gravelly fine to coarse Sand		
					58.54	0.30 (0.50)	Drillers note: MADE GROUND: 804 fill		
					58.04	0.80	Drillers Note: Brown clayey fine Sand		
1.00-1.21 1.00	SPT(C) 50/60 B02			7,9/50			Dense grey very sandy subangular to subrounded fine to coarse GRAVEL		
2.00-2.45 2.00	SPT(C) N=41 B03			7,7/9,10,10,12		(2.20)			
3.00-3.45 3.00	SPT(C) N=49 B04			7,10/19,9,9,12	55.84	3.00 (1.00)	Dense grey sandy subangular to subrounded fine to coarse GRAVEL with occasional subrounded cobbles and some bands of brown slightly sandy slightly gravelly Clay		▼1
4.00-4.06 4.00	SPT(C) 25*/20 50/40 B05			25/50	54.84	4.00 (0.50)	Dense grey slightly sandy subangular fine to coarse GRAVEL with some subangular to subrounded cobbles		
				Water strike(1) at 4.50m, rose to 3.00m in 20 mins.	54.34	4.50	Complete at 4.50m		∇1

Remarks
BH-01 terminated at 4.50m BGL due to obstruction.
Chiselling from 4.50m to 4.50m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No.
10299-12-20.BH-01

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Borehole Number: **BH-02**

Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 0.70m	**Ground Level (mOD)** 58.02	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location (dGPS) 710724.1 E 730510.2 N	**Dates** 25/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					57.89	(0.13) 0.13	TARMACADAM		
0.50	B01				57.32	(0.57) 0.70	MADE GROUND: Brown slightly clayey very sandy subangular to subrounded fine to coarse GRAVEL with occasional subangular to subrounded cobbles		
							Complete at 0.70m		

Remarks
BH-02 terminated at 0.70m BGL due to obstruction.
Offset location and re-drill BH-02a
Chiselling from 0.70m to 0.70m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No. 10299-12-20.BH-02

Ground Investigations Ireland Ltd www.gii.ie			Site Greenhills Road	Borehole Number **BH-02A**
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 0.80m	**Ground Level (mOD)** 58.00	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location	**Dates** 28/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES01				57.90	0.10	TARMACADAM		
0.50	B01					(0.70)	MADE GROUND: Light brown slightly sandy gravelly Clay with occasional subangular to suborunded cobbles		
					57.20	0.80	Complete at 0.80m		

Remarks
BH-02A terminated at 1.20m BGL due to obstruction.
Chiselling from 0.80m to 0.80m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No.
10299-12-20.BH-02A

Ground Investigations Ireland Ltd www.gii.ie		Site: Greenhills Road	Borehole Number: BH-03
Machine : Dando 2000 Method : Cable Percussion	Casing Diameter: 200mm cased to 1.80m	Ground Level (mOD): 56.81	Client: Lohan and Donnelly	Job Number: 10299-12-20
	Location (dGPS): 710761.6 E 730546.6 N	Dates: 25/01/2021	Project Contractor: GII	Sheet: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					56.65	(0.16) 0.16	CONCRETE		
0.50	B01					(1.04)	MADE GROUND: Brown clayey gravelly fine to coarse Sand with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
1.00-1.29 1.00 1.00	SPT(C) 50/135 B02 ES01			1,2/19,31	55.61	1.20 (0.60)	Drillers note: Pushing cobble in front of casing. No recovery		
					55.01	1.80	Complete at 1.80m		

Remarks
BH-03 terminated at 1.80m BGL due to obstruction.
Offset location and re-drill BH-03a
Chiselling from 1.20m to 1.80m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No. 10299-12-20.BH-03

Ground Investigations Ireland Ltd www.gii.ie		Site: Greenhills Road	Borehole Number: BH-03A
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter:** 200mm cased to 1.20m **Ground Level (mOD):**	**Client:** Lohan and Donnelly	**Job Number:** 10299-12-20
	Location: **Dates:** 28/01/2021	**Project Contractor:** GII	**Sheet:** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.20	ES01					0.10	TARMACADAM		
0.50 0.50	B01 ES02					(0.90)	Possible MADE GROUND: Light brown slightly sandy slightly gravelly silty CLAY with occasional subangular to suborunded cobbles. Gravel is subangular to subrounded fine to coarse		
1.00-1.45 1.00	SPT(C) N=50 B02			6,7/14,22,14		1.00 (0.20) 1.20	Very stiff light brown slightly sandy slightly gravelly silty CLAY with occasional subangular to suborunded cobbles. Gravel is subangular to subrounded fine to coarse		
							Complete at 1.20m		

Remarks
BH-03A terminated at 1.20m BGL due to obstruction.
Chiselling from 1.20m to 1.20m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 10299-12-20.BH-03A

Ground Investigations Ireland Ltd www.gii.ie			Site: Greenhills Road	Borehole Number: **BH-04**
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 3.30m	**Ground Level (mOD)** 56.50	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710728.4 E 730621.4 N	**Dates** 27/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.70	ES01				56.30	(0.20) 0.20	TARMACADAM			
0.50	B01						Soft to firm light brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
1.00-1.45 1.00	SPT(C) N=8 B02			1,1/1,2,2,3		(1.50)				
1.70-3.00	ES02				54.80	1.70	Medium dense dark brown slightly clayey slightly gravelly SAND. Gravel is subangular to subrounded fine to coarse			
2.00-2.45 2.00	SPT(C) N=32 B03			3,3/6,7,10,9		(0.50)				
					54.30	2.20	Very stiff dark brown gravelly very sandy CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		1	
						(0.80)				
3.00-3.45 3.00 3.30	SPT(C) N=50 B04 B05			17,9/19,31 Water strike(1) at 3.20m, rose to 2.50m in 20 mins.	53.50	3.00	Dense grey slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL		1	
					53.20	(0.30) 3.30	Complete at 3.30m			

Remarks
BH-04 terminated at 3.30m BGL due to obstruction.
50mm slotted standpipe installed from 3.80m to 1.00m BGL with pea gravel surrond, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover
Chiselling from 3.30m to 3.30m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 10299-12-20.BH-04

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Borehole Number: BH-05

Machine : Dando 2000	Casing Diameter	Ground Level (mOD)	Client	Job Number
Method : Cable Percussion	200mm cased to 3.20m	56.30	Lohan and Donnelly	10299-12-20
	Location	**Dates**	**Project Contractor**	**Sheet**
	710790.6 E 730600.4 N	27/01/2021	GII	1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES01				56.10	(0.20) 0.20	CONCRETE		
					55.80	(0.30) 0.50	POSSIBLE MADE GROUND: Dark brown slightly silty slightly sandy slightly gravelly Clay		
0.50 0.50-2.40	B01 ES02								
1.00-1.45 1.00	SPT(C) N=5 B02			1,0/1,1,1,2	54.30	(1.50) 2.00	Soft dark brown mottled grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
2.00-2.45 2.00	SPT(C) N=17 B03			1,2/3,4,4,6	53.90	(0.40) 2.40	Stiff dark brown mottled grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		▼1
2.40-3.00	ES03				53.30	(0.60) 3.00	Stiff dark grey mottled brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse		
3.00-3.40 3.00	SPT(C) 50*/100 N=50 B04			50/50 Water strike(1) at 3.20m, rose to 2.20m in 20 mins.	53.10	(0.20) 3.20	Dense grey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles		∇1
							Complete at 3.20m		

Remarks	Scale (approx)	Logged By
BH-05 terminated at 3.20m BGL due to obstruction. Chiselling from 3.00m to 3.20m for 1 hour.	1:50	PM
	Figure No. 10299-12-20.BH-05	

Ground Investigations Ireland Ltd www.gii.ie		Site Greenhills Road	Borehole Number **BH-06**
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 3.30m **Location** 710836.6 E 730597.5 N	**Ground Level (mOD)** 55.97 **Dates** 27/01/2021	**Client** Lohan and Donnelly **Project Contractor** GII	**Job Number** 10299-12-20 **Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.30	ES01				55.87	0.10	TARMACADAM			
0.30-0.80	ES02				55.67	(0.20) 0.30	MADE GROUND: Dark brown slightly silty sandy fine to coarse subangular to subrounded Gravel			
0.50	B01					(0.50)	POSSIBLE MADE GROUND: Greyish brown slightly silty slightly gravelly sandy Clay with occasional subangular to subrounded cobbles. (reworked)			
0.80-3.00	ES03				55.17	0.80				
1.00-1.45 1.00	SPT(C) N=5 B02			1,0/1,1,1,2		(1.20)	Soft dark brown slightly sandy slightly gravelly silty CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
2.00-2.45 2.00	SPT(C) N=17 B03			1,2/3,4,4,6	53.97	2.00 (0.70)	Stiff dark brown slightly sandy slightly gravelly silty CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
				Water strike(1) at 2.70m, fell to 3.20m in 20 mins.	53.27	2.70 (0.60)	Dense grey slightly sandy silty subangular to subrounded fine to coarse GRAVEL Strong hydrocarbon odour odour noted at 3.30m BGL		∇1 ▼1	
3.00 3.00-3.40 3.00-3.30	B04 SPT(C) 50*/100 N=50 ES04			50/50	52.67	3.30	Complete at 3.30m			

Remarks
Strong hydrocarbon odour noted at 3.30m BGL.
BH-06 terminated at 3.30m BGL due to obstruction.
50mm slotted standpipe installed from 3.30m to 1.00m BGL with pea gravel surrond, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover
Chiselling from 1.20m to 1.20m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No.
10299-12-20.BH-06

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Borehole Number: BH-07

Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 3.10m	**Ground Level (mOD)** 55.57	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location (dGPS) 710845.7 E 730676.7 N	**Dates** 26/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					55.52	0.05	TARMACADAM		
0.50	B01					(1.25)	Possible MADE GROUND: Brown gravelly very clayey fine to coarse Sand		
1.00-1.45 1.00 1.00	SPT(C) N=15 B02 ES01			3,3/4,3,4,4					
					54.27	1.30 (0.70)	Medium dense grey sandy subangular to subrounded fine to coarse GRAVEL		
2.00-2.44 2.00	SPT(C) 50/285 B03			6,9/10,12,14,14	53.57	2.00 (0.60)	Dense grey sandy subangular to subrounded fine to coarse GRAVEL		
					52.97	2.60 (0.50)	Dense grey subangular to subrounded coarse GRAVEL with some to many subangular to subrounded cobbles		
3.00-3.12 3.00	SPT(C) 25*/100 50/20 B04			17,8/50	52.47	3.10	Complete at 3.10m		

Remarks
BH-07 terminated at 3.10m BGL due to obstruction.
Chiselling from 3.10m to 3.10m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No. 10299-12-20.BH-07

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Borehole Number: BH-08

Machine : Dando 2000 Method : Cable Percussion	Casing Diameter: 200mm cased to 3.80m	Ground Level (mOD): 55.36	Client: Lohan and Donnelly	Job Number: 10299-12-20
	Location (dGPS): 710867.4 E 730633.6 N	Dates: 26/01/2021	Project Contractor: GII	Sheet: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					55.26	0.10	TARMACADAM			
					55.06	(0.20) 0.30	Drillers Note: MADE GROUND: Gravel			
0.50	B01					(0.60)	MADE GROUND: Orangish brown slightly sandy slightly gravelly CLAY with organic odour			
1.00-1.45 1.00	SPT(C) N=20 B02			2,2/3,5,6,6	54.46	0.90 (0.70)	Medium dense dark brown clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse			
					53.76	1.60 (0.50)	Medium dense brown slightly gravelly very silty fine to coarse SAND. Gravel is subrounded fine to coarse			
2.00-2.45 2.00 2.00	SPT(C) N=14 B03 ES01			2,2/3,3,4,4	53.26	2.10 (0.40)	Drillers note: Brown sandy gravelly Clay (stiff)			
					52.86	2.50 (0.20)	Drillers note: pushing cobble in front of casing. No recovery			
3.00 3.00-3.29	B04 SPT(C) 50/135			Water strike(1) at 3.00m, rose to 2.90m in 20 mins, sealed at 3.20m. 6,9/17,33	52.66	2.70 (1.10)	Very stiff grey slightly sandy slightly gravelly CLAY. Gravely is subangular to subrounded fine to coarse		1 1	
3.80 3.80	B05 ES02				51.56	3.80	Complete at 3.80m			

Remarks
50mm slotted standpipe installed from 3.80m to 1.00m BGL with pea gravel surrond, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover
BH-08 terminated at 3.80m BGL due to obstruction.
Chiselling from 3.80m to 3.80m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No. 10299-12-20.BH-08

APPENDIX 4 – Laboratory Testing

National Materials Testing Laboratory Ltd.

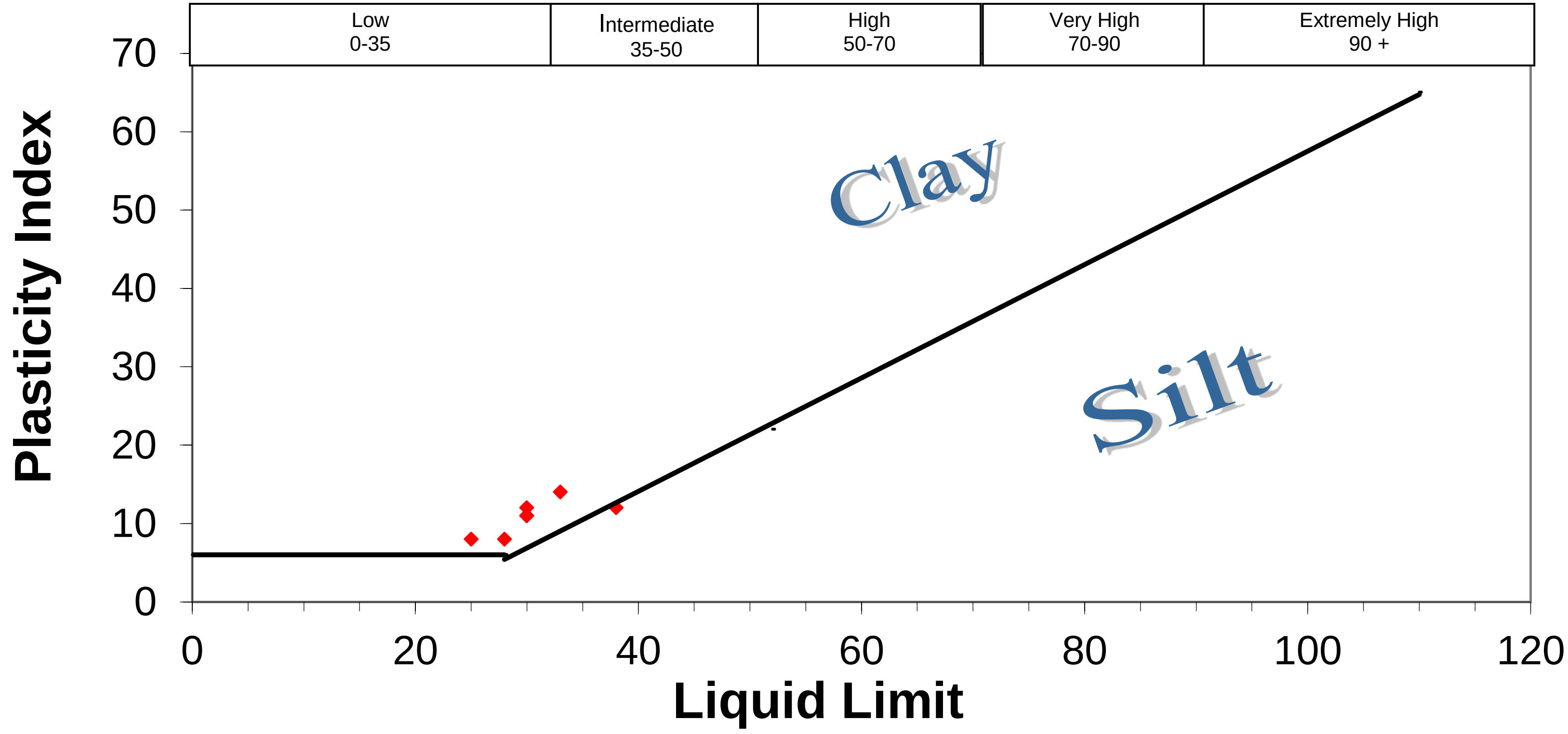
SUMMARY OF TEST RESULTS

				Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
BH01	2.00	B	4.0											
BH04	1.00	B	13.0		19.8	38	26	12						
BH04	2.00	B	11.4		29.8	25	17	8						
BH05	1.00	B	15.2		43.4	30	19	11						
BH05	2.00	B	14.9		63.3	30	19	11						
BH06	1.00	B	12.6		51.5	30	18	12						
BH06	2.00	B	15.1		58.2	33	19	14						
BH07	2.00	B	2.6											
BH08	1.00	B	13.2											
BH08	3.00	B	15.2		46.2	28	20	8						

NMTL		Notes :	Job ref No.	NMTL 3351	GII Project ID:	10299-12-20
		1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Greenhills Road		

Revision-02

NMTL LTD	**Contract:**	**Greenhills Road**			
Unit 18c, Tullow Industrial Estate	**Client:**	**Ground Investigations Ireland Ltd**			
Tullow	**Engineer:**	**James Cashen**			
County Carlow	**GII Project ID**	**10299-12-20**			
Tel: 00353 59 9180822	**Date:**	**01/03/2021**			
Mob: 00353 872575508	**Tested By:**	**Sb/Tch/Ms**	**Checked:**	**Bc**	
billa@nmtl.ie	**Job ref No.**	**NMTL 3351**			

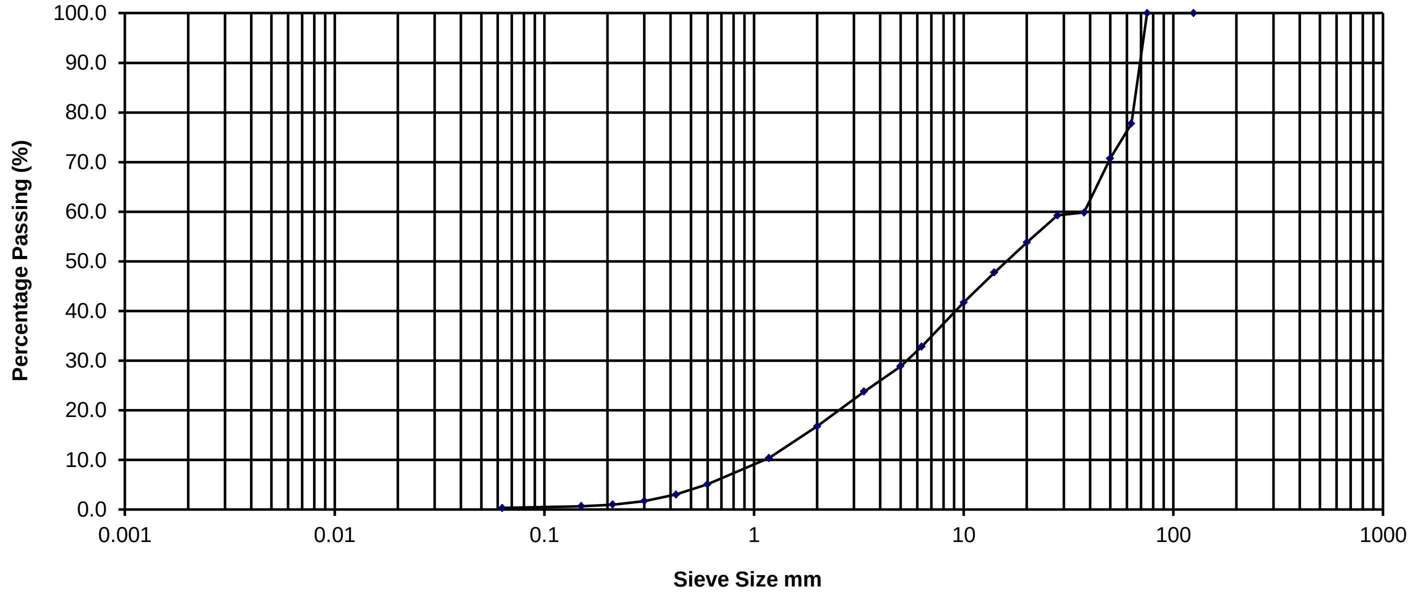


NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	77.7
50.000	70.7
37.500	59.9
28.000	59.2
20.000	53.8
14.000	47.8
10.000	41.7
6.300	32.8
5.000	28.9
3.350	23.8
2.000	16.8
1.180	10.4
0.600	5.1
0.425	3.0
0.300	1.7
0.212	1.0
0.150	0.7
0.063	0.3

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	0.3	16.4	61.0	22.3	0.0

Sample Description: Grey sandy fine to coarse GRAVEL.

Project: Greenhills Road

GII PROJECT ID:10299-12-20

Project No.	NMTL 3351
BH/TP No.	BH01
Sample No.	B
Depth	2.0m

NM TL Ltd

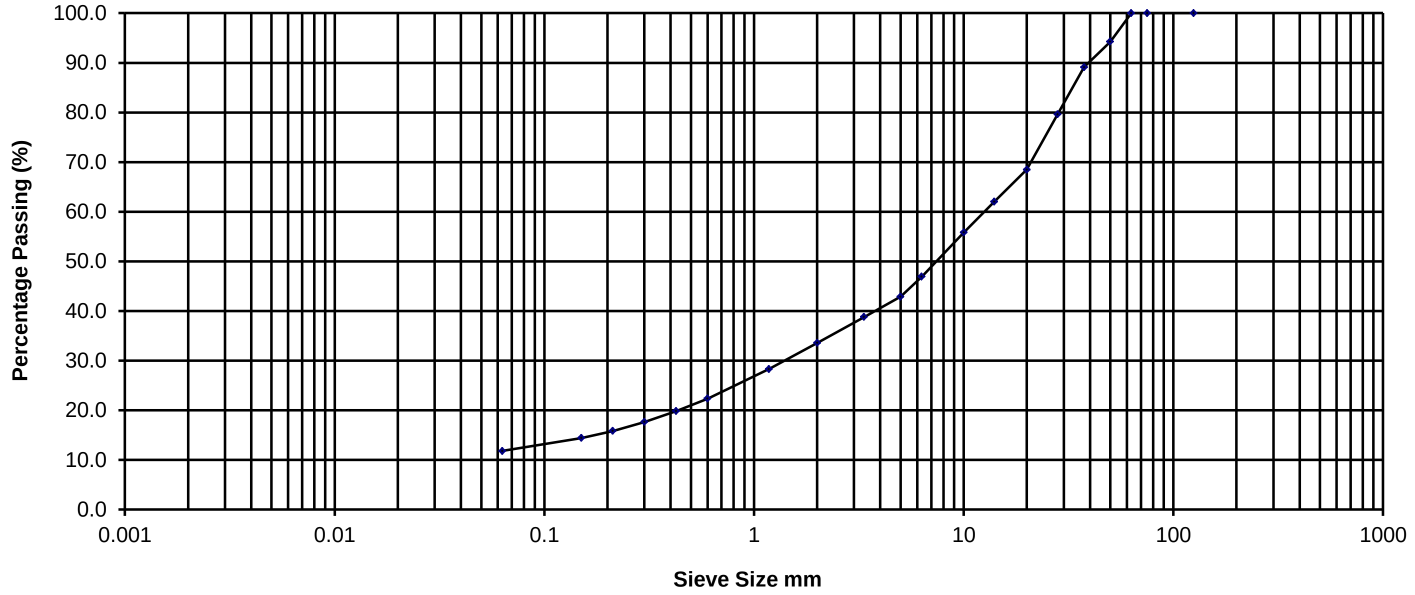
Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	94.2
37.500	89.1
28.000	79.6
20.000	68.5
14.000	62.0
10.000	55.8
6.300	46.9
5.000	42.9
3.350	38.8
2.000	33.6
1.180	28.3
0.600	22.4
0.425	19.8
0.300	17.6
0.212	15.8
0.150	14.4
0.063	11.8

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	11.8	21.8	66.4	0.0	0.0

Sample Description Brown clayey silty sandy GRAVEL.

Project No. NMTL 3351

BH/TP No. BH04

Project Greenhills Road GII PROJECT ID:10299-12-20

Sample No. B

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021	Depth	1.0m

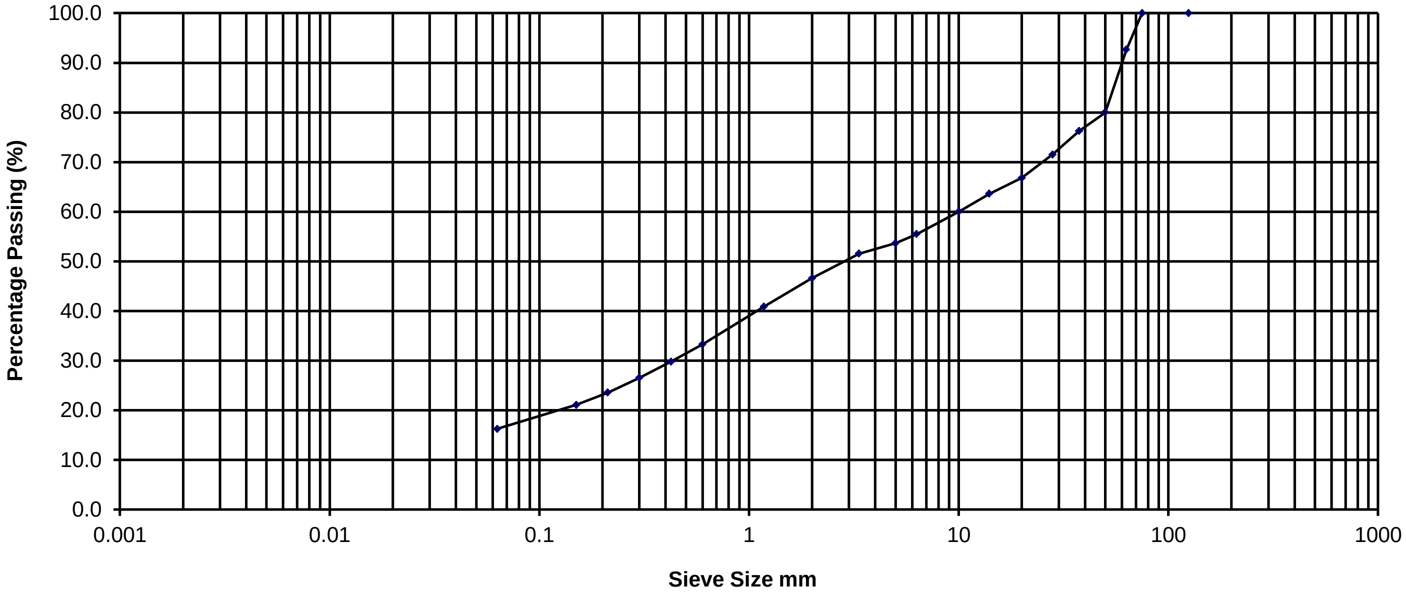
NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	92.6
50.000	80.0
37.500	76.2
28.000	71.5
20.000	66.8
14.000	63.6
10.000	60.0
6.300	55.5
5.000	53.6
3.350	51.6
2.000	46.6
1.180	40.9
0.600	33.3
0.425	29.8
0.300	26.5
0.212	23.6
0.150	21.1
0.063	16.3

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	16.3	30.3	46.0	7.4	0.0

Sample Description: Brown silty clayey very sandy GRAVEL.

Project: Greenhills Road

GII PROJECT ID:10299-12-20

Project No.	NMTL 3351
BH/TP No.	BH04
Sample No.	B
Depth	3.0m

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021

NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	90.7
37.500	87.3
28.000	81.3
20.000	79.0
14.000	75.1
10.000	69.3
6.300	64.4
5.000	62.0
3.350	59.8
2.000	56.1
1.180	52.3
0.600	46.7
0.425	43.4
0.300	39.6
0.212	35.7
0.150	32.1
0.063	25.5

Determination of Particle Size Distribution

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

Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	25.5			30.7			43.9			0.0	0.0

Sample Description	Brown slightly sandy gravelly silty CLAY.	Project No.	NMTL 3351
		BH/TP No.	BH05
Project	Greenhills Road GII PROJECT ID:10299-12-20	Sample No.	B

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021	Depth	1.00m

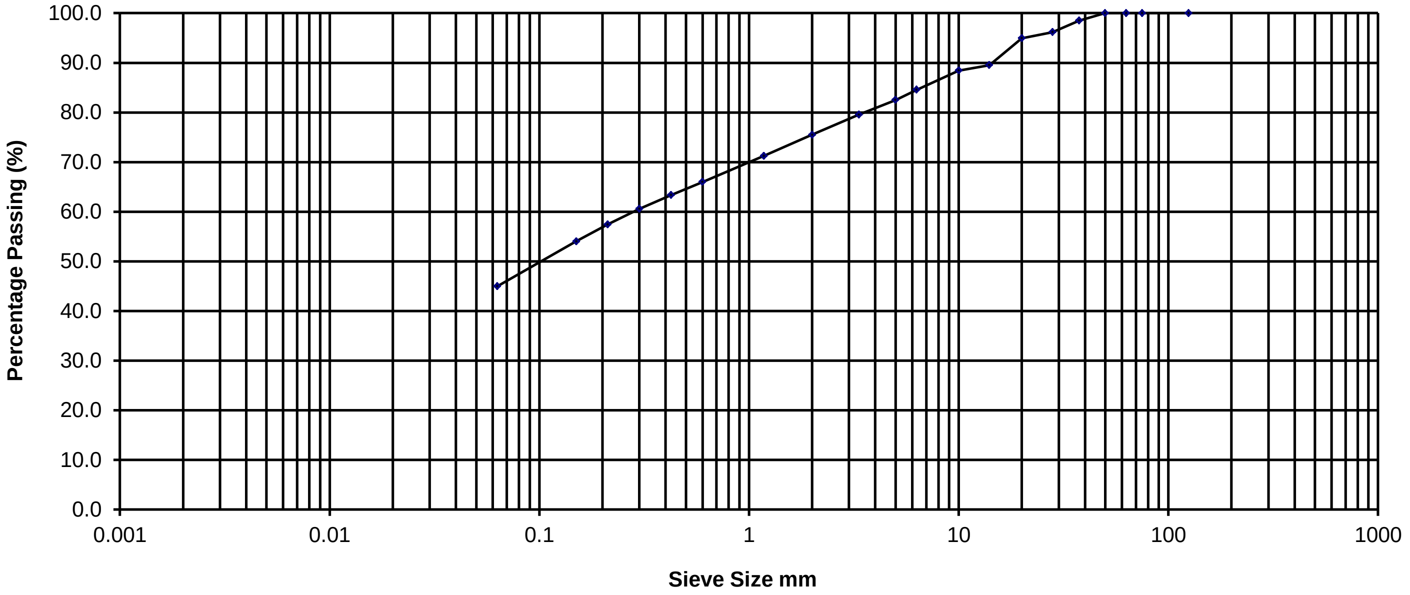
NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	98.5
28.000	96.2
20.000	94.9
14.000	89.5
10.000	88.5
6.300	84.6
5.000	82.5
3.350	79.6
2.000	75.5
1.180	71.3
0.600	66.0
0.425	63.3
0.300	60.6
0.212	57.5
0.150	54.0
0.063	45.0

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	45.0	30.5	24.5	0.0	0.0

Sample Description	Brown slightly gravelly slightly sandy silty CLAY.	Project No.	NMTL 3351
		BH/TP No.	BH05
Project	Greenhills Road GII PROJECT ID:10299-12-20	Sample No.	B

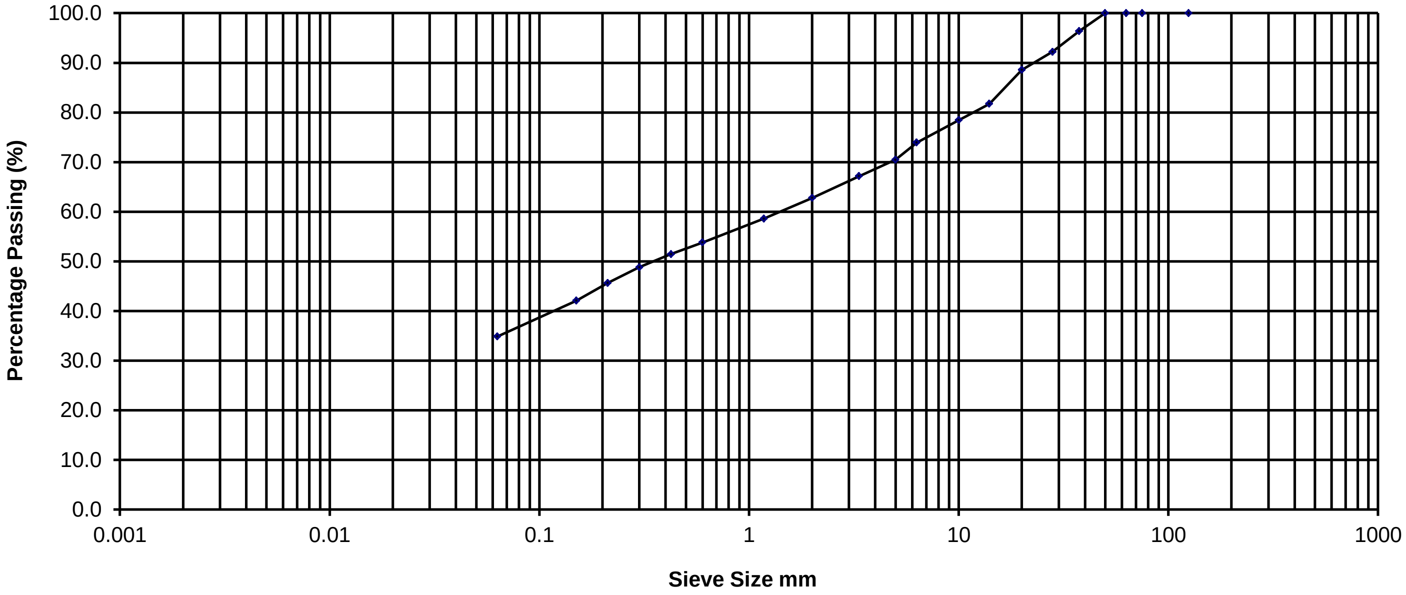
NM TL Ltd	Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested 25/02/2021	Depth	2.00m

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	96.4
28.000	92.2
20.000	88.6
14.000	81.7
10.000	78.5
6.300	73.9
5.000	70.5
3.350	67.2
2.000	62.8
1.180	58.6
0.600	53.8
0.425	51.5
0.300	48.8
0.212	45.7
0.150	42.1
0.063	34.9

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	34.9			27.9			37.2			0.0	0.0

Sample Description Brown slightly sandy slightly gravelly silty CLAY.

Project No. NMTL 3351
BH/TP No. BH06

Project Greenhills Road GII PROJECT ID:10299-12-20

Sample No. B

NM TL Ltd

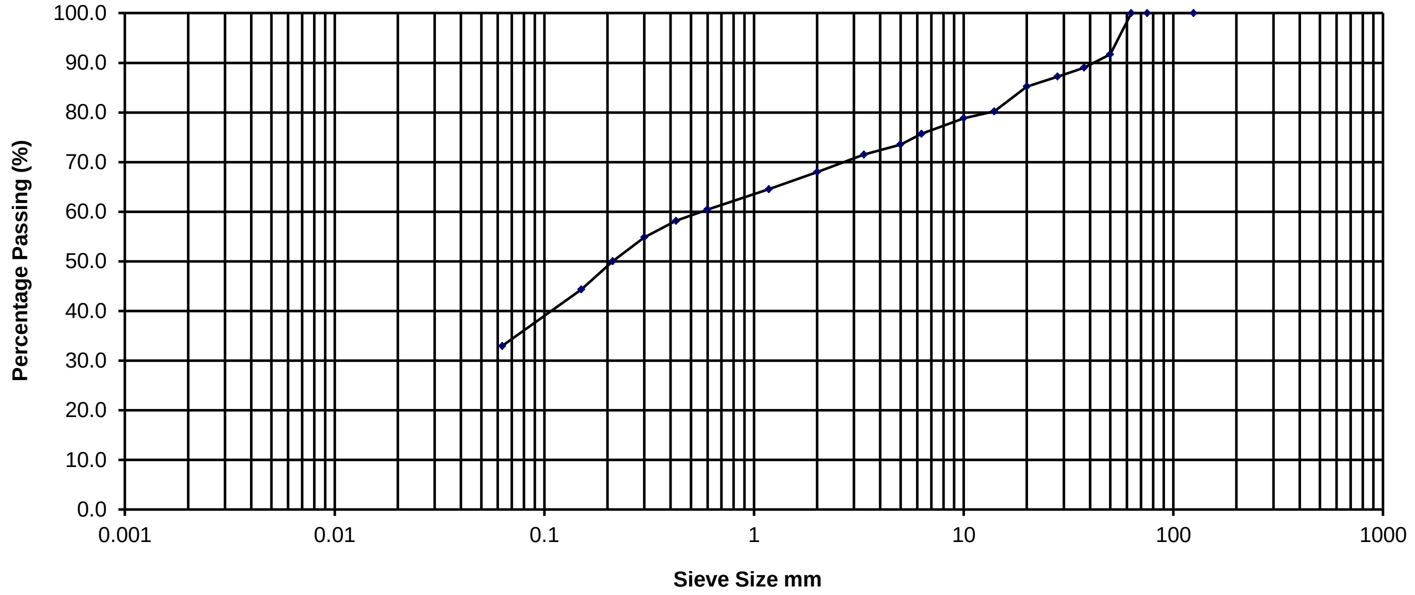
Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021	Depth	1.0m

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	91.7
37.500	89.0
28.000	87.2
20.000	85.2
14.000	80.2
10.000	78.8
6.300	75.7
5.000	73.6
3.350	71.5
2.000	68.0
1.180	64.6
0.600	60.4
0.425	58.2
0.300	54.8
0.212	50.0
0.150	44.3
0.063	32.9

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	32.9	35.0	32.0	0.0	0.0

Sample Description Brown slightly gravelly sandy silty CLAY.

Project Greenhills Road

GII PROJECT ID:10299-12-20

Project No.	NMTL 3351
BH/TP No.	BH06
Sample No.	B
Depth	2.0m

NM TL Ltd

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	93.2
50.000	83.8
37.500	76.4
28.000	66.1
20.000	55.4
14.000	43.5
10.000	37.1
6.300	28.1
5.000	23.6
3.350	19.7
2.000	12.0
1.180	6.4
0.600	3.5
0.425	2.8
0.300	2.4
0.212	2.0
0.150	1.8
0.063	1.3

Determination of Particle Size Distribution

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

Percentage Particle Size

Clay	Fine / Medium / Coarse	Fine / Medium / Coarse	Fine / Medium / Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	1.3	10.6	81.2	6.8	0.0

Sample Description	Grey slightly silty sandy GRAVEL.	Project No.	NMTL 3351
		BH/TP No.	BH07
Project	Greenhills Road — GII PROJECT ID:10299-12-20	Sample No.	B

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021	Depth	2.0m

NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	93.5
37.500	85.6
28.000	77.6
20.000	68.0
14.000	60.5
10.000	55.2
6.300	48.9
5.000	46.6
3.350	43.9
2.000	41.3
1.180	38.9
0.600	35.1
0.425	31.8
0.300	27.0
0.212	22.0
0.150	18.0
0.063	12.0

Determination of Particle Size Distribution

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

Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	12.0	29.3	58.7	0.0	0.0

Sample Description	Grey/brown silty very sandy GRAVEL.	Project No.	NMTL 3351
		BH/TP No.	BH08
Project	Greenhills Road GII PROJECT ID:10299-12-20	Sample No.	B

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021	Depth	1.00m

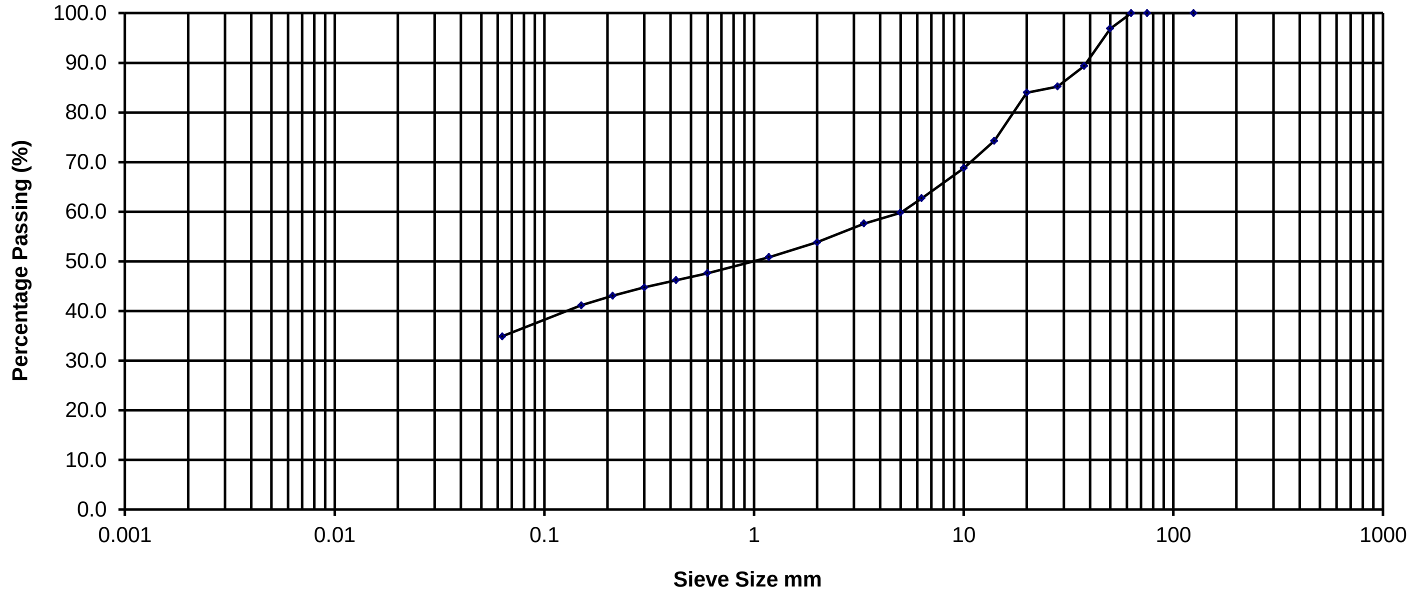
NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	96.9
37.500	89.4
28.000	85.2
20.000	84.0
14.000	74.3
10.000	68.8
6.300	62.7
5.000	59.8
3.350	57.6
2.000	53.8
1.180	50.8
0.600	47.6
0.425	46.2
0.300	44.8
0.212	43.1
0.150	41.2
0.063	34.9

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	34.9	19.0	46.2	0.0	0.0

Sample Description Brown/grey slightly sandy gravelly silty CLAY.

Project Greenhills Road

GII PROJECT ID:10299-12-20

Project No.	NMTL 3351
BH/TP No.	BH08
Sample No.	B
Depth	3.0m

NM TL Ltd

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021

Element Materials Technology
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Zone 3
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Deeside
CH5 2UA

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

Attention :	Barry Sexton
Date :	8th February, 2021
Your reference :	10299-12-20
Our reference :	Test Report 21/925 Batch 1
Location :	Greenhills Road
Date samples received :	25th January, 2021
Status :	Final report
Issue :	1

Twenty one samples were received for analysis on 25th January, 2021 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.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	1-3	13-15	22-24	28-29,63	33-35	39-41	45-47	57-59	60-62				
Sample ID	WS01	WS03	WS04	WS05	WS06	WS09	WS10	WS11	WS08A				
Depth	0.50	1.5	1.30	2.10	1.00	1.70	0.50	2.50	1.00				
COC No / misc													
Containers	V J T	V J T	V J T	J T V	V J T	V J T	V J T	V J T	V J T				
Sample Date	18/01/2021	18/01/2021	18/01/2021	19/01/2021	19/01/2021	19/01/2021	20/01/2021	20/01/2021	20/01/2021				
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	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021		LOD/LOR	Units	Method No.
Antimony	2	1	2	2	2	2	2	2	1		<1	mg/kg	TM30/PM15
Arsenic #	11.7	6.2	8.5	7.4	5.8	9.4	12.1	9.1	4.0		<0.5	mg/kg	TM30/PM15
Barium #	67	51	49	43	40	50	66	64	30		<1	mg/kg	TM30/PM15
Cadmium #	2.1	1.0	1.5	1.6	1.5	1.5	2.2	1.6	1.0		<0.1	mg/kg	TM30/PM15
Chromium #	51.0	30.9	37.9	24.6	66.4	67.7	42.6	34.8	71.7		<0.5	mg/kg	TM30/PM15
Copper #	27	14	19	21	15	25	29	22	11		<1	mg/kg	TM30/PM15
Lead #	35	23	13	12	8	13	18	11	11		<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM30/PM15
Molybdenum #	4.6	2.4	3.3	3.1	5.4	5.9	5.1	4.7	5.8		<0.1	mg/kg	TM30/PM15
Nickel #	34.0	17.6	26.1	25.6	21.7	44.4	37.9	31.3	13.4		<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1	<1	5	<1	1	1	<1	<1		<1	mg/kg	TM30/PM15
Zinc #	94	47	72	64	62	87	102	83	45		<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	0.08	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.08	<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	0.18	<0.04	<0.04	<0.04	<0.04	<0.04	0.06	<0.04		<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	0.27	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	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	0.11	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05		<0.03	mg/kg	TM4/PM8
Pyrene #	0.03	0.11	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.04		<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	0.08	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	mg/kg	TM4/PM8
Chrysene #	0.02	0.07	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	0.12	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07		<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<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	<0.04		<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	<0.04		<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	0.23	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22		<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	1.10	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64		<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<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	91	95	96	100	97	98	93	108	111		<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30	116	<30	<30	<30	<30	<30	225	<30		<30	mg/kg	TM5/PM8/PM16

Element Materials Technology

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	10299-12-20		
Location:	Greenhills Road	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Barry Sexton		
EMT Job No:	21/925		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	13-15	22-24	28-29,63	33-35	39-41	45-47	57-59	60-62				
Sample ID	WS01	WS03	WS04	WS05	WS06	WS09	WS10	WS11	WS08A				
Depth	0.50	1.5	1.30	2.10	1.00	1.70	0.50	2.50	1.00				
COC No / misc													
Containers	V J T	V J T	V J T	J T V	V J T	V J T	V J T	V J T	V J T				
Sample Date	18/01/2021	18/01/2021	18/01/2021	19/01/2021	19/01/2021	19/01/2021	20/01/2021	20/01/2021	20/01/2021				
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	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021				
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL) #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) #	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	9.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.3	<0.1		<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL) #	<0.2	18.2	<0.2	<0.2	<0.2	<0.2	<0.2	21.8	<0.2		<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) #	<4	49	<4	<4	<4	<4	<4	90	<4		<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) #	<7	49	<7	<7	<7	<7	<7	85	<7		<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL) #	<7	<7	<7	<7	<7	<7	<7	28	<7		<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	126	<26	<26	<26	<26	<26	227	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	9.6	<0.1	<0.1	<0.1	<0.1	<0.1	2.3	<0.1		<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	126	<10	<10	<10	<10	<10	206	<10		<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	<10	<10	<10	<10	<10	<10	<10	<10		<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR) #	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) #	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR) #	<0.2	14.8	<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	50	<4	<4	<4	<4	<4	31	<4		<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) #	<7	49	<7	<7	<7	<7	<7	52	<7		<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) #	<7	15	<7	<7	<7	<7	<7	16	<7		<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	129	<26	<26	<26	<26	<26	99	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	255	<52	<52	<52	<52	<52	326	<52		<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR) #	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	<10	141	<10	<10	<10	<10	<10	84	<10		<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	<10	<10	<10	<10	<10	<10	<10	<10		<10	mg/kg	TM5/PM8/PM16
MTBE #	<5	11	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Benzene #	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Toluene #	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	46	<5	<5	<5	<5	<5	15	<5		<5	ug/kg	TM36/PM12
m/p-Xylene #	<5	182	<5	<5	<5	<5	<5	42	<5		<5	ug/kg	TM36/PM12
o-Xylene #	<5	188	<5	<5	<5	<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

Element Materials Technology

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	10299-12-20		
Location:	Greenhills Road	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Barry Sexton		
EMT Job No:	21/925		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	13-15	22-24	28-29,63	33-35	39-41	45-47	57-59	60-62				
Sample ID	WS01	WS03	WS04	WS05	WS06	WS09	WS10	WS11	WS08A				
Depth	0.50	1.5	1.30	2.10	1.00	1.70	0.50	2.50	1.00				
COC No / misc													
Containers	V J T	V J T	V J T	J T V	V J T	V J T	V J T	V J T	V J T				
Sample Date	18/01/2021	18/01/2021	18/01/2021	19/01/2021	19/01/2021	19/01/2021	20/01/2021	20/01/2021	20/01/2021				
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	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021				
Natural Moisture Content	14.2	18.4	7.2	12.5	11.9	8.7	14.3	13.8	6.6		<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	12.4	15.5	6.8	11.1	10.7	8.0	12.5	12.1	6.2		<0.1	%	PM4/PM0
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
Chromium III	51.0	30.9	37.9	24.6	66.4	67.7	42.6	34.8	71.7		<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.89	0.61	0.38	0.38	0.36	0.45	0.67	0.35	0.34		<0.02	%	TM21/PM24
pH #	8.21	7.73	8.61	8.77	8.27	8.41	8.19	8.18	8.55		<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1016	0.1129	0.0989	0.1031	0.1029	0.1011	0.1136	0.1002	0.0964			kg	NONE/PM17
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

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All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name:	Ground Investigations Ireland
Reference:	10299-12-20
Location:	Greenhills Road
Contact:	Barry Sexton
EMT Job No:	21/925

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.	1-3	13-15	22-24	28-29,63	33-35	39-41	45-47	57-59	60-62		LOD/LOR	Units	Method No.
Sample ID	WS01	WS03	WS04	WS05	WS06	WS09	WS10	WS11	WS08A				
Depth	0.50	1.5	1.30	2.10	1.00	1.70	0.50	2.50	1.00				
COC No / misc													
Containers	V J T	V J T	V J T	J T V	V J T	V J T	V J T	V J T	V J T				
Sample Date	18/01/2021	18/01/2021	18/01/2021	19/01/2021	19/01/2021	19/01/2021	20/01/2021	20/01/2021	20/01/2021				
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	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021				
Dissolved Antimony #	<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 Antimony (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 Arsenic #	<0.0025	0.0127	0.0026	<0.0025	<0.0025	0.0027	<0.0025	<0.0025	<0.0025		<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	0.127	0.026	<0.025	<0.025	0.027	<0.025	<0.025	<0.025		<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.007	0.053	0.021	0.006	0.003	0.004	0.017	0.005	0.005		<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.07	0.53	0.21	0.06	<0.03	0.04	0.17	0.05	0.05		<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	<0.0015	<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	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 #	0.007	0.047	0.008	0.008	<0.002	0.006	0.012	0.016	0.010		<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.07	0.47	0.08	0.08	<0.02	0.06	0.12	0.16	0.10		<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	0.004	<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	0.04	<0.03	<0.03		<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	0.004	0.003	0.004	0.005	0.003	<0.003	<0.003	<0.003		<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	0.04	<0.03	0.04	0.05	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	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	<0.3	<0.3	<0.3	<0.3	<0.3		<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	4	<3	<3	<3	<3	<3		<3	mg/kg	TM173/PM0
Sulphate as SO4 #	24.8	<0.5	3.8	2.2	2.6	3.1	20.2	1.4	15.7		<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	248	<5	38	22	26	31	202	14	157		<5	mg/kg	TM38/PM0
Chloride #	0.5	2.9	0.6	0.4	0.5	2.8	1.4	<0.3	0.5		<0.3	mg/l	TM38/PM0
Chloride #	5	29	6	4	5	28	14	<3	5		<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	4	14	4	3	3	3	5	2	7		<2	mg/l	TM60/PM0
Dissolved Organic Carbon	40	140	40	30	30	30	50	20	70		<20	mg/kg	TM60/PM0
pH	8.38	8.29	8.52	8.65	8.44	8.44	8.05	8.13	8.01		<0.01	pH units	TM73/PM0
Total Dissolved Solids #	103	148	57	41	46	88	245	<35	72		<35	mg/l	TM20/PM0
Total Dissolved Solids #	1030	1480	570	410	460	880	2451	<350	720		<350	mg/kg	TM20/PM0

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Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	1-3	13-15	22-24	28-29,63	33-35	39-41	45-47	57-59	60-62		Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	WS01	WS03	WS04	WS05	WS06	WS09	WS10	WS11	WS08A							
Depth	0.50	1.5	1.30	2.10	1.00	1.70	0.50	2.50	1.00							
COC No / misc																
Containers	V J T	V J T	V J T	J T V	V J T	V J T	V J T	V J T	V J T							
Sample Date	18/01/2021	18/01/2021	18/01/2021	19/01/2021	19/01/2021	19/01/2021	20/01/2021	20/01/2021	20/01/2021							
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	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021							
Solid Waste Analysis																
Total Organic Carbon #	0.89	0.61	0.38	0.38	0.36	0.45	0.67	0.35	0.34		3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	0.416	<0.025	<0.025	<0.025	<0.025	<0.025	0.057	<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	116	<30	<30	<30	<30	<30	225	<30		500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	0.23	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22		-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	1.10	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64		100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	0.127	0.026	<0.025	<0.025	0.027	<0.025	<0.025	<0.025		0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.07	0.53	0.21	0.06	<0.03	0.04	0.17	0.05	0.05		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	<0.015	<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		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 #	0.07	0.47	0.08	0.08	<0.02	0.06	0.12	0.16	0.10		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	<0.02	<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	0.04	<0.03	<0.03		0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	0.04	<0.03	0.04	0.05	0.03	<0.03	<0.03	<0.03		4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	1030	1480	570	410	460	880	2451	<350	720		4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	40	140	40	30	30	30	50	20	70		500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	88.7	79.8	91.2	87.7	87.5	88.8	79.5	89.6	93.4		-	-	-	<0.1	%	NONE/PM4
pH #	8.21	7.73	8.61	8.77	8.27	8.41	8.19	8.18	8.55		-	-	-	<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	<3	<3	<3	<3	<3		-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	248	<5	38	22	26	31	202	14	157		1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	5	29	6	4	5	28	14	<3	5		800	15000	25000	<3	mg/kg	TM38/PM0

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Client Name: Ground Investigations Ireland

Reference: 10299-12-20

Location: Greenhills Road

Contact: Barry Sexton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
21/925	1	WS01	0.50	1-3	No interpretation possible
21/925	1	WS03	1.5	13-15	Possible degraded diesel
21/925	1	WS04	1.30	22-24	No interpretation possible
21/925	1	WS05	2.10	28-29,63	No interpretation possible
21/925	1	WS06	1.00	33-35	No interpretation possible
21/925	1	WS09	1.70	39-41	No interpretation possible
21/925	1	WS10	0.50	45-47	No interpretation possible
21/925	1	WS11	2.50	57-59	Possible degraded diesel
21/925	1	WS08A	1.00	60-62	No interpretation possible

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

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). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

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

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/925	1	WS01	0.50	2	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS03	1.5	14	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS04	1.30	23	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS05	2.10	28	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS06	1.00	34	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS09	1.70	40	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS10	0.50	46	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/925	1	WS10	0.50	46	27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS11	2.50	58	27/01/2021	**General Description (Bulk Analysis)**	soil/stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS08A	1.00	61	27/01/2021	**General Description (Bulk Analysis)**	soil/stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 21/925						

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

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 21/925

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an 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 or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

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 extracted.
#2	EU_Total but with fatty acids extracted.
_	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: 21/925

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, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

EMT Job No: 21/925

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	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	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	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 (comparabl	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 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
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: 21/925

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 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	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.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

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

Attention :	Barry Sexton
Date :	17th February, 2021
Your reference :	10299-12-20
Our reference :	Test Report 21/925 Batch 2
Location :	Greenhills Road
Date samples received :	28th January, 2021
Status :	Final report
Issue :	1

Five samples were received for analysis on 28th January, 2021 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology Environmental UK Limited
Registered in England and Wales
Registered Office: 10 Lower Grosvenor Place, London, SW1W 0EN
Company Registration No: 11371415

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	64-66	67-69	70-72	73-75	LOD/LOR	Units	Method No.
Sample ID	BH01	BH03	BH07	BH08			
Depth	0.20	1.00	1.00	2.00			
COC No / misc							
Containers	V J T	V J T	V J T	V J T			
Sample Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021			
Sample Type	Soil	Soil	Soil	Soil			
Batch Number	2	2	2	2			
Date of Receipt	28/01/2021	28/01/2021	28/01/2021	28/01/2021			
Antimony	1	1	1	2	<1	mg/kg	TM30/PM15
Arsenic #	14.0	7.0	6.1	7.4	<0.5	mg/kg	TM30/PM15
Barium #	53	58	58	49	<1	mg/kg	TM30/PM15
Cadmium #	1.4	2.1	1.8	2.2	<0.1	mg/kg	TM30/PM15
Chromium #	37.7	35.8	36.9	39.2	<0.5	mg/kg	TM30/PM15
Copper #	19	27	48	121	<1	mg/kg	TM30/PM15
Lead #	10	11	12	16	<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	3.6	4.5	3.8	3.6	<0.1	mg/kg	TM30/PM15
Nickel #	21.7	28.5	27.7	35.7	<0.7	mg/kg	TM30/PM15
Selenium #	1	1	1	7	<1	mg/kg	TM30/PM15
Zinc #	54	84	80	101	<5	mg/kg	TM30/PM15
PAH MS							
Naphthalene #	<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	mg/kg	TM4/PM8
Acenaphthene #	<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	mg/kg	TM4/PM8
Phenanthrene #	<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	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<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	mg/kg	TM4/PM8
Coronene	<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	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	93	88	93	94	<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_Total)	73	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	10299-12-20		
Location:	Greenhills Road	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Barry Sexton		
EMT Job No:	21/925		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	64-66	67-69	70-72	73-75									
Sample ID	BH01	BH03	BH07	BH08									
Depth	0.20	1.00	1.00	2.00									
COC No / misc													
Containers	V J T	V J T	V J T	V J T									
Sample Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	2	2	2	2							LOD/LOR	Units	Method No.
Date of Receipt	28/01/2021	28/01/2021	28/01/2021	28/01/2021									
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<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	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<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	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4	<4	<4							<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	56	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	17	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	73	<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	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	<10	<10	<10							<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	46	<10	<10	<10							<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<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	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<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	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	<4	<4	<4							<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	12	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	106	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	40	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	158	<26	<26	<26							<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	231	<52	<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	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	25	<10	<10	<10							<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	90	<10	<10	<10							<10	mg/kg	TM5/PM8/PM16
MTBE#	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
Benzene#	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
Toluene#	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
m/p-Xylene#	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
o-Xylene#	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
PCB 28#	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 52#	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 101#	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 118#	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 138#	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 153#	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 180#	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	<35	<35	<35							<35	ug/kg	TM17/PM8

All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	64-66	67-69	70-72	73-75									
Sample ID	BH01	BH03	BH07	BH08									
Depth	0.20	1.00	1.00	2.00									
COC No / misc													
Containers	V J T	V J T	V J T	V J T									
Sample Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	2	2	2	2									
Date of Receipt	28/01/2021	28/01/2021	28/01/2021	28/01/2021							LOD/LOR	Units	Method No.
Natural Moisture Content	8.5	14.7	13.8	22.0							<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	7.8	12.8	12.1	18.0							<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3							<0.3	mg/kg	TM38/PM20
Chromium III	37.7	35.8	36.9	39.2							<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.34	0.32	0.30	0.29							<0.02	%	TM21/PM24
pH #	8.78	8.73	8.60	8.09							<0.01	pH units	TM73/PM11
Mass of raw test portion	0.0972	0.1015	0.1035	0.1221								kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09								kg	NONE/PM17

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	64-66	67-69	70-72	73-75							LOD/LOR	Units	Method No.
Sample ID	BH01	BH03	BH07	BH08									
Depth	0.20	1.00	1.00	2.00									
COC No / misc													
Containers	V J T	V J T	V J T	V J T									
Sample Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	2	2	2	2									
Date of Receipt	28/01/2021	28/01/2021	28/01/2021	28/01/2021									
Dissolved Antimony #	<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	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025							<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	<0.025							<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	0.005	<0.003	0.004							<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	0.05	<0.03	0.04							<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<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	mg/kg	TM30/PM17
Dissolved Chromium #	<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	mg/kg	TM30/PM17
Dissolved Copper #	<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	mg/kg	TM30/PM17
Dissolved Lead #	<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	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.006	0.013	0.007	0.004							<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.06	0.13	0.07	0.04							<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<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	mg/kg	TM30/PM17
Dissolved Selenium #	<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	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	0.003	0.004	<0.003							<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	0.04	<0.03							<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<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	mg/kg	TM61/PM0
Phenol	<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	mg/kg	TM26/PM0
Fluoride	<0.3	<0.3	<0.3	<0.3							<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3							<3	mg/kg	TM173/PM0
Sulphate as SO4 #	1.7	1.1	0.7	1.4							<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	17	11	7	14							<5	mg/kg	TM38/PM0
Chloride #	<0.3	0.3	0.5	<0.3							<0.3	mg/l	TM38/PM0
Chloride #	<3	<3	5	<3							<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	2	3	<2							<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	<20	30	<20							<20	mg/kg	TM60/PM0
pH	8.58	8.47	8.17	8.06							<0.01	pH units	TM73/PM0
Total Dissolved Solids #	<35	<35	<35	52							<35	mg/l	TM20/PM0
Total Dissolved Solids #	<350	<350	<350	520							<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.

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	64-66	67-69	70-72	73-75											
Sample ID	BH01	BH03	BH07	BH08											
Depth	0.20	1.00	1.00	2.00											
COC No / misc															
Containers	V J T	V J T	V J T	V J T											
Sample Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021											
Sample Type	Soil	Soil	Soil	Soil											
Batch Number	2	2	2	2											
Date of Receipt	28/01/2021	28/01/2021	28/01/2021	28/01/2021							Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Solid Waste Analysis															
Total Organic Carbon #	0.34	0.32	0.30	0.29							3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<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							1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	73	<30	<30	<30							500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	<0.22	<0.22							-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64							100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate															
Arsenic #	<0.025	<0.025	<0.025	<0.025							0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	0.05	<0.03	0.04							20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<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							0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<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							0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.06	0.13	0.07	0.04							0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<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							0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<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							0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	0.04	<0.03							4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	<350	<350	<350	520							4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	<20	30	<20							500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	92.2	88.2	86.9	73.4							-	-	-	<0.1	%	NONE/PM4
pH #	8.78	8.73	8.60	8.09							-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1							1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	<3	<3	<3							-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	17	11	7	14							1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	<3	5	<3							800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland

Reference: 10299-12-20

Location: Greenhills Road

Contact: Barry Sexton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
21/925	2	BH01	0.20	64-66	Possible trace tarmac/bitumen
21/925	2	BH03	1.00	67-69	No interpretation possible
21/925	2	BH07	1.00	70-72	No interpretation possible
21/925	2	BH08	2.00	73-75	No interpretation possible

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

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). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

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

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/925	2	BH01	0.20	65	09/02/2021	**General Description (Bulk Analysis)**	Soil/Stone
					09/02/2021	**Asbestos Fibres**	NAD
					09/02/2021	**Asbestos ACM**	NAD
					09/02/2021	**Asbestos Type**	NAD
					09/02/2021	**Asbestos Level Screen**	NAD
21/925	2	BH03	1.00	68	09/02/2021	**General Description (Bulk Analysis)**	Soil/Stone
					09/02/2021	**Asbestos Fibres**	NAD
					09/02/2021	**Asbestos ACM**	NAD
					09/02/2021	**Asbestos Type**	NAD
					09/02/2021	**Asbestos Level Screen**	NAD
21/925	2	BH07	1.00	71	09/02/2021	**General Description (Bulk Analysis)**	Soil/Stone
					09/02/2021	**Asbestos Fibres**	NAD
					09/02/2021	**Asbestos ACM**	NAD
					09/02/2021	**Asbestos Type**	NAD
					09/02/2021	**Asbestos Level Screen**	NAD
21/925	2	BH08	2.00	74	09/02/2021	**General Description (Bulk Analysis)**	Soil/Stone
					09/02/2021	**Asbestos Fibres**	NAD
					09/02/2021	**Asbestos ACM**	NAD
					09/02/2021	**Asbestos Type**	NAD
					09/02/2021	**Asbestos Level Screen**	NAD

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 21/925						

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.

EMT Job No.: 21/925

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an 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 or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

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 extracted.
#2	EU_Total but with fatty acids extracted.
_	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: 21/925

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, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

EMT Job No: 21/925

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	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	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	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: 21/925

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 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	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.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

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4225

Attention :	Barry Sexton
Date :	3rd March, 2021
Your reference :	10299-12-20
Our reference :	Test Report 21/1882 Batch 1
Location :	Greenhills Road
Date samples received :	11th February, 2021
Status :	Final report
Issue :	2

Eleven samples were received for analysis on 11th February, 2021 of which six were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	4-6	7-9	16-18	28-30	31-33					LOD/LOR	Units	Method No.
Sample ID	BH-02A	BH-03A	BH-04	BH-05	BH-06	BH-06							
Depth	0.00-0.50	0.00-1.20	0.00-1.70	0.50-2.40	0.80-3.00	3.00-3.30							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Solid							
Batch Number	1	1	1	1	1	1							
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021							
Antimony	<1	-	1	2	-	1					<1	mg/kg	TM30/PM15
Arsenic	-	-	-	-	-	5.0					<0.5	mg/kg	TM30/PM15
Arsenic #	6.2	-	11.1	9.7	-	-					<0.5	mg/kg	TM30/PM15
Barium	-	-	-	-	-	50					<1	mg/kg	TM30/PM15
Barium #	41	-	52	60	-	-					<1	mg/kg	TM30/PM15
Cadmium	-	-	-	-	-	1.2					<0.1	mg/kg	TM30/PM15
Cadmium #	1.5	-	0.9	1.8	-	-					<0.1	mg/kg	TM30/PM15
Chromium	-	-	-	-	-	30.1					<0.5	mg/kg	TM30/PM15
Chromium #	32.6	-	51.1	35.9	-	-					<0.5	mg/kg	TM30/PM15
Copper	-	-	-	-	-	9					<1	mg/kg	TM30/PM15
Copper #	16	-	17	27	-	-					<1	mg/kg	TM30/PM15
Lead	-	-	-	-	-	7					<5	mg/kg	TM30/PM15
Lead #	12	-	16	16	-	-					<5	mg/kg	TM30/PM15
Mercury	-	-	-	-	-	<0.1					<0.1	mg/kg	TM30/PM15
Mercury #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM30/PM15
Molybdenum	-	-	-	-	-	2.7					<0.1	mg/kg	TM30/PM15
Molybdenum #	3.0	-	3.6	3.8	-	-					<0.1	mg/kg	TM30/PM15
Nickel	-	-	-	-	-	12.4					<0.7	mg/kg	TM30/PM15
Nickel #	19.4	-	22.2	33.6	-	-					<0.7	mg/kg	TM30/PM15
Selenium	-	-	-	-	-	<1					<1	mg/kg	TM30/PM15
Selenium #	<1	-	<1	1	-	-					<1	mg/kg	TM30/PM15
Zinc	-	-	-	-	-	61					<5	mg/kg	TM30/PM15
Zinc #	50	-	60	80	-	-					<5	mg/kg	TM30/PM15

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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: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	4-6	7-9	16-18	28-30	31-33							
Sample ID	BH-02A	BH-03A	BH-04	BH-05	BH-06	BH-06							
Depth	0.00-0.50	0.00-1.20	0.00-1.70	0.50-2.40	0.80-3.00	3.00-3.30							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Solid							
Batch Number	1	1	1	1	1	1					LOD/LOR	Units	Method No.
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021							
PAH MS													
Naphthalene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Naphthalene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	-	<0.03	<0.03	-	<0.03					<0.03	mg/kg	TM4/PM8
Acenaphthene	-	-	-	-	-	<0.05					<0.05	mg/kg	TM4/PM8
Acenaphthene #	<0.05	-	<0.05	<0.05	-	-					<0.05	mg/kg	TM4/PM8
Fluorene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Fluorene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Phenanthrene	-	-	-	-	-	<0.03					<0.03	mg/kg	TM4/PM8
Phenanthrene #	<0.03	-	<0.03	0.07	-	-					<0.03	mg/kg	TM4/PM8
Anthracene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Anthracene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Fluoranthene	-	-	-	-	-	<0.03					<0.03	mg/kg	TM4/PM8
Fluoranthene #	<0.03	-	<0.03	0.11	-	-					<0.03	mg/kg	TM4/PM8
Pyrene	-	-	-	-	-	<0.03					<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	-	<0.03	0.11	-	-					<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene	-	-	-	-	-	<0.06					<0.06	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	-	<0.06	0.10	-	-					<0.06	mg/kg	TM4/PM8
Chrysene	-	-	-	-	-	<0.02					<0.02	mg/kg	TM4/PM8
Chrysene #	<0.02	-	<0.02	0.08	-	-					<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene	-	-	-	-	-	<0.07					<0.07	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	-	<0.07	0.14	-	-					<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	-	<0.04	0.06	-	-					<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Coronene	<0.04	-	<0.04	<0.04	-	<0.04					<0.04	mg/kg	TM4/PM8
PAH 6 Total	-	-	-	-	-	<0.22					<0.22	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	-	<0.22	0.31	-	-					<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	-	<0.64	0.67	-	<0.64					<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	-	<0.05	0.10	-	<0.05					<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	-	<0.02	0.04	-	<0.02					<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	-	<1	<1	-	<1					<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	91	-	90	88	-	92					<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	42	-	<30	<30	-	160					<30	mg/kg	TM5/PM8/PM16

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	4-6	7-9	16-18	28-30	31-33					LOD/LOR	Units	Method No.
Sample ID	BH-02A	BH-03A	BH-04	BH-05	BH-06	BH-06							
Depth	0.00-0.50	0.00-1.20	0.00-1.70	0.50-2.40	0.80-3.00	3.00-3.30							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Solid							
Batch Number	1	1	1	1	1	1							
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021							
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>C5-C6 (HS_1D_AL) #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) #	<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	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)	-	-	-	-	-	10.2					<0.2	mg/kg	TM5/PM8/PM16
>C10-C12 (EH_CU_1D_AL) #	<0.2	-	<0.2	<0.2	-	-					<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)	-	-	-	-	-	62					<4	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) #	10	-	<4	<4	-	-					<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)	-	-	-	-	-	65					<7	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) #	20	-	<7	<7	-	-					<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)	-	-	-	-	-	23					<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL) #	12	-	<7	<7	-	-					<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	-	<7	<7	-	<7					<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	42	-	<26	<26	-	160					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	-	<0.1	<0.1	-	0.1					<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	35	-	<10	<10	-	167					<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	-	<10	<10	-	<10					<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>C5-EC7 (HS_1D_AR) #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)	-	-	-	-	-	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>EC10-EC12 (EH_CU_1D_AR) #	<0.2	-	<0.2	<0.2	-	-					<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)	-	-	-	-	-	28					<4	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) #	<4	-	<4	<4	-	-					<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)	-	-	-	-	-	52					<7	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) #	<7	-	<7	<7	-	-					<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)	-	-	-	-	-	15					<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) #	<7	-	<7	<7	-	-					<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	-	<7	<7	-	<7					<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	-	<26	<26	-	95					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	-	<52	<52	-	255					<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>EC6-EC10 (HS_1D_AR) #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	<10	-	<10	<10	-	102					<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	-	<10	<10	-	<10					<10	mg/kg	TM5/PM8/PM16
MTBE	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12

Element Materials Technology

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	10299-12-20		
Location:	Greenhills Road	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Barry Sexton		
EMT Job No:	21/1882		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	16-18	28-30	31-33							
Sample ID	BH-02A	BH-03A	BH-04	BH-05	BH-06	BH-06							
Depth	0.00-0.50	0.00-1.20	0.00-1.70	0.50-2.40	0.80-3.00	3.00-3.30							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Solid							
Batch Number	1	1	1	1	1	1					LOD/LOR	Units	Method No.
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021							
MTBE #	<5	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
Benzene	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12
Benzene #	<5	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
Toluene	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12
Toluene #	14	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
Ethylbenzene	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
m/p-Xylene	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12
m/p-Xylene #	10	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
o-Xylene	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12
o-Xylene #	<5	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
PCB 28	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 28 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 52	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 52 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 101	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 101 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 118	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 118 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 138	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 138 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 153	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 153 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 180	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 180 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
Total 7 PCBs	-	-	-	-	-	<35					<35	ug/kg	TM17/PM8
Total 7 PCBs #	<35	-	<35	<35	-	-					<35	ug/kg	TM17/PM8
Natural Moisture Content	13.6	-	13.7	14.9	-	4.3					<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	12.0	-	12.0	13.0	-	4.1					<0.1	%	PM4/PM0
Hexavalent Chromium	-	-	-	-	-	<0.3					<0.3	mg/kg	TM38/PM20
Hexavalent Chromium #	<0.3	-	<0.3	<0.3	-	-					<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	-	0.0832	0.0166	-	0.6427	-					<0.0015	g/l	TM38/PM20
Chromium III	32.6	-	51.1	35.9	-	30.1					<0.5	mg/kg	NONE/NONE
Total Organic Carbon	-	-	-	-	-	0.34					<0.02	%	TM21/PM24
Total Organic Carbon #	0.38	-	0.24	0.35	-	-					<0.02	%	TM21/PM24
pH	-	-	-	-	-	8.75					<0.01	pH units	TM73/PM11
pH #	8.44	8.65	9.17	8.65	8.57	-					<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1538	-	0.103	0.1064	-	0.0956						kg	NONE/PM17

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	4-6	7-9	16-18	28-30	31-33							
Sample ID	BH-02A	BH-03A	BH-04	BH-05	BH-06	BH-06							
Depth	0.00-0.50	0.00-1.20	0.00-1.70	0.50-2.40	0.80-3.00	3.00-3.30							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Solid							
Batch Number	1	1	1	1	1	1					LOD/LOR	Units	Method No.
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021							
Mass of dried test portion	0.09	-	0.09	0.09	-	0.09						kg	NONE/PM17

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	7-9	16-18	31-33			
Sample ID	BH-02A	BH-04	BH-05	BH-06			
Depth	0.00-0.50	0.00-1.70	0.50-2.40	3.00-3.30			
COC No / misc							
Containers	V J T	V J T	V J T	V J T			
Sample Date	28/01/2021	28/01/2021	27/01/2021	27/01/2021			
Sample Type	Soil	Soil	Soil	Solid			
Batch Number	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021			
Dissolved Antimony	-	-	-	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Antimony#	<0.002	<0.002	<0.002	-	<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10)	-	-	-	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Antimony (A10)#	<0.02	<0.02	<0.02	-	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic	-	-	-	<0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic#	<0.0025	0.0046	<0.0025	-	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10)	-	-	-	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Arsenic (A10)#	<0.025	0.046	<0.025	-	<0.025	mg/kg	TM30/PM17
Dissolved Barium	-	-	-	0.006	<0.003	mg/l	TM30/PM17
Dissolved Barium#	0.007	0.005	0.005	-	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10)	-	-	-	0.06	<0.03	mg/kg	TM30/PM17
Dissolved Barium (A10)#	0.07	0.05	0.05	-	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium	-	-	-	<0.0005	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium#	<0.0005	<0.0005	<0.0005	-	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10)	-	-	-	<0.005	<0.005	mg/kg	TM30/PM17
Dissolved Cadmium (A10)#	<0.005	<0.005	<0.005	-	<0.005	mg/kg	TM30/PM17
Dissolved Chromium	-	-	-	<0.0015	<0.0015	mg/l	TM30/PM17
Dissolved Chromium#	<0.0015	<0.0015	<0.0015	-	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10)	-	-	-	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Chromium (A10)#	<0.015	<0.015	<0.015	-	<0.015	mg/kg	TM30/PM17
Dissolved Copper	-	-	-	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper#	<0.007	<0.007	<0.007	-	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10)	-	-	-	<0.07	<0.07	mg/kg	TM30/PM17
Dissolved Copper (A10)#	<0.07	<0.07	<0.07	-	<0.07	mg/kg	TM30/PM17
Dissolved Lead	-	-	-	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead#	<0.005	<0.005	<0.005	-	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10)	-	-	-	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Lead (A10)#	<0.05	<0.05	<0.05	-	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum	-	-	-	0.008	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum#	0.006	0.004	0.007	-	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10)	-	-	-	0.08	<0.02	mg/kg	TM30/PM17
Dissolved Molybdenum (A10)#	0.06	0.04	0.07	-	<0.02	mg/kg	TM30/PM17
Dissolved Nickel	-	-	-	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel#	<0.002	<0.002	<0.002	-	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10)	-	-	-	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Nickel (A10)#	<0.02	<0.02	<0.02	-	<0.02	mg/kg	TM30/PM17
Dissolved Selenium	-	-	-	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Selenium#	<0.003	<0.003	<0.003	-	<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10)	-	-	-	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Selenium (A10)#	<0.03	<0.03	<0.03	-	<0.03	mg/kg	TM30/PM17
Dissolved Zinc	-	-	-	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc#	<0.003	<0.003	<0.003	-	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10)	-	-	-	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Zinc (A10)#	<0.03	<0.03	<0.03	-	<0.03	mg/kg	TM30/PM17

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: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	7-9	16-18	31-33							LOD/LOR	Units	Method No.
Sample ID	BH-02A	BH-04	BH-05	BH-06									
Depth	0.00-0.50	0.00-1.70	0.50-2.40	3.00-3.30									
COC No / misc													
Containers	V J T	V J T	V J T	V J T									
Sample Date	28/01/2021	28/01/2021	27/01/2021	27/01/2021									
Sample Type	Soil	Soil	Soil	Solid									
Batch Number	1	1	1	1									
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021									
Mercury Dissolved by CVAF	-	-	-	<0.00001							<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	-							<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF	-	-	-	<0.0001							<0.0001	mg/kg	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	-							<0.0001	mg/kg	TM61/PM0
Phenol	<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	mg/kg	TM26/PM0
Fluoride	0.3	<0.3	<0.3	<0.3							<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3							<3	mg/kg	TM173/PM0
Sulphate as SO4	-	-	-	1.5							<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	31.7	4.4	<0.5	-							<0.5	mg/l	TM38/PM0
Sulphate as SO4	-	-	-	15							<5	mg/kg	TM38/PM0
Sulphate as SO4 #	317	44	<5	-							<5	mg/kg	TM38/PM0
Chloride	-	-	-	1.5							<0.3	mg/l	TM38/PM0
Chloride #	0.6	0.6	<0.3	-							<0.3	mg/l	TM38/PM0
Chloride	-	-	-	15							<3	mg/kg	TM38/PM0
Chloride #	6	6	<3	-							<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	3	<2	<2							<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	30	<20	<20							<20	mg/kg	TM60/PM0
pH	7.96	9.04	8.26	8.20							<0.01	pH units	TM73/PM0
Total Dissolved Solids	-	-	-	<35							<35	mg/l	TM20/PM0
Total Dissolved Solids #	106	40	44	-							<35	mg/l	TM20/PM0
Total Dissolved Solids	-	-	-	<350							<350	mg/kg	TM20/PM0
Total Dissolved Solids #	1060	400	440	-							<350	mg/kg	TM20/PM0

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All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	7-9	16-18	31-33												
Sample ID	BH-02A	BH-04	BH-05	BH-06												
Depth	0.00-0.50	0.00-1.70	0.50-2.40	3.00-3.30												
COC No / misc																
Containers	V J T	V J T	V J T	V J T												
Sample Date	28/01/2021	28/01/2021	27/01/2021	27/01/2021												
Sample Type	Soil	Soil	Soil	Solid												
Batch Number	1	1	1	1												
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021							Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Solid Waste Analysis																
Total Organic Carbon #	0.38	0.24	0.35	-							3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<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	-							1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	42	<30	<30	160							500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	0.31	-							-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	0.67	<0.64							100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	0.046	<0.025	-							0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.07	0.05	0.05	-							20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	-							0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	-							0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	-							2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	-							0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.06	0.04	0.07	-							0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	-							0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	-							0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	<0.02	-							0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	-							0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	<0.03	-							4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	1060	400	440	-							4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	30	<20	<20							500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	86.1	87.7	84.6	94.6							-	-	-	<0.1	%	NONE/PM4
PAH MS																
PAH 6 Total	-	-	-	<0.22							-	-	-	<0.22	mg/kg	TM4/PM8
Total 7 PCBs	-	-	-	<0.035							1	-	-	<0.035	mg/kg	TM17/PM8
Total Organic Carbon	-	-	-	0.34							3	5	6	<0.02	%	TM21/PM24
pH	-	-	-	8.75							-	-	-	<0.01	pH units	TM73/PM11
pH #	8.44	9.17	8.65	-							-	-	-	<0.01	pH units	TM73/PM11

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: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	7-9	16-18	31-33							Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	BH-02A	BH-04	BH-05	BH-06												
Depth	0.00-0.50	0.00-1.70	0.50-2.40	3.00-3.30												
COC No / misc																
Containers	V J T	V J T	V J T	V J T												
Sample Date	28/01/2021	28/01/2021	27/01/2021	27/01/2021												
Sample Type	Soil	Soil	Soil	Solid												
Batch Number	1	1	1	1												
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021												
Dissolved Antimony (A10)	-	-	-	<0.02							0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic (A10)	-	-	-	<0.025							0.5	2	25	<0.025	mg/kg	TM30/PM17
Dissolved Barium (A10)	-	-	-	0.06							20	100	300	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium (A10)	-	-	-	<0.005							0.04	1	5	<0.005	mg/kg	TM30/PM17
Dissolved Chromium (A10)	-	-	-	<0.015							0.5	10	70	<0.015	mg/kg	TM30/PM17
Dissolved Copper (A10)	-	-	-	<0.07							2	50	100	<0.07	mg/kg	TM30/PM17
Dissolved Lead (A10)	-	-	-	<0.05							0.5	10	50	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum (A10)	-	-	-	0.08							0.5	10	30	<0.02	mg/kg	TM30/PM17
Dissolved Nickel (A10)	-	-	-	<0.02							0.4	10	40	<0.02	mg/kg	TM30/PM17
Dissolved Selenium (A10)	-	-	-	<0.03							0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Dissolved Zinc (A10)	-	-	-	<0.03							4	50	200	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF	-	-	-	<0.0001							0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Phenol	<0.1	<0.1	<0.1	<0.1							1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	<3	<3	<3							-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4	-	-	-	15							1000	20000	50000	<5	mg/kg	TM38/PM0
Sulphate as SO4 #	317	44	<5	-							1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride	-	-	-	15							800	15000	25000	<3	mg/kg	TM38/PM0
Chloride #	6	6	<3	-							800	15000	25000	<3	mg/kg	TM38/PM0
Total Dissolved Solids	-	-	-	<350							4000	60000	100000	<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: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
21/1882	1	BH-02A	0.00-0.50	1-3	No interpretation possible
21/1882	1	BH-04	0.00-1.70	7-9	No interpretation possible
21/1882	1	BH-05	0.50-2.40	16-18	No interpretation possible
21/1882	1	BH-06	3.00-3.30	31-33	Degraded diesel

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

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). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

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

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/1882	1	BH-02A	0.00-0.50	2	12/02/2021	**General Description (Bulk Analysis)**	Soil/Stones
					12/02/2021	**Asbestos Fibres**	NAD
					12/02/2021	**Asbestos ACM**	NAD
					12/02/2021	**Asbestos Type**	NAD
					12/02/2021	**Asbestos Level Screen**	NAD
21/1882	1	BH-04	0.00-1.70	8	12/02/2021	**General Description (Bulk Analysis)**	soil.stones
					12/02/2021	**Asbestos Fibres**	NAD
					12/02/2021	**Asbestos ACM**	NAD
					12/02/2021	**Asbestos Type**	NAD
					12/02/2021	**Asbestos Level Screen**	NAD
21/1882	1	BH-05	0.50-2.40	17	12/02/2021	**General Description (Bulk Analysis)**	Soil/Stones
					12/02/2021	**Asbestos Fibres**	NAD
					12/02/2021	**Asbestos ACM**	NAD
					12/02/2021	**Asbestos Type**	NAD
					12/02/2021	**Asbestos Level Screen**	NAD
21/1882	1	BH-06	3.00-3.30	32	12/02/2021	**General Description (Bulk Analysis)**	Soil/Stones
					12/02/2021	**Asbestos Fibres**	NAD
					12/02/2021	**Asbestos ACM**	NAD
					12/02/2021	**Asbestos Type**	NAD
					12/02/2021	**Asbestos Level Screen**	NAD

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
21/1882	1	BH-02A	0.00-0.50	1-3	EPH, GRO, PAH, PCB	Sample holding time exceeded
21/1882	1	BH-04	0.00-1.70	7-9	EPH, PAH, PCB	Sample holding time exceeded
21/1882	1	BH-05	0.50-2.40	16-18	EPH, GRO, PAH, PCB	Sample holding time exceeded prior to receipt

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.

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an 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 or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

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 extracted.
#2	EU_Total but with fatty acids extracted.
_	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: 21/1882

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.			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.			AR	Yes

EMT Job No: 21/1882

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
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, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	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, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
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	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	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	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.			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	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

EMT Job No: 21/1882

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	PM0	No preparation is required.			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		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.			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.			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
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes

EMT Job No: 21/1882

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.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.			AR	No
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.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

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Ireland

Attention :	Barry Sexton
Date :	17th February, 2021
Your reference :	10299-12-20
Our reference :	Test Report 21/925 Batch 3
Location :	Greenhills Road
Date samples received :	8th February, 2021
Status :	Final report
Issue :	1

Three samples were received for analysis on 8th February, 2021 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Client Name:	Ground Investigations Ireland	**Report :**	**Liquid**
Reference:	10299-12-20		
Location:	Greenhills Road		
Contact:	Barry Sexton	**Liquids/products:**	V=40ml vial, G=glass bottle, P=plastic bottle
EMT Job No:	21/925		$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HNO_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	79-86	87-94	95-102										
Sample ID	BH04	BH06	BH08										
Depth													
COC No / misc													
Containers	V H HNUF HCL Z P G	V H HNUF HCL Z P G	V H HNUF HCL Z P G										
Sample Date	04/02/2021	04/02/2021	04/02/2021										
Sample Type	Ground Water	Ground Water	Ground Water										
Batch Number	3	3	3										
Date of Receipt	08/02/2021	08/02/2021	08/02/2021								LOD/LOR	Units	Method No.
Dissolved Arsenic #	<2.5	4.2	5.3								<2.5	ug/l	TM30/PM14
Dissolved Boron	19	25	24								<12	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5	<0.5	<0.5								<0.5	ug/l	TM30/PM14
Total Dissolved Chromium #	<1.5	<1.5	<1.5								<1.5	ug/l	TM30/PM14
Dissolved Copper #	<7	<7	<7								<7	ug/l	TM30/PM14
Dissolved Lead #	<5	<5	<5								<5	ug/l	TM30/PM14
Dissolved Manganese #	1166	3	714								<2	ug/l	TM30/PM14
Dissolved Mercury #	<1	<1	<1								<1	ug/l	TM30/PM14
Dissolved Nickel #	9	<2	9								<2	ug/l	TM30/PM14
Dissolved Phosphorus #	<5	7	<5								<5	ug/l	TM30/PM14
Dissolved Potassium #	8.1	1.4	2.5								<0.1	mg/l	TM30/PM14
Dissolved Zinc #	<3	<3	<3								<3	ug/l	TM30/PM14
PAH MS													
Naphthalene #	<5.0$_{AA}$	<0.1	<0.1								<0.1	ug/l	TM4/PM30
Acenaphthylene #	<0.650$_{AA}$	0.215	0.023								<0.013	ug/l	TM4/PM30
Acenaphthene #	0.975$_{AA}$	0.168	0.027								<0.013	ug/l	TM4/PM30
Fluorene #	1.712$_{AA}$	0.572	0.091								<0.014	ug/l	TM4/PM30
Phenanthrene #	4.311$_{AA}$	1.279	0.034								<0.011	ug/l	TM4/PM30
Anthracene #	<0.650$_{AA}$	0.121	<0.013								<0.013	ug/l	TM4/PM30
Fluoranthene #	0.617$_{AA}$	<0.012	<0.012								<0.012	ug/l	TM4/PM30
Pyrene #	1.769$_{AA}$	0.265	<0.013								<0.013	ug/l	TM4/PM30
Benzo(a)anthracene #	<0.750$_{AA}$	<0.015	<0.015								<0.015	ug/l	TM4/PM30
Chrysene #	<0.550$_{AA}$	<0.011	<0.011								<0.011	ug/l	TM4/PM30
Benzo(bk)fluoranthene #	<0.900$_{AA}$	<0.018	<0.018								<0.018	ug/l	TM4/PM30
Benzo(a)pyrene #	<0.800$_{AA}$	<0.016	<0.016								<0.016	ug/l	TM4/PM30
Indeno(123cd)pyrene #	<0.550$_{AA}$	<0.011	<0.011								<0.011	ug/l	TM4/PM30
Dibenzo(ah)anthracene #	<0.50$_{AA}$	<0.01	<0.01								<0.01	ug/l	TM4/PM30
Benzo(ghi)perylene #	<0.550$_{AA}$	<0.011	<0.011								<0.011	ug/l	TM4/PM30
PAH 16 Total #	<9.750$_{AA}$	2.620	<0.195								<0.195	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.50$_{AA}$	<0.01	<0.01								<0.01	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.50$_{AA}$	<0.01	<0.01								<0.01	ug/l	TM4/PM30
PAH Surrogate % Recovery	74$_{AA}$	74	82								<0	%	TM4/PM30
Methyl Tertiary Butyl Ether #	<0.1	<0.1	<0.1								<0.1	ug/l	TM15/PM10
Benzene #	<0.5	<0.5	<0.5								<0.5	ug/l	TM15/PM10
Toluene #	<5	<5	<5								<5	ug/l	TM15/PM10
Ethylbenzene #	<1	<1	<1								<1	ug/l	TM15/PM10
m/p-Xylene #	<2	<2	<2								<2	ug/l	TM15/PM10
o-Xylene #	<1	<1	<1								<1	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	104	104	104								<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	99	96	97								<0	%	TM15/PM10

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: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

Report : **Liquid**

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	79-86	87-94	95-102										
Sample ID	BH04	BH06	BH08										
Depth													
COC No / misc													
Containers	V H HNUF HCL Z P G	V H HNUF HCL Z P G	V H HNUF HCL Z P G										
Sample Date	04/02/2021	04/02/2021	04/02/2021										
Sample Type	Ground Water	Ground Water	Ground Water										
Batch Number	3	3	3								LOD/LOR	Units	Method No.
Date of Receipt	08/02/2021	08/02/2021	08/02/2021										
TPH CWG													
Aliphatics													
>C5-C6 #	<10	<10	<10								<10	ug/l	TM36/PM12
>C6-C8 #	<10	<10	<10								<10	ug/l	TM36/PM12
>C8-C10 #	<10	205	<10								<10	ug/l	TM36/PM12
>C10-C12 #	883	268	<5								<5	ug/l	TM5/PM16/PM30
>C12-C16 #	3880	1230	<10								<10	ug/l	TM5/PM16/PM30
>C16-C21 #	4270	1080	<10								<10	ug/l	TM5/PM16/PM30
>C21-C35 #	2410	350	<10								<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35 #	11443	3133	<10								<10	ug/l	TM5/TM36/PM12/PM16/PM30
Aromatics													
>C5-EC7 #	<10	<10	<10								<10	ug/l	TM36/PM12
>EC7-EC8 #	<10	<10	<10								<10	ug/l	TM36/PM12
>EC8-EC10 #	<10	<10	<10								<10	ug/l	TM36/PM12
>EC10-EC12 #	98	82	<5								<5	ug/l	TM5/PM16/PM30
>EC12-EC16 #	1390	630	<10								<10	ug/l	TM5/PM16/PM30
>EC16-EC21 #	3440	930	<10								<10	ug/l	TM5/PM16/PM30
>EC21-EC35 #	2270	470	<10								<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35 #	7198	2112	<10								<10	ug/l	TM5/TM36/PM12/PM16/PM30
Total aliphatics and aromatics(C5-35) #	18641	5245	<10								<10	ug/l	TM5/TM36/PM12/PM16/PM30
Phenol #	<0.01	<0.01	<0.01								<0.01	mg/l	TM26/PM0
Sulphate as SO4 #	20.6	29.0	21.0								<0.5	mg/l	TM38/PM0
Chloride #	7.4	8.3	9.5								<0.3	mg/l	TM38/PM0
Nitrate as NO3 #	4.9	<0.2	0.4								<0.2	mg/l	TM38/PM0
Nitrite as NO2 #	0.38	<0.02	<0.02								<0.02	mg/l	TM38/PM0
Total Cyanide #	<0.01	<0.01	<0.01								<0.01	mg/l	TM89/PM0
Ammoniacal Nitrogen as NH3 #	0.20	<0.03	<0.03								<0.03	mg/l	TM38/PM0
Hexavalent Chromium	<0.006	<0.006	<0.006								<0.006	mg/l	TM38/PM0
Electrical Conductivity @25C #	592	819	650								<2	uS/cm	TM76/PM0
pH #	7.88	7.36	7.65								<0.01	pH units	TM73/PM0

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Client Name:	Ground Investigations Ireland	**VOC Report :**	**Liquid**
Reference:	10299-12-20		
Location:	Greenhills Road		
Contact:	Barry Sexton		
EMT Job No:	21/925		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	79-86	87-94	95-102			
Sample ID	BH04	BH06	BH08			
Depth						
COC No / misc						
Containers	V H HNUF HCL Z P G	V H HNUF HCL Z P G	V H HNUF HCL Z P G			
Sample Date	04/02/2021	04/02/2021	04/02/2021			
Sample Type	Ground Water	Ground Water	Ground Water			
Batch Number	3	3	3			
Date of Receipt	08/02/2021	08/02/2021	08/02/2021	LOD/LOR	Units	Method No.
VOC MS						
Dichlorodifluoromethane	<2	<2	<2	<2	ug/l	TM15/PM10
Methyl Tertiary Butyl Ether #	<0.1	<0.1	<0.1	<0.1	ug/l	TM15/PM10
Chloromethane #	<3	<3	<3	<3	ug/l	TM15/PM10
Vinyl Chloride #	<0.1	<0.1	<0.1	<0.1	ug/l	TM15/PM10
Bromomethane	<1	<1	<1	<1	ug/l	TM15/PM10
Chloroethane #	<3	<3	<3	<3	ug/l	TM15/PM10
Trichlorofluoromethane #	<3	<3	<3	<3	ug/l	TM15/PM10
1,1-Dichloroethene (1,1 DCE) #	<3	<3	<3	<3	ug/l	TM15/PM10
Dichloromethane (DCM) #	<5	<5	<5	<5	ug/l	TM15/PM10
trans-1-2-Dichloroethene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,1-Dichloroethane #	<3	<3	<3	<3	ug/l	TM15/PM10
cis-1-2-Dichloroethene #	<3	<3	<3	<3	ug/l	TM15/PM10
2,2-Dichloropropane	<1	<1	<1	<1	ug/l	TM15/PM10
Bromochloromethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Chloroform #	<2	<2	<2	<2	ug/l	TM15/PM10
1,1,1-Trichloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
1,1-Dichloropropene #	<3	<3	<3	<3	ug/l	TM15/PM10
Carbon tetrachloride #	<2	<2	<2	<2	ug/l	TM15/PM10
1,2-Dichloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Benzene #	<0.5	<0.5	<0.5	<0.5	ug/l	TM15/PM10
Trichloroethene (TCE) #	<3	13	<3	<3	ug/l	TM15/PM10
1,2-Dichloropropane #	<2	<2	<2	<2	ug/l	TM15/PM10
Dibromomethane #	<3	<3	<3	<3	ug/l	TM15/PM10
Bromodichloromethane #	<2	<2	<2	<2	ug/l	TM15/PM10
cis-1-3-Dichloropropene	<2	<2	<2	<2	ug/l	TM15/PM10
Toluene #	<5	<5	<5	<5	ug/l	TM15/PM10
trans-1-3-Dichloropropene	<2	<2	<2	<2	ug/l	TM15/PM10
1,1,2-Trichloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Tetrachloroethene (PCE) #	<3	<3	<3	<3	ug/l	TM15/PM10
1,3-Dichloropropane #	<2	<2	<2	<2	ug/l	TM15/PM10
Dibromochloromethane #	<2	<2	<2	<2	ug/l	TM15/PM10
1,2-Dibromoethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Chlorobenzene #	<2	<2	<2	<2	ug/l	TM15/PM10
1,1,1,2-Tetrachloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Ethylbenzene #	<1	<1	<1	<1	ug/l	TM15/PM10
m/p-Xylene #	<2	<2	<2	<2	ug/l	TM15/PM10
o-Xylene #	<1	<1	<1	<1	ug/l	TM15/PM10
Styrene	<2	<2	<2	<2	ug/l	TM15/PM10
Bromoform #	<2	<2	<2	<2	ug/l	TM15/PM10
Isopropylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,1,2,2-Tetrachloroethane	<4	<4	<4	<4	ug/l	TM15/PM10
Bromobenzene #	<2	<2	<2	<2	ug/l	TM15/PM10
1,2,3-Trichloropropane #	<3	<3	<3	<3	ug/l	TM15/PM10
Propylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
2-Chlorotoluene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,3,5-Trimethylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
4-Chlorotoluene #	<3	<3	<3	<3	ug/l	TM15/PM10
tert-Butylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,2,4-Trimethylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
sec-Butylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
4-Isopropyltoluene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,3-Dichlorobenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,4-Dichlorobenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
n-Butylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dichlorobenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dibromo-3-chloropropane	<2	<2	<2	<2	ug/l	TM15/PM10
1,2,4-Trichlorobenzene	<3	<3	<3	<3	ug/l	TM15/PM10
Hexachlorobutadiene	<3	<3	<3	<3	ug/l	TM15/PM10
Naphthalene	<2	<2	<2	<2	ug/l	TM15/PM10
1,2,3-Trichlorobenzene	<3	<3	<3	<3	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	104	104	104	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	99	96	97	<0	%	TM15/PM10

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: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 21/925						

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.

EMT Job No.: 21/925

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an 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 or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x50 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 extracted.
#2	EU_Total but with fatty acids extracted.
_	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: 21/925

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
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5/TM36	please refer to TM5 and TM36 for method details	PM12/PM16/PM30	please refer to PM16/PM30 and PM12 for method details	Yes			
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.				
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.	Yes			
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes			
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE 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			

EMT Job No: 21/925

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	PM0	No preparation is required.				
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM0	No preparation is required.	Yes			
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM76	Modified US EPA method 120.1 (1982). Determination of Specific Conductance by Metrohm automated probe analyser.	PM0	No preparation is required.	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.	PM0	No preparation is required.	Yes			

APPENDIX 5 – Groundwater and Gas Monitoring

Ground Investigations Ireland Gas Monitoring Field Sheet (Revision V2 September 2020)

	Project Number	10299-12-20	Sample Date	04/02/2021
	Client	Lohan Donnelly	Current Weather	Dry
	Site Name	Greenhills Road	Weather Prev 24 hours	Wet
	Sampler I.D.	NM	Gas Meter Model	Geotech GA 5000

Sample I.D.	BH04	BH06	BH08									
Casing Diameter (mm)	N/A	N/A	N/A									
Standpipe Diameter (mm)	50	50	50									
Stick Up (mm)	-	-	-									
Cover Condition	Good	Good	Good									
Standpipe Type uPVC etc.	PVC	PVC	PVC									
Total Well Depth (m)	3.33	3.2	3.42									
Water Level (mBBGL)	2.45	1.65	2.7									
Odour	HC Odour	None	HC Odour									
Gas Valve/Cap Condition	Good	Good	Good									
Flow (litre/hour)	0.5	0.6	0.3									
CH4 (%)	0.5	0.5	0.5									
CO2 (%)	1.4	1.4	0.1									
CO (%)	0	1	0									
H2S (ppm)	0	0	0									
O2 (%)	16.4	18.4	20.6									
Barometric Pressure	996	995	996									
Additional Comment												

Ground Investigations Ireland Gas Monitoring Field Sheet (Revision V2 September 2020)

GROUND INVESTIGATIONS IRELAND Geotechnical & Environmental	Project Number	10299-12-20	Sample Date	12/02/2021
	Client	Lohan Donnelly	Current Weather	Dry
	Site Name	Greenhills Road	Weather Prev 24 hours	Dry
	Sampler I.D.	NM	Gas Meter Model	Geotech GA 5000

Sample I.D.	BH04	BH06	BH08									
Casing Diameter (mm)	N/A	N/A	N/A									
Standpipe Diameter (mm)	50	50	50									
Stick Up (mm)	-	-	-									
Cover Condition	Good	Good	Good									
Standpipe Type uPVC etc.	PVC	PVC	PVC									
Total Well Depth (m)	3.33	3.2	3.42									
Water Level (mBBGL)	2.71	1.87	-									
Odour	HC Odour	None	-									
Gas Valve/Cap Condition	Good	Good	Good									
Flow (litre/hour)	0.5	0.5	0.4									
CH_4 (%)	0.4	0.6	0.6									
CO_2 (%)	1.1	5.7	0.1									
CO (%)	1	0	0									
H_2S (ppm)	0	0	0									
O_2 (%)	20.3	10.9	21.5									
Barometric Pressure	1018	1018	1018									
Additional Comment												

Ground Investigations Ireland Gas Monitoring Field Sheet (Revision V2 September 2020)

Project Number	10299-12-20	Sample Date	15/02/2021
Client	Lohan Donnelly	Current Weather	Wet
Site Name	Greenhills Road	Weather Prev 24 hours	Wet
Sampler I.D.	NM	Gas Meter Model	Geotech GA 5000

Sample I.D.	BH04	BH06	BH08									
Casing Diameter (mm)	N/A	N/A	N/A									
Standpipe Diameter (mm)	50	50	50									
Stick Up (mm)	-	-	-									
Cover Condition	Good	Good	Good									
Standpipe Type uPVC etc.	PVC	PVC	PVC									
Total Well Depth (m)	3.33	3.2	3.42									
Water Level (mBBGL)	2.76	1.94	-									
Odour	HC Odour	None	-									
Gas Valve/Cap Condition	Good	Good	Good									
Flow (litre/hour)	0.6	0.6	0.6									
CH_4 (%)	0.5	0.5	0.5									
CO_2 (%)	1.7	5.5	0.5									
CO (%)	1	0	0									
H_2S (ppm)	0	0	0									
O_2 (%)	19	10.6	20.4									
Barometric Pressure	1002	1002	1002									
Additional Comment												

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Groundwater Monitoring Field Sheet

Project Number	10299-12-20	Sample Date	04/02/2021
Client	Lohan Donnelly	Current Weather	Dry
Site Name	Greenhills Road	Weather Prev 24 hours	Wet
Sampler I.D.	NM	Sampling Method/Type	Pump/Bailer

Sample I.D.	BH04	BH06	BH08									
Casing Diameter (mm)	N/A	N/A	N/A									
Standpipe Diameter (mm)	50	50	50									
Stick Up (mm)	-	-	-									
Cover Condition	Good	Good	Good									
Standpipe Type uPVC etc.	PVC	PVC	PVC									
Total Well Depth (m)	3.33	3.2	3.42									
Water Level (mBGL)	2.45	1.65	2.7									
Odour	HC Odour	None	HC Odour									
Time Purging Start	12:20	10:50	11:15									
Timer Purging End	12:20	10:55	11:15									
Purge Volume (litres)	0	2	0									
Sampling Time	12:30	11:10	11:30									
Litres Purged	0	2	0									
Ph (pH Units)	7.65	7.79	7.8									
EC (mS/cm)	0.57	0.88	0.69									
Temp (Degrees)	10.5	12.7	11.2									
ORP (mV)	166	173	`77									
DO (mg/l)												
Colour	Brown	Brown	Brown									
Odour	HC Odour	None	HC Odour									
Additional Comments												

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Groundwater Monitoring Field Sheet

Project Number	10299-12-20	Sample Date	12/02/2021
Client	Lohan Donnelly	Current Weather	Dry
Site Name	Greenhills Road	Weather Prev 24 hours	Dry
Sampler I.D.	NM	Sampling Method/Type	N/A

Sample I.D.	BH04	BH06	BH08												
Casing Diameter (mm)	N/A	N/A	N/A												
Standpipe Diameter (mm)	50	50	50												
Stick Up (mm)	-	-	-												
Cover Condition	Good	Good	Good												
Standpipe Type uPVC etc.	PVC	PVC	PVC												
Total Well Depth (m)	3.33	3.2	3.42												
Water Level (mBGL)	2.71	1.87	Gas Tap Sealed												
Odour	HC Odour	None													
Time Purging Start	N/A	N/A	N/A												
Timer Purging End	N/A	N/A	N/A												
Purge Volume (litres)	N/A	N/A	N/A												
Sampling Time	N/A	N/A	N/A												
Litres Purged	N/A	N/A	N/A												
Ph (pH Units)	N/A	N/A	N/A												
EC (mS/cm)	N/A	N/A	N/A												
Temp (Degrees)	N/A	N/A	N/A												
ORP (mV)	N/A	N/A	N/A												
DO (mg/l)	N/A	N/A	N/A												
Colour	N/A	N/A	N/A												
Odour	N/A	N/A	N/A												
Additional Comments															

Ground Investigations Ireland Groundwater Monitoring Field Sheet

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Project Number	10299-12-20	Sample Date	15/02/2021
Client	Lohan Donnelly	Current Weather	Wet
Site Name	Greenhills Road	Weather Prev 24 hours	Wet
Sampler I.D.	NM	Sampling Method/Type	N/A

Sample I.D.	BH04	BH06	BH08									
Casing Diameter (mm)	N/A	N/A	N/A									
Standpipe Diameter (mm)	50	50	50									
Stick Up (mm)	-	-	-									
Cover Condition	Good	Good	Good									
Standpipe Type uPVC etc.	PVC	PVC	PVC									
Total Well Depth (m)	3.33	3.2	3.42									
Water Level (mBGL)	2.76	1.94	Gas Tap Sealed									
Odour	HC Odour	None										
Time Purging Start	N/A	N/A	N/A									
Timer Purging End	N/A	N/A	N/A									
Purge Volume (litres)	N/A	N/A	N/A									
Sampling Time	N/A	N/A	N/A									
Litres Purged	N/A	N/A	N/A									
Ph (pH Units)	N/A	N/A	N/A									
EC (mS/cm)	N/A	N/A	N/A									
Temp (Degrees)	N/A	N/A	N/A									
ORP (mV)	N/A	N/A	N/A									
DO (mg/l)	N/A	N/A	N/A									
Colour	N/A	N/A	N/A									
Odour	N/A	N/A	N/A									
Additional Comments												

APPENDIX 7

NRA/TII Criteria for Rating the Magnitude and Significance of Impacts at EIA Stage

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NRA/TII Criteria for Rating the Magnitude and Significance of Impacts at EIA Stage National Roads Authority (NRA/ TII, 2009)

Table 1 Criteria for Rating Site Attributes – Estimation of Importance of Hydrological Attributes (NRA)

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

Table 2 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Hydrological Attribute (NRA)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	Loss or extensive change to a waterbody or water dependent habitat. Increase in predicted peak flood level >100mm. Extensive loss of fishery. Calculated risk of serious pollution incident >2% annually. Extensive reduction in amenity value.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50mm. Partial loss of fishery. Calculated risk of serious pollution incident >1% annually. Partial reduction in amenity value.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10mm. Minor loss of fishery. Calculated risk of serious pollution incident >0.5% annually. Slight reduction in amenity value.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level. Calculated risk of serious pollution incident <0.5% annually.
Minor Beneficial	Results in minor improvement of attribute quality	Reduction in predicted peak flood level >10mm. Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually.
Moderate Beneficial	Results in moderate improvement of attribute quality	Reduction in predicted peak flood level >50mm. Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually.
Major Beneficial	Results in major improvement of attribute quality	Reduction in predicted peak flood level >100mm

Table 3 Rating of Significant Environmental Impacts at EIS Stage (NRA)

Importance of Attribute	**Magnitude of Importance**			
	Negligible	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

APPENDIX 9

9.1 AMBIENT AIR QUALITY STANDARDS

9.2 Dust Management Plan

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9.1 AMBIENT AIR QUALITY STANDARDS

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time which was the issue of acid rain. As a result of this sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, has been passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and started to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, has published limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08 which has been transposed into Irish Law as S.I. 180 of 2011. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. The margins of tolerance specific to each pollutant were also slightly adjusted from previous directives. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for $PM_{2.5}$ are included in Directive 2008/50/EC. The approach for $PM_{2.5}$ was to establish a target value of 25 μg/m^3, as an annual average (to be attained everywhere by 2010) and a limit value of 25 μg/m^3, as an annual average (to be attained everywhere by 2015), coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5 μg/m^3 to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 μg/m^3). Where the AEI is currently greater than 22 μg/m^3 all appropriate measures should be employed to reduce this level to 18 μg/m^3 by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008 - 2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 μg/m^3 was set to be complied with by 2015 again based on the AEI.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 96/62/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 96/62/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 96/62/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 96/62/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_X (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex VI of EU Directive 1999/30/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 23 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

9.2 Dust Management Plan

The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the following management plan has been formulated by drawing on best practice guidance from Ireland, the UK (IAQM (2014), BRE (2003), The Scottish Office (1996), UK ODPM (2002)) and the USA (USEPA, 1997).

Site Management
The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design and effective control strategies.

At the construction planning stage, the siting of activities and storage piles will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance (see Figure 9.1 for the windrose for Casement Aerodrome). As the prevailing wind is predominantly westerly to south-westerly, locating construction compounds and storage piles downwind of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors.

Good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or quickly implementing effective control measures before the potential for nuisance occurs. When rainfall is greater than 0.2mm/day, dust generation is generally suppressed (IAQM, 2014; UK ODPM, 2002). The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7m above ground) to release loose material from storage piles and other exposed materials (USEPA, 1986). Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods were care will be needed to ensure that dust nuisance does not occur. The following measures shall be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:

- The Principal Contractor or equivalent must monitor the contractors' performance to ensure that the proposed mitigation measures are implemented and that dust impacts and nuisance are minimised;
- During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions;
- The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary, this notice board should also include head/regional office contact details;
- It is recommended that community engagement be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses;
- A complaints register will be kept on site detailing all telephone calls and letters of complaint received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out;
- It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions herein;
- At all times, the procedures put in place will be strictly monitored and assessed.

The dust minimisation measures shall be reviewed at regular intervals during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed and satisfactory procedures implemented to rectify the problem. Specific dust control measures to be employed are described below.

Preparing and Maintaining the Site
- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.

- Fully enclose specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating Vehicles / 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 20 kph haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)

Operations
- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management
- Avoid bonfires and burning of waste materials.

Measures Specific to Demolition
- Prior to demolition blocks should be soft striped inside buildings (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- During the demolition process, water suppression should be used, preferably with a hand-held spray. Only the use of cutting, grinding or sawing equipment fitted or used in conjunction with a suitable dust suppression technique such as water sprays/local extraction should be used.
- Drop heights from conveyors, loading shovels, hoppers and other loading equipment should be minimised, if necessary fine water sprays should be employed.

Measures Specific to Earthworks
- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
- Only remove the cover in small areas during work and not all at once.
- During dry and windy periods, and when there is a likelihood of dust nuisance, a bowser will operate to ensure moisture content is high enough to increase the stability of the soil and thus suppress dust.

Measures Specific to Construction
- Avoid scabbling (roughening of concrete surfaces) if possible.

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.

Measures Specific to Trackout
Site roads (particularly unpaved) can be a significant source of fugitive dust from construction sites if control measures are not in place. The most effective means of suppressing dust emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25 to 80% (UK ODPM, 2002).

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles.
- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use. If sweeping using a road sweeper is not possible due to the nature of the surrounding area then a suitable smaller scale street cleaning vacuum will be used.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
- Access gates to be located at least 10 m from receptors where possible.

Summary of Dust Mitigation Measures
The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory performance of the contractor. The key features with respect to control of dust will be:

- The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
- The development of a documented system for managing site practices with regard to dust control;
- The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
- The specification of effective measures to deal with any complaints received.

APPENDIX 11

11.1 Engineering Services Report (incl. Interim Ground Investigation Report dated February 2021)

11.2 Utility Services Report

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Engineering Services Report

Project:

Residential Development at Greenhills Road, Walkinstown, Dublin 12.

Green Vale Greenhills

STEEPLEFIELD LTD.

Project Reference No.:

20189

Report Reference No.:

20189-LDE-ZZ-ZZ-RP-0001

Revision	*Author:*	*Date:*	*Approved by:*	*Date*
P	Edvinas Valadka	30-11-2021	Gordon Poyntz	30-11-2021
P1	Edvinas Valadka	08-03-2022	Gordon Poyntz	08-03-2022

Table of Contents

1.0 Introduction

This report has been prepared by Lohan & Donnelly Consulting Engineers and relates to the proposed residential development located at Greenhills Road, Walkinstown, Dublin 12. The Engineering Services Report is to be read in conjunction with all of the accompanying documentation, calculations & Engineering drawings. The purpose of this report is to capture and address the following areas relating to the required drainage network system to service the development:

- Foul Water Network
- Surface Water Network
- Water main
- Roads

2.0 Project Overview

2.1 Site Location

The site is located at Greenhills Road, Walkinstown, Dublin 12, as shown in Figure 1 of map below.

Figure 1: Site Location.
(Source: Google Earth 2020)

2.2 Description of Existing Site

The site is approximately 2.79 hectares in area, located within an industrially surrounded zone and comprises of existing low-rise disused industrial units which are to be demolished as part of the subject proposal. The site currently has 3 vehicular accesses all of which are located along the southern part of the site boundary. The existing development does not have any SuDS measures in place.

Topographical survey of existing site indicates that the site is gradually sloping down from west to east and north to south with a very steep, in places almost vertical ascent/decent transition from the site to the Greenhills Road neighboring the northern site boundary. The western site boundary, abutted to the boundary of the neighboring development is separated via a retaining wall, with a level difference between the site in question and neighboring development of approximately 6 meters.

2.3 Description of Existing Ground Conditions

A ground investigation survey was conducted for the proposed development by Ground Investigations Ireland in-between January and February of 2021 with the following purpose and scope.

- Visit project site to observe existing conditions
- Carry out 14 No. Window Sample Boreholes to recover soil samples
- Carry out 10 No. Cable percussion Boreholes to a maximum depth of 4.50m BGL
- Installation of 3 No. Groundwater monitoring wells
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

The ground conditions encountered during the investigations are summarized below:

- Tarmacadam or concrete surfacing course to a max. depth of 0.3m BGL
- Brown clayey sandy sub-angular to sub-rounded fire to course gravel or a grayish brown sandy gravelly clay with rage fragment of red brick have been found beneath the surfacing course to a depth of between 0.4m and 2.4m BGL.
- Cohesive deposits described as dark brown/grey sandy gravelly clay with occasional cobbles were encountered beneath the made ground and/or surfacing course.
- Granular deposits described as grey/brown clayey sub-angular to sub-rounded fine to course gravel with occasional cobblers and brown clayey gravelly fine

to course sand were encountered beneath the made ground and/or cohesive deposits.

Based on the three groundwater monitoring wells, installed in the boreholes where groundwater was struck, ground investigation report concludes that groundwater was encountered at 2.45m for borehole 'BH04', 1.65m for 'BH06' and 2.7m for 'BH08'. The monitoring wells have been revisited twice after the initial measurements were recorded, 8 and 11 days later. On The 11th day it was noted that for borehole 'BH04' the groundwater level dropped by 13% to 2.76m BGL, for borehole 'BH06' groundwater level dropped by 18% to 1.94m BGL and no results were recorded for borehole 'BH08'.

Ground level for 'BH06' was measured at 55.97 meters above Ordnance Datum (mOD) and 55.36m (mOD) for 'BH08'. The difference in ground level of 0.61m explain the discrepancy in the groundwater table levels between the two boreholes. It is therefore, based on the results of the survey, safe to assume an average water table of 2.35m BGL, which is the average groundwater level between 'BH06' and 'BH08'.

A copy of the ground investigations report including borehole logs, recommendations & conclusions is included in Appendix G of this document.

2.4 Description of Proposed Development

(i) The demolition of the former Chadwicks Builders Merchant development comprising 1 no. two storey office building and 9 no. storage/warehouse buildings ranging in height from 3 m – 9.9 m as follows: Building A (8,764 sq.m.), Building B (1,293 sq.m.), Building C (two-storey office building) (527 sq.m.), Building D (47 sq.m.), Building E (29 sq.m.), Building F (207 sq.m.), Building G (101 sq.m.), Building H (80 sq.m.), Building I (28 sq.m.), and Building J (44 sq.m.), in total comprising 11,120 sq.m.;

(ii) the construction of a mixed-use Build-to-Rent residential and commercial development comprising 633 no. build-to-rent apartment units (292 no. one-beds, 280 no. two-beds and 61 no. three-beds), 1 no. childcare facility and 10 no. commercial units in 4 no. blocks (A-D) ranging in height from 5 to 12 storeys as follows:

(a) Block A comprises 209 no. apartments (102 no. 1 bed-units, 106 no. 2 bed-units and 1 no. 3-bed units) measuring 5 - 10 storeys in height. (b) Block B comprises 121 no. apartments (53 no. 1 bed-units, 45 no. 2 bed-units and 23 no. 3 bed-units) measuring 8 - 10 storeys in height. (c) Block C comprises 130 no. apartments (38 no. 1-bed units, 71 no. 2-bed units and 21 no. 3-bed units) measuring 8 - 12 storeys in height. (d) Block D comprises 173 no. apartments (99 no. 1 bed-units, 58 no. 2 bed-units and 16 no. 3 bed-units) measuring 6 - 10 storeys in height. All apartments will be provided with private balconies/terraces;

(iii) provision of indoor communal residential amenity/management facilities including a co-working space, communal meeting room/ work space, foyer, toilets at ground floor of Block A; gym, changing rooms, toilets, resident's lounge, studio, laundry room, communal meeting room/ work space, multi-function space with kitchen at ground floor of Block B; games room with kitchenette, media room, co-working space, resident's lounge, communal meeting room/ work space, reception area, management office with ancillary staff room and toilets, toilets, parcel room at ground floor of Block C;

(iv) the construction of 1 no. childcare facility with dedicated outdoor play area located at ground floor of Block A;

(v) the construction of 8 no. commercial units at ground floor level of Blocks A, B and D, and 2 no. commercial units at second floor level (fronting Greenhills Road) of Block C as follows: Block A has 3 no. units at ground floor comprising 79.46 sq.m., 90.23 sq.m., and 121.39 sq.m., Block B has 1 no. unit at ground floor comprising 127.03 sq.m., Block C has two units at second floor comprising 120.85 sq.m. and 125.45 sq.m., and Block D has 4 no. units at ground floor comprising 84.45 sq.m., 149.77 sq.m., 155.48 sq.m. and 275.59 sq.m.;

(vi) the construction of 3 no. vehicular entrances; a primary entrance via vehicular ramp from the north (access from Greenhills Road) and 2 no. secondary entrances from the south for emergency access and services (access from existing road to the south of the site) with additional pedestrian accesses proposed along Greenhills Road;

(vii) provision of 424 no. car parking spaces comprising 398 no. standard spaces, 21 no. mobility spaces and 5 no. car club spaces located at ground floor level car park located within Block A and accessed via the proposed entrance at Greenhills Road, a two-storey car park located within Blocks C and D also accessed from the proposed entrance at Greenhills Road and on-street parking at ground floor level adjacent to Blocks A and C. Provision of an additional 15 no. commercial/ unloading/ drop-off on-street parking spaces at ground floor level (providing for an overall total of 439 car parking spaces). Provision of 4 no. dedicated motorcycle spaces at ground floor level parking area within Blocks C and D;

(viii) provision of 1363 no. bicycle parking spaces comprising 1035 no. residents' bicycle spaces, 5 no. accessible bicycle spaces and 7 no. cargo bicycle spaces in 9 no. bicycle storerooms in ground and first floor parking areas within Blocks A, C and D, and 316 no. visitors' bicycle spaces located externally at ground floor level throughout the development;

(ix) provision of outdoor communal amenity space (5,020 sq.m.) comprising landscaped courtyards that include play areas, seating areas, grass areas, planting, and scented gardens located on podiums at first and second floor levels; provision of a communal amenity roof garden in Block C with seating area and planting (176 sq.m.); and inclusion of centrally located public open space (3,380 sq.m.) adjacent to Blocks B and C comprising grassed areas, planting, seating areas, play areas, water feature, flexible use space; and incidental open space/public realm;

(x) development also includes landscaping and infrastructural works, foul and surface water drainage, bin storage, ESB substations, plant rooms, boundary treatments, internal roads, cycle paths and footpaths and all associated site works to facilitate the development.

This application is accompanied by an Environmental Impact Assessment Report (EIAR).

3.0 Foul Water Network

3.1 Existing Foul Water Drainage Infrastructure

Irish Water drainage record map shows an existing 225mm diameter foul water sewer located in close vicinity to the proposed development. The sewer originates from south-eastern direction, wraps around the outside of the southern and eastern site boundary and turns north-east, continuing towards the Walkinstown roundabout. Irish Water drainage record map enclosed in Appendix A of this document.

3.2 Proposed Foul Water Drainage Infrastructure

The foul water drainage infrastructure for the proposed development has been designed and is to be constructed in accordance to Irish Water's "Code of Practice for Wastewater Infrastructure (Document IW-CDS-5030-03)", "Wastewater Infrastructure Standard Details (Document IW-CDS-5030-01)" and the Building Regulation requirements.

To service the development, a 225/300mm diameter foul water pipe will be provided, commencing from the south-west corner of the site, extending to the last foul water manhole of site 'FW01'. The foul water will then flow towards the existing foul water manhole 'EX.FW01' located south-east of the site, on the access road parallel to the southern site boundary, discharging all the foul water generated from the proposed development. For connection details, refer to drawing "20189-LDE-07-00-DR-SC-1C01a".

Foul water flow rates for the proposed development are tabulated in table 3.1 below. For full flow rate calculations refer to wastewater calculation sheet in Appendix C of this document.

	No. of Units	Occupancy	Flow per person, per day (Liters)	Daily Discharge (l/day)	10% Infiltration Allowance	Dry Weather Flow (DWF) (l/s)	Peak Dry Weather Flow (6DWF) (l/s)
Apartments	633	1710	150	256500	282150	3.266	19.594
Commercial	-	60	50	3000	3300	0.038	0.229
Residential Amenity	-	695	40	27800	30580	0.353	2.124
Creche	-	74	50	3700	4070	0.047	0.283
Total	-	-	-	291000	320100	3.704	22.229

Table 3.1: Wastewater flow rates for Proposed Development.

Table 3.1 above is generated in accordance with "Code of Practice for Wastewater Infrastructure (Document IW-CDS-5030-03)" Section 3.6, Appendix C, and Section 2.2.5 of Appendix B. For full foul water drainage infrastructure scheme for the proposed development refer to drawing "20189-LDE-07-00-DR-SC-1C01a".

Pre-connection enquiry form (Reference No. CDS20007999) was submitted on the 08th of December, 2020 to new connections department within Irish Water to determine whether a connection for the proposed development is feasible and could be established. Confirmation of feasibility from Irish Water has been received on the 18th of March, 2021 stating that a foul water connection for the proposed development is feasible, subject to upgrade works.

The confirmation of feasibility letter, with regards to the feasibility of a wastewater connection states the following:

"It will be necessary to carry out further detailed study and investigations to confirm the available capacity and to determine the full extent of any upgrades which may be required to be completed to Irish Water Infrastructure, prior to agreeing to the proposed connection. Should you wish to have such studies and investigations

progressed by Irish Water, you will be required to enter into Project Works Service Agreement."

We have since liaised with a Design Engineer from Irish Water, with the intent of entering the Project Works Service Agreement (PWSA). Irish Water are currently gathering information on the scope of works which will be implemented to determine the upgrades which may or may not be required.

Based on the existing size of wastewater sewer, Irish Water estimated that the likelihood of upgrades not being required are very slim, however this will only be fully known pending the results of the surveys and detailed studies which are going to be carried out over an average time period of 18 months. The timeline is extensive however necessary to adequately check the capacity of the existing wastewater sewer. The design intent of the required (if any at all) upgrade works will be known at an earlier stage, the 18 month time period covers the full extent of (PWSA) detailed studies and investigations from start to closure. Upgrades, if required will likely be in the form of replacing the existing sewer with a larger diameter pipe capable of facilitating higher flow rates. Confirmation of feasibility letter from Irish Water enclosed in Appendix B within this document.

Update - Irish Water (24/05/2021)

Irish Water have contacted us on the 24th of May, 2021 to inform that the Project Works Services Agreement (PWSA) will no longer be required. Irish Water will be undertaking upgrade works for the existing public wastewater infrastructure system in the area of where the proposed development is located. The extent of required upgrades is yet to be determined by Irish Water however, it is likely to be in the form of replacing the existing 225mm diameter public wastewater sewer (which we are currently proposing to connect to, as can be seen on our drawing "20189-LDE-07-00-DR-SC-1C01a") to a larger diameter sewer. The wastewater connection location for our proposed development into the upgraded public wastewater sewer will be identified by Irish Water post a New Connection Application form has been submitted to & reviewed by Irish Water.

Update - Irish Water (24/02/2022)

Statement of Design Acceptance was received from Irish Water on the 24th of February, 2022. The letter of design acceptance states that Irish Water are satisfied with the drainage infrastructure scheme for the proposed development and have no objections.

Two recommendations were made by Irish Water with regards to the proposed foul water sewer which reads as follows:

1. "*It is recommended a minimum clearance of 3m of an existing or proposed structure for sewer pipes*"
2. "*It is recommended that the foul sewer network is located deeper, depth of cover is less than 500mm in some areas*"

The comments made have been adhered to. All existing and proposed foul water sewers have a minimum seperational distance from the proposed structure of 3 meters throughout the development.

Furthermore, there are only two foul water pipes located under the footpath which do not meet the minimum cover requirement of 500mm. These pipes will have adequate protection measures in place in accordance with paragraph 1.7.3.2 of Building Regulations Technical Guidance Document H - Drainage and Waste Water Disposal. Concrete paving slabs will be laid to act as bridging above the pipes with 75mm of granular material between the top of pipe and underside of paving slab. Refer to Appendix I of this document. Statement of Design Acceptance letter from Irish Water enclosed in Appendix I within this document.

4.0 Surface Water Network

4.1 Existing Surface Water Drainage Infrastructure

Irish Water drainage record map shows an existing 225mm diameter surface water sewer located on the access road east of the development, parallel to the Chadwicks Plumb Centre. The sewer commences near the junction of the access road and Greenhills Road and continuous towards the south-east direction. Irish Water drainage record map enclosed in Appendix A of this document.

4.2 Proposed Surface Water Drainage Infrastructure

The surface water drainage infrastructure for the proposed development has been designed and is to be constructed in accordance to "Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Technical Document – Volume 2, New Developments, 2005, "Greater Dublin Regional Code of Practice Works" and the Building Regulation requirements.

It is proposed to provide a 225, 300 & 450mm diameter surface water pipes to service the development. Surface water collected from within the site boundary will flow into the last manhole on site "SW02", from there the surface water will flow into an intermediate manhole "SW01" in-between the last manhole on site and the existing surface water sewer. Finally the surface water will discharge into the existing 225mm surface water sewer located on the access road parallel to Chadwicks Plumb Centre, south of the proposed development via a saddle connection. For connection details, refer to drawing "20189-LDE-07-00-DR-SC-1C01a".

4.3 SuDS Measures Considered

As a requirement outlined in the "Greater Dublin Regional Code of Practice for Drainage Works" document, Version 6.0, enforced in collaboration with several different councils within Ireland, including South Dublin City Council (where the proposed development will be located), all new developments must incorporate sustainable urban drainage system (SuDS). Therefore, the proposed development will implement (SuDS) as an approach to manage the surface water within the site, reducing, delaying and purifying the run-off from the site, hence lowering the strain and the pollution content on the existing public sewer. The following SuDS measures have been considered by L&D to determine which measures are feasible and can be incorporated into the proposed development.

SuDS Measure Considered	Incorporated within Design?	Comments
Extensive Green Roof	Y	Both extensive and intensive green roof systems will be incorporated at podium level serving block A, C & D.
Intensive Green Roof	Y	Both extensive and intensive green roof systems will be incorporated at podium level serving block A, C & D.
Swales	N	Insufficient space within the site.
Filter Drains	N	Insufficient space within the site.
Permeable Paving	Y	Permeable paving is proposed throughout all paved areas throughout the full extent of the development.
Porous (Permeable) Asphalt	Y	Porous Asphalt is proposed to be used on the main external 6.0m wide service road within the development.
Petrol Interceptor	Y	Class 2 Petrol interceptors are proposed in both undercroft car parks serving block A and blocks C & D. Petrol interceptors are connected to the surface water sewer prior to surface water discharging into the external foul water manhole outside the car park.
Attenuation Tank	Y	Stormtech MC-3500 stormwater attenuation tank is proposed to be used, located under the courtyard area, adjacent to block B.
Rain Gardens	Y	Rain Gardens are proposed to be used on both sides along the internal 6.0m wide service road, in-between block A & B.
Tree Pitts	Y	Tree Pitts are proposed to be used along the full extent of the southern site frontage.
Detension Basins, Retention Ponds,	N	Insufficient space within the site.

Stormwater Wetlands		
Rainwater Harvesting	N	No Rainwater harvesting is proposed within the development.
Hydrobrake (Site Run-off Control)	Y	Hydrobrake is proposed to be used, installed on the last surface water manhole within the site to limit the outfall rate leaving the development to 8.021 l/s.

4.3.1 Permeable Paving

It is proposed to incorporate a permeable paving system into the paved areas surrounding the development, with the aim of reducing run-off from the site in times of precipitation and improving the quality of run-off generally. A minimum of 300mm depth of 63mm-10mm sub base with approximately 30% voids is to be used to provide additional sub-ground storage volume for rainfall events. The intention is to provide a sustainable form of storm water source control within the site that will reduce the total runoff from the site by temporarily retaining the runoff within the pavers/bedding, promoting evaporation and facilitating infiltration into the sub-soil. The quality of run-off from the site shall also be improved due to the filtering process of the paving, which retains silts and degrades hydrocarbons.

4.3.2 Blue Roof

It is proposed to provide an extensive blue roofing system by Bauder, covering 60% of the total roof area with the aim, similarly to a green roof to reduce runoff from the site in times of precipitation and remove the atmospherically deposited urban pollutants. A blue roof will act as a roof level attenuation tank, minimizing the in-ground attenuation tanks at ground level. Rainwater on the blue roof will be absorbed by the vegetation layer, for heavier storm events, when the vegetation layer is no longer capable of retaining any more water. The water will then be deposited into a 100mm deep "Bauder attenuation cell 100" and used by the vegetation layer once it has recovered. In heavy 1 in a 100 year storm event, when the water can no longer be held within the vegetation layer or attenuation cells it will discharge into the surface water sewer located at ground level at a controlled rate via flow restrictors of 2 l/s. In a 1:100yr storm event, with 20% increase in storage volume to allow for climate change and total blue roof area of 5058m^2, the total required attenuation volume equates to 228.45m^3. Refer to page 1 of Appendix D for attenuation calculations. The total provided attenuation by the blue roofs is 505.8m^3.

4.3.3 Tree Pits

It is proposed to provide a total of 21 tree pits along the southern boundary as can be seen on drawing “20189-LDE-07-00-DR-SC-1C01a”. The tree pits will provide a natural source of surface water infiltration & attenuation with the intent of attenuating the adjacent grass verge and cycle path, thus minimizing the in ground attenuation storage requirements. To enable infiltration into the sub-soil, the tree pits will be interlinked together via a 150mm perforated pipe. As a secondary measure of precaution and to prevent damage to trees from too much water ingress, the 150mm perforated pipe will be connected to the last surface water manhole on site SW02. In a 1:100yr storm event, with 20% increase in storage volume to allow for climate change and total area to be attenuated of 1185m^2, the total required attenuation volume equates to 31.668m^3. Refer to page 2 of Appendix D for attenuation calculations. The total provided attenuation by the tree pits is 54.337m^3.

4.3.4 Green Podium

Similarly to a green roof, it is proposed to incorporate a combination of a soft and a hard landscaping system into the design to form an accessible, intensive green podium. For hard & soft options to be considered as a green roof/podium system, both have to be permeable, capable of filtering the water through into the water storage and drainage layers. The top layers of soft landscaping will consist of an intensive vegetation layer on an intensive substrate layer, while hard landscaping will be consisting of paving blocks on granite chipping/gravel base. The intention is to provide an additional natural and sustainable form of attenuation within the site that will reduce the total runoff from the site by temporarily retaining the runoff within the sedum layer and promoting evaporation. Additionally, green roof/podium surface water treatment process removes atmospherically deposited urban pollutants. Refer to Figure 4.1 below for typical build-up layers of soft & hard landscaped green roofs.

Figure 2: Build-up for soft & hard landscaped Green Roof systems.
(Source: Bauder Green Roof technical design guide 2020).

4.3.5 Attenuation Chambers

It is proposed to provide Stormtech MC-3500 attenuation chambers for the 1:100yr storm event and a 20% increase in storage volume to allow for climate change, equating to a total required attenuation volume of 895.74m^3. Refer to page 3 of Appendix D for attenuation calculations. The podium slab over the car parking areas is taken as a green podium area and is approximately 8500m^2. This area, the proposed permeable paving areas (6526m^2) and grassed areas (3621m^2) equal to a total area of

18647m^2. For all of the listed areas above, the following impermeability factors have been applied:

- Green podium – 60%
- Permeable paving – 60%
- Grassed areas – 15%

Applying the impermeability factors to the total area (excluding blue roof, tree pits and their associated areas which are not attenuated by an in ground attenuation system) of 18972m^2, a total required impermeable attenuation area of 11984m^2 is generated. For a return period of 2 years, the maximum anticipated run-off is approximately 187.77 l/s. Additionally, the proposed attenuation chambers allow for the removal of total suspended solids and provides easy access for inspection and maintenance. To increase the process of percolation, the attenuation chambers are to be surrounded with a permeable geotextile to promote infiltration.

4.3.6 Rain Gardens

It is proposed to provide rain gardens at both sides of the 6.0m internal access road servicing the development, in-between blocks A and B. The rain gardens will be enclosed within a raised kerb system. To allow rainwater surrounding the rain gardens to enter, the continuous kerb around the perimeter of the rain gardens will be dropped to achieve level access between the rain gardens and the adjacent pavement. Rain gardens be composed of a landscaped area with high permeability soil. Rain gardens will provide treatment to the collected rainwater and promote evaporation. For a heavy rainfall event, to mitigate any potential over flooding of the rain gardens, a 150mm diameter perforated pipe will be provided to drain any excess surface water to the surface water drainage network servicing the development.

4.3.7 Hydro-brake

The maximum run-off for the site has been calculated to be 187.77 l/s. To ensure that the existing surface water sewer is not over capacitated, the flow of surface water leaving the last manhole "SW02" on site (as per Greater Dublin Regional Code of Practice for Drainage Works, Rev 6) will be limited to 8.021 l/s via a hydro-brake, a flow control device capable of managing the flow rate of water. Refer to Appendix E & F for Q-Bar and run-off calculations.

4.3.8 Petrol Interceptor

All surface water from the car parks will go through a petrol interceptor to separate any hazardous chemicals and petroleum prior to joining the externally situated surface water sewer.

4.4 Interception Storage

Interception storage refers to precipitation which will be stored and intercepted by certain alleviation measures, preventing the rain water from contacting and being absorbed by the subgrade. The Greater Dublin Strategic Drainage Study (GDSDS) document states that a minimum of 5mm, and preferably 10mm of interception storage must be provided. The development comprises of blue roofs, green podiums, permeable paving/asphalt and grassed areas. The total impermeable area for the development amounts to 15793m^2. To successfully intercept 10mm of rain water leaving the development the interception volume has to equate to:

15793 x 0.01 = 157.93m^3

4.4.1 Blue Roofs

The area of blue roofs provided for the development amounts to 5058m2. The blue roof system will have 100mm deep attenuation cells with 95% void space, which equals to a total rain water interception volume of:

$5058 \times 0.1 \times 0.95 = 480.51m^3$

4.4.2 Green Podium

The area of green podium provide for the development amounts to $8500m^2$. It is proposed to incorporate a 20mm dimple drainage sheet below the substrate of the green roof with 90% void space. The 20mm sheet will be positioned below the level of drainage outlets on the roof in order to retain the water and facilitate evapotranspiration. The volume of interception storage provided by the green roof areas would be equivalent to:

$8500 \times 0.02 \times 0.90 = 153m^3$

4.4.3 Permeable Paving/Asphalt

The area of permeable paving/asphalt amounts to $7561m^2$. The a 63 – 10mm coarse aggregate 250mm sub-base, forming the permeable paving system has a 30% void ratio. This void ratio will be utilized as interception storage. The interception storage volume provided within the 250mm sub-base equates to the following:

$7561 \times 0.25 \times 0.3 = 567m^3$

The total interception storage provided for the entire development amounts to $1200.51m^3$, more than both the minimum 5mm storage requirement and the recommended 10mm storage capacity, as denoted within the GDSDS code of practice document.

5.0 Water Main

5.1 Existing Water Main (Outside Site Boundary)

Irish Water drainage record map shows an existing 101.6mm diameter uPVC water main located on the service road, parallel to the southern boundary with several extensions to service other nearby developments. Another 101.6mm diameter Cast-Iron water main can be seen on Greenhills Road, parallel to the northern site boundary, continuing towards the Walkinstown roundabout. Irish Water drainage record map enclosed in Appendix A of this document.

5.2 Existing Water Main (Inside Site Boundary)

Irish Water drainage record maps indicates a 101.6mm uPVC water main inside the site boundary, situated within the western part of the development. The water main is shown to have two separate extensions, one extension connected perpendicularly to the existing water main parallel to the southern site boundary, the other connected to the existing water main south-west of the development.

The existing water main was serving the previous development which is to be demolished for the following reasons:

1. Existing water main layout is not compliant with Irish Water's code of practice or the structural layout of the proposed development (i.e. existing water main is currently located under the proposed structures).
2. Existing water main does not have sufficient capacity to service the new proposed development.

Furthermore, another existing water main is present in the northern part of the development. This water main is 1200mm in diameter and traverses the site, entering from middle-north and exiting in the north-east corner of the development. Within the confirmation of feasibility letter, Irish Water have stated the following instructions with regards to the existing 1200mm diameter water main.

"Irish Water records indicate the presence of an Irish Water asset on the Site which will have to be diverted as part of the Development. It will not be permitted to build over any Irish Water infrastructure. The layout of the development must ensure that this pipe is protected, and adequate separation distances are provided between Irish Water infrastructure and any structures on site. Alternatively, you may enter into a diversion agreement with Irish Water and divert the pipe to accommodate your development. If you wish to proceed with this option, please contact Irish Water 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 Irish Water and ensure that it is accessible for maintenance."

It is intended to retain the existing water main using the method outlined within Irish Water's instructions above, rather than diverting & removing it from the premises. To achieve this a 7.5m, unobstructed wayleave either side of the pipe will be provided, to ensure that the existing water main is accessible for any potential future maintenance. For details, refer to drawing "20189-LDE-07-00-DR-SC-1C01a".

5.3 Proposed Water main

The water main infrastructure for the proposed development has been designed and is to be constructed in accordance to Irish Water's "Code of Practice for Water Infrastructure (Document IW-CDS-5020-01)", "Water Infrastructure Standard Details (Document IW-CDS-5020-03)" and the Building Regulation requirements.

To service the development, it is proposed to provide a 200mm MDPE (medium density polyethylene) type PE-80 water main. The water main will be connected to the plant rooms where the water distribution system is located, distributing the water to the residing residents of the apartment complexes. To comply with guidance specification for fire hydrants, offline & on-line fire hydrants will be provided along the water main to provide full coverage of the proposed development in the event of a fire. The water main will exit the proposed development in the north-east corner and connect to the newly laid 200mm diameter water main as per the conditions set out in Irish Water's confirmation of feasibility letter. Prior to exiting the site, a boundary box and telemetry kiosk will be installed to measure the water usage for the development.

Pre-connection enquiry form (Reference No. CDS20007999) was submitted on the 08th of December, 2020 to new connections department within Irish Water to determine whether a connection for the proposed development is feasible and could be established. Confirmation of feasibility from Irish Water has been received on the 18th of March, 2021 stating that a water main connection for the proposed development is feasible, subject to upgrade works.

The confirmation of feasibility letter, with regards to the feasibility of a water main connection states the following:

"In order to accommodate the proposed connection at the Premises, upgrade works are required to increase the capacity of the Irish Water network. A new main of 200mm ID is required to be laid for approximately 280m in parallel with the existing 6" uPVC in Greenhills Road, and connected to: the connection main, the existing 4" uPVC and the existing 6" uPVC. This should include closed existing valve upstream of the 6" uPVC

The connection point for the proposed development should be made to the newly laid 200mm DI main."

In order to comply with the condition above and achieve a feasible water main connection for the development, a new 200mm ID ductile iron water main is to be laid for approximately 280 meters. The new water main is to be parallel to the existing 150mm uPVC water main located on Greenhills road. The newly laid water main will be used as a connection point for the proposed development. Confirmation of feasibility letter from Irish Water enclosed in Appendix B within this document.

Update - Irish Water (24/02/2022)

Statement of Design Acceptance was received from Irish Water on the 24th of February, 2022. The letter of design acceptance states that Irish Water are satisfied with the drainage infrastructure scheme for the proposed development and have no objections.

One recommendation was made by Irish Water with regards to the water main which reads as follows:

- "*It is recommended a minimum clearance of 5m of an existing or proposed structure for watermain between 200mm and 600mm in diameter*"

The comment made was adhered to. The proposed 200mm water main has a minimum seperational distance from the proposed structure of 5 meters throughout the development. Statement of Design Acceptance letter from Irish Water enclosed in Appendix I within this document.

6.0 Flood Risk

As per the Flood Risk Assessment, report ref. (20189-LDE-ZZ-ZZ-RP-0002), the site is located in a flood zone type C and therefore has a low probability of experiencing a flood event. It is therefore our opinion that the risk of flooding at this site and the risk of flooding due to the development of this site is minimal and within acceptable limits.

7.0 Roads

7.1 Existing Road Network

The existing site has three access points, all located and accessible through the industrial access road along the full extent of the southern boundary of the site. The site is vacant and the existing access roads within the site comprise of concrete or tarmacadam surface courses, both of which are in poor condition and overgrown with vegetation.

7.2 Proposed Road Network

It is proposed to provide a 6m wide vehicular access road to service the development. The primary point of access will be provided in the north-east corner of the proposed development, linking the internal access road into the existing Greenhills Road. Additionally, the development will have secondary access points used for emergency scenarios, a total of two emergency access points located along the southern site boundary of the proposed development.

Following the S247 pre-planning consultation meeting, South Dublin County Council (SDCC) have expressed their concern regarding the potential level difference of the proposed north-east access point servicing the development and the future Greenhills Junction/Calmount Road extension.

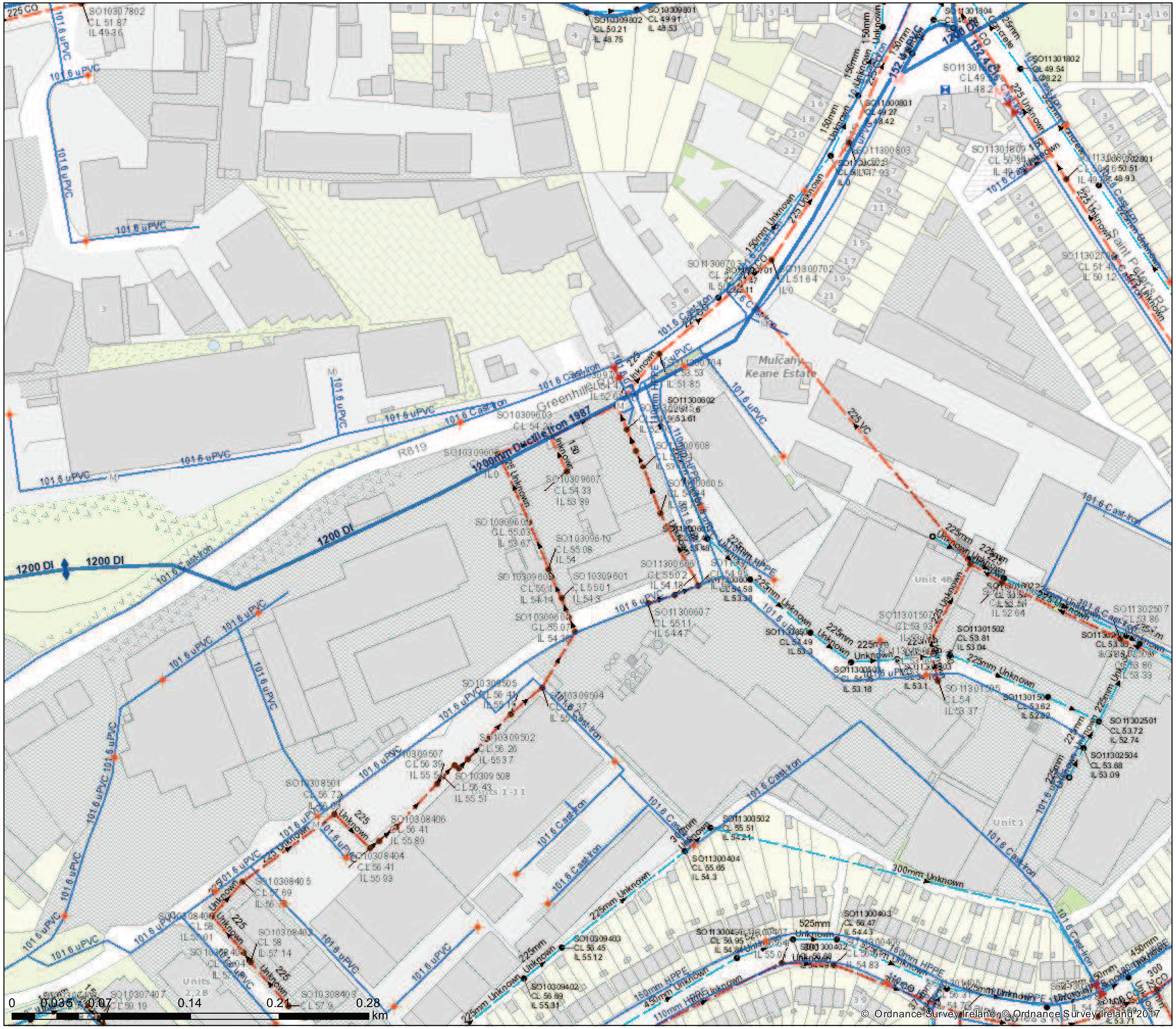
To comply with the levels for the future Calmount Road extension, we have since liaised with SDCC and confirmed that the level at which we are proposing to connect into the existing Greenhills Road is compliant with the future Calmount Road extension.

The development will introduce a total of five GoCar cars and will be used as a sharing service. By allowing multiple people to use the same vehicle at different times it promotes a more environmentally friendly driving system. It has been proven that most car share users tend to use the sharing service only when necessary and rather walk, cycle or use the public transport more often than car owners. Refer to Appendix H in which a Letter of Intent from GoCar car sharing company can be found, acknowledging that five vehicles will be provided upon completion of the development.

Mr. Edvinas Valadka B.Eng., **Date: 8th March. 2022**
Engineer,
For Lohan & Donnelly Consulting Engineers.

Appendix A – Dublin City Council Drainage Records

Irish Water Web Map



UISCE ÉIREANN : IRISH WATER

Print Date: 16/12/2020

Printed by:Irish Water

Appendix B – Confirmation of Feasibility (Irish Water)

UISCE ÉIREANN : IRISH WATER

Edvinas Valadka

13 Gardiner Place
Mountjoy Square
Dublin 1
Dublin
D01VOT8

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

Irish Water
PO Box 448,
South City Delivery Office,
Cork City.

www.water.ie

18 March 2021

Re: CDS20007999 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 780 unit(s) at Greenhills Road, Walkinstown, Dublin 12, Co.Dublin

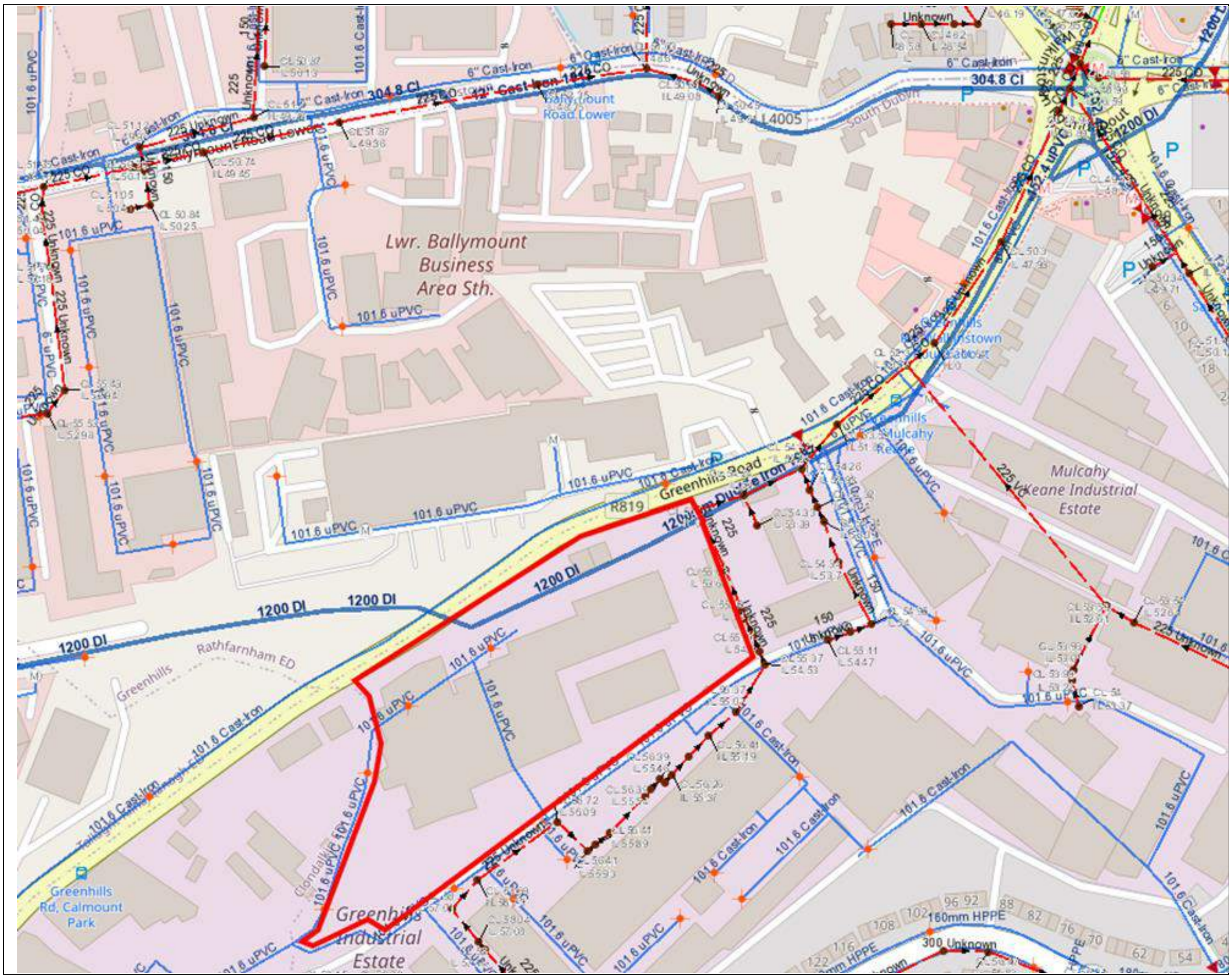
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Greenhills Road, Walkinstown, Dublin 12, Co.Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

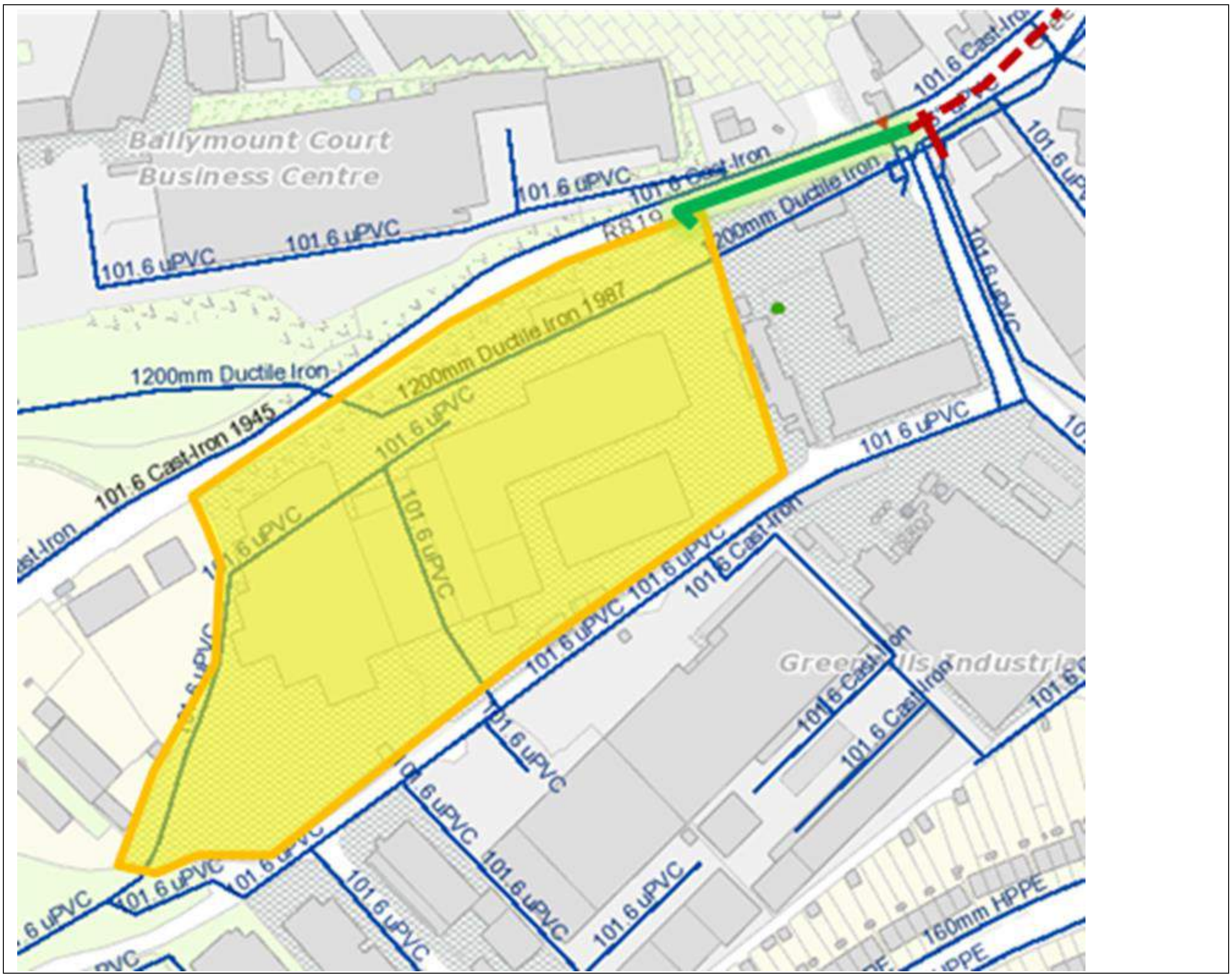
SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible Subject to upgrades
Wastewater Connection	Feasible Subject to upgrades
SITE SPECIFIC COMMENTS	
Water Connection	In order to accommodate the proposed connection at the Premises, upgrade works are required to increase the capacity of the Irish Water network. A new main of 200mm ID is required to be laid for approximately 280m in parallel with the existing 6" uPVC in Greenhills Road, and connected to: the connection main, the existing 4" uPVC and the existing 6" uPVC .This should include closed existing valve upstream of the 6" uPVC. The connection point for the proposed development should be made to the newly laid 200mm DI main. Irish Water currently does not have any plans to extend or commence upgrade works to its network in this area.

	Should you wish to progress with the connection, the extension works fee will be calculated and be a part of Irish Water connection offer for the Development. Irish Water records indicate the presence of an Irish Water asset on the Site which will have to be diverted as part of the Development. It will not be permitted to build over any Irish Water infrastructure. The layout of the development must ensure that this pipe is protected, and adequate separation distances are provided between Irish Water infrastructure and any structures on site. Alternatively, you may enter into a diversion agreement with Irish Water and divert the pipe to accommodate your development. If you wish to proceed with this option, please contact Irish Water 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 Irish Water and ensure that it is accessible for maintenance. It is required to provide a storage for the average day peak week demand rate of the commercial section for 24-hour period. The supply will have a re-fill time of 12 hours. Please note that the connection main should have a bulk meter installed along it; this meter will be linked with telemetry.
Wastewater Connection	It will be necessary to carry out further detailed study and investigations to confirm the available capacity and to determine the full extent of any upgrades which may be required to be completed to Irish Water Infrastructure, prior to agreeing to the proposed connection. Should you wish to have such studies and investigations progressed by Irish Water, you will be required to enter into Project Works Service Agreement.
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Lwr. Ballymount
Business
Area Sth.
Mulcahy
Keane Industrial
Estate
Greenhills
Industrial
Estate
Greenhills Road
R819
Rathfarnham ED
Greenhills
Greenhills
Rd, Calmount
Park
Ballymount
Road Lower
1200 DI
304.8 CI
101.6 uPVC
101.6 Cast-Iron
6" Cast-Iron
225 Unknown
160mm HPPE
300 Unknown



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.

4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Lara Nagle from the design team on email lanagle@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Yvonne Harris

Head of Customer Operations

Appendix C – Foul Water Calculations

Outfall Manhole: FW01 **To Existing Manhole: EX.FW01**

Assume:	300 dia. pipe @ 1: 225	
flow capacity:	69.80	l/sec.)
Length of Run:	160	m.
Residential (Appartments)		
Occupancy:	1710	persons.
Daily Flow (DWF):	282150	l/day.
6 x DWF:	1692900	l/day.
Flow per second: DWF	3.265625	l/sec.
Flow per Second: 6 DWF	19.594	l/sec.
Commercial (1326.47m2)		
Occupancy:	60	persons.
Daily Flow (DWF):	3300	l/day.
6 x DWF:	19800	l/day.
Flow per second: DWF	0.0381944	l/sec.
Flow per Second: 6 DWF	0.229	l/sec.
Residential Amenity (1359.6m2)		
Occupancy:	695	persons.
Daily Flow (DWF):	30580	l/day.
6 x DWF:	183480	l/day.
Flow per second: DWF	0.3539352	l/sec.
Flow per Second: 6 DWF	2.124	l/sec.
Creche		
Occupancy:	74	persons.
Daily Flow (DWF):	4070	l/day.
6 x DWF:	24420	l/day.
Flow per second: DWF	0.0471065	l/sec.
Flow per Second: 6 DWF	0.283	l/sec.
Total		
Flow per Second: DWF	3.7048611	l/sec.
Flow per Second: 6 DWF	22.229	l/sec.

Therefore **300 Dia. Pipe @ 1:225** **O.K.**

Note: 10% extra for infiltration allowance to be included, as per section 3.6.3 and section 2.2.4 of Appendix B within Irish Water "Code of practice for wastewater infrastructure (IW-CDS-5030-03)" document

Appendix D – Attenuation Calculations

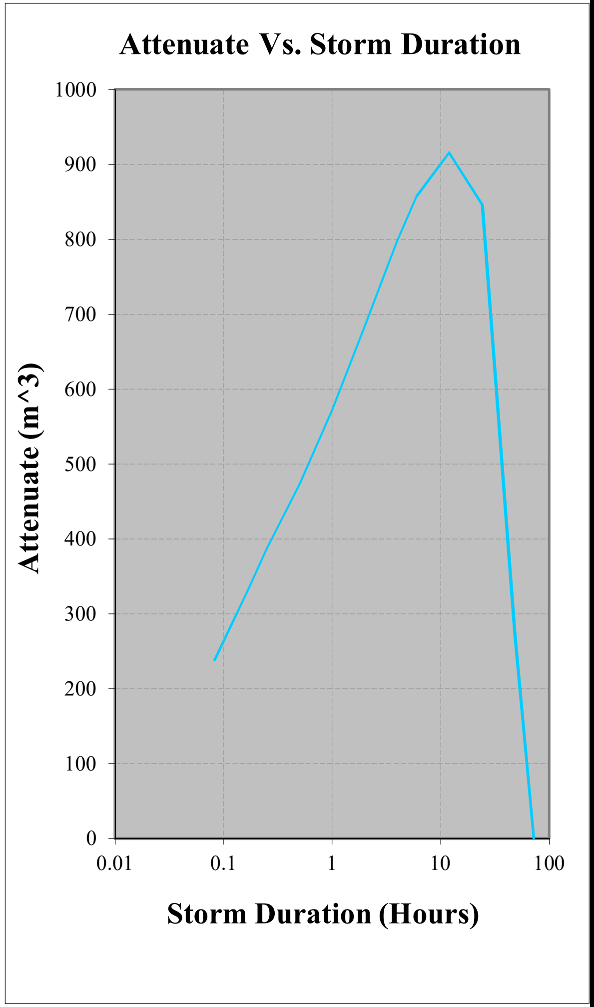
LOHAN & DONNELLY
Consulting Engineers
13 Gardiner Place, Mountjoy Square, Dublin 1. T: 01 8787770
W: www.lohan-donnelly.com E: info@lohan-donnelly.com

Blue Roof Attenuation | Project: BTR Residential Development, at Greenhills Road, Walkinstown, Dublin 12 | Job No: 20189 | Page No: 1

Page: 1 | Date: 08/03/2022 | Calc'd by: E.V | Checked by: G.P

Hard Area: 0 m^2 | I. Factor: 0.80 | Tree Pits: 0 m^2
Permeable: 0 m^2 | I. Factor: 0.60 | I. Factor: 0.6
Grassed: 0 m^2 | I. Factor: 0.15
Blue Roof 5058 m^2 | I. Factor: 0.6
Green Podium: 0 m^2 | I. Factor: 0.6
Equivalent Impermeable Area: 3035 m^2
Attenuated Flow Rate: 2 l/s

Storm Duration (Hours)	Rainfall (mm)	Total Surface Water (m^3)	Allowable Discharge (m^3)	Attenuate (m^3)
0.083	17.00	51.59	0.5976	50.99
0.166	23.70	71.92	1.1952	70.73
0.25	27.90	84.67	1.8	82.87
0.50	34.50	104.70	3.6	101.10
1.00	42.60	129.28	7.2	122.08
2.00	52.70	159.93	14.4	145.53
3.00	59.70	181.18	21.6	159.58
4.00	65.20	197.87	28.8	169.07
6.00	73.80	223.97	43.2	180.77
12.00	91.20	276.77	86.4	190.37
24.00	112.80	342.33	172.8	169.53
48.00	125.30	380.26	345.6	34.66
72.00	135.90	412.43	518.4	0



Maximum Volume of Attenuate: 190.37 m^3 Climate Change/Urban Expansion: 1.2 Required Attenuation Volume = 228.45 m^3

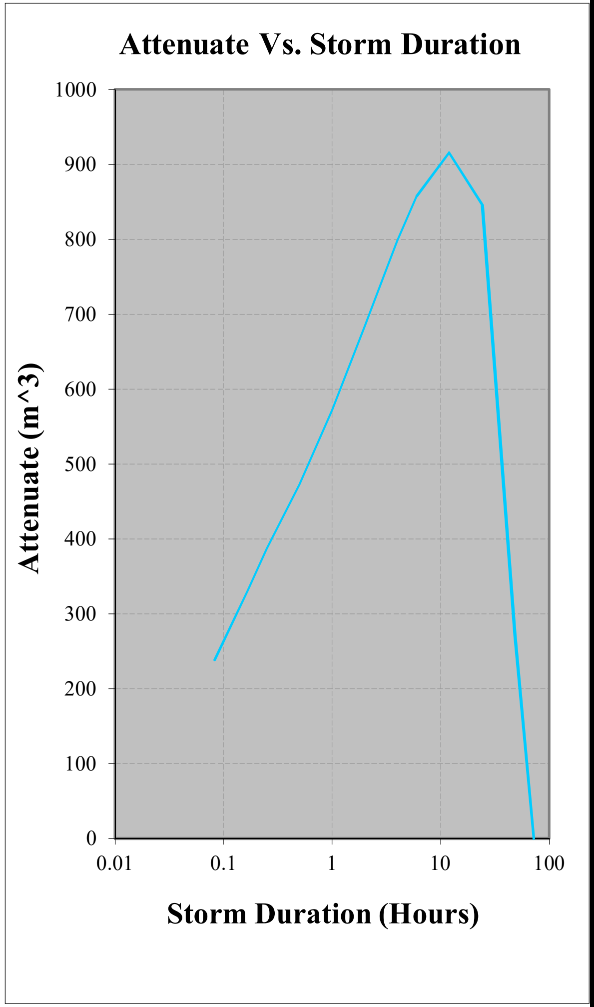
Note: This spreadsheet calculates the Volume of Attenuate based on a Return Period of: 100 years.

LOHAN & DONNELLY
Consulting Engineers
13 Gardiner Place, Mountjoy Square, Dublin 1. T: 01 8787770
W: www.lohan-donnelly.com E: info@lohan-donnelly.com

Stormtech Attenuation	Project: BTR Residential Development, at Greenhills Road, Walkinstown, Dublin 12		Job No: 20189
			Page No: 1
Page: 3	Date: 08/03/2022	Calc'd by: E.V	Checked by: G.P

Hard Area: ### m^2	Permeable: 6526	Grassed: 3621 m^2	Blue Roof 0 m^2	Green Podium: 8500 m^2	Equivalent Impermeable Area: 11984 m^2	Attenuated Flow Rate: 8.02 l/s
I. Factor: 0.80	I. Factor: 0.60	I. Factor: 0.15	I. Factor: 0.6	I. Factor: 0.6		
Tree Pits: 0 m^2	I. Factor: 0.6					

Storm Duration (Hours)	Rainfall (mm)	Total Surface Water (m^3)	Allowable Discharge (m^3)	Attenuate (m^3)
0.083	17.00	203.73	2.396771429	201.34
0.166	23.70	284.03	4.793542858	279.24
0.25	27.90	334.36	7.219191051	327.14
0.50	34.50	413.46	14.4383821	399.02
1.00	42.60	510.53	28.8767642	481.66
2.00	52.70	631.58	57.7535284	573.82
3.00	59.70	715.47	86.63029261	628.84
4.00	65.20	781.38	115.5070568	665.87
6.00	73.80	884.45	173.2605852	711.18
12.00	91.20	1092.97	346.5211704	746.45
24.00	112.80	1351.83	693.0423409	658.79
48.00	125.30	1501.64	1386.084682	115.55
72.00	135.90	1628.67	2079.127023	0



Maximum Volume of Attenuate: 746.45 m^3 Climate Change/Urban Expansion: 1.2 Required Attenuation Volume = 895.74 m^3

Note: This spreadsheet calculates the Volume of Attenuate based on a Return Period of: 100 years.

LOHAN & DONNELLY
Consulting Engineers
13 Gardiner Place, Mountjoy Square, Dublin 1. T: 01 8787770
W: www.lohan-donnelly.com E: info@lohan-donnelly.com

Tree Pit Attenuation

Project: BTR Residential Development, at Greenhills Road, Walkinstown, Dublin 12

Job No: 20189

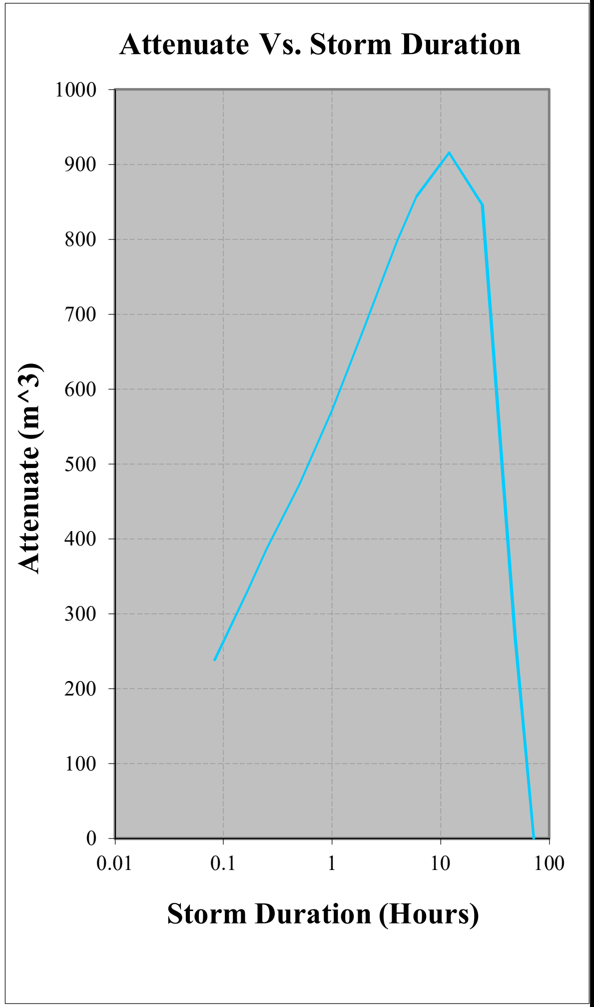
Page No: 1

Page: 2 | Date: 08/03/2022 | Calc'd by: E.V | Checked by: G.P

Hard Area: 0 m^2 I. Factor: 0.80 | Permeable: 1035 m^2 I. Factor: 0.60 | Grassed: 150 m^2 I. Factor: 0.15 | Blue Roof 0 m^2 I. Factor: 0.6 | Green Podium: 0 m^2 I. Factor: 0.6 | Equivalent Impermeable Area: 774 m^2 | Attenuated Flow Rate: 2 l/s

Tree Pits: 218 m^2 I. Factor: 0.6

Storm Duration (Hours)	Rainfall (mm)	Total Surface Water (m^3)	Allowable Discharge (m^3)	Attenuate (m^3)
0.083	17.00	13.16	0.5976	12.56
0.166	23.70	18.34	1.1952	17.15
0.25	27.90	21.59	1.8	19.79
0.50	34.50	26.70	3.6	23.10
1.00	42.60	32.97	7.2	25.77
2.00	52.70	40.79	14.4	26.39
3.00	59.70	46.21	21.6	24.61
4.00	65.20	50.46	28.8	21.66
6.00	73.80	57.12	43.2	13.92
12.00	91.20	70.59	86.4	0
24.00	112.80	87.31	172.8	0
48.00	125.30	96.98	345.6	0
72.00	135.90	105.19	518.4	0



Maximum Volume of Attenuate: 26.39 m^3 Climate Change/Urban Expansion: 1.2 Required Attenuation Volume = 31.668 m^3

Note: This spreadsheet calculates the Volume of Attenuate based on a Return Period of: 100 years.

Appendix E – Q-Bar Calculations

LOHAN & DONNELLY Consulting Engineers 13 Gardiner Place, Mountjoy Square, Dublin 1. T: 01 8787770 W: www.lohan-donnelly.com E: info@lohan-donnelly.com	Project: BTR Residential Development, at Greenhills Road, Walkinstown, Dublin 12			
	Element: Q-Bar Calculation			
	By: E.V.	Date: 08/03/2022	Proj. No.: 20189	
	Chk' d: G.P	Date: 08/03/2022	Sht. No.: 1	of 1

Ref.	Calculations	Output

The site is greater than 1 hectare and less than 50 hectares, linear interpolation will therefore be used to determine the surface water discharge rate (Qbar).

Qbar for for 50 hectare site:

Area (sq km)	0.5	
SAAR (mm)	700	Typical for Dublin
Soil value	0.37	Based on site specific ground investigation report
100 year return growth curve for Dublin Rivers	2.6	
QBARrural	143 2/3	l/s

Qbar for for 2.7922 hectare site (Proposed Development):

Area (sq km)	0.027922	
SAAR (mm)	700	Typical for Dublin
Soil value	0.37	Based on site specific ground investigation report
100 year return growth curve for Dublin Rivers	2.6	
QBARrural	8.0213234	l/s

Appendix F – Run-Off Calculations

LOHAN & DONNELLY
Consulting Engineers

13 Gardiner Place, Mountjoy Square, Dublin 1. T: 01 8787770
W: www.lohan-donnelly.com E: info@lohan-donnelly.com

Project:	BTR Residential Development, at Greenhills Road, Walkinstown, Dublin 12	Job No:	20189
		Page No:	2
Date: 08/03/2022	Calc'd by: E.V	Checked by:	GP

Remarks	From	To	Area (m^2)	Previous Area (m^2)	Total Area (m^2)	Length of Pipe (m)	Gradient	Size (mm)	Velocity (m/s)	Capacity (l/s)	Time of Entry (min)	Time of Flow (min)	Time of Concentration (min)	Rainfall Intensity (mm/hr)	Total Run-Off (l/s)
	SW43	SW45	80	0	80	9.7	1: 100	225	1.22	48.6	4	0.13	4.1	68.60	1.52
	SW45	SW44	410	80	490	28.9	1: 100	225	1.22	48.6	4	0.39	4.4	66.80	9.09
	SW44	SW20	130	490	620	10.5	1: 225	225	0.82	32.4	4	0.21	4.2	68.10	11.73
	SW20	SW19	585	620	1205	90	1: 100	225	1.22	48.6	4	1.23	5.2	62.50	20.92
	SW19	SW18	960	1205	2165	87	1: 100	225	1.22	48.6	4	1.19	5.2	62.50	37.59
	SW49	SW48	115	0	115	11.1	1: 50	225	1.73	68.8	4	0.11	4.1	68.60	2.19
	SW48	SW47	180	115	295	35.5	1: 50	225	1.73	68.8	4	0.34	4.3	67.30	5.51
	SW47	SW46	400	295	695	36	1: 30	225	2.23	88.8	4	0.27	4.3	67.30	12.99
	SW46	SW09	580	695	1275	18.7	1: 225	225	0.82	32.4	4	0.38	4.4	66.80	23.66
	SW09	SW10	540	1275	1815	41.2	1: 225	300	0.99	69.8	4	0.70	4.7	65.00	32.77
	SW14	SW13	270	0	270	28	1: 100	225	1.22	48.6	4	0.38	4.4	66.80	5.01
	SW13	SW12	342	270	612	41.5	1: 225	225	0.82	32.4	4	0.85	4.8	64.50	10.97
	SW12	SW10	750	612	1362	10.7	1: 225	225	0.82	32.4	4	0.22	4.2	68.10	25.76
	SW10	SW11	357	3177	3534	4.6	1: 50	225	1.73	68.8	4	0.04	4.0	69.30	68.03
	SW11	Att. Tank	0	3534	3534						4				
	Att. Tank	SW15	0	3534	3534						4				
	SW15	SW16	0	3534	3534	15.4	1: 225	300	0.99	69.8	4	0.26	4.3	67.30	66.07
	SW17	SW16	360	0	360	29.2	1: 225	225	0.82	32.4	4	0.60	4.6	65.50	6.55
	SW16	SW18	355	3894	4249	18	1: 225	450	1.29	205.9	4	0.23	4.2	68.10	80.38
	SW18	SW31	345	6414	6759	6.9	1: 225	450	1.29	205.9	4	0.09	4.1	68.60	128.80
	SW31	SW03	560	6759	7319	55	1: 225	450	1.29	205.9	4	0.71	4.7	65.00	132.15
	SW08	SW07	180	0	180	30.6	1: 225	225	0.82	32.4	4	0.63	4.6	65.50	3.28
	SW07	SW06	520	180	700	44.8	1: 225	225	0.82	32.4	4	0.92	4.9	64.00	12.44
	SW06	SW05	840	700	1540	41	1: 225	225	0.82	32.4	4	0.84	4.8	64.50	27.59
	SW05	SW04	565	1540	2105	21.3	1: 225	300	0.99	69.8	4	0.36	4.4	66.80	39.06
	SW04	SW03	115	2105	2220	12.5	1: 225	300	0.99	69.8	4	0.21	4.2	68.10	42.00
	SW03	SW02	315	9539	9854	6.5	1: 225	450	1.29	205.9	4	0.08	4.1	68.60	187.77
Flow Limited to 8.021/s	SW02	SW01	40	9854	9894						4				8.021
Flow Limited to 8.021/s	SW01	EX. SEWER	0	9894	9894						4				8.021

Note: This spreadsheet calculates the flow in pipes based on the Modified Rational Method and a Return Period of: 2 years.

Appendix G – Ground Investigations Report

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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

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

Ground Investigations Ireland

Greenhills Road

Lohan & Donnelly

Ground Investigation Report

February 2021

1.0 Preamble

On the instructions of Lohan & Donnelly Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd. in January 2021 at the site of the proposed residential development on the Greenhills Road, Dublin 12.

2.0 Overview

2.1. Background

It is proposed to construct new residential development with associated services, access roads and car parking at the proposed site. The site was historically used as a gravel quarry, with a large retaining wall structure marking the southwestern boundary of the site. The site is currently occupied by several derelict industrial/commercial buildings and is situated near the Walkinstown Roundabout, on the southern side of Greenhills Road (R918), Dublin 12. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant.

2.2. Purpose and Scope

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

- Visit project site to observe existing conditions
- Carry out 14 No. Window Sample Boreholes to recover soil samples
- Carry out 10 No. Cable Percussion boreholes to a maximum depth of 4.50m BGL
- Installation of 3 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. Window Sampling

The window sampling was carried out at the locations shown in Figure 2 in Appendix 1 using a Tecopsa SPT Tec 10 percussion drilling rig. The window sampling consists of a 1m long steel tube with a cutting edge and an internal plastic liner which is mechanically driven into the ground utilising a 50kg weight falling a height of 500mm. Upon completion of the 1m sample, the tube is withdrawn and the plastic liner removed and sealed for logging and sub sampling by a Geotechnical Engineer/Engineering Geologist. The tube is replaced in the borehole and a subsequent 1m sample can be recovered. Occasionally outer casing or a reduced diameter tube is utilised to enable the window sample to progress in difficult drilling conditions. Geotechnical or environmental soil samples can be recovered from each of the liners following logging. The window sample records are provided in Appendix 2 of this Report.

3.3. Cable Percussion Boreholes

The Cable Percussion Boreholes were drilled using a Dando 2000 drilling rig with regular in-situ testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.
The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata.
Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 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 3 of this Report.

3.4. Surveying

The exploratory hole locations have been recorded using a Trimble R10 GNSS System which records the coordinates and elevation of the locations to ITM, as required by the project specification. In areas where the Trimble R10 GNSS System was unable to record the data due to building interference, observation

methods were used to estimate the exploratory hole location. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.5. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.
Environmental & Chemical testing as required by the specification, including the Rilta Suite, pH and sulphate testing was carried out by Element Materials Technology Laboratory in the UK. The Rilta suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria.
Geotechnical testing consisting of moisture content, Atterberg limits and, Particle Size Distribution (PSD), tests were carried out in NMTL's Geotechnical Laboratory in Carlow.
The results of the completed laboratory are included in Appendix 4 of this Report.

4.0 Ground Conditions

4.1. General

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

The sequence of strata encountered were variable across the site but generally comprised;

- Surfacing
- Made Ground
- Cohesive Deposits
- Granular Deposits

SURFACING: Tarmacadam or Concrete surfacing was present in all exploratory holes and was present to a maximum depth of 0.30m BGL.

MADE GROUND: Made Ground and suspected Made Ground deposits were encountered beneath the surfacing and were present to a depth of between 0.40m and 2.40m BGL, with the full extent of these deposits not determined at BH02, BH02A, BH03, WS02, WS02A, WS02B, WS08, and WS08A. These deposits varied across the site but were generally were described as either a *brown clayey sandy subangular to subrounded fine to coarse Gravel* or a *greyish brown sandy gravelly Clay,* and contained *rare fragments of red brick.*

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the made ground and/or surfacing at BH03A, BH04, BH05, BH06, WS03, WS04, WS05, WS09, WS10, and WS11. These deposits were described typically as *dark brown/grey slightly sandy gravelly CLAY with occasional cobbles.* The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had occasional, some or many cobble and boulder content were noted on the exploratory hole logs.

GRANULAR DEPOSITS: Granular deposits were encountered beneath the made ground and/or cohesive deposits at BH01, BH04, BH05, BH06, BH07, BH08, WS01, WS06, and WS07. These deposits were generally described as *grey/brown clayey subangular to subrounded fine to coarse GRAVEL with occasional cobbl*es and *brown clayey gravelly fine to coarse SAND*. The secondary sand/gravel and silt/clay constituents varied across the site and with depth while occasional, some or many cobble and boulder content also present where noted on the exploratory hole logs.
Based on the SPT N values the deposits are typically medium dense and become dense with depth.

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 BH04, BH06 and BH08 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 5 of this Report.

4.3. Laboratory Testing

4.3.1. Geotechnical Laboratory Testing

Will be included in the final report.

4.3.2. Chemical Laboratory Testing

Will be included in the final report.

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 environmental assessment report is included under the cover of a sperate report by Ground Investigations Ireland.

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

5.0 Recommendations & Conclusions

5.1. General

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

5.2. Foundations

The allowable bearing capacities are outlined in Table 1 below and are recommended for conventional strip or pad foundations to permit the foundation assessment. The possibility for variation in the depth of the made ground in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete. Where granular deposits and cohesive deposits are encountered at foundation level, we would recommend that all the foundations of the unit in question be lowered to the same stratum to avoid differential settlement. Where shallow refusal is noted, rotary core drilling is recommended to confirm the type and condition of the stratum below the refusal depth.

Table 1.

Allowable Bearing Capacities (ABC) – Borehole Locations							
Shallowest Practical Depth				Depth to 250 kN/m^2			
Probe No.	ABC kN/m2	Depth m BGL	Comment	Probe No.	ABC kN/m2	Depth m BGL	Comment
BH01	100	1.20	Granular	BH01	250	2.00	Granular
BH02	-	-	Shallow Refusal	BH02	-	-	
BH02A	-	-	Shallow Refusal	BH02A	-	-	
BH03	-	-	Shallow Refusal	BH03	-	-	
BH03A	125	1.20	Shallow Refusal	BH03A	-	-	
BH04	125	2.20	Cohesive	BH04	250	3.00	Granular
BH05	125	2.00	Cohesive	BH05	250	3.00	Granular
BH06	125	2.00	Cohesive	BH06	250	3.00	Granular
BH07	100	1.50	Granular	BH07	250	2.00	Granular
BH08	100	1.20	Granular	BH08	250	3.00	Cohesive

A ground bearing floor slab is recommended to be based on the stiff cohesive deposits or medium dense granular deposits with an appropriate depth of compacted hardcore specified by the consulting engineer and in accordance with the limits and guidelines in SR21:2014+A1:2016 and/or NRA SRW CL808 Type E granular stone fill. Where the depth of Made Ground/Soft deposits exceeds 0.90m then suspended floor slabs should be considered.

Due to the high loading anticipated, piled foundations may be more economically advantageous 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.

5.3. Excavations

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

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

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.

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 Environmental Assessment Report.

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 3 – Cable Percussion Borehole Records

www.gii.ie

Ground Investigations Ireland Ltd www.gii.ie			Site Greenhills Road	Borehole Number **BH-01**
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 4.50m	**Ground Level (mOD)** 58.84	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location (dGPS) 710668.2 E 730490.5 N	**Dates** 20/01/2021- 25/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10 0.20	B01 ES01				58.74 58.64 58.54	0.10 0.20 0.30 (0.50)	TARMACADAM MADE GROUND: Brown slightly silty slightly gravelly fine to coarse Sand Drillers note: MADE GROUND: 804 fill		
					58.04	0.80	Drillers Note: Brown clayey fine Sand		
1.00-1.21 1.00	SPT(C) 50/60 B02			7,9/50			Dense grey very sandy subangular to subrounded fine to coarse GRAVEL		
						(2.20)			
2.00-2.45 2.00	SPT(C) N=41 B03			7,7/9,10,10,12					
3.00-3.45 3.00	SPT(C) N=49 B04			7,10/19,9,9,12	55.84	3.00 (1.00)	Dense grey sandy subangular to subrounded fine to coarse GRAVEL with occasional subrounded cobbles and some bands of brown slightly sandy slightly gravelly Clay		▼1
4.00-4.06 4.00	SPT(C) 25*/20 50/40 B05			25/50	54.84	4.00 (0.50)	Dense grey slightly sandy subangular fine to coarse GRAVEL with some subangular to subrounded cobbles		
				Water strike(1) at 4.50m, rose to 3.00m in 20 mins.	54.34	4.50	Complete at 4.50m		∇1

Remarks	Scale (approx)	Logged By
BH-01 terminated at 4.50m BGL due to obstruction. Chiselling from 4.50m to 4.50m for 1 hour.	1:50	SG
	Figure No. 10299-12-20.BH-01	

Ground Investigations Ireland Ltd www.gii.ie		Site: Greenhills Road	Borehole Number: **BH-02**
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter:** 200mm cased to 0.70m **Ground Level (mOD):** 58.02	**Client:** Lohan and Donnelly	**Job Number:** 10299-12-20
	Location (dGPS): 710724.1 E 730510.2 N **Dates:** 25/01/2021	**Project Contractor:** GII	**Sheet:** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					57.89	(0.13) 0.13	TARMACADAM		
0.50	B01					(0.57)	MADE GROUND: Brown slightly clayey very sandy subangular to subrounded fine to coarse GRAVEL with occasional subangular to subrounded cobbles		
					57.32	0.70			
							Complete at 0.70m		

Remarks
BH-02 terminated at 0.70m BGL due to obstruction.
Offset location and re-drill BH-02a
Chiselling from 0.70m to 0.70m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No. 10299-12-20.BH-02

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Borehole Number: BH-02A

Machine : Dando 2000	Casing Diameter	Ground Level (mOD)	Client	Job Number
Method : Cable Percussion	200mm cased to 0.80m	58.00	Lohan and Donnelly	10299-12-20
	Location	Dates: 28/01/2021	Project Contractor: GII	Sheet: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES01				57.90	0.10	TARMACADAM		
						(0.70)	MADE GROUND: Light brown slightly sandy gravelly Clay with occasional subangular to suborunded cobbles		
0.50	B01								
					57.20	0.80			
							Complete at 0.80m		

Remarks
BH-02A terminated at 1.20m BGL due to obstruction.
Chiselling from 0.80m to 0.80m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 10299-12-20.BH-02A

Ground Investigations Ireland Ltd
www.gii.ie

Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 1.80m	**Ground Level (mOD)** 56.81	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location (dGPS) 710761.6 E 730546.6 N	**Dates** 25/01/2021	**Project Contractor** GII	**Sheet** 1/1

Site: Greenhills Road
Borehole Number: BH-03

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					56.65	(0.16) 0.16	CONCRETE		
0.50	B01					(1.04)	MADE GROUND: Brown clayey gravelly fine to coarse Sand with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
1.00-1.29 1.00 1.00	SPT(C) 50/135 B02 ES01			1,2/19,31	55.61	1.20 (0.60)	Drillers note: Pushing cobble in front of casing. No recovery		
					55.01	1.80	Complete at 1.80m		

Remarks
BH-03 terminated at 1.80m BGL due to obstruction.
Offset location and re-drill BH-03a
Chiselling from 1.20m to 1.80m for 1 hour.

Scale (approx) 1:50
Logged By SG
Figure No. 10299-12-20.BH-03

Ground Investigations Ireland Ltd www.gii.ie		Site: Greenhills Road	Borehole Number: BH-03A
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter:** 200mm cased to 1.20m **Ground Level (mOD):**	**Client:** Lohan and Donnelly	**Job Number:** 10299-12-20
	Location: **Dates:** 28/01/2021	**Project Contractor:** GII	**Sheet:** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.20	ES01					0.10	TARMACADAM		
0.50	B01					(0.90)	Possible MADE GROUND: Light brown slightly sandy slightly gravelly silty CLAY with occasional subangular to suborunded cobbles. Gravel is subangular to subrounded fine to coarse		
0.50	ES02								
1.00-1.45	SPT(C) N=50			6,7/14,22,14		1.00	Very stiff light brown slightly sandy slightly gravelly silty CLAY with occasional subangular to suborunded cobbles. Gravel is subangular to subrounded fine to coarse		
1.00	B02					(0.20) 1.20			
							Complete at 1.20m		

Remarks
BH-03A terminated at 1.20m BGL due to obstruction.
Chiselling from 1.20m to 1.20m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 10299-12-20.BH-03A

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Borehole Number: **BH-04**

Machine : Dando 2000 Method : Cable Percussion	Casing Diameter: 200mm cased to 3.30m	Ground Level (mOD): 56.50	Client: Lohan and Donnelly	Job Number: 10299-12-20
	Location: 710728.4 E 730621.4 N	Dates: 27/01/2021	Project Contractor: GII	Sheet: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.70	ES01				56.30	(0.20) 0.20	TARMACADAM			
0.50	B01						Soft to firm light brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
1.00-1.45 1.00	SPT(C) N=8 B02			1,1/1,2,2,3		(1.50)				
1.70-3.00	ES02				54.80	1.70	Medium dense dark brown slightly clayey slightly gravelly SAND. Gravel is subangular to subrounded fine to coarse			
2.00-2.45 2.00	SPT(C) N=32 B03			3,3/6,7,10,9		(0.50)				
					54.30	2.20	Very stiff dark brown gravelly very sandy CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		▼1	
						(0.80)				
3.00-3.45 3.00 3.30	SPT(C) N=50 B04 B05			17,9/19,31 Water strike(1) at 3.20m, rose to 2.50m in 20 mins.	53.50	3.00 (0.30)	Dense grey slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL		∇1	
					53.20	3.30	Complete at 3.30m			

Remarks
BH-04 terminated at 3.30m BGL due to obstruction.
50mm slotted standpipe installed from 3.80m to 1.00m BGL with pea gravel surrond, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover
Chiselling from 3.30m to 3.30m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 10299-12-20.BH-04

Ground Investigations Ireland Ltd www.gii.ie			Site: Greenhills Road	Borehole Number: **BH-05**
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 3.20m	**Ground Level (mOD)** 56.30	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710790.6 E 730600.4 N	**Dates** 27/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES01				56.10	(0.20) 0.20	CONCRETE		
					55.80	(0.30) 0.50	POSSIBLE MADE GROUND: Dark brown slightly silty slightly sandy slightly gravelly Clay		
0.50 0.50-2.40 1.00-1.45 1.00	B01 ES02 SPT(C) N=5 B02			1,0/1,1,1,2		(1.50)	Soft dark brown mottled grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
2.00-2.45 2.00	SPT(C) N=17 B03			1,2/3,4,4,6	54.30 53.90	2.00 (0.40) 2.40	Stiff dark brown mottled grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		▼1
2.40-3.00	ES03				53.30	(0.60) 3.00	Stiff dark grey mottled brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse		
3.00-3.40 3.00	SPT(C) 50*/100 N=50 B04			50/50 Water strike(1) at 3.20m, rose to 2.20m in 20 mins.	53.10	(0.20) 3.20	Dense grey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles		∇1
							Complete at 3.20m		

Remarks
BH-05 terminated at 3.20m BGL due to obstruction.
Chiselling from 3.00m to 3.20m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 10299-12-20.BH-05

Ground Investigations Ireland Ltd
www.gii.ie

Site: Greenhills Road				**Borehole Number**: BH-06
Machine: Dando 2000 **Method**: Cable Percussion	**Casing Diameter**: 200mm cased to 3.30m	**Ground Level (mOD)**: 55.97	**Client**: Lohan and Donnelly	**Job Number**: 10299-12-20
	Location: 710836.6 E 730597.5 N	**Dates**: 27/01/2021	**Project Contractor**: GII	**Sheet**: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.30	ES01				55.87	0.10	TARMACADAM			
0.30-0.80	ES02				55.67	(0.20) 0.30	MADE GROUND: Dark brown slightly silty sandy fine to coarse subangular to subrounded Gravel			
0.50	B01					(0.50)				
0.80-3.00	ES03				55.17	0.80	POSSIBLE MADE GROUND: Greyish brown slightly silty slightly gravelly sandy Clay with occasional subangular to subrounded cobbles. (reworked)			
1.00-1.45 1.00	SPT(C) N=5 B02			1,0/1,1,1,2		(1.20)	Soft dark brown slightly sandy slightly gravelly silty CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
2.00-2.45 2.00	SPT(C) N=17 B03			1,2/3,4,4,6	53.97	2.00 (0.70)	Stiff dark brown slightly sandy slightly gravelly silty CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
3.00 3.00-3.40 3.00-3.30	B04 SPT(C) 50*/100 N=50 ES04			Water strike(1) at 2.70m, fell to 3.20m in 20 mins. 50/50	53.27	2.70 (0.60)	Dense grey slightly sandy silty subangular to subrounded fine to coarse GRAVEL Strong hydrocarbon odour odour noted at 3.30m BGL		∇1 ▼1	
					52.67	3.30	Complete at 3.30m			

Remarks
Strong hydrocarbon odour noted at 3.30m BGL.
BH-06 terminated at 3.30m BGL due to obstruction.
50mm slotted standpipe installed from 3.30m to 1.00m BGL with pea gravel surrond, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover
Chiselling from 1.20m to 1.20m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 10299-12-20.BH-06

Ground Investigations Ireland Ltd www.gii.ie		Site: Greenhills Road	Borehole Number: **BH-07**
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 3.10m; **Ground Level (mOD)** 55.57	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location (dGPS) 710845.7 E 730676.7 N; **Dates** 26/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					55.52	0.05	TARMACADAM		
0.50	B01					(1.25)	Possible MADE GROUND: Brown gravelly very clayey fine to coarse Sand		
1.00-1.45	SPT(C) N=15			3,3/4,3,4,4					
1.00	B02								
1.00	ES01				54.27	1.30	Medium dense grey sandy subangular to subrounded fine to coarse GRAVEL		
						(0.70)			
2.00-2.44	SPT(C) 50/285			6,9/10,12,14,14	53.57	2.00	Dense grey sandy subangular to subrounded fine to coarse GRAVEL		
2.00	B03					(0.60)			
					52.97	2.60	Dense grey subangular to subrounded coarse GRAVEL with some to many subangular to subrounded cobbles		
						(0.50)			
3.00-3.12	SPT(C) 25*/100 50/20			17,8/50	52.47	3.10	Complete at 3.10m		
3.00	B04								

Remarks
BH-07 terminated at 3.10m BGL due to obstruction.
Chiselling from 3.10m to 3.10m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No. 10299-12-20.BH-07

Ground Investigations Ireland Ltd www.gii.ie			Site: Greenhills Road	Borehole Number: BH-08
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 3.80m	**Ground Level (mOD)** 55.36	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location (dGPS) 710867.4 E 730633.6 N	**Dates** 26/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
					55.26	0.10	TARMACADAM
					55.06	(0.20) 0.30	Drillers Note: MADE GROUND: Gravel
0.50	B01					(0.60)	MADE GROUND: Orangish brown slightly sandy slightly gravelly CLAY with organic odour
1.00-1.45 1.00	SPT(C) N=20 B02			2,2/3,5,6,6	54.46	0.90 (0.70)	Medium dense dark brown clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse
					53.76	1.60 (0.50)	Medium dense brown slightly gravelly very silty fine to coarse SAND. Gravel is subrounded fine to coarse
2.00-2.45 2.00 2.00	SPT(C) N=14 B03 ES01			2,2/3,3,4,4	53.26	2.10 (0.40)	Drillers note: Brown sandy gravelly Clay (stiff)
					52.86	2.50 (0.20)	Drillers note: pushing cobble in front of casing. No recovery
3.00 3.00-3.29	B04 SPT(C) 50/135			Water strike(1) at 3.00m, rose to 2.90m in 20 mins, sealed at 3.20m. 6,9/17,33	52.66	2.70 (1.10)	Very stiff grey slightly sandy slightly gravelly CLAY. Gravely is subangular to subrounded fine to coarse
3.80 3.80	B05 ES02				51.56	3.80	Complete at 3.80m

Remarks
50mm slotted standpipe installed from 3.80m to 1.00m BGL with pea gravel surrond, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover
BH-08 terminated at 3.80m BGL due to obstruction.
Chiselling from 3.80m to 3.80m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No. 10299-12-20.BH-08

Appendix H – GoCar Letter of Intent

Steeplefield Limited,
32 Molesworth Street,
Dublin 2,
D02 Y512

13/01/2022

To Whom It May Concern,

This is a letter to confirm that GoCar intends to provide a service of up to 5no. shared car club vehicles, 1no. of the vehicles provided will be a BEV (Battery Electric Vehicle) with a standalone electric vehicle charge point provided by the developer within the proposed Strategic Housing Development (SHD) located south of the Walkinstown Roundabout on Greenhills Road. GoCar representatives have discussed the project with representatives of Lohan & Donnelly, who are the Consulting Engineers for the development, and are excited to provide a car sharing service at this location. While it is the intention for most of these vehicles to be used exclusively by the residents of the development, GoCar may agree with the eventual managers of the site to allow some vehicles to be open for access to other GoCar members nearby. This will depend on usership levels and will be reviewed at various periods to ensure adequate supply for the residents of the development.

GoCar is Ireland's leading car sharing service with over 60,000 members and over 800 cars and vans on fleet.
Each GoCar which is placed in a community has the potential to replace the journeys of up to 15 private cars.
The Department of Housing's Design Standards for New Apartments - Guidelines for Planning Authorities 2018 outline:
"For all types of location, where it is sought to eliminate or reduce car parking provision, it is necessary to ensure... provision is also to be made for alternative mobility solutions including facilities for car sharing club vehicles."

Carsharing is a sustainable service. By allowing multiple people to use the same vehicle at different times, car sharing reduces car ownership, car dependency, congestion, noise, and air pollution. It frees up land which would otherwise be used for additional parking spaces. Most GoCar users only use a car when necessary, and walk and use public transport more often than car owners.

By having GoCar car sharing vehicles in a development such as this, the residents therein will have access to pay-asyou-go driving, in close proximity to their homes, which will increase usership of the service.

I trust that this information is satisfactory. For any queries, please do not hesitate to contact me.

Rob Montgomery
Revenue and Growth Manager
GoCar Carsharing Ltd
Mobile: 086 609 7096
E: robert.montgomery@gocar.ie

Appendix I – Statement of Design Acceptance (Irish Water)

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

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

Edvinas Valadka
13 Gardiner Place
Mountjoy Square
Dublin 1, Dublin D01VOT8

23 February 2022

Re: Design Submission for Greenhills Road, Walkinstown, Dublin 12, Co.Dublin (the “Development”)
(the “Design Submission”) / Connection Reference No: CDS20007999

Dear Edvinas Valadka,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water’s current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water’s network(s) (the “**Self-Lay Works**”), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:
Name: Dario Alvarez
Email: dalvarez@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- [20189-LDE-07-00-DR-SC-1C01a]
- [20189-LDE-07-00-DR-SC-1C01b]
- [20189-LDE-07-00-DR-SC-1C01c]
- [20189-LDE-07-00-DR-SC-1C01d]
- [20189-LDE-07-00-DR-SC-1C01e]
- [20189-LDE-07-00-DR-SC-1C01f]

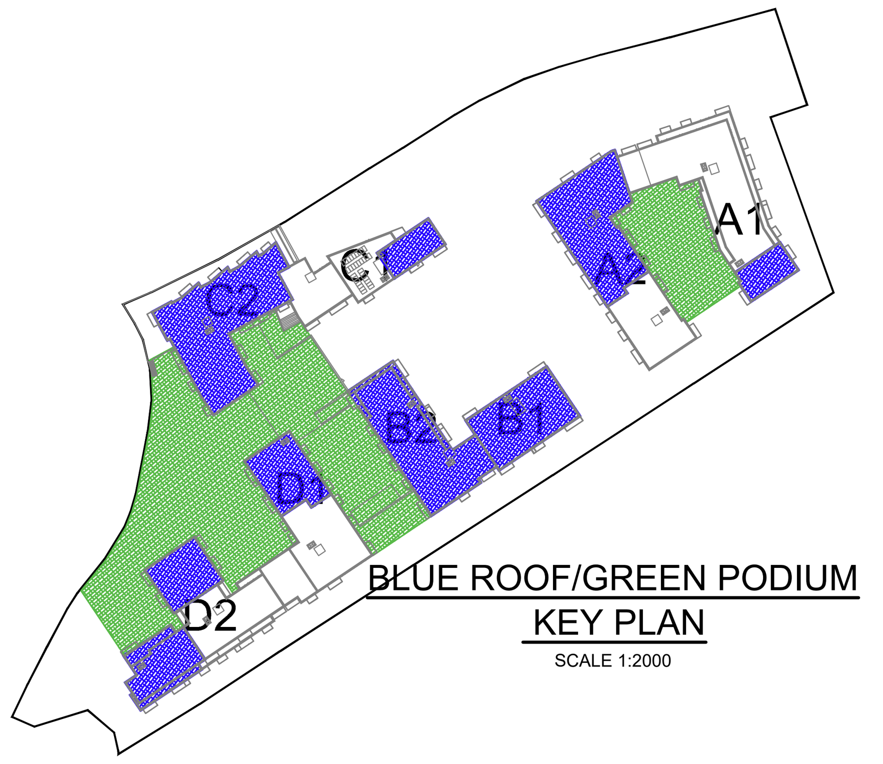
Standard Details/Code of Practice Exemption:

While Irish Water notes that the water and wastewater services infrastructure will remain private and not be vested, we have the following comments:

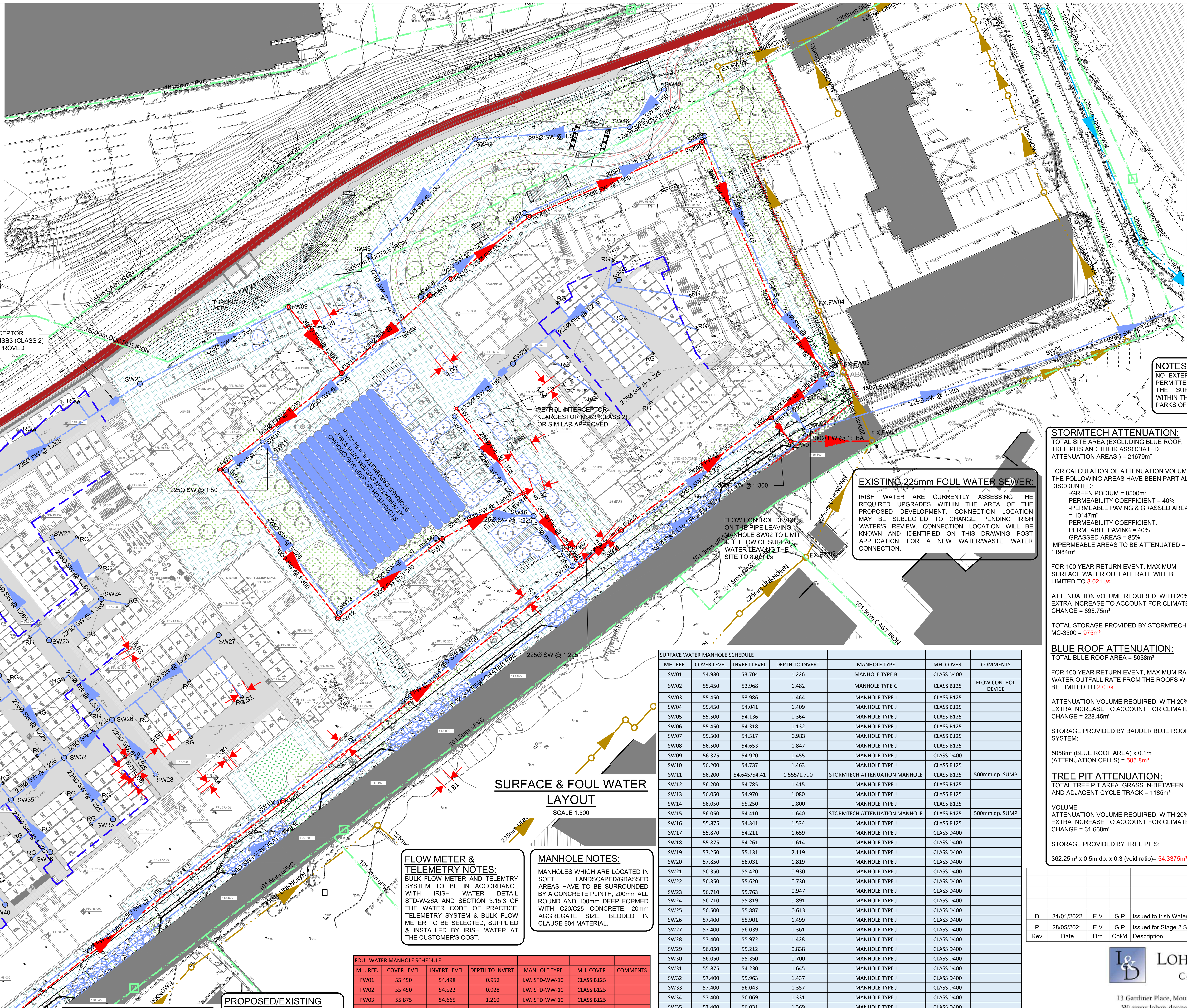
- *It is recommended that the foul sewer network is located deeper, depth of cover is less than 500mm in some areas.*
- *It is recommended a minimum clearance of 5m of an existing or proposed structure for watermains between 200mm and 600mm in diameter.*
- *It is recommended a minimum clearance of 3m of an existing or proposed structure for sewer pipes.*

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

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



BLUE ROOF/GREEN PODIUM
KEY PLAN
SCALE 1:2000



SURFACE & FOUL WATER LAYOUT

SCALE 1:500

LEGEND

- EX. SURFACE WATER SEWER — EX. SW03
- EX. FOUL WATER SEWER — EX. FW03
- NEW FOUL WATER SEWER — FW03
- NEW SURFACE WATER SEWER — SW03
- ROAD GULLY — RG
- EXISTING WATERMAIN
- NEW 200 MDPE TYPE PE-80 WATERMAIN
- NEW 150 MDPE TYPE PE-80 SERVICE MAIN
- NEW 150 MDPE TYPE PE-80 DISTRIBUTION MAIN
- EXISTING GROUND LEVELS /CONTOURS — 00.00
- METER/BOUNDARY BOX
- SLUICE VALVE
- SCOUR VALVE/SCOUR VALVE CHAMBER — SCV
- (CLASS 2) PETROL INTERCEPTOR
- NEW HYDRANT — H
- NEW WASHOUT HYDRANT — WH
- NEW ONLINE HYDRANT — H
- EXISTING FIRE HYDRANT — H
- FLOW METER KIOSK
- EXISTING FIRE HYDRANT — AV
- OUTLINE OF STRUCTURES ABOVE
- SITE BOUNDARY

NOTES:

NO EXTERNAL SURFACE WATER IS PERMITTED TO BE COLLECTED BY THE SURFACE WATER SEWERS WITHIN THE TWO UNDERCROFT CAR PARKS OF THE DEVELOPMENT.

HYDRANTS, AIR VALVES, SLUICE VALVES & SCOUR VALVES:

ALL AIR VALVES, HYDRANTS, SLUICE VALVES, SCOUR VALVES & SCOUR VALVE CHAMBERS SHALL BE BUILT IN ACCORDANCE TO SECTION 3.18 OF IRISH WATER CODE OF PRACTICE DOCUMENT (IW-CDS-5020-03)

EXISTING 225mm FOUL WATER SEWER:

IRISH WATER ARE CURRENTLY ASSESSING THE REQUIRED UPGRADES WITHIN THE AREA OF THE PROPOSED DEVELOPMENT. CONNECTION LOCATION MAY BE SUBJECTED TO CHANGE, PENDING IRISH WATER'S REVIEW. CONNECTION LOCATION WILL BE KNOWN AND IDENTIFIED ON THIS DRAWING POST APPLICATION FOR A NEW WATER/WASTE WATER CONNECTION.

STORMTECH ATTENUATION:

TOTAL SITE AREA (EXCLUDING BLUE ROOF, TREE PITS AND THEIR ASSOCIATED ATTENUATION AREAS) = 21679m²

FOR CALCULATION OF ATTENUATION VOLUME, THE FOLLOWING AREAS HAVE BEEN PARTIALLY DISCOUNTED:

- -GREEN PODIUM = 8500m²
  PERMEABILITY COEFFICIENT = 40%
- -PERMEABLE PAVING & GRASSED AREAS = 10147m²
  PERMEABILITY COEFFICIENT:
  PERMEABLE PAVING = 40%
  GRASSED AREAS = 85%

IMPERMEABLE AREAS TO BE ATTENUATED = 11984m²

FOR 100 YEAR RETURN EVENT, MAXIMUM SURFACE WATER OUTFALL RATE WILL BE LIMITED TO 8.021 l/s

ATTENUATION VOLUME REQUIRED, WITH 20% EXTRA INCREASE TO ACCOUNT FOR CLIMATE CHANGE = 895.75m³

TOTAL STORAGE PROVIDED BY STORMTECH MC-3500 = 975m³

BLUE ROOF ATTENUATION:

TOTAL BLUE ROOF AREA = 5058m²

FOR 100 YEAR RETURN EVENT, MAXIMUM RAIN WATER OUTFALL RATE FROM THE ROOFS WILL BE LIMITED TO 2.0 l/s

ATTENUATION VOLUME REQUIRED, WITH 20% EXTRA INCREASE TO ACCOUNT FOR CLIMATE CHANGE = 228.45m³

STORAGE PROVIDED BY BAUDER BLUE ROOF SYSTEM:

5058m² (BLUE ROOF AREA) x 0.1m (ATTENUATION CELLS) = 505.8m³

TREE PIT ATTENUATION:

TOTAL TREE PIT AREA, GRASS IN-BETWEEN AND ADJACENT CYCLE TRACK = 1185m²

VOLUME
ATTENUATION VOLUME REQUIRED, WITH 20% EXTRA INCREASE TO ACCOUNT FOR CLIMATE CHANGE = 31.668m³

STORAGE PROVIDED BY TREE PITS:

362.25m² x 0.5m dp. x 0.3 (void ratio)= 54.3375m³

NOTES:

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DETAIL DRAWINGS AND SPECIFICATIONS.

DO NOT SCALE DIMENSIONS, REFER TO ARCHITECTS DRAWINGS FOR ALL SETTING OUT DIMENSIONS. WORK TO FIGURED DIMENSIONS ONLY.

THE ENGINEER IS TO BE AFFORDED SUFFICIENT TIME TO CARRY OUT INSPECTIONS OF THE WORKS IN ACCORDANCE WITH THE PROJECT INSPECTION PLAN AND INSPECTION NOTIFICATION FRAMEWORK.

ALL CONSTRUCTION PRODUCTS TO HAVE RELEVANT CE MARKING WHERE APPLICABLE.

ALL DEMOLITION WORKS TO BE IN ACCORDANCE WITH BS 6187: 2011.

ALL CONTRACTORS OR SUB-CONTRACTORS RESPONSIBLE FOR SPECIALIST DESIGN MUST PROVIDE PROFESSIONAL INDEMNITY INSURANCES, ANCILLARY CERTIFICATES FOR DESIGN AND ANCILLARY CERTIFICATES FOR INSPECTION IN ACCORDANCE WITH BCAR 2014.

DRAINAGE

ALL DRAINAGE WORK TO BE CARRIED OUT IN ACCORDANCE WITH IS EN 752: 2008, TGD PART H, GDR CODE OF PRACTICE FOR DRAINAGE WORKS V6.0 AND IRISH WATER SPECIFICATIONS.

MIN. 150mm C16/20 CONCRETE BED & SURROUND TO BE PROVIDED TO SEWER PIPELINES WHERE THE COVER IS LESS THAN 1.200m UNDER ROADS, VERGES AND FOOTPATHS.

BACKFILL FOR ALL uPVC PIPES TO BE FREE FROM STONE EXCEEDING 50mm FOR 300mm ABOVE GRANULAR SURROUND.

ALL REINSTATEMENT WORKS TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL AUTHORITY.

ALL MANHOLES COVERS AND FRAME ARE TO BE CLASS D400 TO BS EN 124 U.N.O.

SEWER PIPE LINES TO BE uPVC PIPES UP TO AND INCLUDING 300Ø TO IS 123 ON GRANULAR BED AND SURROUND LAID STRICTLY TO MANUFACTURERS INSTRUCTIONS.

ALL VERTICAL STACK CONNECTIONS TO FOUL SEWER CHAMBERS TO INCORPORATE LONG RADIUS BENDS AND MUST JOIN MAIN SEWER LINE AT 45° TO DIRECTION OF FLOW.

FLOW METER & TELEMETRY NOTES:

BULK FLOW METER AND TELEMTRY SYSTEM TO BE IN ACCORDANCE WITH IRISH WATER DETAIL STD-W-26A AND SECTION 3.15.3 OF THE WATER CODE OF PRACTICE. TELEMETRY SYSTEM & BULK FLOW METER TO BE SELECTED, SUPPLIED & INSTALLED BY IRISH WATER AT THE CUSTOMER'S COST.

MANHOLE NOTES:

MANHOLES WHICH ARE LOCATED IN SOFT LANDSCAPED/GRASSED AREAS HAVE TO BE SURROUNDED BY A CONCRETE PLINTH, 200mm ALL ROUND AND 100mm DEEP FORMED WITH C20/C25 CONCRETE, 20mm AGGREGATE SIZE, BEDDED IN CLAUSE 804 MATERIAL.

PAVING LEGEND

- PERMEABLE PAVING
- GREEN PODIUM
- BLUE ROOF
- RAIN GARDEN
- TREE PIT (5000 x 3450)
- GRASS
- REINFORCED GRASSED AREAS
- HARSTANDING/NON PERMEABLE SURFACE

PROPOSED/EXISTING PLANTING NOTES:

WATERMAIN - ALL SERVICES TO HAVE SUFFICIENT CLEARENCE AWAY FROM EXISTING/NEW PLANTING AND APPROPRIATE PREVENTION MEASURES IN PLACE AS PER IRISH WATER RECOMMENDATIONS SET OUT IN THE "WATER INFRASTRUCTURE STANDARD DETAILS ", DRAWINGS "STD-W-12 & STD-W-12A".

FOUL WATER - ALL FOUL SEWERS TO HAVE SUFFICIENT CLEARENCE AWAY FROM EXISTING/NEW PLANTING AND APPROPRIATE PREVENTION MEASURES IN PLACE AS PER IRISH WATER RECOMMENDATIONS SET OUT IN THE "WASTEWATER INFRASTRUCTURE STANDARD DETAILS ", DRAWINGS "STD-WW-06 & STD-WW-06A".

FOUL WATER MANHOLE SCHEDULE

MH. REF.	COVER LEVEL	INVERT LEVEL	DEPTH TO INVERT	MANHOLE TYPE	MH. COVER	COMMENTS
FW01	55.450	54.498	0.952	I.W. STD-WW-10	CLASS B125	
FW02	55.450	54.522	0.928	I.W. STD-WW-10	CLASS B125	
FW03	55.875	54.665	1.210	I.W. STD-WW-10	CLASS B125	
FW04	55.450	54.576	0.874	I.W. STD-WW-10	CLASS D400	
FW05	55.450	54.641	0.809	I.W. STD-WW-10	CLASS B125	
FW06	55.450	54.778	0.672	I.W. STD-WW-10	CLASS B125	
FW07	55.500	54.922	0.578	I.W. STD-WW-10	CLASS B125	
FW08	56.500	55.471	1.029	I.W. STD-WW-10	CLASS B125	
FW09	56.200	55.276	0.924	I.W. STD-WW-10	CLASS B125	
FW10	56.500	55.151	1.349	I.W. STD-WW-10	CLASS B125	
FW11	56.350	55.092	1.258	I.W. STD-WW-10	CLASS B125	
FW12	56.050	54.947	1.103	I.W. STD-WW-10	CLASS B125	
FW13	56.050	54.847	1.203	I.W. STD-WW-10	CLASS B125	
FW14	55.875	55.005	0.870	I.W. STD-WW-10	CLASS D400	
FW15	55.875	54.706	1.169	I.W. STD-WW-10	CLASS D400	
FW16	57.250	55.576	1.674	I.W. STD-WW-10	CLASS B125	
FW17	57.850	56.701	1.149	I.W. STD-WW-10	CLASS B125	
FW18	55.875	54.776	1.099	I.W. STD-WW-10	CLASS B125	
FW19	56.350	55.211	1.139	I.W. STD-WW-10	CLASS B125	
EX.FW01	55.070	54.380	0.690	N/A	N/A	

Note: ALL MANHOLE TYPES AS PER GDS CODE OF PRACTICE

SURFACE WATER MANHOLE SCHEDULE

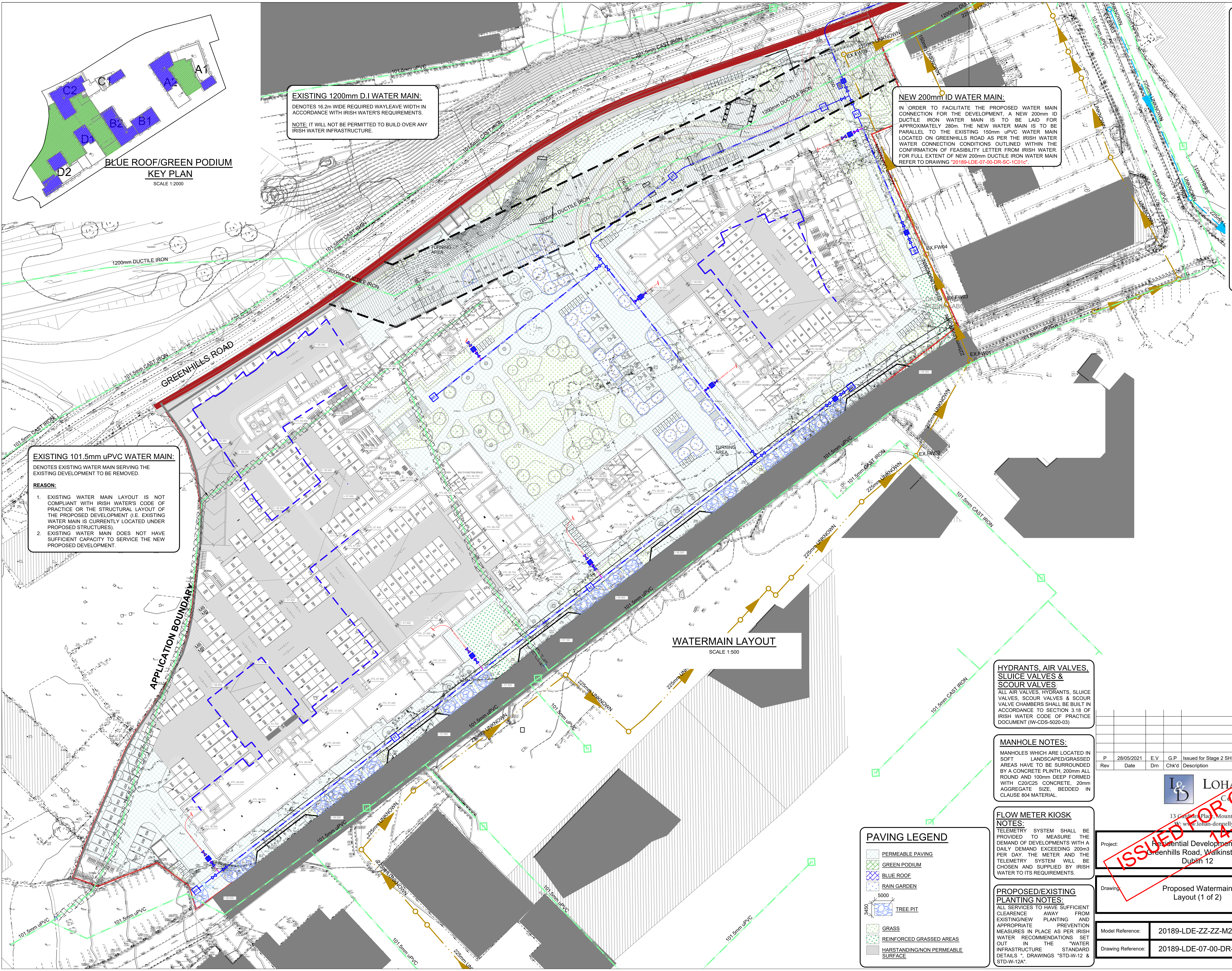
MH. REF.	COVER LEVEL	INVERT LEVEL	DEPTH TO INVERT	MANHOLE TYPE	MH. COVER	COMMENTS
SW01	54.930	53.704	1.226	MANHOLE TYPE B	CLASS D400	
SW02	55.450	53.968	1.482	MANHOLE TYPE G	CLASS B125	FLOW CONTROL DEVICE
SW03	55.450	53.986	1.464	MANHOLE TYPE J	CLASS B125	
SW04	55.450	54.041	1.409	MANHOLE TYPE J	CLASS B125	
SW05	55.500	54.136	1.364	MANHOLE TYPE J	CLASS B125	
SW06	55.450	54.318	1.132	MANHOLE TYPE J	CLASS B125	
SW07	55.500	54.517	0.983	MANHOLE TYPE J	CLASS B125	
SW08	56.500	54.653	1.847	MANHOLE TYPE J	CLASS B125	
SW09	56.375	54.920	1.455	MANHOLE TYPE J	CLASS D400	
SW10	56.200	54.737	1.463	MANHOLE TYPE J	CLASS B125	
SW11	56.200	54.645/54.41	1.555/1.790	STORMTECH ATTENUATION MANHOLE	CLASS B125	500mm dp. SUMP
SW12	56.200	54.785	1.415	MANHOLE TYPE J	CLASS B125	
SW13	56.050	54.970	1.080	MANHOLE TYPE J	CLASS B125	
SW14	56.050	55.250	0.800	MANHOLE TYPE J	CLASS B125	
SW15	56.050	54.410	1.640	STORMTECH ATTENUATION MANHOLE	CLASS B125	500mm dp. SUMP
SW16	55.875	54.341	1.534	MANHOLE TYPE J	CLASS B125	
SW17	55.870	54.211	1.659	MANHOLE TYPE J	CLASS D400	
SW18	55.875	54.261	1.614	MANHOLE TYPE J	CLASS D400	
SW19	57.250	55.131	2.119	MANHOLE TYPE J	CLASS D400	
SW20	57.850	56.031	1.819	MANHOLE TYPE J	CLASS D400	
SW21	56.350	55.420	0.930	MANHOLE TYPE J	CLASS D400	
SW22	56.350	55.620	0.730	MANHOLE TYPE J	CLASS D400	
SW23	56.710	55.763	0.947	MANHOLE TYPE J	CLASS D400	
SW24	56.710	55.819	0.891	MANHOLE TYPE J	CLASS D400	
SW25	56.500	55.887	0.613	MANHOLE TYPE J	CLASS D400	
SW26	57.400	55.901	1.499	MANHOLE TYPE J	CLASS D400	
SW27	57.400	56.039	1.361	MANHOLE TYPE J	CLASS D400	
SW28	57.400	55.972	1.428	MANHOLE TYPE J	CLASS D400	
SW29	56.050	55.212	0.838	MANHOLE TYPE J	CLASS D400	
SW30	56.050	55.350	0.700	MANHOLE TYPE J	CLASS D400	
SW31	55.875	54.230	1.645	MANHOLE TYPE J	CLASS D400	
SW32	57.400	55.963	1.437	MANHOLE TYPE J	CLASS D400	
SW33	57.400	56.043	1.357	MANHOLE TYPE J	CLASS D400	
SW34	57.400	56.069	1.331	MANHOLE TYPE J	CLASS D400	
SW35	57.400	56.031	1.369	MANHOLE TYPE J	CLASS D400	
SW36	57.400	56.098	1.302	MANHOLE TYPE J	CLASS D400	
SW37	57.400	56.119	1.281	MANHOLE TYPE J	CLASS D400	
SW38	58.000	56.102	1.898	MANHOLE TYPE J	CLASS D400	
SW39	58.000	56.6350	1.3650	MANHOLE TYPE J	CLASS D400	
SW40	58.000	56.8220	1.1780	MANHOLE TYPE J	CLASS D400	
SW41	58.000	56.1880	1.8120	MANHOLE TYPE J	CLASS D400	
SW42	58.000	56.2590	1.741	MANHOLE TYPE J	CLASS D400	
SW43	58.000	56.4660	1.5340	MANHOLE TYPE J	CLASS D400	
SW44	58.000	56.0770	1.9230	MANHOLE TYPE J	CLASS D400	
SW45	58.000	56.3660	1.6340	MANHOLE TYPE J	CLASS D400	
SW46	55.875	54.875	1.000	MANHOLE TYPE J	CLASS D400	
SW47	57.250	56.308	0.942	MANHOLE TYPE J	CLASS D400	
SW48	58.200	57.048	1.152	MANHOLE TYPE J	CLASS D400	
SW49	58.600	57.2780	1.3220	MANHOLE TYPE J	CLASS D400	
EX.SW01	54.580	53.380	1.200	N/A	N/A	
EX.SW02	54.480	53.480	1.000	N/A	N/A	

Note: ALL MANHOLE TYPES AS PER GDS CODE OF PRACTICE

Rev	Date	Drn	Chk'd	Description
D	31/01/2022	E.V	G.P	Issued to Irish Water for Statement of Design Acceptance.
P	28/05/2021	E.V	G.P	Issued for Stage 2 SHD Planning.

LOHAN & DONNELLY
Consulting Engineers
13 Gardiner Place, Mountjoy Square, Dublin 1. T: 01 8787770
W: www.lohan-donnelly.com E: info@lohan-donnelly.com

Project:	Residential Development at Greenhills Road, Walkinstown, Dublin 12
Drawing:	Proposed Surface & Foul Water Layout
Model Reference:	20189-LDE-ZZ-ZZ-M2-SC-0001
Drawing Reference:	20189-LDE-07-00-DR-SC-1C01a
Project No.	20189
Drg. No.	C01a
Scale	@A1
Date	Feb. 2021
Drawn	E.V
Rev.	D
Model Rev:	P01
Suitability:	S01



EXISTING 1200mm D.I WATER MAIN:

DENOTES 16.2m WIDE REQUIRED WAYLEAVE WIDTH IN ACCORDANCE WITH IRISH WATER'S REQUIREMENTS.

NOTE: IT WILL NOT BE PERMITTED TO BUILD OVER ANY IRISH WATER INFRASTRUCTURE.

NEW 200mm ID WATER MAIN:

IN ORDER TO FACILITATE THE PROPOSED WATER MAIN CONNECTION FOR THE DEVELOPMENT, A NEW 200mm ID DUCTILE IRON WATER MAIN IS TO BE LAID FOR APPROXIMATELY 280m. THE NEW WATER MAIN IS TO BE PARALLEL TO THE EXISTING 150mm uPVC WATER MAIN LOCATED ON GREENHILLS ROAD AS PER THE IRISH WATER WATER CONNECTION CONDITIONS OUTLINED WITHIN THE CONFIRMATION OF FEASIBILITY LETTER FROM IRISH WATER. FOR FULL EXTENT OF NEW 200mm DUCTILE IRON WATER MAIN REFER TO DRAWING "20189-LDE-07-00-DR-SC-1C01c".

EXISTING 101.5mm uPVC WATER MAIN:

DENOTES EXISTING WATER MAIN SERVING THE EXISTING DEVELOPMENT TO BE REMOVED.

REASON:

1. EXISTING WATER MAIN LAYOUT IS NOT COMPLIANT WITH IRISH WATER'S CODE OF PRACTICE OR THE STRUCTURAL LAYOUT OF THE PROPOSED DEVELOPMENT (I.E. EXISTING WATER MAIN IS CURRENTLY LOCATED UNDER PROPOSED STRUCTURES).
2. EXISTING WATER MAIN DOES NOT HAVE SUFFICIENT CAPACITY TO SERVICE THE NEW PROPOSED DEVELOPMENT.

LEGEND

EX. SURFACE WATER SEWER — EX. SW03
EX. FOUL WATER SEWER — EX. FW03
NEW FOUL WATER SEWER — FW03
NEW SURFACE WATER SEWER — SW03
ROAD GULLY — RG
EXISTING WATERMAIN — EX W/M
NEW 200 MDPE TYPE PE-80 WATERMAIN — NEW W/M
NEW 150 MDPE TYPE PE-80 SERVICE MAIN — NEW S/W
NEW 150 MDPE TYPE PE-80 DISTRIBUTION MAIN — NEW D/W
EXISTING GROUND LEVELS /CONTOURS — 00.00
METER/BOUNDARY BOX
SLUICE VALVE
SCOUR VALVE/SCOUR VALVE CHAMBER — SCV
(CLASS 2) PETROL INTERCEPTOR
NEW HYDRANT — H
NEW WASHOUT HYDRANT — WH
NEW ONLINE HYDRANT — H
EXISTING FIRE HYDRANT — H
FLOW METER KIOSK
EXISTING FIRE HYDRANT — AV
OUTLINE OF STRUCTURES ABOVE
SITE BOUNDARY

NOTES:

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MIN. 150mm C16/20 CONCRETE BED & SURROUND TO BE PROVIDED TO SEWER PIPELINES WHERE THE COVER IS LESS THAN 1.200m UNDER ROADS, VERGES AND FOOTPATHS.

BACKFILL FOR ALL uPVC PIPES TO BE FREE FROM STONE EXCEEDING 50mm FOR 300mm ABOVE GRANULAR SURROUND.

ALL REINSTATEMENT WORKS TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL AUTHORITY.

ALL MANHOLES COVERS AND FRAME ARE TO BE CLASS D400 TO BS EN 124 U.N.O.

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ALL VERTICAL STACK CONNECTIONS TO FOUL SEWER CHAMBERS TO INCORPORATE LONG RADIUS BENDS AND MUST JOIN MAIN SEWER LINE AT 45° TO DIRECTION OF FLOW.

PAVING LEGEND

PERMEABLE PAVING
GREEN PODIUM
BLUE ROOF
RAIN GARDEN
TREE PIT (5000 × 3450)
GRASS
REINFORCED GRASSED AREAS
HARSTANDING/NON PERMEABLE SURFACE

HYDRANTS, AIR VALVES, SLUICE VALVES & SCOUR VALVES:

ALL AIR VALVES, HYDRANTS, SLUICE VALVES, SCOUR VALVES & SCOUR VALVE CHAMBERS SHALL BE BUILT IN ACCORDANCE TO SECTION 3.18 OF IRISH WATER CODE OF PRACTICE DOCUMENT (IW-CDS-5020-03)

MANHOLE NOTES:

MANHOLES WHICH ARE LOCATED IN SOFT LANDSCAPED/GRASSED AREAS HAVE TO BE SURROUNDED BY A CONCRETE PLINTH, 200mm ALL ROUND AND 100mm DEEP FORMED WITH C20/C25 CONCRETE, 20mm AGGREGATE SIZE, BEDDED IN CLAUSE 804 MATERIAL.

FLOW METER KIOSK NOTES:

TELEMETRY SYSTEM SHALL BE PROVIDED TO MEASURE THE DEMAND OF DEVELOPMENTS WITH A DAILY DEMAND EXCEEDING 200m3 PER DAY. THE METER AND THE TELEMETRY SYSTEM WILL BE CHOSEN AND SUPPLIED BY IRISH WATER TO ITS REQUIREMENTS.

PROPOSED/EXISTING PLANTING NOTES:

ALL SERVICES TO HAVE SUFFICIENT CLEARENCE AWAY FROM EXISTING/NEW PLANTING AND APPROPRIATE PREVENTION MEASURES IN PLACE AS PER IRISH WATER RECOMMENDATIONS SET OUT IN THE "WATER INFRASTRUCTURE STANDARD DETAILS ", DRAWINGS "STD-W-12 & STD-W-12A".

Rev	Date	Drn	Chk'd	Description
P	28/05/2021	E.V	G.P	Issued for Stage 2 SHD Planning.

ISSUED FOR COORDINATION 14-01-2021

LOHAN & DONNELLY
Consulting Engineers
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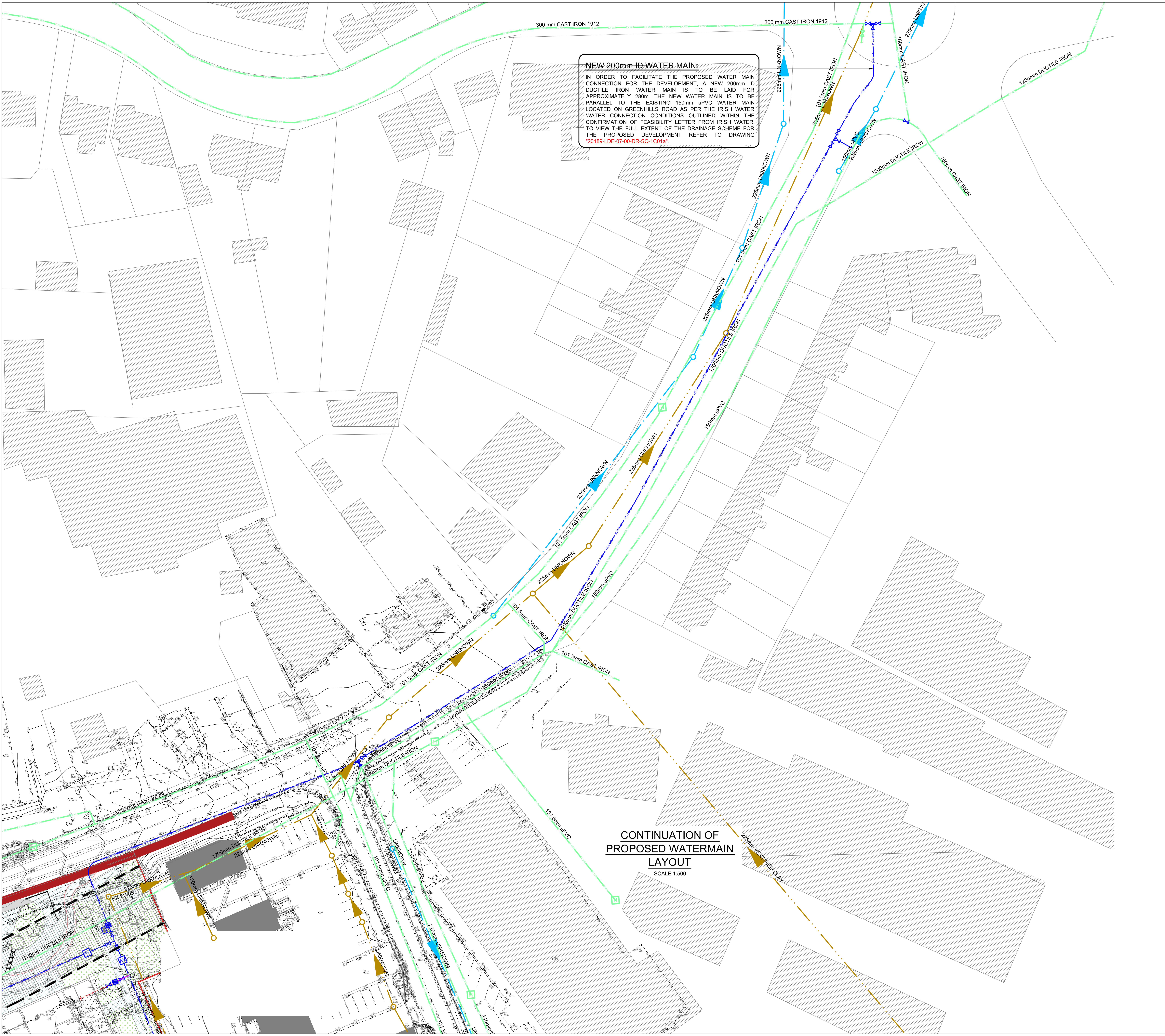
W: www.lohan-donnelly.com E: info@lohan-donnelly.com

Project:	Residential Development at Greenhills Road, Walkinstown, Dublin 12
Drawing:	Proposed Watermain Layout (1 of 2)
Model Reference:	20189-LDE-ZZ-ZZ-M2-SC-0001
Drawing Reference:	20189-LDE-07-00-DR-SC-1C01b

Project No. 20189	Drg. No. C01b
Scale @A1	Date Feb. 2021
Drawn E.V	Rev. P
Model Rev:	P01
Suitability:	S01



NEW 200mm ID WATER MAIN:

IN ORDER TO FACILITATE THE PROPOSED WATER MAIN CONNECTION FOR THE DEVELOPMENT, A NEW 200mm ID DUCTILE IRON WATER MAIN IS TO BE LAID FOR APPROXIMATELY 280m. THE NEW WATER MAIN IS TO BE PARALLEL TO THE EXISTING 150mm uPVC WATER MAIN LOCATED ON GREENHILLS ROAD AS PER THE IRISH WATER WATER CONNECTION CONDITIONS OUTLINED WITHIN THE CONFIRMATION OF FEASIBILITY LETTER FROM IRISH WATER. TO VIEW THE FULL EXTENT OF THE DRAINAGE SCHEME FOR THE PROPOSED DEVELOPMENT REFER TO DRAWING "20189-LDE-07-00-DR-SC-1C01a".

CONTINUATION OF PROPOSED WATERMAIN LAYOUT

SCALE 1:500

LEGEND

EX. SURFACE WATER SEWER	EX. SW03
EX. FOUL WATER SEWER	EX. FW03
NEW FOUL WATER SEWER	FW03
NEW SURFACE WATER SEWER	SW03
ROAD GULLY	RG
EXISTING WATERMAIN	EX W/M
NEW 200 MDPE TYPE PE-80 WATERMAIN	NEW W/M
NEW 150 MDPE TYPE PE-80 SERVICE MAIN	NEW S/W
NEW 150 MDPE TYPE PE-80 DISTRIBUTION MAIN	NEW D/W
EXISTING GROUND LEVELS /CONTOURS	00.00
METER/BOUNDARY BOX	
SLUICE VALVE	
SCOUR VALVE/SCOUR VALVE CHAMBER	SCV
(CLASS 2) PETROL INTERCEPTOR	
NEW HYDRANT	H
NEW WASHOUT HYDRANT	WH
NEW ONLINE HYDRANT	H
EXISTING FIRE HYDRANT	H
FLOW METER KIOSK	
EXISTING FIRE HYDRANT	AV
OUTLINE OF STRUCTURES ABOVE	
SITE BOUNDARY	

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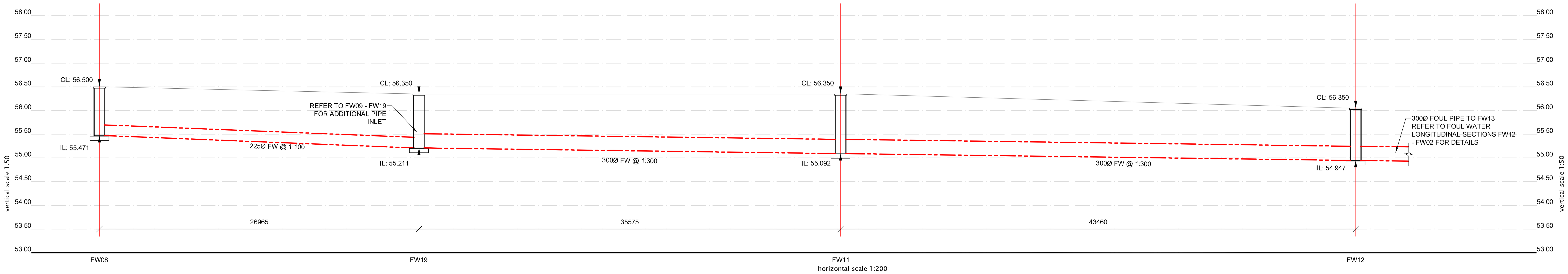
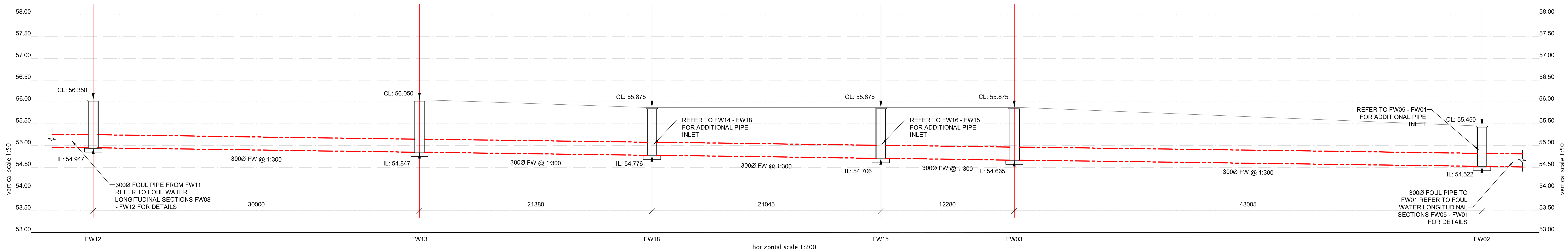
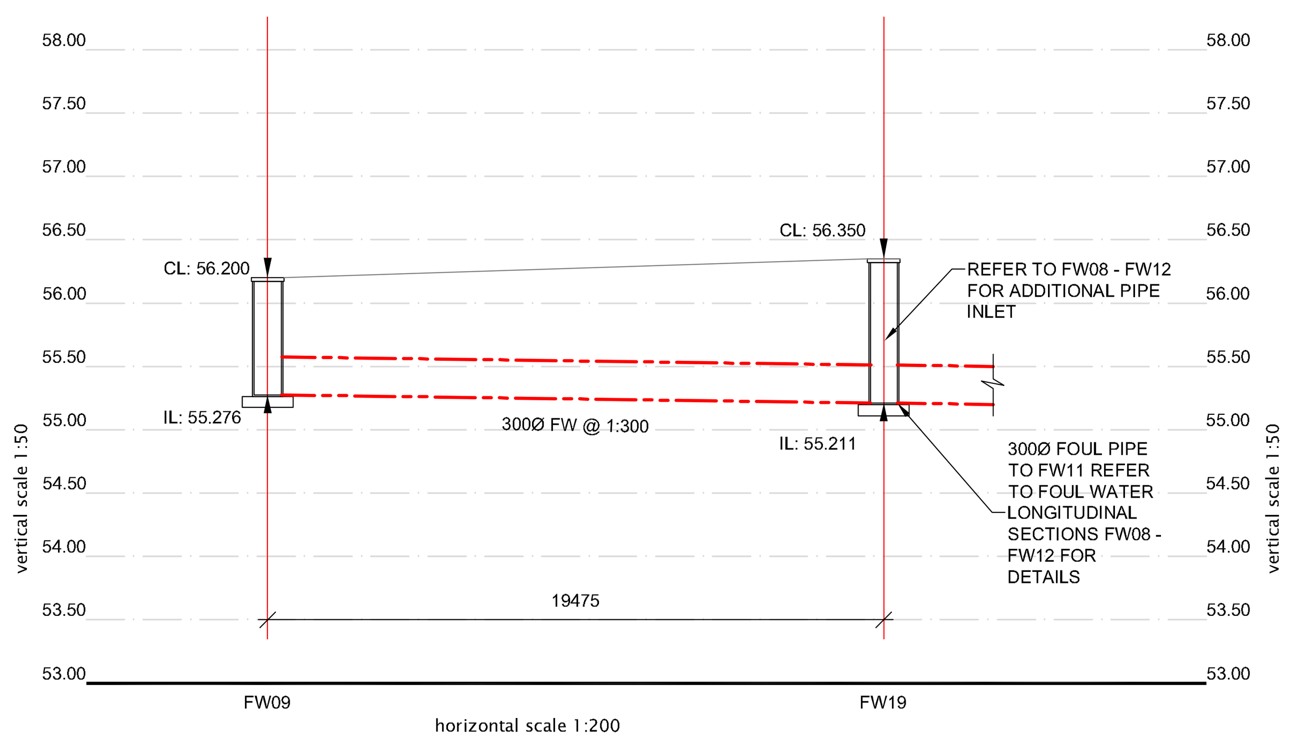
Project:	Residential Development at Greenhills Road, Walkinstown, Dublin 12	Project No. 20189	Drg. No. C01c
		Scale @A1	Date Feb. 2021
Drawing:	Proposed Watermain Layout (2 of 2)	Drawn E.V	Rev. P
Model Reference:	20189-LDE-ZZ-ZZ-M2-SC-0001	Model Rev:	P01
Drawing Reference:	20189-LDE-07-00-DR-SC-1C01c	Suitability:	S01



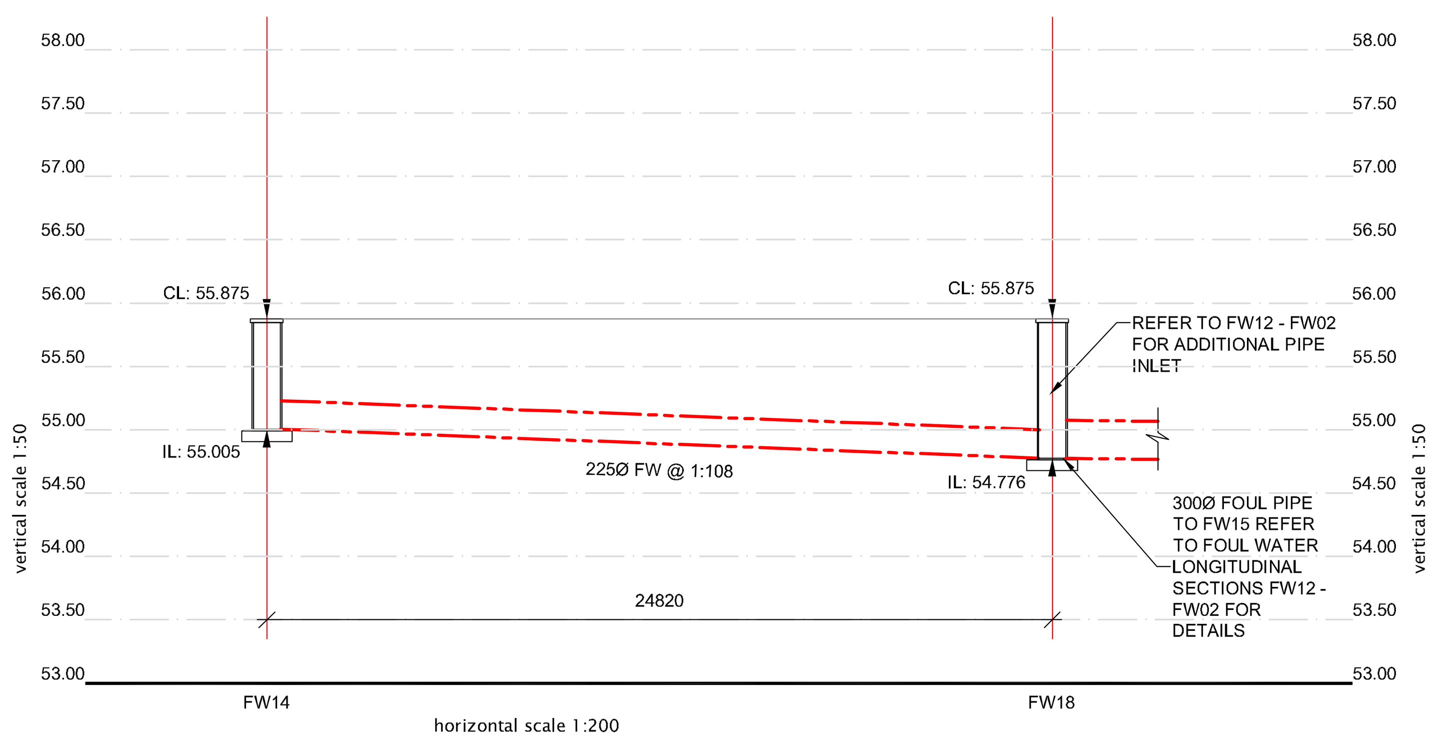
FOUL WATER LONGITUDINAL SECTIONS
FW08 - FW12
SCALE 1:200



FOUL WATER LONGITUDINAL SECTIONS
FW12 - FW02
SCALE 1:200



FOUL WATER LONGITUDINAL SECTIONS
FW09 - FW19
SCALE 1:200



FOUL WATER LONGITUDINAL SECTIONS
FW14 - FW18
SCALE 1:200

Rev	Date	Drn	Chk'd	Description
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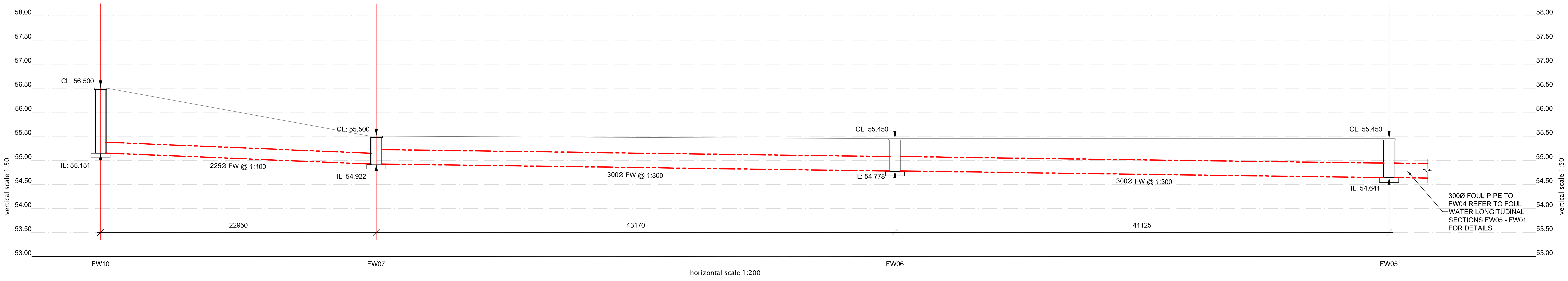
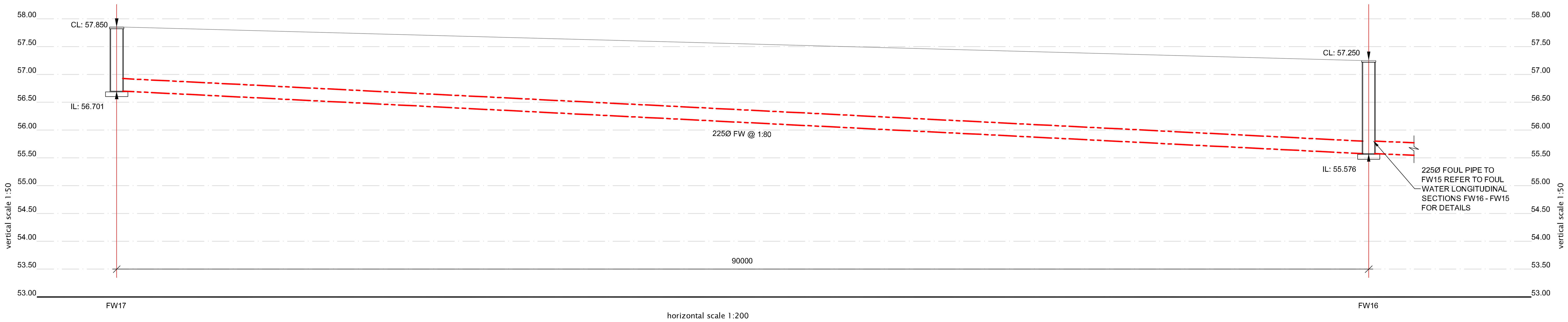
Project:	Residential Development at Greenhills Road, Walkinstown, Dublin 12
Drawing:	Foul Sewer Longitudinal Sections (1 of 3)
Model Reference:	20189-LDE-ZZ-ZZ-M2-SC-0001
Drawing Reference:	20189-LDE-07-00-DR-SC-1C01d

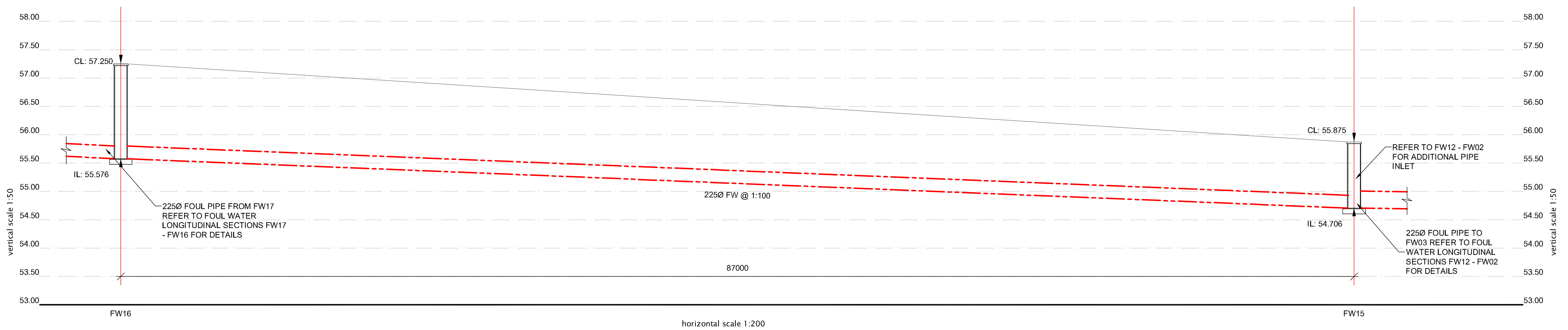
Project No. 20189	Drg. No. C01d
Scale @A1	Date Feb. 2021
Drawn D.M	Rev. D
Model Rev:	P01
Suitability:	S01



FOUL WATER LONGITUDINAL SECTIONS
FW10 - FW05



FOUL WATER LONGITUDINAL SECTIONS
FW17 - FW16
SCALE 1:200



FOUL WATER LONGITUDINAL SECTIONS
FW16 - FW15
SCALE 1:200

Rev	Date	Drn	Chk'd	Description
D	31/01/2022	D.M	G.P	Issued to Irish Water for Statement of Design Acceptance.

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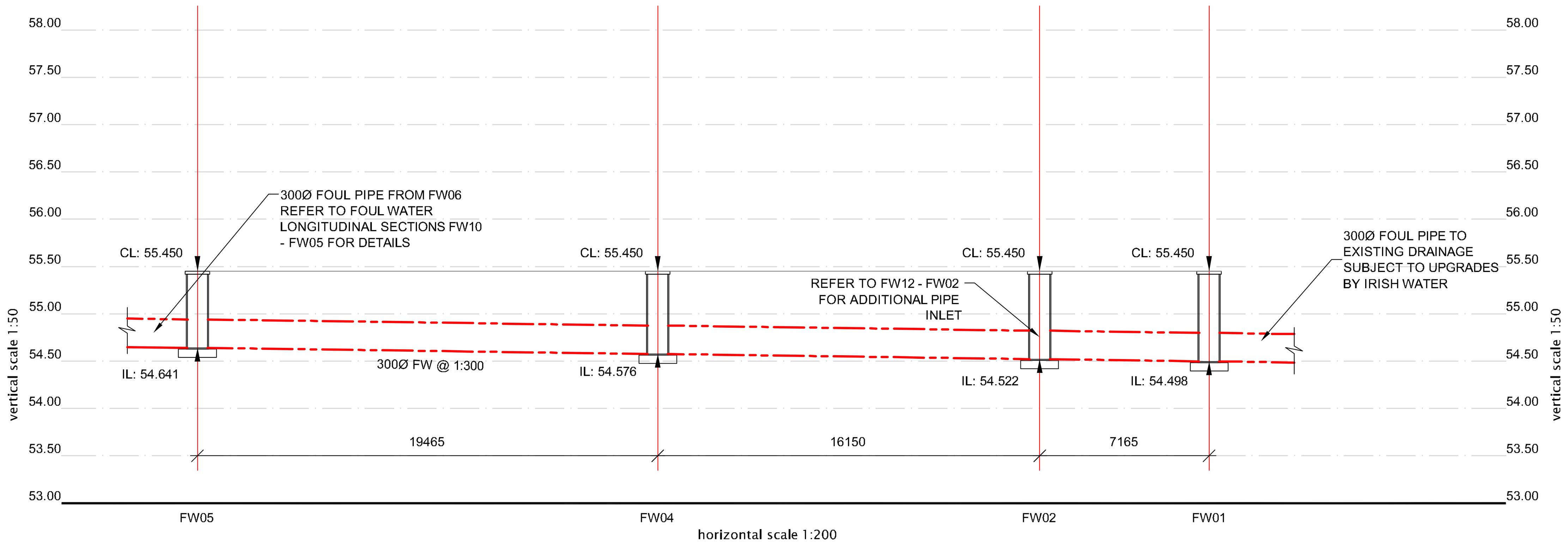
Drawing:	Foul Sewer Longitudinal Sections (2 of 3)
Model Reference:	20189-LDE-ZZ-ZZ-M2-SC-0001
Drawing Reference:	20189-LDE-07-00-DR-SC-1C01e

Project No. 20189	Drg. No. C01e
Scale @A1	Date Feb. 2021
Drawn D.M	Rev. D
Model Rev:	P01
Suitability:	S01



FOUL WATER LONGITUDINAL SECTIONS
FW05 - FW01

SCALE 1:200

Section	Area of Site (m2)	Number of residential units	Number of commercial units	Residential Amenity Area	Creche Unit	Q actual (m3/sec)	Q actual (l/sec)	Q actual (6DWF) (l/sec)	Diameter (m)	Pipe Falls	Radius (m)	Area (m2)	Length (m)	V actual (m/sec)	V design (m/sec)	Q design (m3/sec)	Q design (l/sec)	Spare %
FW17 - FW16	3911.0	88.7	1	0.0	0	0.000495	0.495	2.972430	0.225	80	0.1125	0.0298	90.0	0.01662	1.37	0.040833	40.833	92.72
FW16 - FW15	7415.2	168.1	4	138.9	0	0.001058	1.058	6.347243	0.225	100	0.1125	0.0298	87.0	0.03549	1.22	0.036363	36.363	82.54
FW08 - FW19	730.4	16.6	0	0.0	0	0.000085	0.085	0.512319	0.225	100	0.1125	0.0298	27.0	0.00286	1.22	0.036363	36.363	98.59
FW09 - FW19	813.8	18.5	0	0.0	0	0.000095	0.095	0.570818	0.300	300	0.1500	0.0530	19.5	0.00180	0.86	0.045569	45.569	98.75
FW19 - FW11	2428.5	55.1	0	261.7	0	0.000356	0.356	2.135592	0.300	300	0.1500	0.0530	35.6	0.00672	0.86	0.045569	45.569	95.31
FW11 - FW12	8062.8	182.8	0	551.2	0	0.001094	1.094	6.565714	0.300	300	0.1500	0.0530	43.5	0.02065	0.86	0.045569	45.569	85.59
FW12 - FW13	9571.4	217.0	0	767.4	0	0.001330	1.330	7.980926	0.300	300	0.1500	0.0530	30.0	0.02510	0.86	0.045569	45.569	82.49
FW13 - FW18	10442.7	236.8	0	986.3	0	0.001492	1.492	8.953579	0.300	300	0.1500	0.0530	21.4	0.02816	0.86	0.045569	45.569	80.35
FW14 - FW18	614.4	13.9	0	0.0	0	0.000072	0.072	0.430954	0.225	108	0.1125	0.0298	24.8	0.00241	1.22	0.036363	36.363	98.81
FW18 - FW15	11587.3	262.7	0	986.3	0	0.001626	1.626	9.756428	0.300	300	0.1500	0.0530	21.1	0.03069	0.86	0.045569	45.569	78.59
FW15 - FW03	19959.1	452.5	5	1125.2	0	0.002834	2.834	17.003818	0.300	300	0.1500	0.0530	12.3	0.05348	0.86	0.045569	45.569	62.69
FW03 - FW02	21072.2	477.8	7	1125.2	1	0.003088	3.088	18.525544	0.300	300	0.1500	0.0530	43.0	0.05827	0.86	0.045569	45.569	59.35
FW10 - FW07	976.5	22.1	1	160.7	0	0.000197	0.197	1.179495	0.225	100	0.1125	0.0298	30.0	0.00660	1.22	0.036363	36.363	96.76
FW07 - FW06	2914.1	66.1	1	160.7	0	0.000423	0.423	2.538572	0.300	300	0.1500	0.0530	43.2	0.00798	0.86	0.045569	45.569	94.43
FW06 - FW05	4660.9	105.7	1	160.7	0	0.000627	0.627	3.763817	0.300	300	0.1500	0.0530	41.1	0.01184	0.86	0.045569	45.569	91.74
FW05 - FW04	5561.9	126.1	1	160.7	0	0.000733	0.733	4.395798	0.300	300	0.1500	0.0530	19.5	0.01383	0.86	0.045569	45.569	90.35
FW04 - FW02	5794.1	131.4	1	160.7	0	0.000760	0.760	4.558669	0.300	300	0.1500	0.0530	16.2	0.01434	0.86	0.045569	45.569	90.00
FW02 - FW01	27768.0	629.6	8	1285.9	1	0.003953	3.953	23.716685	0.300	300	0.1500	0.0530	7.2	0.07460	0.86	0.045569	45.569	47.95
FW01 - PUBLIC	27919.6	633.0	8	1285.9	1	0.003971	3.971	23.823021	0.300	300	0.1500	0.0530	18.0	0.07493	0.86	0.045569	45.569	47.72

FOUL WATER PIPE FLOW CAPACITIES
& VELOCITIES

SCALE 1:100

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		Scale @A1	Date Feb. 2021
Drawing:	Foul Sewer Longitudinal Sections (3 of 3)	Drawn D.M	Rev. D
Model Reference:	20189-LDE-ZZ-ZZ-M2-SC-0001	Model Rev:	P01
Drawing Reference:	20189-LDE-07-00-DR-SC-1C01f	Suitability:	S01

FORMER CHADWICKS SITE GREENHILLS ROAD, WALKINSTOWN, DUBLIN	HOMAN O'BRIEN Engineering Excellence.

Project Ref.	Document Title	Rev	Prepared by:	Issue Date	Approved by:
2034	**Site Utility Services Report with Local and Extended Utility Maps**	**P03**	**SOB**	**31/01/22**	**SOB**

CONTENTS:

1.0. INTRODUCTION

This Site Utility Services Report prepared by Homan O'Brien is to form part of the planning Submission documentation to An Bord Pleanala for the Former Chadwicks Site, Greenhills Road Development.

The proposed development will consist of the following:

(i) The demolition of the existing 10 no. single/two storey warehouse buildings on site;

(ii) the construction of a mixed-use (commercial and residential) development of 633 no. build-to-rent apartment units (292 no. one beds, 280 no. two beds and 61 no. three beds), 1 no. childcare facility and 10 no. commercial/retail units in 4 no. blocks (A-D) ranging in height from 5 to 12 storeys as follows:

(a) Block A comprises 209 no. apartments (102 no. 1 bed units, 106 no. 2 bed units and 1 no. 3 bed unit) measuring 5 - 10 storeys in height with all apartments provided with private balconies/terraces.

(b) Block B comprises 121 no. apartments (53 no. 1 bed units, 45 no. 2 bed units and 23 no. 3 bed units) measuring 8 - 10 storeys in height with all apartments provided with private balconies/terraces.

(c) Block C comprises 130 no. apartments (38 no. 1 bed units, 71 no. 2 bed units and 21 no. 3 bed units) measuring 8 - 12 storeys in height with all apartments provided with private balconies/terraces.

(d) Block D comprises 173 no. apartments (99 no. 1 bed units, 58 no. 2 bed units and 16 no. 3 bed units) measuring 6 - 10 storeys in height with all apartments provided with private balconies/terraces;

(iii) provision of indoor communal residential amenity/management facilities including a co-working space, work space, wc at ground floor of Block A; gym, resident's lounge, work space, laundry room, multi-function space at ground floor of Block B; games room, media room, co-working space, resident's lounge, management office, wc, parcel room at ground floor of Block C;

(iv) the construction of 1 no. childcare facility located at ground floor of Block A;

(v) the construction of 8 no. commercial units at ground floor level of Blocks A, B and D, and 2 no. commercial units at second floor level (fronting Greenhills Road) of Block C,

(vi) the construction of 3 no. vehicular entrances; a primary entrance from the north (access from Greenhills Road) and 2 no. secondary entrances from the south for emergency access and services (access from existing road to the south of the site) with additional pedestrian accesses proposed along Greenhills Road;

(vii) provision of 398 no. car parking spaces, 21 no. mobility spaces and 5 no. car club spaces (total of 424 spaces) located at street level and in two levels of undercroft parking areas located under Blocks A, C and D all of which are accessed from the proposed entrance at Greenhills Road. Provision of an additional 15 no. commercial/ unloading/ resident parking spaces at street level and 4 no. dedicated motorcycle spaces at undercroft level;

(viii) provision of bike storerooms to accommodate 1035 no. standard residents' bicycle spaces, 5 no. accessible bicycle spaces and 7 no. cargo bicycle spaces in undercroft parking areas, and provision of 316 visitors' bicycle spaces at street level;

(ix) provision of outdoor communal amenity space comprising landscaped courtyards located on podiums at first and second floor levels with roof garden also proposed at 11th floor level of Block C, and public open space at ground floor level;

(x) Planning permission is also sought for landscaping and infrastructural works, foul and surface water drainage, bin storage, ESB substations, plant rooms, open space areas including playground, boundary treatments, internal roads and footpaths and all associated site works to facilitate the development.

This application is accompanied by an Environmental Impact Assessment Report (EIAR).

2.0. ESB

2.1. Existing:

2.1.1 Please refer to the ESB Services Map in Appendix B.

2.1.2. The site is generally clear of ESB Cables.

2.1.3. There is an existing ESB Substation on the site, reference "Chadwicks 316 S 400". This Substation would need to be relocated as part of any new works.

2.1.4. There are ESB 10kV Underground Cables adjacent to the Site that should not be moved.

2.2. Proposed Design Standard

2.2.1. ESB Standard Substation size - 1000kVA

2.2.2. ESB Substation loading up to 80%

2.2.3. ESB Power required per Apartment 3.5kVA

2.2.4. Allowance to be made for Retail.

2.2.5. Allowance to be made for EV Charging and future capacity.

2.3. Proposed Requirement for Site

2.3.1. 633 Apartments on site.

2.3.2. Retail units.

2.3.3. Car parking.

2.3.4. EV Charging.

2.3.5.

633 Units x 3.5kVA	=	2215.5kVA
Retail Units	=	200kVA
Car Parking / EV Charging	=	400kVA
Total		2815.5kVA

2.3.6. Total of 4 number 1000kVA ESB Substations required.

Each Substation 4.0mw x 3.5m deep with adjoining Switchroom of similar dimensions (refer Appendix A for typical drawing). All at Ground Floor with access to outside.

Local Meter Room can be accommodated internally per Block.

3.0. GAS NETWORKS IRELAND

3.1. Existing:

3.1.1. Please refer to GNI Services Map in Appendix B.

3.1.2. There is a 4Bar Gas Main in the road to the south of the site.

3.1.3. The site is generally clear of any existing Gas Mains.

3.2. Proposed:

3.2.1 It is not proposed to provide Natural Gas to the Site.

4.0. TELECOMS

4.1. VIRGIN MEDIA

4.1.1. Please refer to Virgin Media Services Map in Appendix B.

4.1.2. There are existing Virgin Media Underground Services adjacent to the site. Virgin Media have confirmed the following *"Please note that these services contain live fibre, transmitting data traffic of a highly sensitive nature. Any work to be carried out in the vicinity of this ducting will necessitate that a Virgin Media Plant Protection Officer be present during the work."*

4.2. EIR

4.2.1. Please refer to the EIR Services Map in Appendix B.

4.2.2. There are existing EIR Services underground around the perimeter of the site.

4.2.3. The site itself appears clear of Telecom Services.

4.3. BT

4.3.1. Please refer to the BT Services Map in Appendix B.

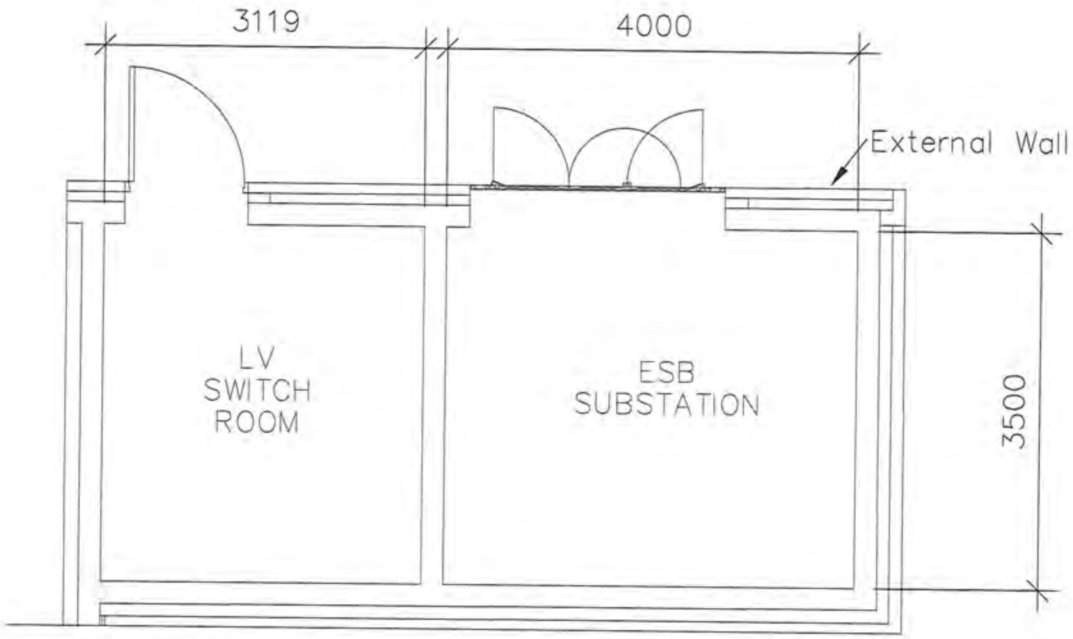
4.3.2. There are existing BT Services around the perimeter of the site.

4.4. Proposed Telecoms

4.4.1. New Telecom Distribution Ductwork will be provided on the site to facilitate Telecom Connections to the new Development.

APPENDIX A

TYPICAL DRAWING



Typical ESB Substation &
LV Switchroom

Electrical Services Installation

Floor Level
Services Description

HOMAN O'BRIEN
Engineering Excellence.
Consulting Engineers
89 Booterstown Avenue,
Blackrock, Co. Dublin.
Telephone: 2056300, Fax: 2056301
E-mail: info@homanobrien.ie
Web: www.homanobrien.ie

Drawing Number	Date	Scale	Drawn	Checked	Issue
		Refer to Scalebar	00	00	00

APPENDIX B

EXISTING SITE SERVICES MAPS

ESB Networks

TITLE: 20201221-036_A3

COLOUR CODE:

- BLACK - 38KV & HIGHER VOLTAGE OVERHEAD LINES
- GREEN - MV(10KV/20KV) OVERHEAD LINES
- BLUE - LV (400V/230V) OVERHEAD LINES
- CYAN - 38KV & HIGHER VOLTAGE UNDERGROUND CABLE ROUTES
- RED - MV/LV (10KV/20KV/400V/230V) UNDERGROUND CABLE ROUTES

DATE: 21-Dec-2020

** SCALE: 1:2500

** SCALE WHEN PRINTED ON AN A3 PAGE
XY COORDINATES DISPLAYED IN IRISH GRID COORDINATE SYSTEM

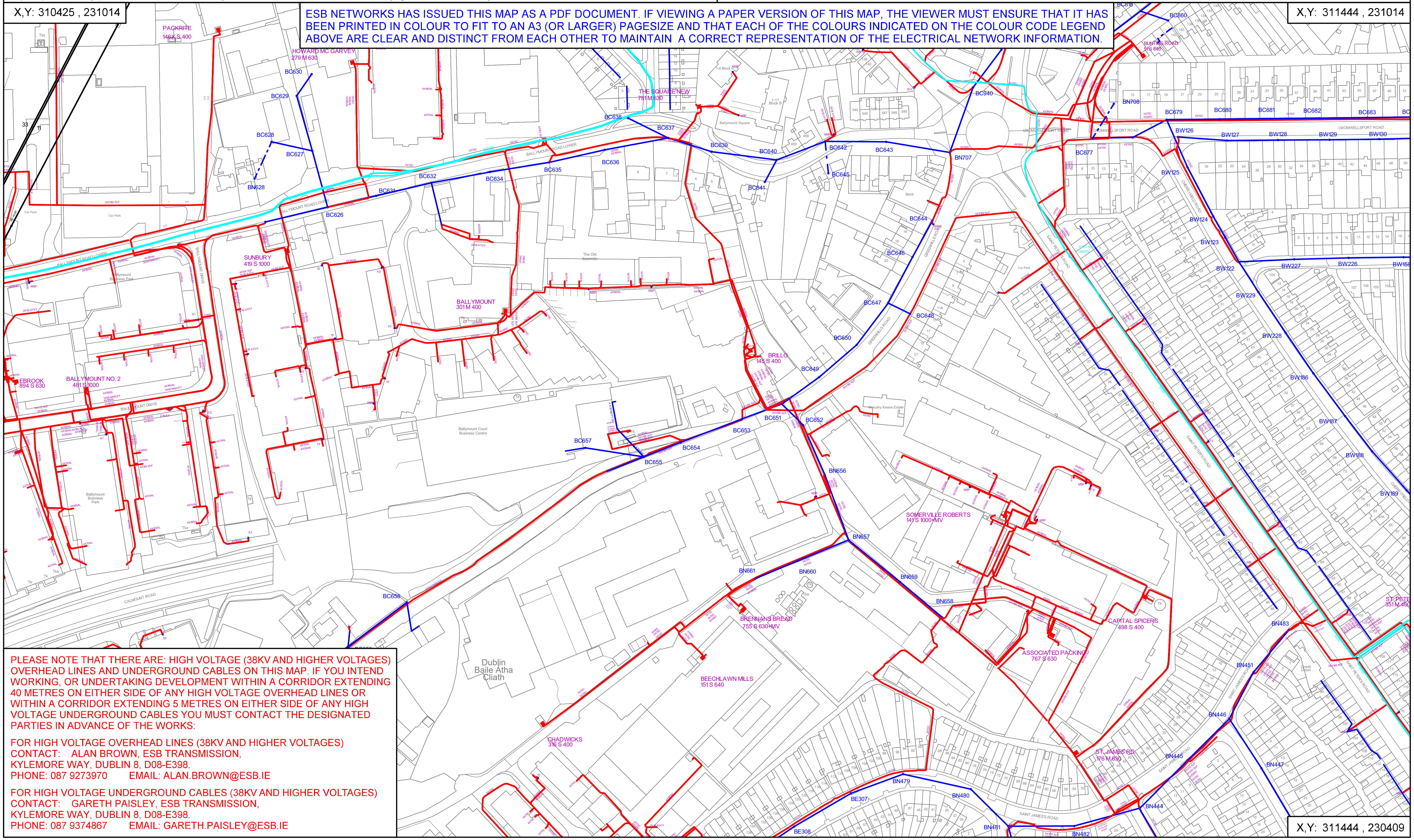
WARNING

THIS MAP INDICATES THE APPROXIMATE LOCATION OF ESB TRANSMISSION (400KV, 220KV, 110KV, 38KV) AND DISTRIBUTION (20KV, 10KV, 230V/400V) UNDERGROUND CABLES AND OVERHEAD LINES IN THE GENERAL AREA OF THE PROPOSED WORKS. ESB NETWORKS TAKES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE MAP. IT IS THE USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE INFORMATION AND THE LOCATION OF UNDERGROUND CABLES AND OVERHEAD LINES. LOW VOLTAGE (230V/400V) SERVICE CABLES (E.G. HOUSE SERVICES, FACTORY/SHOP SERVICES, PUBLIC LIGHTING LAMP SERVICES, ETC) ARE NOT INCLUDED BUT THEIR PRESENCE SHOULD BE ANTICIPATED. THE DEPTHS OF UNDERGROUND CABLES MUST NEVER BE ASSUMED. ADDITIONAL MORE DETAILED INFORMATION IS AVAILABLE FOR HIGH VOLTAGE TRANSMISSION UNDERGROUND CABLES (38KV, 110KV, 220KV, 400KV) FROM THE LOCAL ESB NETWORKS TRANSMISSION REPRESENTATIVE - SEE ATTACHED LIST FOR CONTACT DETAILS OR CALL 1850 372 757. NO WORK SHOULD BE CARRIED OUT IN THE VICINITY OF 38KV OR HIGHER VOLTAGE UNDERGROUND CABLES WITHOUT PRIOR CONSULTATION WITH ESB NETWORKS. BEFORE ANY MECHANICAL EXCAVATION IS UNDERTAKEN, THE ACTUAL LOCATION OF ALL UNDERGROUND ELECTRICITY CABLES MUST BE ESTABLISHED AND VERIFIED ON THE SITE USING: (A) UP-TO-DATE MAP RECORDS; (B) CABLE LOCATER EQUIPMENT OPERATED IN BOTH POWER AND RADIO MODES; (C) CAREFUL HAND DIGGING OF TRIAL HOLES USING 'SAFE DIGGING PRACTICE'. REFER ALSO TO 'HSA CODE OF PRACTICE FOR AVOIDING DANGER FROM UNDERGROUND SERVICES'. ESB TAKES NO RESPONSIBILITY FOR AND SHALL BEAR NO LIABILITY, HOWSOEVER ARISING, IN RELATION TO ANY DAMAGE, INJURY/DEATH OR LOSS OF SUPPLY AS A RESULT OF DAMAGE OR INTERFERENCE WITH ITS NETWORKS.

X,Y: 310425 , 231014

X,Y: 311444 , 231014

ESB NETWORKS HAS ISSUED THIS MAP AS A PDF DOCUMENT. IF VIEWING A PAPER VERSION OF THIS MAP, THE VIEWER MUST ENSURE THAT IT HAS BEEN PRINTED IN COLOUR TO FIT TO AN A3 (OR LARGER) PAGESIZE AND THAT EACH OF THE COLOURS INDICATED ON THE COLOUR CODE LEGEND ABOVE ARE CLEAR AND DISTINCT FROM EACH OTHER TO MAINTAIN A CORRECT REPRESENTATION OF THE ELECTRICAL NETWORK INFORMATION.



PLEASE NOTE THAT THERE ARE: HIGH VOLTAGE (38KV AND HIGHER VOLTAGES) OVERHEAD LINES AND UNDERGROUND CABLES ON THIS MAP. IF YOU INTEND WORKING, OR UNDERTAKING DEVELOPMENT WITHIN A CORRIDOR EXTENDING 40 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE OVERHEAD LINES OR WITHIN A CORRIDOR EXTENDING 5 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE UNDERGROUND CABLES YOU MUST CONTACT THE DESIGNATED PARTIES IN ADVANCE OF THE WORKS:

FOR HIGH VOLTAGE OVERHEAD LINES (38KV AND HIGHER VOLTAGES)
CONTACT: ALAN BROWN, ESB TRANSMISSION,
KYLEMORE WAY, DUBLIN 8, D08-E398.
PHONE: 087 9273970 EMAIL: ALAN.BROWN@ESB.IE

FOR HIGH VOLTAGE UNDERGROUND CABLES (38KV AND HIGHER VOLTAGES)
CONTACT: GARETH PAISLEY, ESB TRANSMISSION,
KYLEMORE WAY, DUBLIN 8, D08-E398.
PHONE: 087 9374867 EMAIL: GARETH.PAISLEY@ESB.IE

X,Y: 311444 , 230409

ESB Networks

TITLE:

20211019-072_A0

COLOUR CODE:

- BLACK - 38KV & HIGHER VOLTAGE OVERHEAD LINES
- GREEN - MV(10KV/20KV) OVERHEAD LINES
- BLUE - LV (400V/230V) OVERHEAD LINES
- CYAN - 38KV & HIGHER VOLTAGE UNDERGROUND CABLE ROUTES
- RED - MV/LV (10KV/20KV/400V/230V) UNDERGROUND CABLE ROUTES

DATE: 19-Oct-2021

** SCALE: 1:2600

** SCALE WHEN PRINTED ON AN A0 PAGE
XY COORDINATES DISPLAYED IN IRISH GRID COORDINATE SYSTEM

WARNING

THIS MAP INDICATES THE APPROXIMATE LOCATION OF ESB TRANSMISSION (400KV, 220KV, 110KV, 38KV) AND DISTRIBUTION (20KV, 10KV, 230V/400V) UNDERGROUND CABLES AND OVERHEAD LINES IN THE GENERAL AREA OF THE PROPOSED WORKS. ESB NETWORKS TAKES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE MAP. IT IS THE USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE INFORMATION AND THE LOCATION OF UNDERGROUND CABLES AND OVERHEAD LINES. LOW VOLTAGE (230V/400V) SERVICE CABLES (E.G. HOUSE SERVICES, FACTORY/SHOP SERVICES, PUBLIC LIGHTING LAMP SERVICES, ETC) ARE NOT INCLUDED BUT THEIR PRESENCE SHOULD BE ANTICIPATED. THE DEPTHS OF UNDERGROUND CABLES MUST NEVER BE ASSUMED. ADDITIONAL MORE DETAILED INFORMATION IS AVAILABLE FOR HIGH VOLTAGE TRANSMISSION UNDERGROUND CABLES (38KV, 110KV, 220KV, 400KV) FROM THE LOCAL ESB NETWORKS TRANSMISSION REPRESENTATIVE - SEE ATTACHED LIST FOR CONTACT DETAILS OR CALL 1850 372 757. NO WORK SHOULD BE CARRIED OUT IN THE VICINITY OF 38KV OR HIGHER VOLTAGE UNDERGROUND CABLES WITHOUT PRIOR CONSULTATION WITH ESB NETWORKS. BEFORE ANY MECHANICAL EXCAVATION IS UNDERTAKEN, THE ACTUAL LOCATION OF ALL UNDERGROUND ELECTRICITY CABLES MUST BE ESTABLISHED AND VERIFIED ON THE SITE USING:
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DUBLIN 8, D08-E398. PHONE: 087 9273970 EMAIL: ALAN.BROWN@ESB.IE

FOR HIGH VOLTAGE UNDERGROUND CABLES: (38KV AND HIGHER VOLTAGES)
CONTACT: GARETH PAISLEY, ESB TRANSMISSION, KYLEMORE WAY,
DUBLIN 8, D08-E398. PHONE: 087 9374867 EMAIL: GARETH.PAISLEY@ESB.IE

ESB Networks

TITLE:

20211019-072-001_A0

COLOUR CODE:

- BLACK - 38KV & HIGHER VOLTAGE OVERHEAD LINES
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- BLUE - LV (400V/230V) OVERHEAD LINES
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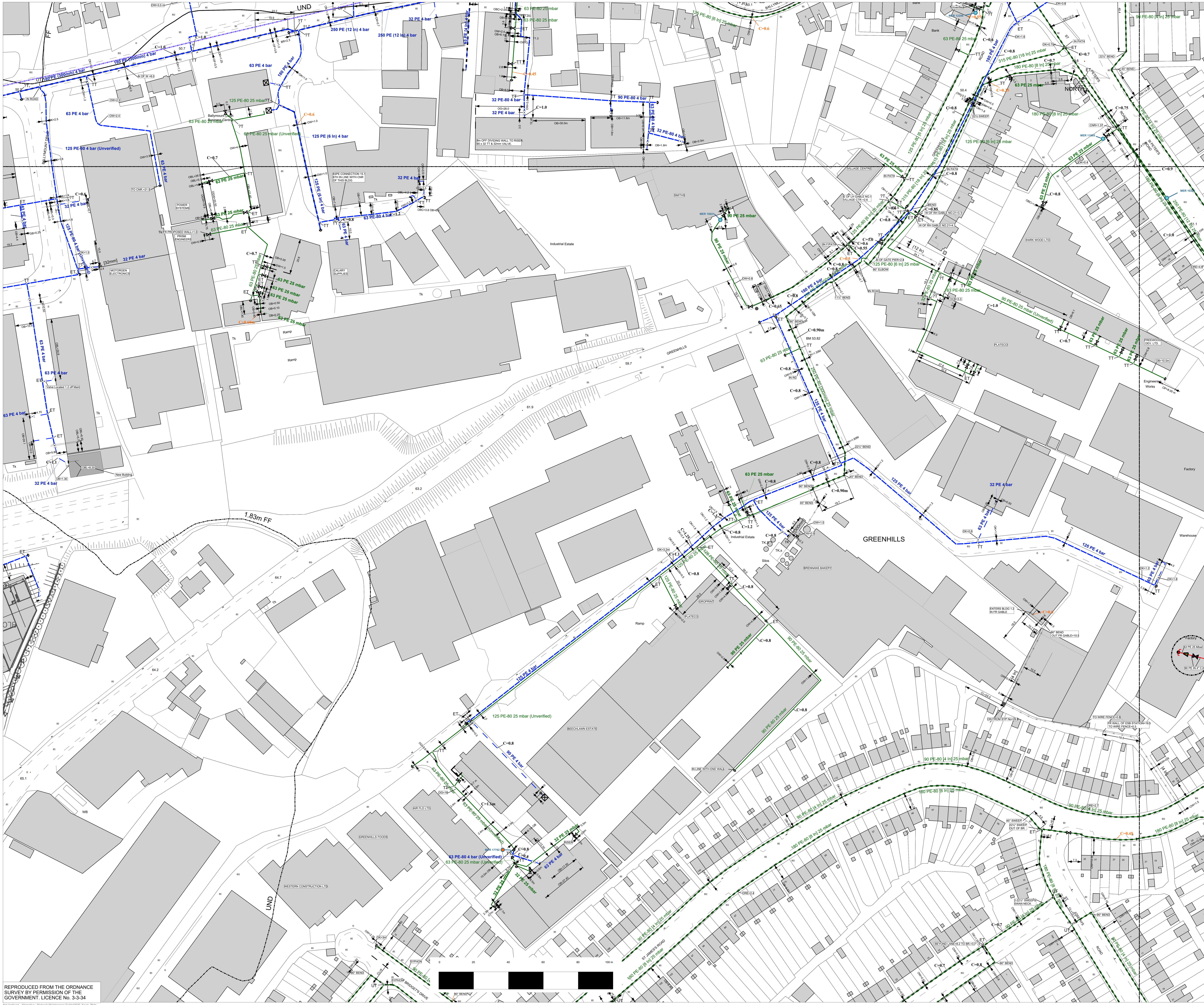

Important Safety Notice:

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- Aurora Telecom Duct
- Aurora Telecom Sub-duct
- Aurora Telecom Inserted Gas Pipe

Contact Aurora Telecom on 1850-427-399 or (01)203-0120.

- Transmission Pipe (High Pressure)
- Transmission Pipe (Construction Issue)
- Distribution Pipe (Medium Pressure)
- Distribution Pipe (Low Pressure)
- Service Pipe (Medium Pressure)
- Service Pipe (Low Pressure)
- Strategic Pipe (Medium Pressure)
- Strategic Pipe (Low Pressure)
- Inserted Pipe (Medium Pressure)
- Inserted Pipe (Low Pressure)
- Distribution Pipe (Abandoned)

C=? Cover (depth in meters)	Pressure Monitor
CP Test Point	Protection (Sleeve)
End Cap	Protection (Slabbing)
Hot Tap	Reducer
Installation	Service Terminator
Valve	Tee
Mains Verification **	Transition

** Please contact GNI on 1850-427747 for specific information.

Design Department - DUBLIN

Gas Networks Ireland

GAS NETWORK INFORMATION

Issue: Homan O Brien	
Location: Greenhills Road Dublin 12	
Plot Date: 17/12/2020	Contact: F Canning
Plotted by: KOC	Scale: 1:1000

Important Safety Notice:

Damage to gas pipelines can result in serious injury or death. Gas network information is provided as a general guide. The exact location and depth of medium or low pressure distribution gas pipes must be verified on site by carrying out necessary investigations, including, for example, hand digging trial holes along the route of the pipe. Service pipes are not generally shown but their presence should always be anticipated.

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Aurora Telecom Duct
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Strategic Pipe (Medium Pressure)
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Inserted Pipe (Low Pressure)
Distribution Pipe (Abandoned)

.C=?	Cover (depth in meters)		Pressure Monitor
	CP Test Point		Protection (Sleeve)
	End Cap		Protection (Slabbing)
	Hot Tap		Reducer
	Installation		Service Terminator
	Valve		Tee
	Mains Verification **		Transition

** Please contact GNI on 1800-427747 for specific information.

Design Department - DUBLIN

Gas Networks Ireland

GAS NETWORK INFORMATION

Issue: Homan O' Brien	
Location: Greenhills Road Walkinstown	
Plot Date: 21/10/2021	Contact: F Canning
Plotted by: KOC	Scale: 1:1000

Important Safety Notice:

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Aurora Telecom Duct
Aurora Telecom Sub-duct
Aurora Telecom Inserted Gas Pipe

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Transmission Pipe (High Pressure)
Transmission Pipe (Construction Issue)
Distribution Pipe (Medium Pressure)
Distribution Pipe (Low Pressure)
Service Pipe (Medium Pressure)
Service Pipe (Low Pressure)
Strategic Pipe (Medium Pressure)
Strategic Pipe (Low Pressure)
Inserted Pipe (Medium Pressure)
Inserted Pipe (Low Pressure)
Distribution Pipe (Abandoned)

.C=?	Cover (depth in meters)		Pressure Monitor
	CP Test Point		Protection (Sleeve)
	End Cap		Protection (Slabbing)
	Hot Tap		Reducer
	Installation		Service Terminator
	Valve		Tee
	Mains Verification **		Transition

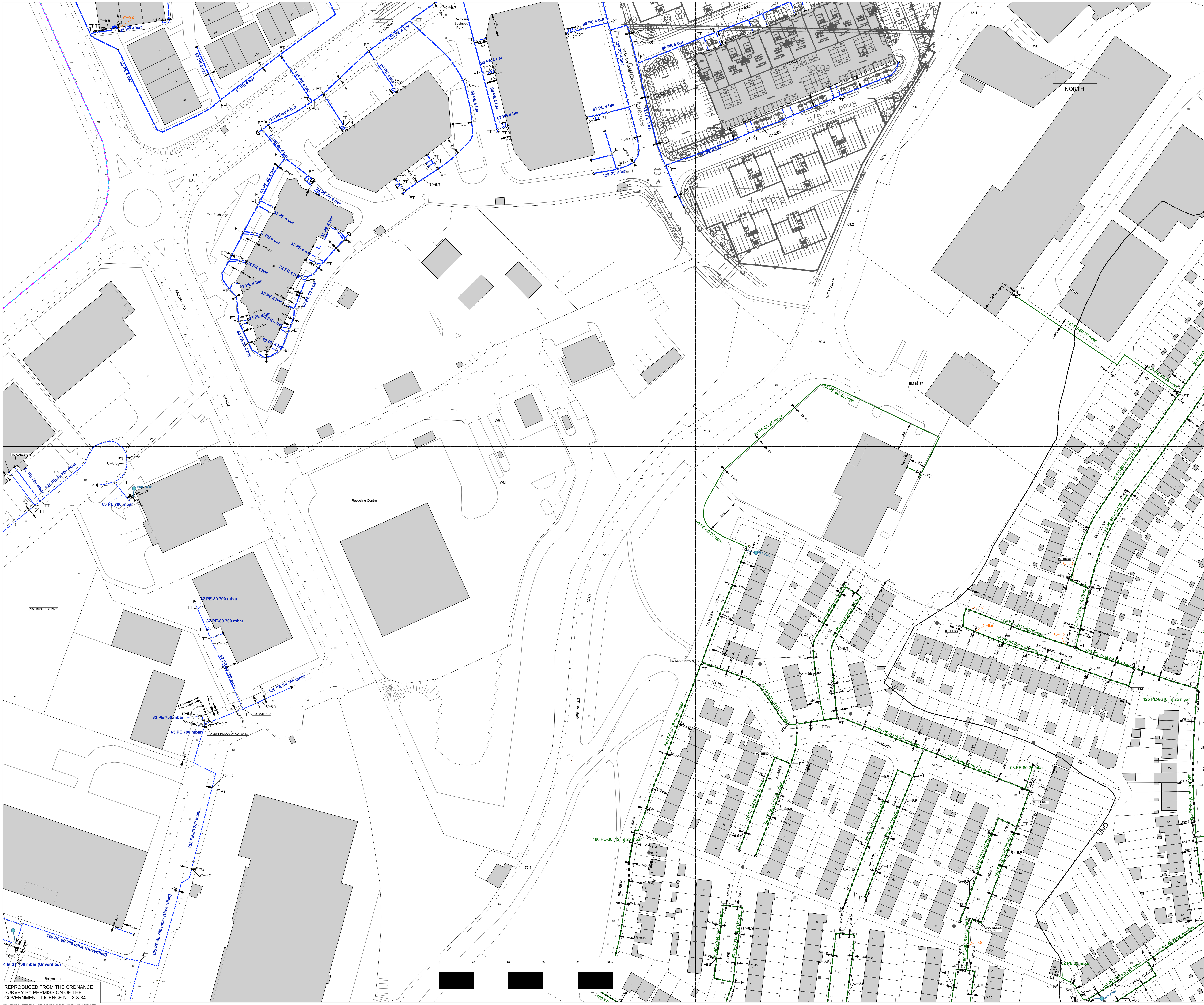
** Please contact GNI on 1800-427747 for specific information.

Design Department - DUBLIN

Gas Networks Ireland

GAS NETWORK INFORMATION

Issue: Homan O' Brien	
Location: Greenhills Road Walkinstown	
Plot Date: 21/10/2021	Contact: F Canning
Plotted by: KOC	Scale: 1:1000



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Protection (Sleeve)
Protection (Slabbing)
Reducer
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Tee
Transition

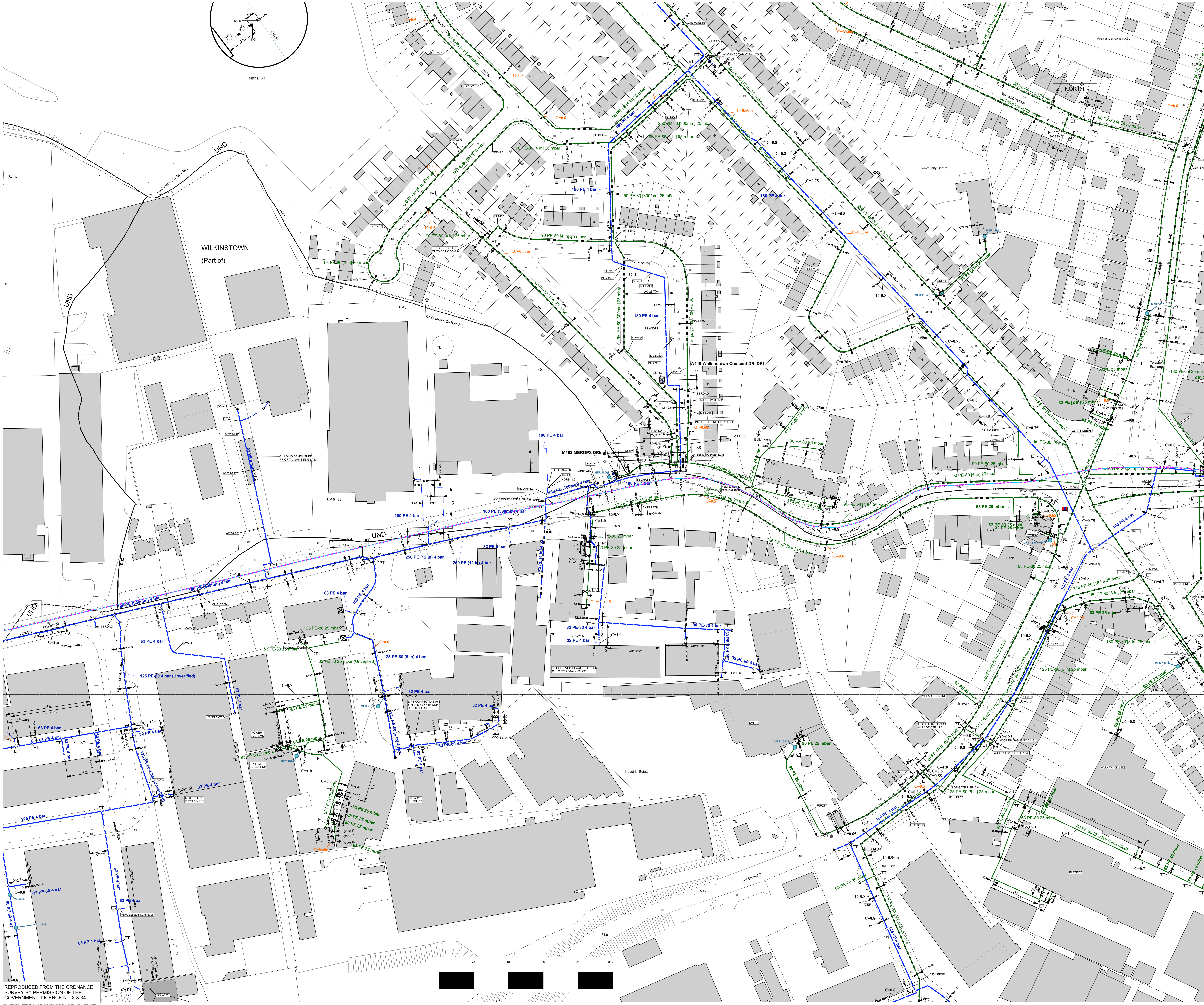
** Please contact GNI on 1800-427747 for specific information.

Design Department - DUBLIN

Gas Networks Ireland

GAS NETWORK INFORMATION

Issue: Homan O' Brien	
Location: Greenhills Road Walkinstown	
Plot Date: 21/10/2021	Contact: F Canning
Plotted by: KOC	Scale: 1:1000



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- Distribution Pipe (Low Pressure)
- Service Pipe (Medium Pressure)
- Service Pipe (Low Pressure)
- Strategic Pipe (Medium Pressure)
- Strategic Pipe (Low Pressure)
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- Inserted Pipe (Low Pressure)
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CP Test Point	Protection (Sleeve)
End Cap	Protection (Slabbing)
Hot Tap	Reducer
Installation	Service Terminator
Valve	Tee
Mains Verification **	Transition

** Please contact GNI on 1800-427747 for specific information.

Design Department - DUBLIN

Gas Networks Ireland

GAS NETWORK INFORMATION

Issue:	Homan O' Brien
Location:	Greenhills Road Walkinstown
Plot Date: 21/10/2021	Contact: F Canning
Plotted by: KOC	Scale: 1:1000

Important Safety Notice:

Damage to gas pipelines can result in serious injury or death. Gas network information is provided as a general guide. The exact location and depth of medium or low pressure distribution gas pipes must be verified on site by carrying out necessary investigations, including, for example, hand digging trial holes along the route of the pipe. Service pipes are not generally shown but their presence should always be anticipated.

High pressure transmission pipelines are shown in red. If a transmission pipeline is identified within 10m of any intended excavations then work must not proceed before GNI has been consulted. The true location and depth of a transmission pipeline must be verified on site by a representative of GNI. Contact can be made through 1800 427 747.

All work in the vicinity of the gas 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 (01 614 7000) or can be downloaded at www.hsa.ie.

Legal Notice:

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Aurora Telecom Fibre Optic Cable
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Aurora Telecom Inserted Gas Pipe

Contact Aurora Telecom on 1800-427-399 or (01)203-0120.

Transmission Pipe (High Pressure)
Transmission Pipe (Construction Issue)
Distribution Pipe (Medium Pressure)
Distribution Pipe (Low Pressure)
Service Pipe (Medium Pressure)
Service Pipe (Low Pressure)
Strategic Pipe (Medium Pressure)
Strategic Pipe (Low Pressure)
Inserted Pipe (Medium Pressure)
Inserted Pipe (Low Pressure)
Distribution Pipe (Abandoned)

.C=?	Cover (depth in meters)		Pressure Monitor
	CP Test Point		Protection (Sleeve)
	End Cap		Protection (Slabbing)
	Hot Tap		Reducer
	Installation		Service Terminator
	Valve		Tee
	Mains Verification **		Transition

** Please contact GNI on 1800-427747 for specific information.

Design Department - DUBLIN

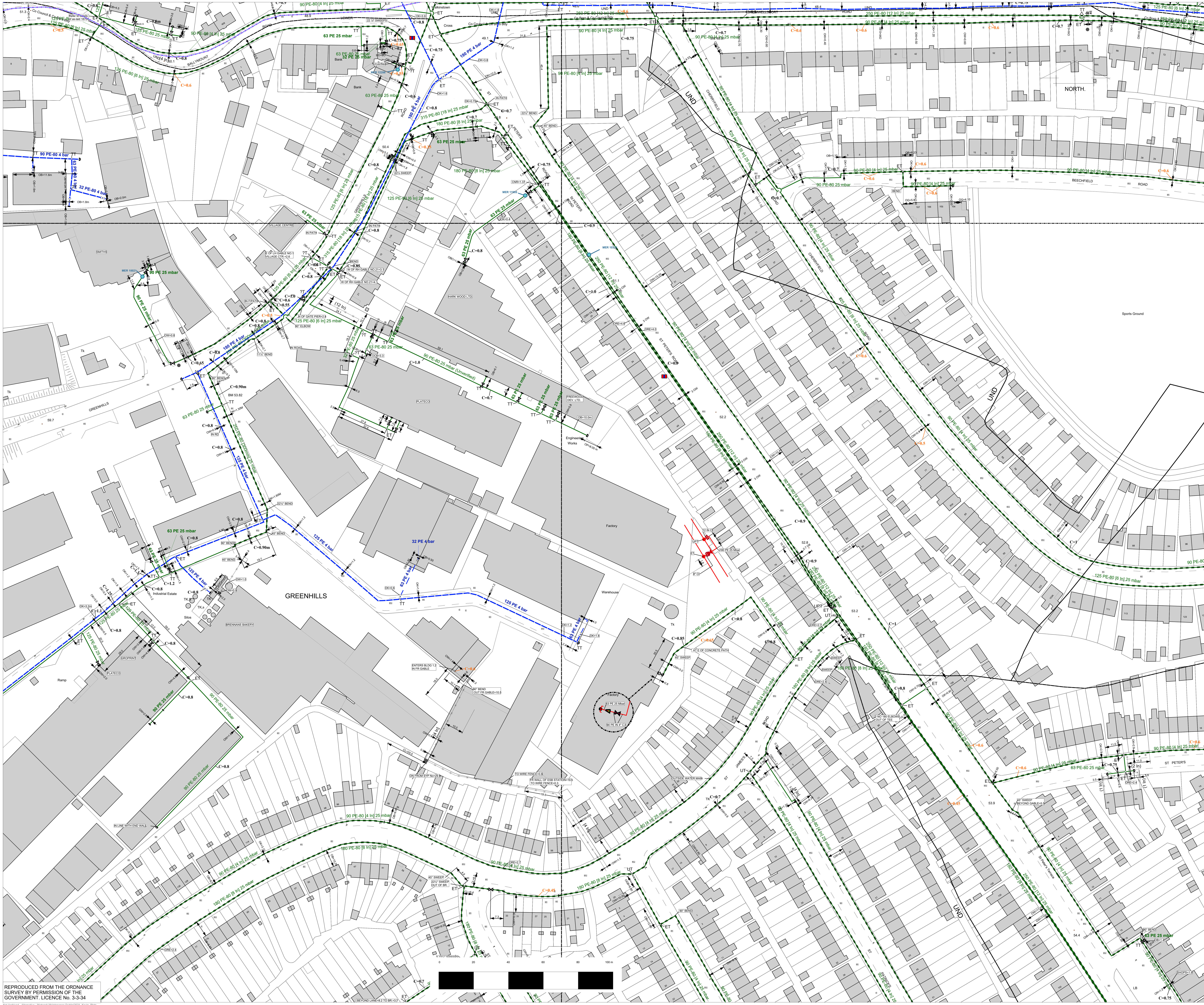
Gas Networks Ireland

GAS NETWORK INFORMATION

Issue: Homan O' Brien

Location: Greenhills Road Walkinstown

Plot Date:	Contact:
21/10/2021	F Canning
Plotted by:	**Scale:**
KOC	1:1000



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Contact Aurora Telecom on 1800-427-399 or (01)203-0120.

- Transmission Pipe (High Pressure)
- Transmission Pipe (Construction Issue)
- Distribution Pipe (Medium Pressure)
- Distribution Pipe (Low Pressure)
- Service Pipe (Medium Pressure)
- Service Pipe (Low Pressure)
- Strategic Pipe (Medium Pressure)
- Strategic Pipe (Low Pressure)
- Inserted Pipe (Medium Pressure)
- Inserted Pipe (Low Pressure)
- Distribution Pipe (Abandoned)

C=? Cover (depth in meters)	Pressure Monitor
CP Test Point	Protection (Sleeve)
End Cap	Protection (Slabbing)
Hot Tap	Reducer
Installation	Service Terminator
Valve	Tee
Mains Verification **	Transition

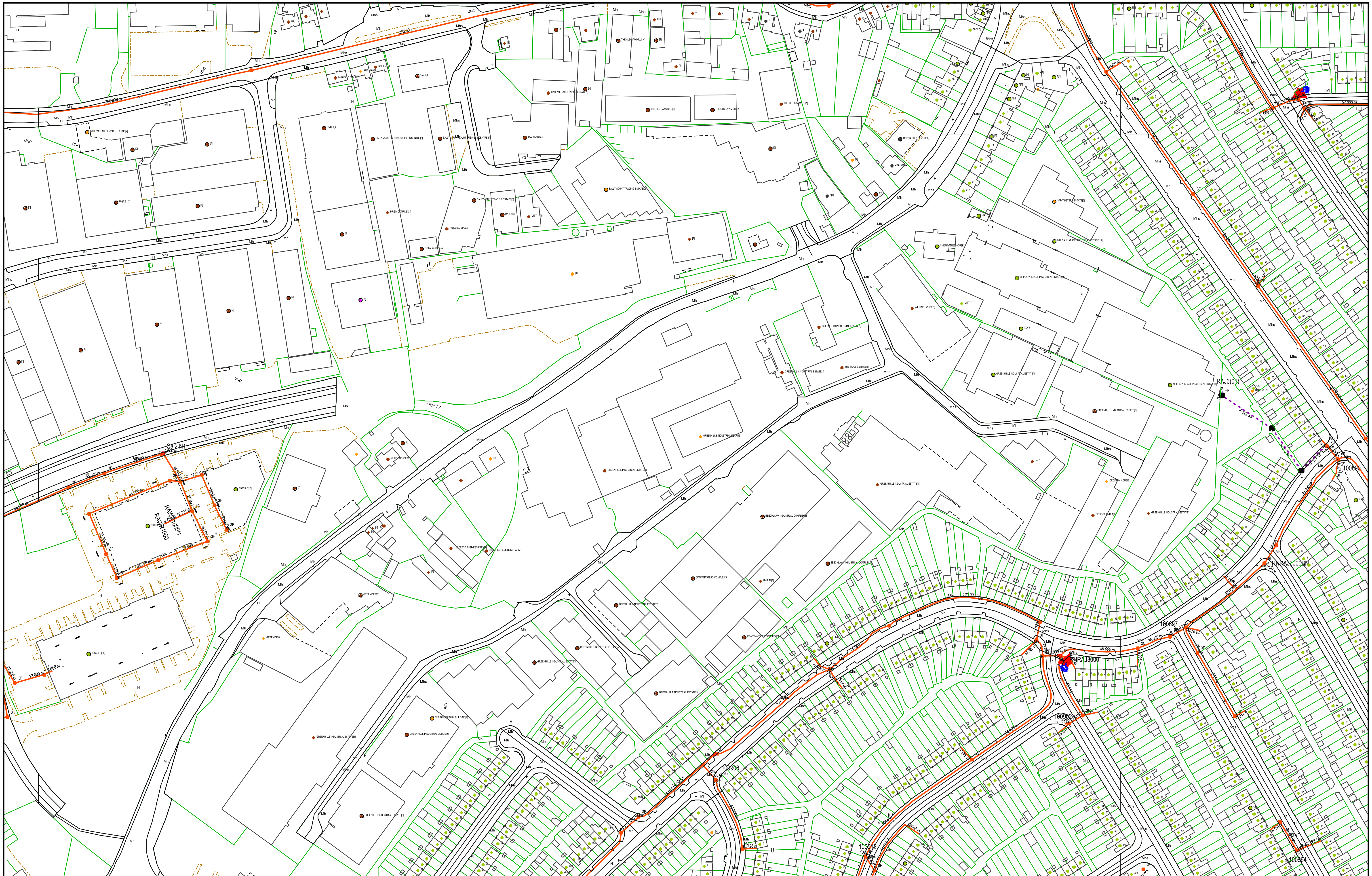
** Please contact GNI on 1800-427747 for specific information.

Design Department - DUBLIN

Gas Networks Ireland

GAS NETWORK INFORMATION

Issue: Homan O' Brien	
Location: Greenhills Road Walkinstown	
Plot Date: 21/10/2021	Contact: F Canning
Plotted by: KOC	Scale: 1:1000



Unit 7,
Westgate Business Park,
Ballymount,
Dublin 24.

PROJECT NAME

DESIGNED BY:

Produced on: 18/12/2020

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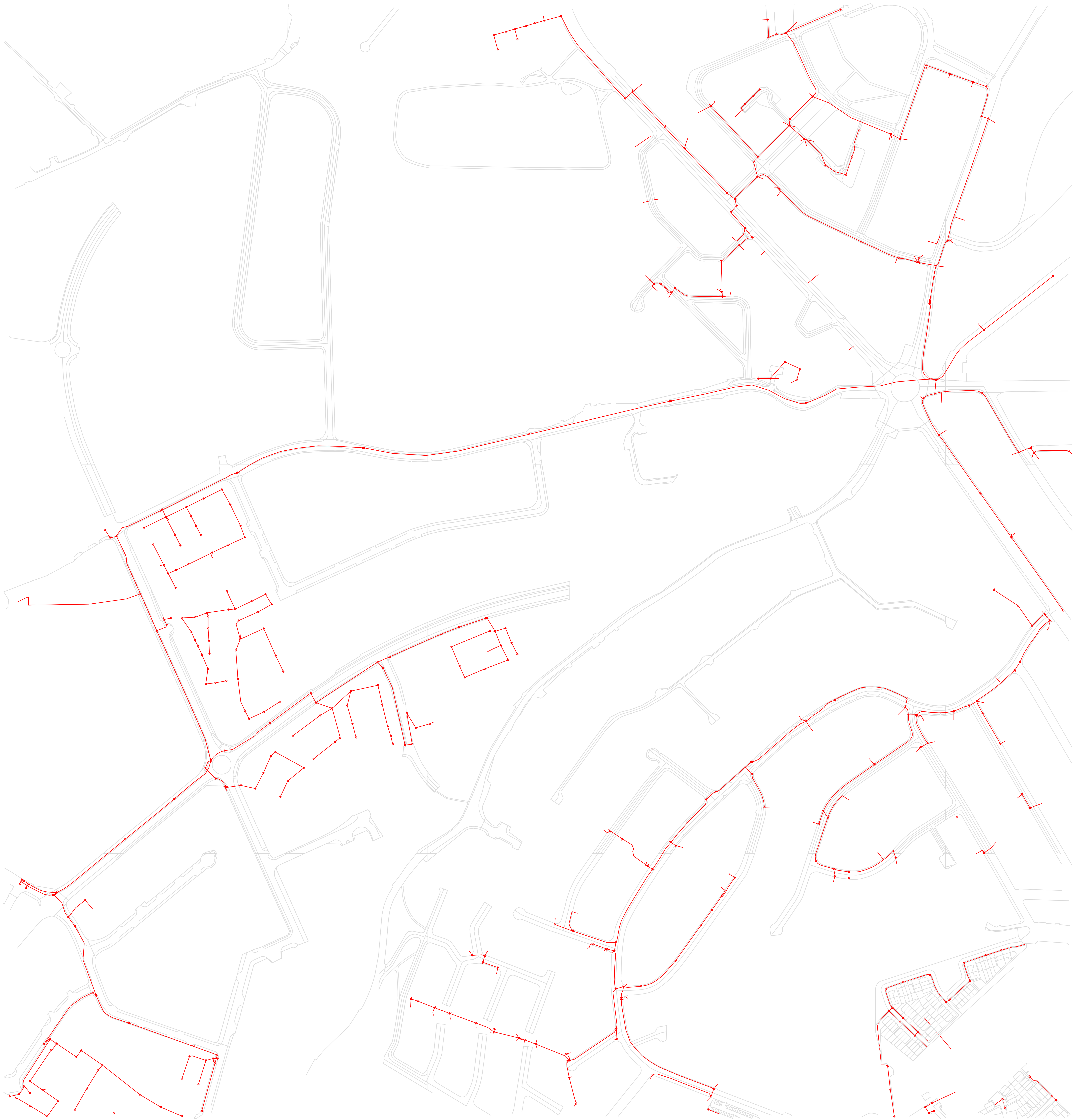

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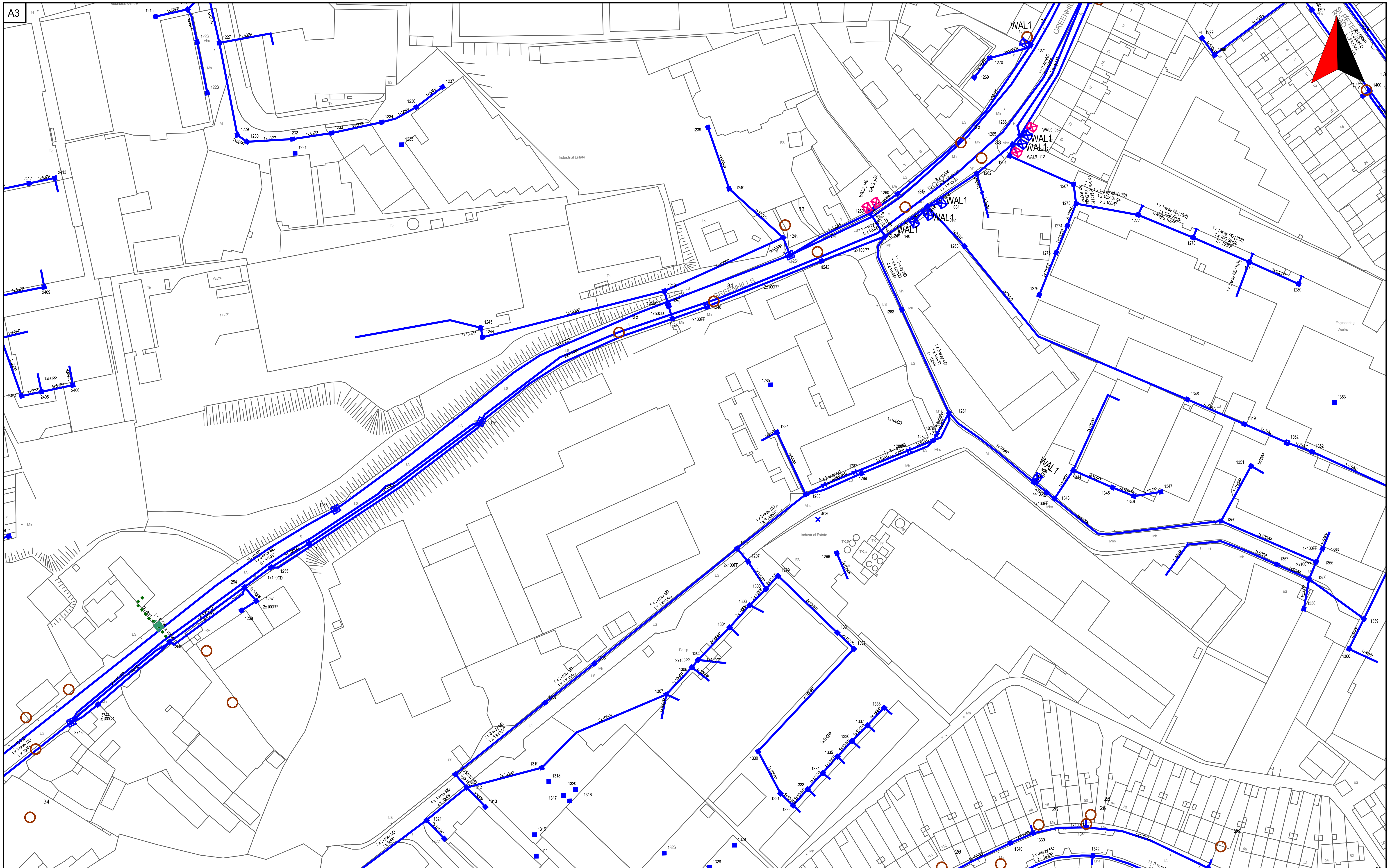

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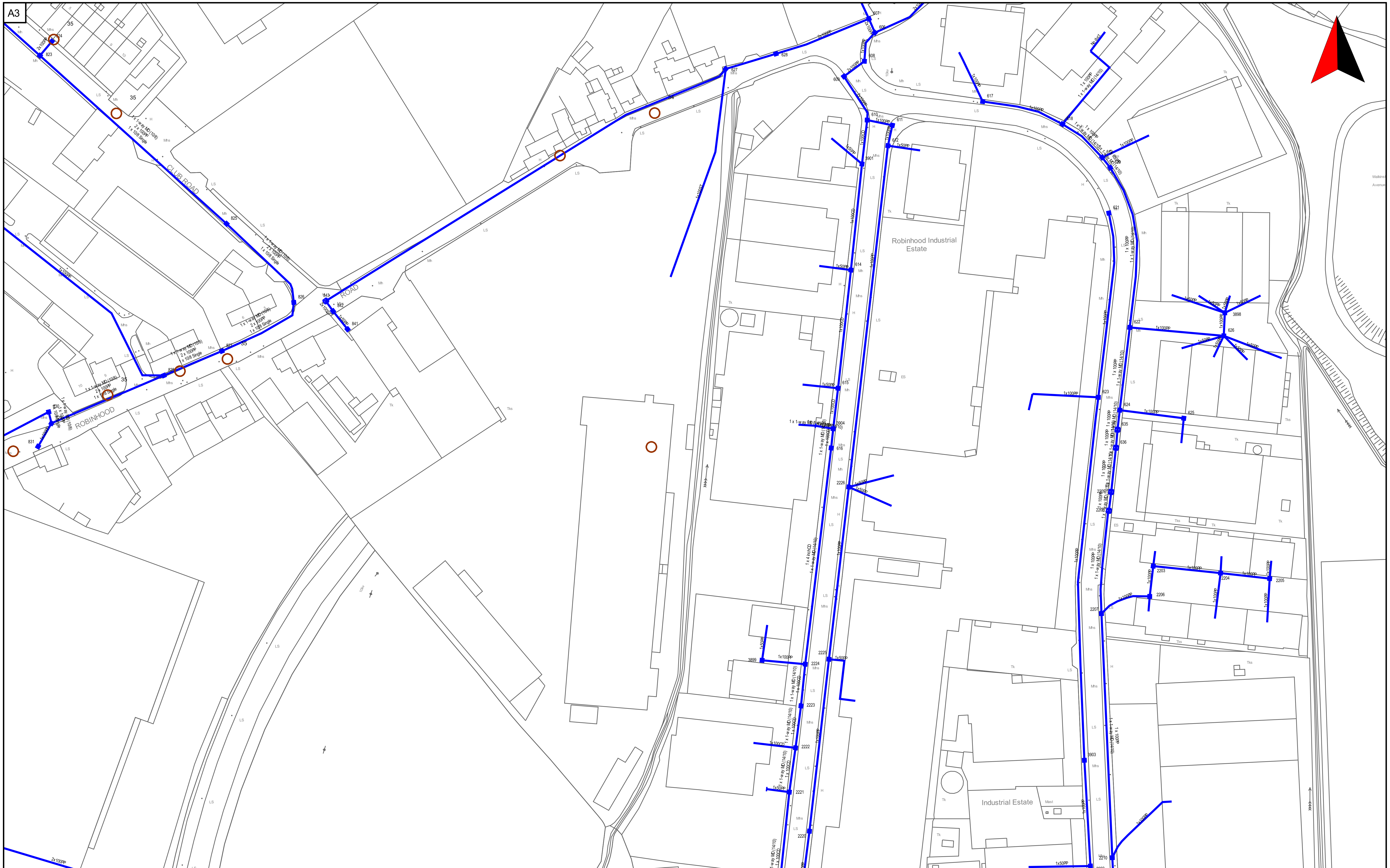

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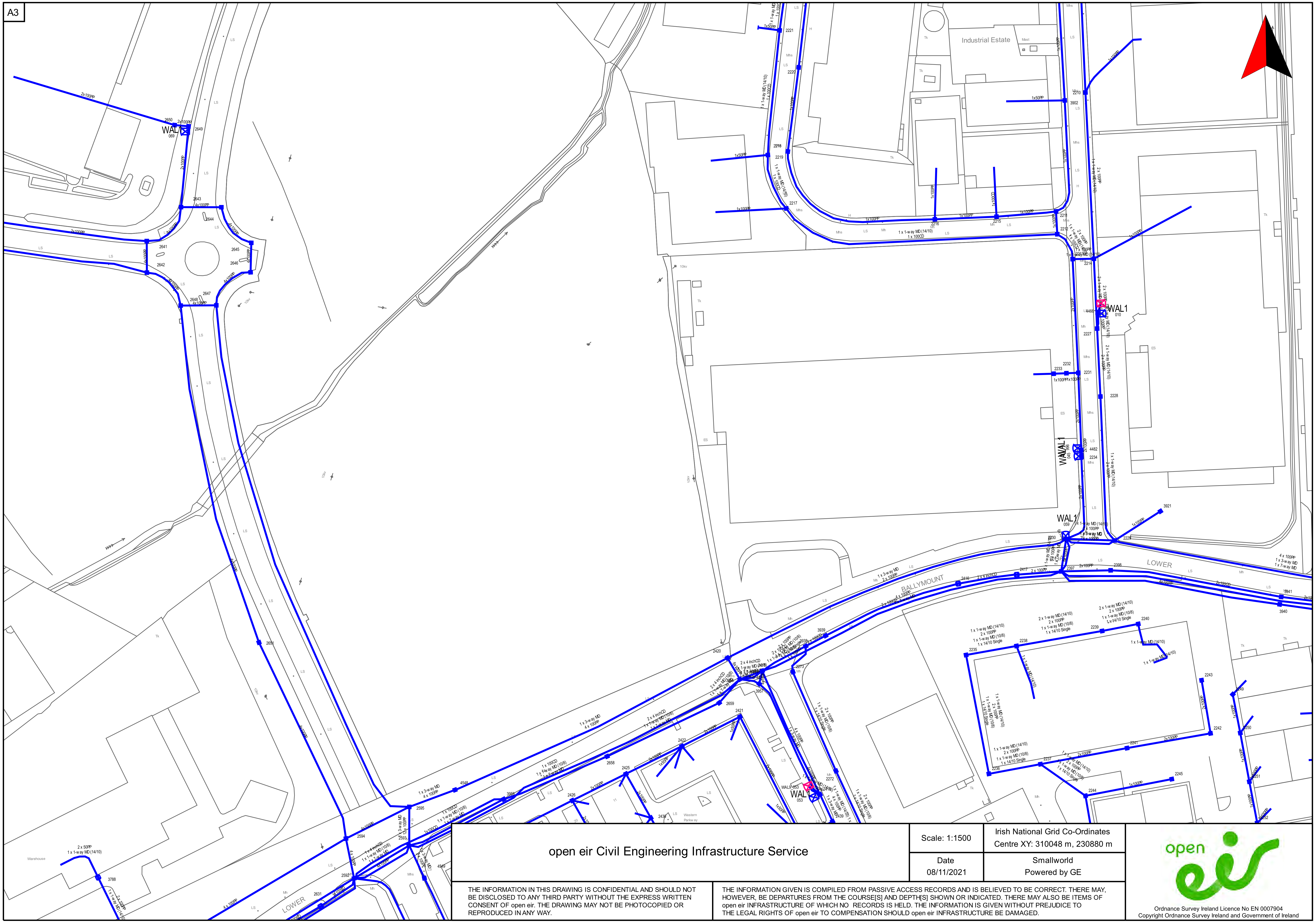

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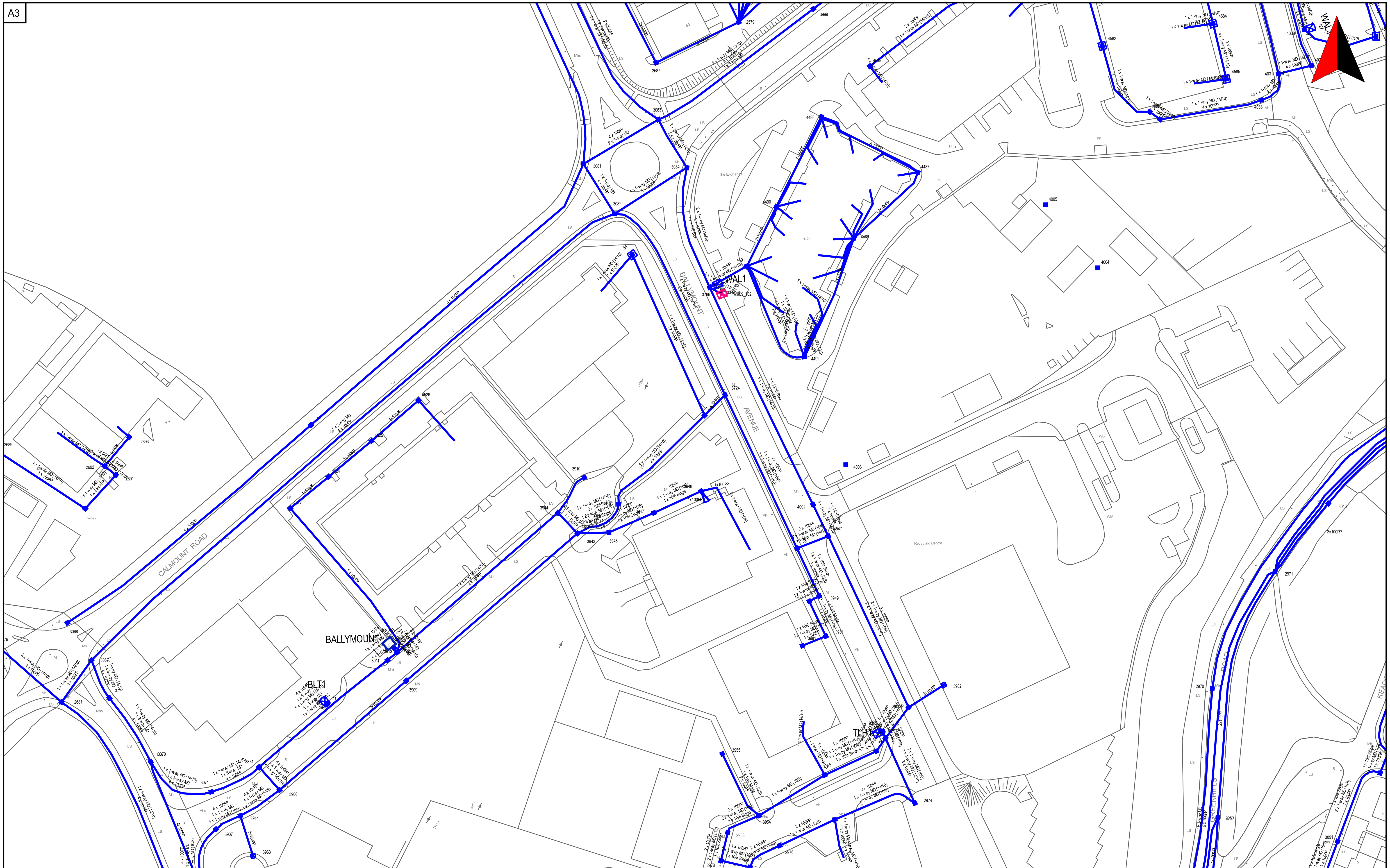

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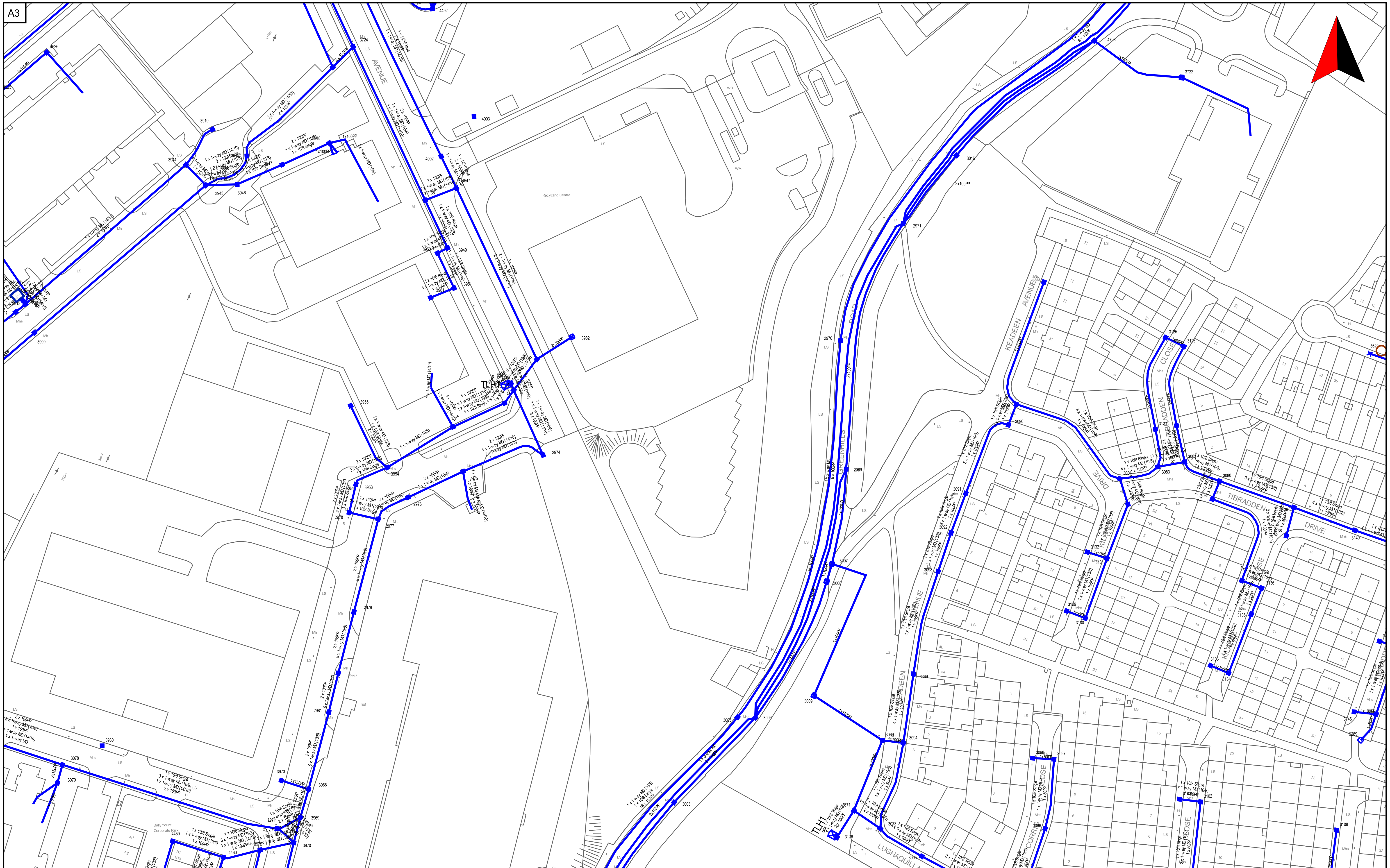

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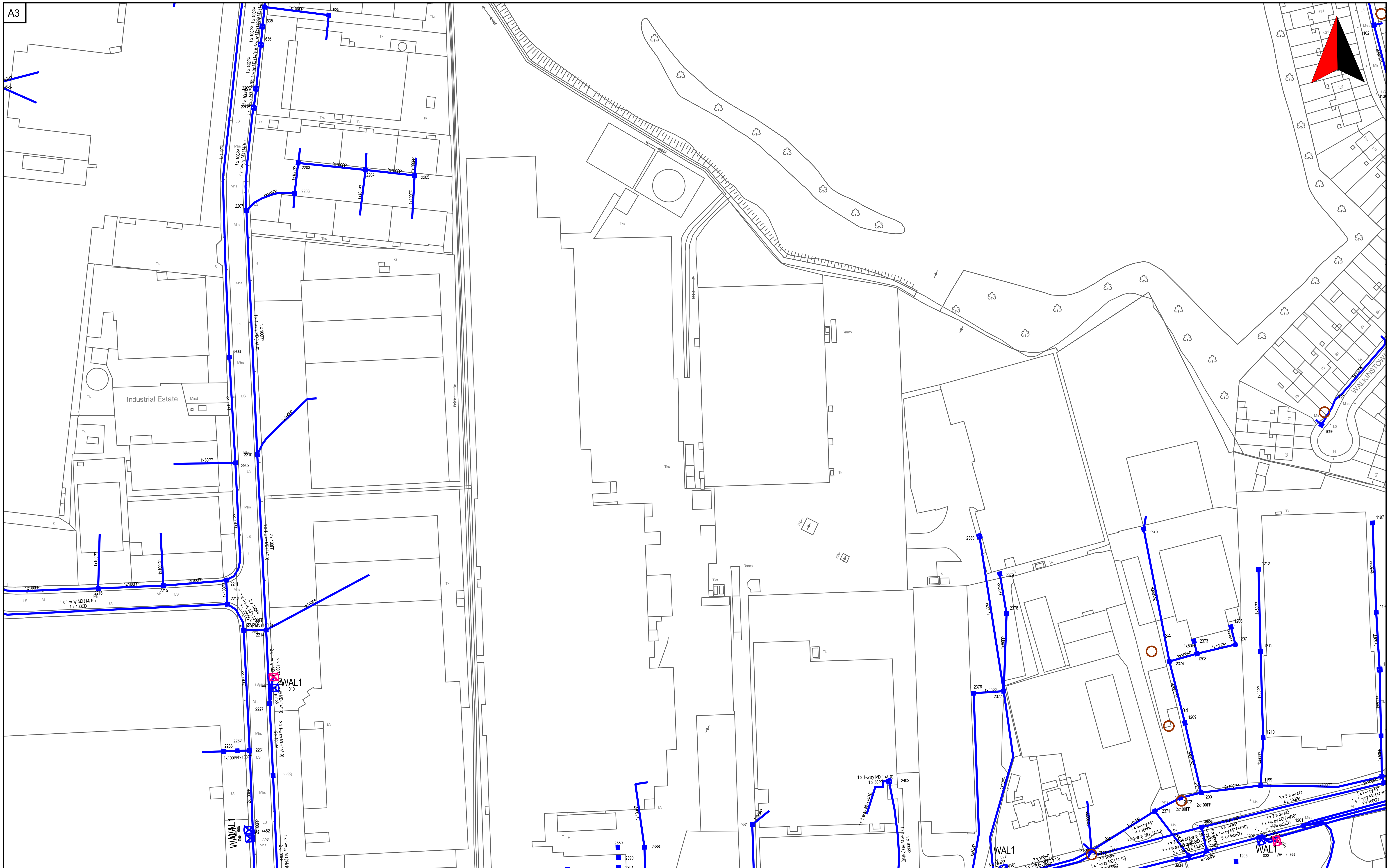

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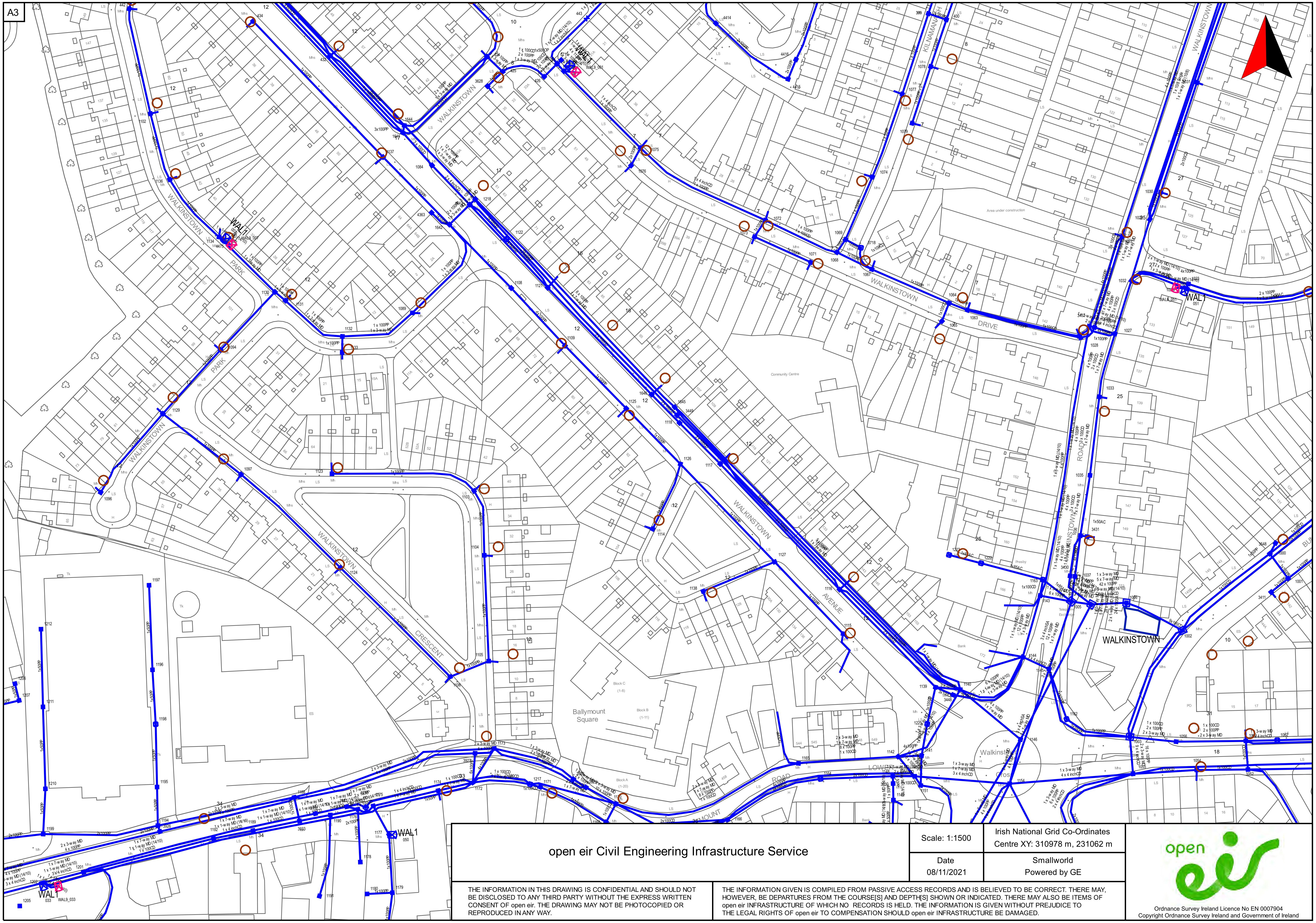

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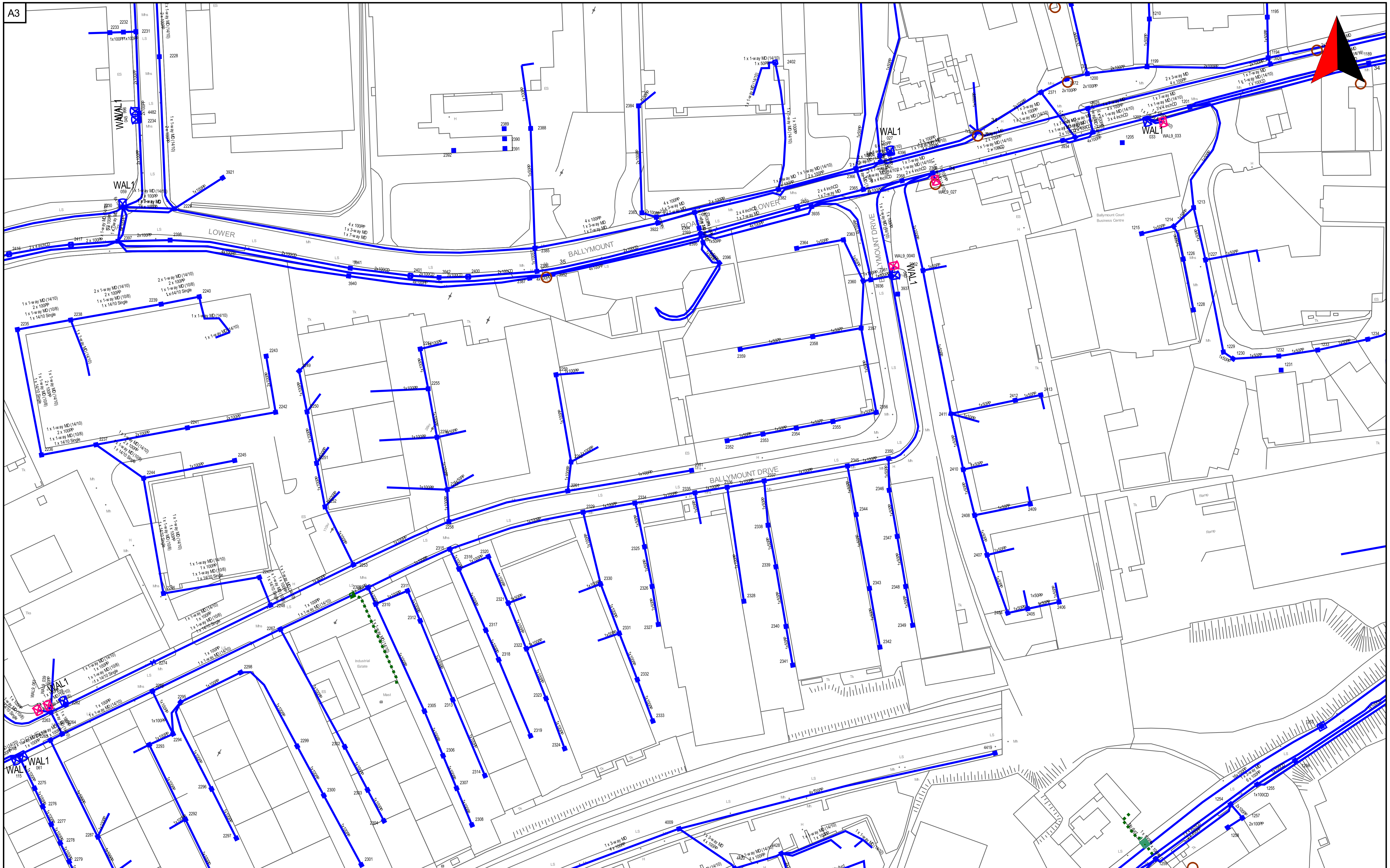

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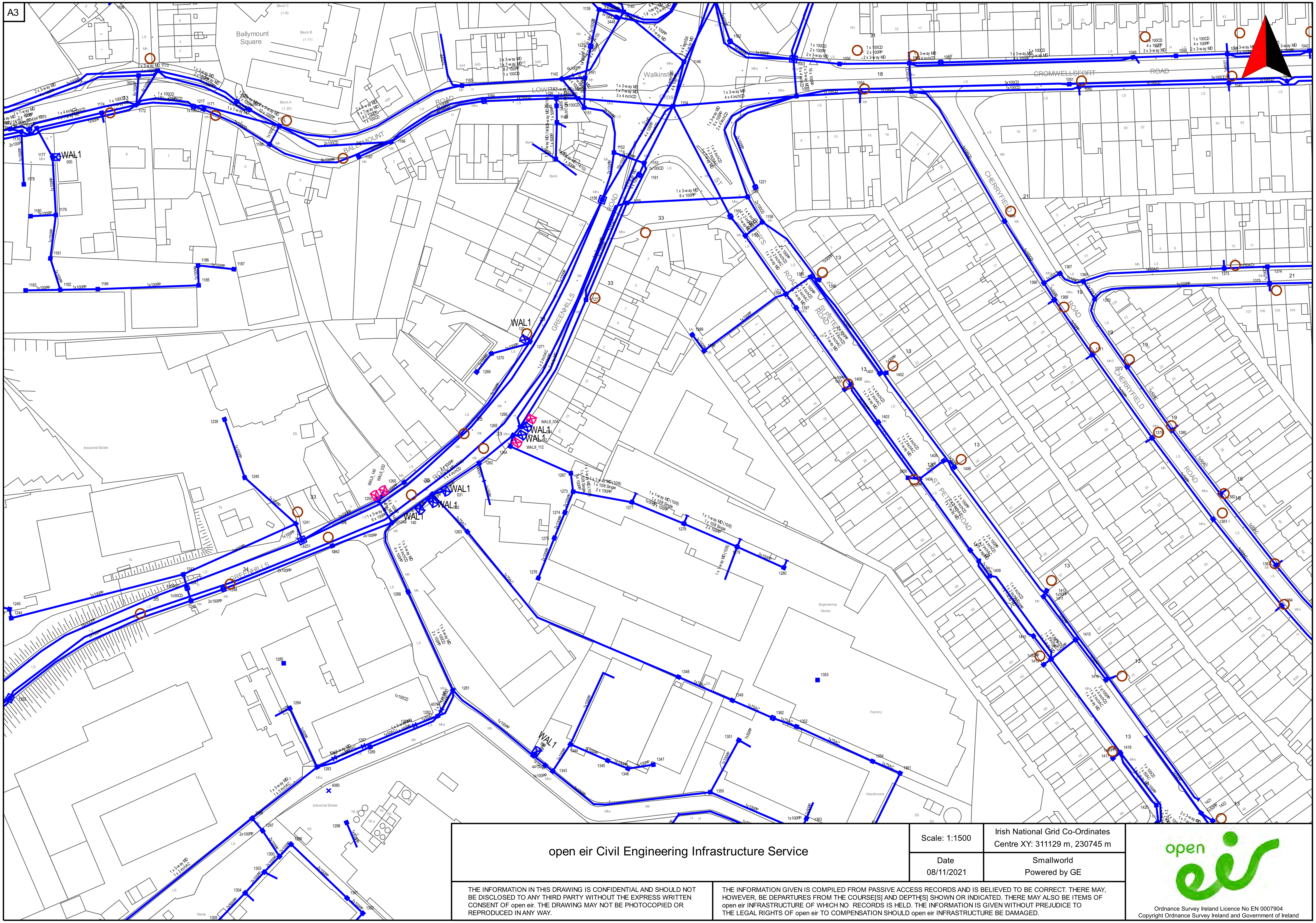

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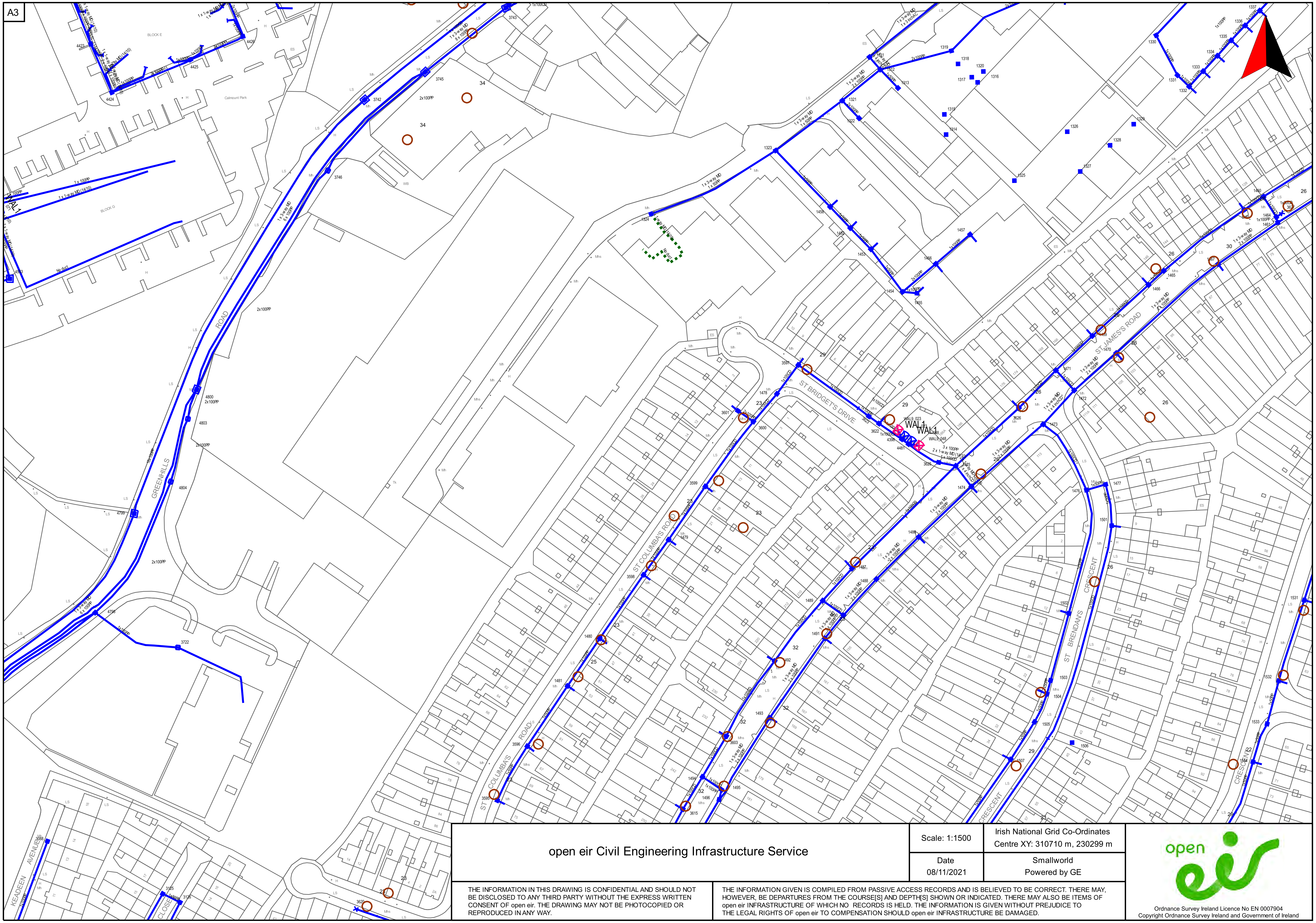

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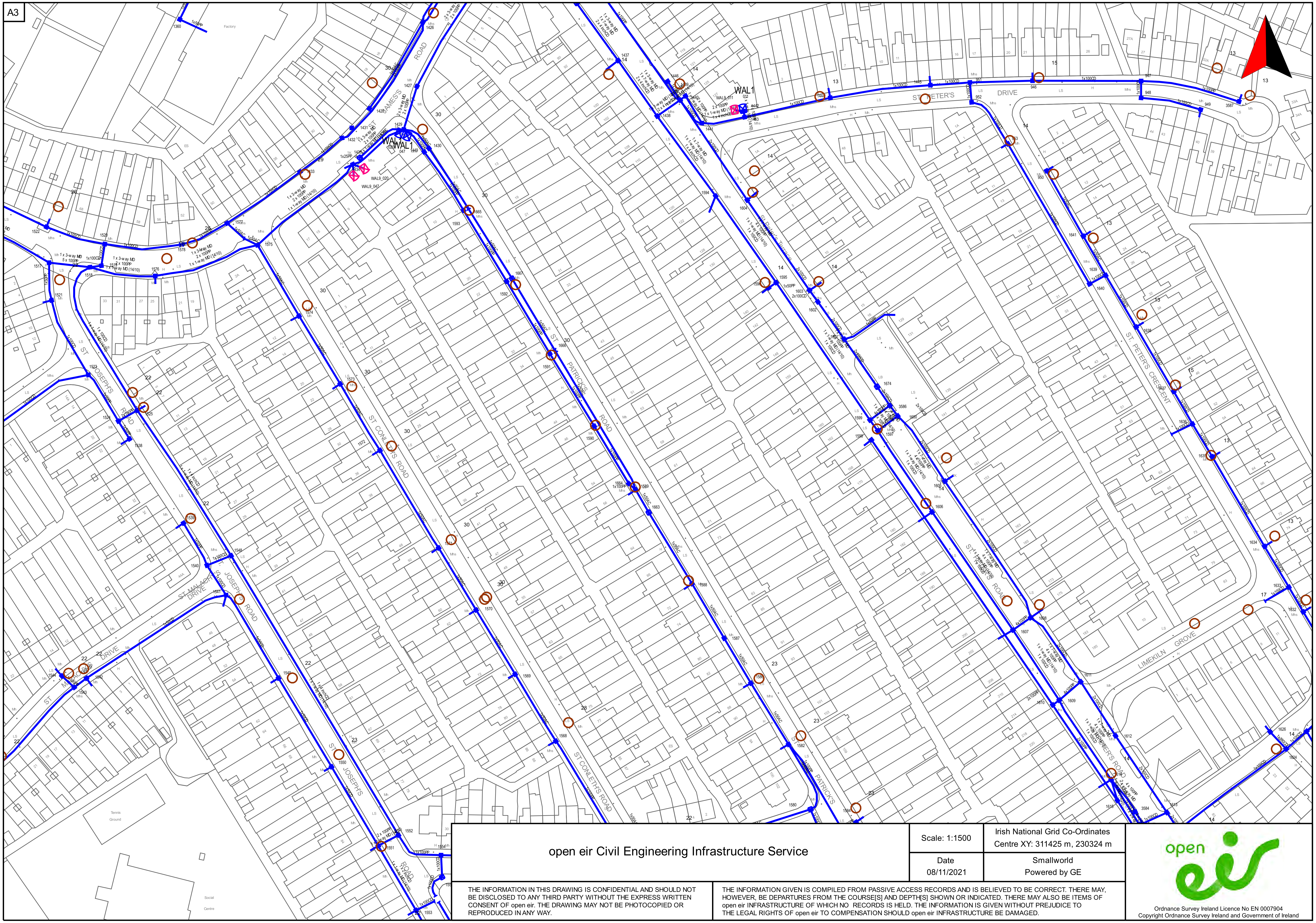

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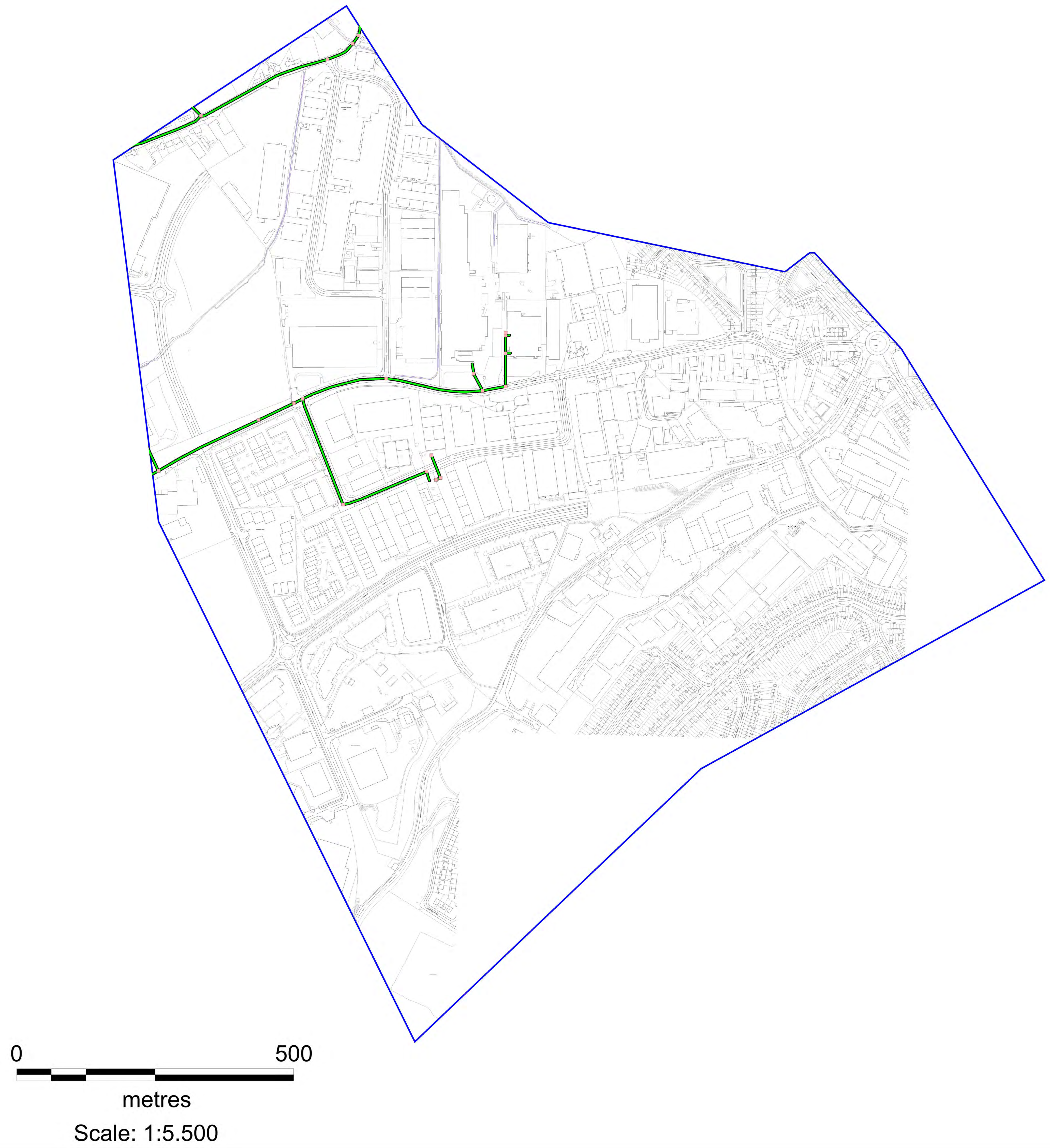

BT Map

APPENDIX 12

12.1 Construction & Demolition Waste Management Plan

12.2 Operational Waste Management Plan

12.3 Ground Investigation Report

85 Merrion Square, Dublin 2, D02 FX60
+353 (0)1 539 0710 info@hpdc.ie www.hpdc.ie

HUGHES PLANNING
& DEVELOPMENT CONSULTANTS

CONSTRUCTION AND WASTE MANAGEMENT PLAN FOR A PROPOSED STRATEGIC HOUSING DEVELOPMENT

AT

FORMER CHADWICK'S SITE, GREENHILLS ROAD, WALKINSTOWN, DUBLIN 12

Report Prepared For

Steeplefield Limited.

Report Prepared By

David Doran
Environmental Consultant

Our Reference

DD/21/12239WMR01

Date of Issue

18 March 2022

Document History

Document Reference		Original Issue Date	
DD/21/12239WMR01		18 March 2022	
Revision Level	Revision Date	Description	Sections Affected

Record of Approval

Details	Written by	Approved by
Signature		
Name	David Doran	Chonaill Bradley
Title	Environmental Consultant	Principal Environmental Consultant
Date	18 March 2022	18 March 2022

Contents **Page**

1.0 INTRODUCTION

AWN Consulting Ltd. (AWN) has prepared this Construction and Demolition (C&D) Waste Management Plan (WMP) on behalf of Steeplefield Limited. for a proposed strategic housing development (SHD). The proposed development will consist of the demolition of existing warehouses and the construction of 633 no. build-to-rent apartment units in 4 no. blocks, along with the construction of a childcare facility, 10 no. commercial units and all ancillary works at the former Chadwick's site, Greenhills Road, Walkinstown, Dublin 12.

This plan will provide information necessary to ensure that the management of construction and demolition (C&D) waste at the site is undertaken in accordance with current legal and industry standards including the *Waste Management Acts 1996* as amended and associated Regulations [1], *Environmental Protection Agency Act 1992* as amended [2], *Litter Pollution Act 1997* as amended [3] and the *Eastern-Midlands Region Waste Management Plan 2015 – 2021* [4]. In particular, this plan aims to ensure maximum recycling, reuse and recovery of waste with diversion from landfill, wherever possible. It also seeks to provide guidance on the appropriate collection and transport of waste from the site to prevent issues associated with litter or more serious environmental pollution (e.g. contamination of soil and/or water).

This C&D WMP includes information on the legal and policy framework for C&D waste management in Ireland, estimates of the type and quantity of waste to be generated by the proposed development and makes recommendations for management of different waste streams. The C&D WMP should be viewed as a live document and should be regularly revisited throughout a project's lifecycle so that opportunities to maximise waste reduction / efficiencies are exploited throughout, and that data is collected on an ongoing basis so that it is as accurate as possible

1.1 National Level

The Irish Government issued a policy statement in September 1998 known as *'Changing Our Ways'* [5], which identified objectives for the prevention, minimisation, reuse, recycling, recovery and disposal of waste in Ireland. The target for C&D waste in this report was to recycle at least 50% of C&D waste within a five year period (by 2003), with a progressive increase to at least 85% over fifteen years (i.e. 2013).

In response to the *Changing Our Ways* report, a task force (Task Force B4) representing the waste sector of the already established Forum for the Construction Industry, released a report entitled '*Recycling of Construction and Demolition Waste'* [6]concerning the development and implementation of a voluntary construction industry programme to meet the Government's objectives for the recovery of C&D waste.

In September 2020, the Irish Government published a new policy document outlining a new action plan for Ireland to cover the period of 2020-2025. This plan *'A Waste Action Plan for a Circular Economy'* [7] (WAPCE), was prepared in response to the 'European Green Deal' which sets a roadmap for a transition to a new economy, where climate and environmental challenges are turned into opportunities, replacing the previous national waste management plan *"A Resource Opportunity"* (2012).

The WAPCE sets the direction for waste planning and management in Ireland up to 2025. This reorientates policy from a focus on managing waste to a much greater focus on creating circular patterns of production and consumption. Other policy statements of a number of public bodies already acknowledge the circular economy as a national policy priority.

The policy document contains over 200 measures across various waste areas including circular economy, municipal waste, consumer protection and citizen engagement, plastics and packaging, construction and demolition, textiles, green public procurement and waste enforcement.

One of the first actions to be taken was the development of the Whole of Government Circular Economy Strategy 2022-2023 'Living More, Using Less' (2021) [8] to set a course for Ireland to transition across all sectors and at all levels of Government toward circularity and was issued in December 2021. It is anticipated that the Strategy will be updated in full every 18 months to 2 years.

The Environmental Protection Agency (EPA) of Ireland issued guildines the '*Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects'* in November 2021 [9]. These guidelines replace the previous 2006 guidelines issued by The National Construction and Demolition Waste Council (NCDWC)and the Department of the Environment, Heritage and Local Government (DoEHLG) in 2006 [10]. The guidelines provide a practical and informed approach which is informed by best practice in the prevention and management of C&D wastes and resources from design to construction of a project, including consideration of the deconstruction of a project. These guidelines have been followed in the preparation of this document and include the following elements:

- Predicted C&D wastes and procedures to prevent, minimise, recycle and reuse wastes;
- Design teams roles and approach;
- Relevant EU, national and local waste policy, legislation and guidelines;
- Waste disposal/recycling of C&D wastes at the site;
- Provision of training for resource manager and site crew;
- Details of proposed record keeping system;
- Details of waste audit procedures and plan; and
- Details of consultation with relevant bodies i.e. waste recycling companies, Local Authority, etc.

Section 3 of the Guidelines identifies thresholds above which there is a requirement for the preparation of a bespoke C&D WMP for developments. The new guidance classifies developments on a two-tiered system. Developments which do not exceed any of the following thresholds may be classed as Tier 1 development, which require a simplified C&D WMP:

- New residential development of less than 10 dwellings.
- Retrofit of 20 dwellings or less.
- New commercial, industrial, infrastructural, institutional, educational, health and other developments with an aggregate floor area less than 1,250m^2.
- Retrofit of commercial, industrial, infrastructural, institutional, educational, health and other developments with an aggregate floor area less than 2,000m^2; and
- Demolition projects generating in total less than 100m^3 in volume of C&D waste.

A development which exceeds one or more of these thresholds is classed as Tier-2 projects.

This development requires a C&D WMP as a Tier 2 development as it above following criterion:

- New residential development of less than 10 dwellings;
- Demolition projects generating in total less than 100m^3 in volume of C&D waste.

Other guidelines followed in the preparation of this report include *'Construction and Demolition Waste Management – a handbook for Contractors and Site Managers'* [9] , published by FÁS and the Construction Industry Federation in 2002 and the previous guidelines, 'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects' (2006).

These guidance documents are considered to define best practice for C&D projects in Ireland and describe how C&D projects are to be undertaken such that environmental impacts and risks are minimised and maximum levels of waste recycling are achieved.

1.2 Regional Level

The proposed development is located in the Local Authority area of South Dublin County Council (SDCC).The *Eastern-Midlands Region Waste Management Plan 2015* – 2021 is the regional waste management plan for the SDCC area published in May 2015. A new *National Waste Management Plan for a Circular Economy* is expected to be published in early 2022 and will supersede the three current regional waste management plans in Ireland.

The current regional plan sets out the strategic targets for waste management in the region and sets a specific target for C&D waste of *"70% preparing for reuse, recycling and other recovery of construction and demolition waste"* (excluding natural soils and stones and hazardous wastes) to be achieved by 2020.

Municipal landfill charges in Ireland are based on the weight of waste disposed. In the Leinster Region, charges are approximately €130 - €150 per tonne of waste which includes a €75 per tonne landfill levy introduced under the *Waste Management (Landfill Levy) (Amendment) Regulations 2012*.

The *South Dublin County Council Development Plan 2016 – 2022* [10] sets out a number of objectives and actions for the South Dublin area in line with the objectives of the waste management plan.

Waste objectives and actions with a particular relevance to the proposed development are as follows:

<u>*Objectives:*</u>

- **IE5 Objective 1:** To support the implementation of the Eastern–Midlands Region Waste Management Plan 2015-2021 by adhering to overarching performance targets, policies and policy actions.

- **IE5 Objective 2:** To support waste prevention through behavioural change activities to de-couple economic growth and resource use.
- **IE5 Objective 3:** To encourage the transition from a waste management economy to a green circular economy to enhance employment and increase the value recovery and recirculation of resources.
- **IE5 Objective 8:** To secure appropriate provision for the sustainable management of waste within developments, including the provision of facilities for the storage, separation and collection of such waste.

Actions:

- Support and facilitate the separation of waste at source into organic and non-organic streams or other waste management systems that divert waste from landfill and maximise the potential for each waste type to be re-used and recycled or composted and divert organic waste from landfill, in accordance with the National Strategy on Biodegradable Waste (2006).
- Implement the objectives of the National Waste Prevention Programme at a local level with businesses, schools, householders, community groups and within the Councils own activities.
- Promote an increase in the amount of waste re-used and recycled consistent with the Regional Waste Management Plan and Waste Hierarchy and facilitate recycling of waste through adequate provision of facilities and good design in new developments.
- Implement the South Dublin Litter Management Plan 2015 - 2019.

With regard to C&D waste specifically the Development Plan requires that the "*Construction and Demolition Waste Management Plan, as a minimum, should include provision for the management of all construction and demolition waste arising on site, and make provision for the re-use of said material and / or the recovery or disposal of this waste to authorised facilities by authorised collectors*." It also requires that where appropriate, excavated material from development sites should be reused on the subject site.

The *Draft South Dublin County Development Plan 2022 – 2028* [11] will supersede the current development plan and is due to be complete and come into effect in August 2022. The following policy and objectives has thus far been incorporated into the draft plan:

Policy and Objectives

- **Policy IE6: Waste Management**
  Implement European Union, National and Regional waste and related environmental policy, legislation, guidance and codes of practice to improve management of material resources and wastes.
- **IE6 Objective 1**
  To encourage a just transition from a waste management economy to a green circular economy to enhance employment and increase the value, recovery and recirculation of resources through compliance with the provisions of the Waste Action Plan for a Circular Economy 2020 – 2025 and to promote the use of, but not limited to, reverse vending machines and deposit return schemes or similar to ensure a wider and varying ways of recycling.
- **IE6 Objective 2**

To support the implementation of the Eastern Midlands Region Waste Management Plan 2015-2021 or as amended by adhering to overarching performance targets, policies and policy actions.

- **IE6 Objective 3**
  To provide for, promote and facilitate high quality sustainable waste recovery and disposal infrastructure/technology in keeping with the EU waste hierarchy and to adequately cater for a growing residential population and business sector.
- **IE6 Objective 4**
  To provide for and maintain the network of bring infrastructure (e.g. civic amenity facilities, bring banks) in the County to facilitate the recycling and recovery of hazardous and non-hazardous municipal wastes.
- **IE6 Objective 5**
  To ensure the provision of adequately sized public recycling facilities in association with new commercial developments and in tandem with significant change of use/extensions of existing commercial developments where appropriate.
- **IE6 Objective 6**
  To continue to roll out a countywide network of green waste centres in suitable locations to expand the collection system for compostable waste
- **IE6 Objective 7**
  To require the appropriate provision for the sustainable management of waste within all developments, ensuring it is suitably designed into the development, including the provision of facilities for the storage, separation and collection of such waste.
- **IE6 Objective 8**
  To adhere to the recommendations of the National Hazardous Waste Management Plan 2014-2020 and any subsequent plan, and to co-operate with other agencies including the EPA in the planning, organisation and supervision of the disposal of hazardous waste streams, including hazardous waste identified during construction and demolition projects.
- **IE6 Objective 9**
  To support the development of indigenous capacity for the treatment of non-hazardous and hazardous wastes where technically, economically and environmentally practicable subject to the relevant environmental protection criteria for the planning and development of such activities being applied.

1.3 Legislative Requirements

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

- Waste Management Act 1996 as amended. Sub-ordinate legislation includes:
  - European Communities (Waste Directive) Regulations 2011 (SI 126 of 2011) as amended
  - Waste Management (Collection Permit) Regulations (S.I No. 820 of 2007) as amended
  - Waste Management (Facility Permit and Registration) Regulations 2007, (S.I No. 821 of 2007) as amended
  - Waste Management (Licensing) Regulations 2004 (S.I. No. 395 of 2004) as amended
  - Waste Management (Packaging) Regulations 2014 (S.I. 282 of 2014) as amended

- Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997)
- Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
- European Union (Waste Electrical and Electronic Equipment) Regulations 2014 as amended
- European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended
- Waste Management (Food Waste) Regulations 2009 (S.I. 508 of 2009), as amended
- European Union (Household Food Waste and Bio-waste) Regulation 2015 (S.I. No. 191 of 2015)
- Waste Management (Hazardous Waste) Regulations, 1998 (S.I. No. 163 of 1998) as amended
- Waste Management (Shipments of Waste) Regulations, 2007 (S.I. No. 419 of 2007) as amended
- Waste Management (Movement of Hazardous Waste) Regulations, 1998 (S.I. No. 147 of 1998)
- European Communities (Transfrontier Shipment of Waste) Regulations 1994 (SI 121 of 1994)
- European Union (Properties of Waste which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015) as amended

- Environmental Protection Agency Act 1992 as amended.
- Litter Pollution Act 1997 as amended.
- Planning and Development Act 2000 as amended [12]

One of the guiding principles of European waste legislation, which has in turn been incorporated into the *Waste Management Act 1996* as amended and subsequent Irish legislation, is the principle of *"Duty of Care"*. This implies that the waste producer is responsible for waste from the time it is generated through until its legal recycling, recovery or disposal (including its method of disposal). As it is not practical in most cases for the waste producer to physically transfer all waste from where it is produced to the final destination, waste contractors will be employed to physically transport waste to the final destination. Following on from this is the concept of *"Polluter Pays"* whereby the waste producer is liable to be prosecuted for pollution incidents, which may arise from the incorrect management of waste produced, including the actions of any contractors engaged (e.g. for transportation and disposal/recovery/recycling of waste).

It is therefore imperative that the developer ensures that the waste contractors engaged by demolition and construction contractors are legally compliant with respect to waste transportation, recycling, recovery and disposal. This includes the requirement that a contractor handle, transport and recycle/recover/dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities.

A collection permit to transport waste must be held by each waste contractor which is issued by the National Waste Collection Permit Office (NWCPO). Waste receiving facilities must also be appropriately permitted or licensed. Operators of such facilities cannot receive any waste, unless in possession of a Certificate of Registration (COR) or waste permit granted by the relevant Local Authority under the *Waste Management (Facility Permit & Registration) Regulations 2007 and Amendments* or a Waste or Industrial Emissions Licence granted by the EPA. The COR / permit / licence held will specify the type and quantity of waste able to be received, stored, sorted, recycled, recovered and/or disposed of at the specified site.

2.0 Design Approach

The client and the design team have integrated the *'Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects'* guidelines into the design workshops, to help review processes, identify and evaluate resource reduction measures and investigate the impact on cost, time, quality, buildability, second life and management post demolition and construction. Further details on these design principals can be found within the aforementioned guidance document.

The design team have undertaken the design process in line with the international best practice principles to firstly prevent wastes, reuse where possible and thereafter sustainably reduce and recover materials. The below sections have been the focal point of the design process and material selections and will continued to be analysed and investigated throughout the design process and when selecting material.

The approaches presented are based on international principles of optimising resources and reducing waste on construction projects through:

- Prevention.
- Reuse.
- Recycling.
- Green Procurement Principles.
- Off-Site Construction.
- Materials Optimisation.
- Flexibility and Deconstruction.

2.1 Designing for Prevention, Reuse And Recycling

Undertaken at the outset and during project feasibility and evaluation the Client and Design Team considered:

- Establishing the potential for any reusable site assets (buildings, structures, equipment, materials, soils, etc.).
- The potential for refurbishment and refit of existing structures or buildings rather than demolition and new build.
- Assessing any existing buildings on the site that can be refurbished either in part or wholly to meet the Client requirements.
- Enabling the optimum recovery of assets on site.

2.2 Designing For Green Procurement

Waste prevention and minimisation pre-procurement have been discussed and will be further discussed in this section. The Design Team will discuss proposed design solutions, encourage innovation in tenders and incentivise competitions to recognise sustainable approaches. They should also discuss options for packaging reduction with the main Contractor and subcontractors/suppliers using measures such as 'Just-in-Time' delivery and use ordering procedures that avoid excessive waste. The Green procurement extends from the planning stage into the detailed design and tender stage and will be an ongoing part of the long-term design and selection process for this development.

2.3 Designing For Off-Site Construction

Use of off-site manufacturing has been shown to reduce residual wastes by up to 90% (volumetric building versus traditional). The decision to use offsite construction is typically cost led but there are significant benefits for resource management. Some further considerations for procurement which are being investigated as part of the planning stage design process are listed as follows:

- Modular buildings as these can displace the use of concrete and the resource losses associated with concrete blocks such as broken blocks, mortars, etc.
  - Modular buildings are typically pre-fitted with fixed plasterboard and installed insulation, eliminating these residual streams from site.
- Use of pre-cast structural concrete panels which can reduce the residual volumes of concrete blocks, mortars, plasters, etc.
- The use of prefabricated composite panels for walls and roofing to reduce residual volumes of insulation and plasterboards.
- Using pre-cast hollow-core flooring instead of in-situ ready mix flooring or timber flooring to reduce the residual volumes of concrete/formwork and wood/packaging, respectively.
- Designing for the preferential use of offsite modular units.

2.4 Designing for Materials Optimisation During Construction

To ensure manufacturers and construction companies adopt lean production models, including maximising the reuse of materials onsite as outlined in section 4.1. This helps to reduce the environmental impacts associated with transportation of materials and from waste management activities. This includes investigating the use of standardised sizes for certain materials to help reduce the amount of offcuts produced on site, focusing on promotion and development of off-site manufacture.

2.5 Designing for Flexibility And Deconstruction

Design flexibility has and will be investigated throughout the design process to ensure that where possible products (including buildings) only contain materials that can be recycled and are designed to be easily disassembled. Material efficiency is being considered for the duration and end of life of a building project to produce; flexible, adaptable spaces that enable a resource-efficient, low-waste future change of use; durability of materials and how they can be recovered effectively when maintenance and refurbishment are undertaken and during disassembly/deconstruction.

3.0 DESCRIPTION OF THE PROJECT

3.1 Location, Size And Scale Of The Development

The proposed development comprises the following:

(i) The demolition of the former Chadwicks Builders Merchant development comprising 1 no. two storey office building and 9 no. storage/warehouse buildings ranging in height from 3 m – 9.9 m as follows: Building A (8,764 sq.m.), Building B (1,293 sq.m.), Building C (two-storey office building) (527 sq.m.), Building D (47 sq.m.), Building E (29 sq.m.), Building F (207 sq.m.), Building G (101 sq.m.), Building H (80 sq.m.), Building I (28 sq.m.), and Building J (44 sq.m.), in total comprising 11,120 sq.m.;

(ii) the construction of a mixed-use Build-to-Rent residential and commercial development comprising 633 no. build-to-rent apartment units (292 no. one-beds, 280 no. two-beds and 61 no. three-beds), 1 no. childcare facility and 10 no. commercial units in 4 no. blocks (A-D) ranging in height from 5 to 12 storeys as follows:

(a) Block A comprises 209 no. apartments (102 no. 1 bed-units, 106 no. 2 bed-units and 1 no. 3-bed units) measuring 5 - 10 storeys in height. (b) Block B comprises 121 no. apartments (53 no. 1 bed-units, 45 no. 2 bed-units and 23 no. 3 bed-units) measuring 8 - 10 storeys in height. (c) Block C comprises 130 no. apartments (38 no. 1-bed units, 71 no. 2-bed units and 21 no. 3-bed units) measuring 8 - 12 storeys in height. (d) Block D comprises 173 no. apartments (99 no. 1 bed-units, 58 no. 2 bed-units and 16 no. 3 bed-units) measuring 6 - 10 storeys in height. All apartments will be provided with private balconies/terraces;

(iii) provision of indoor communal residential amenity/management facilities including a co-working space, communal meeting room/ work space, foyer, toilets at ground floor of Block A; gym, changing rooms, toilets, resident's lounge, studio, laundry room, communal meeting room/ work space, multi-function space with kitchen at ground floor of Block B; games room with kitchenette, media room, co-working space, resident's lounge, communal meeting room/ work space, reception area, management office with ancillary staff room and toilets, toilets, parcel room at ground floor of Block C;

(iv) the construction of 1 no. childcare facility with dedicated outdoor play area located at ground floor of Block A;

(v) the construction of 8 no. commercial units at ground floor level of Blocks A, B and D, and 2 no. commercial units at second floor level (fronting Greenhills Road) of Block C as follows: Block A has 3 no. units at ground floor comprising 79.46 sq.m., 90.23 sq.m., and 121.39 sq.m., Block B has 1 no. unit at ground floor comprising 127.03 sq.m., Block C has two units at second floor comprising 120.85 sq.m. and 125.45 sq.m., and Block D has 4 no. units at ground floor comprising 84.45 sq.m., 149.77 sq.m., 155.48 sq.m. and 275.59 sq.m.;

(vi) the construction of 3 no. vehicular entrances; a primary entrance via vehicular ramp from the north (access from Greenhills Road) and 2 no. secondary entrances from the south for emergency access and services (access from existing road to the south of the site) with additional pedestrian accesses proposed along Greenhills Road;

(vii) provision of 424 no. car parking spaces comprising 398 no. standard spaces, 21 no. mobility spaces and 5 no. car club spaces located at ground floor level car park located within Block A and accessed via the proposed entrance at Greenhills Road, a two-storey car park located within Blocks C and D also accessed from the proposed entrance at Greenhills Road and on-street parking at ground floor level adjacent to Blocks A and C. Provision of an additional 15 no. commercial/ unloading/ drop-off on-street parking spaces at ground floor level (providing for an overall total of 439 car parking spaces). Provision of 4 no. dedicated motorcycle spaces at ground floor level parking area within Blocks C and D;

(viii) provision of 1363 no. bicycle parking spaces comprising 1035 no. residents' bicycle spaces, 5 no. accessible bicycle spaces and 7 no. cargo bicycle spaces in 9 no. bicycle storerooms in ground and first floor parking areas within Blocks A, C and D, and 316 no. visitors' bicycle spaces located externally at ground floor level throughout the development;

(ix) provision of outdoor communal amenity space (5,020 sq.m.) comprising landscaped courtyards that include play areas, seating areas, grass areas, planting, and scented gardens located on podiums at first and second floor levels; provision of a communal

amenity roof garden in Block C with seating area and planting (176 sq.m.); and inclusion of centrally located public open space (3,380 sq.m.) adjacent to Blocks B and C comprising grassed areas, planting, seating areas, play areas, water feature, flexible use space; and incidental open space/public realm;

(x) development also includes landscaping and infrastructural works, foul and surface water drainage, bin storage, ESB substations, plant rooms, boundary treatments, internal roads, cycle paths and footpaths and all associated site works to facilitate the development.

This application is accompanied by an Environmental Impact Assessment Report (EIAR).

Figure 2.1 Site Location

The proposed development shall be constructed in two phases and the site layout can be viewed in Figure 2.2.

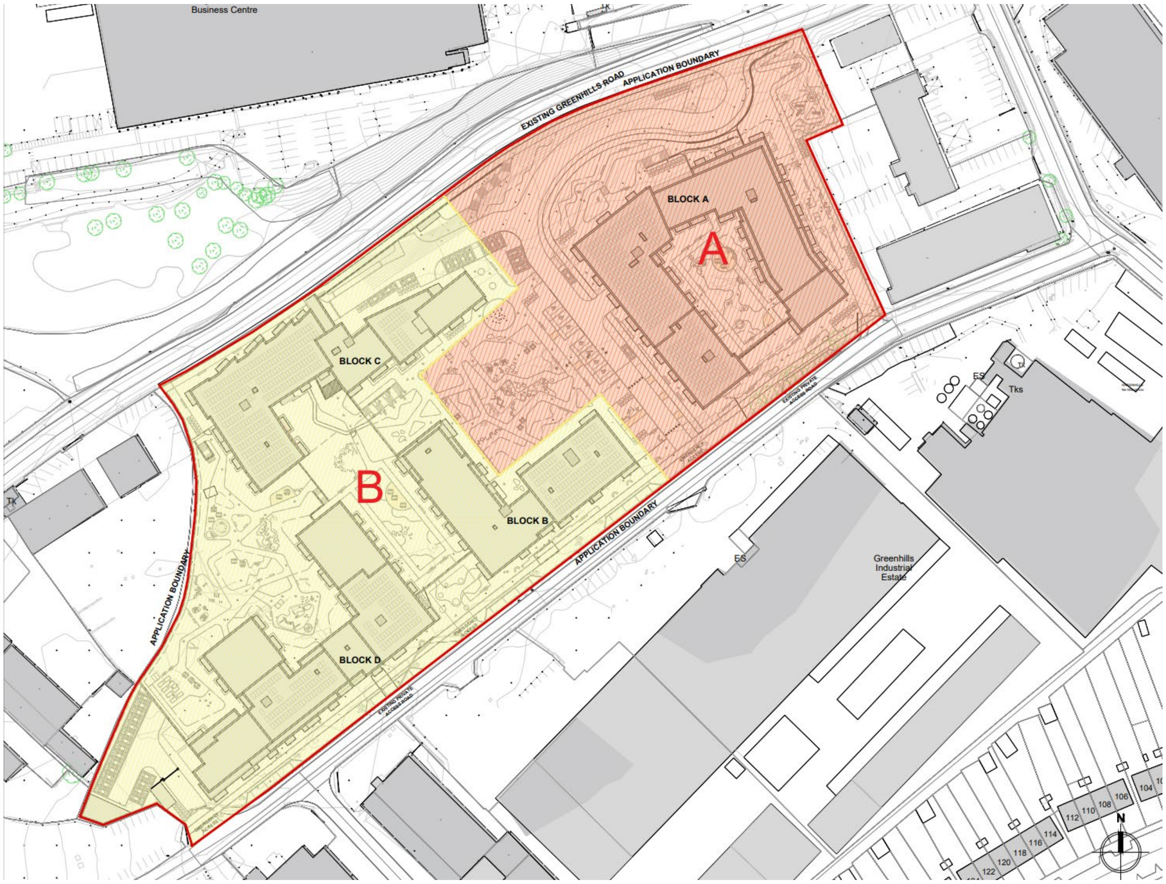

Figure 2.2 Site Map and Proposed Phasing Plan

3.2 Details Of The Non-Hazardous Wastes To Be Produced

There will be waste materials generated from the demolition of existing warehouses on site, as well as from the further excavation of the building foundations. Further details can be found in Section 3.1 Project Description or in Chapter 2 Project Description and Alternatives Examined of the EIAR. The volume of waste generated from demolition will be more difficult to segregate than waste generated from the construction phase, as many of the building materials will be bonded together or integrated i.e. plasterboard on timber ceiling joists, steel embedded in concrete etc.

There will be c. 24,008m^3 of soil, stone, gravel and clay excavated to facilitate construction of new foundations, the installation of underground services, and for landscaping features. It is expected that c. 1,200m^3, of the excavated material will be re-used on site with the remaining c. 22,808m^3 will be taken for appropriate offsite reuse, recovery, recycling and/or disposal.

During the construction phase there may be a surplus of building materials, such as timber off-cuts, broken concrete blocks, cladding, plastics, metals and tiles generated. There may also be excess concrete during construction which will need to be disposed of. Plastic and cardboard waste from packaging and supply of materials will also be generated. The contractor will be required to ensure that oversupply of materials is kept to a minimum and opportunities for reuse of suitable materials is maximised.

Waste will also be generated from construction workers e.g. organic/food waste, dry mixed recyclables (waste paper, newspaper, plastic bottles, packaging, aluminium cans, tins and Tetra Pak cartons), mixed non-recyclables and potentially sewage sludge from temporary welfare facilities provided on site during the construction phase. Waste printer/toner cartridges, waste electrical and electronic equipment (WEEE) and waste batteries may also be generated infrequently from site offices.

3.3 Potential Hazardous Wastes Arising

3.3.1 Contaminated Soil

Ground investigation works were undertaken by Ground Investigations Ireland Ltd. in January 2021 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 14 No. Window Sample Boreholes to recover soil samples
- Carry out 10 No. Cable Percussion boreholes to a maximum depth of 4.50m BGL
- Installation of 3 No. Groundwater monitoring wells
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

Further information on the methodologies used for the works completed can be found in the *Ground Investigation Report* by Ground Investigations Ireland submitted with the planning application.

For the 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 on soil samples, as required by the specification, including the Rilta Suite, pH and sulphate testing was carried out by Element Materials Technology Laboratory in the UK. The Rilta Suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria (WAC). A number of groundwater samples were also tested by Element, using an indicator parameter suite. Geotechnical testing consisting of moisture content, Atterberg limits and, Particle Size Distribution (PSD), tests were carried out in NMTL's Geotechnical Laboratory in Carlow.

All 22 (19 no. soil and 3 no. ground water) of the samples sent for laboratory testing returned inert readings in the WAC analysis as listed in the EU Council Decision 2003/33/EC.

A Waste Characterisation Assessment will be required prior to any excavated material leaving the site.

The WCA will classify the soils as either hazardous or non-hazardous, which in turn enable contractors to obtain disposal costs for various landfills.

All excavations will be carefully monitored by a suitably qualified person to ensure that, if encountered, potentially contaminated soil is identified and segregated from clean/inert material. In the event that any potentially contaminated material is encountered, it will be tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled *Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous* [14] using the *HazWasteOnline* application (or similar approved classification method). The material will then be classified as clean, inert, non-hazardous or hazardous in accordance with the *Decision 2003/33/EC*.

Prior to the removal of excess excavated material from site soil samples will be sent for environmental testing.

No asbestos was identified in the soil samples collected. If, however asbestos or asbestos containing material (ACMs) are identified in any further soil samples or during excavation, the removal will only be carried out by a suitably permitted waste contractor, in accordance with *S.I. No. 386 of 2006 Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010.* All asbestos will be taken to a suitably licensed or permitted facility.

3.3.2 Fuel/Oils

As fuels and oils are classed as hazardous materials, any on-site storage of fuel/oil, all storage tanks and all draw-off points will be bunded and located in a dedicated, secure area of the site. Provided that these requirements are adhered to and the site crew are trained in the appropriate refuelling techniques, it is not expected that there will be any fuel/oil waste generated at the site.

3.3.3 Invasive Plant Species

Enviroguide Consulting Ltd. visited the site on the 21st April 2021 to carry out an invasive species survey; this included walkover of the entire site. There was no invasive alien plant species (as per the Third Schedule of the S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011) noted at the site..

Should a Third Schedule invasive flora species be found at a later date; an Invasive Species Management Plan will be prepared and will likely include a multi-pronged approach to the eradication and treatment.

3.3.4 Other Known Hazardous Substances

Paints, glues, adhesives and other known hazardous substances will be stored in designated areas. They will generally be present in small volumes only and associated waste volumes generated will be kept to a minimum. Wastes will be stored in appropriate receptacles pending collection by an authorised waste contractor.

In addition, WEEE (containing hazardous components), printer toner/cartridges, batteries (Lead, NiCad or Mercury) and/or fluorescent tubes and other mercury containing waste may be generated from during C&D activities or temporary site offices. These wastes, if generated, will be stored in appropriate receptacles in designated areas of the site pending collection by an authorised waste contractor.

3.4 Main Construction And Demolition Waste Categories

The main non-hazardous and hazardous waste streams that could be generated by the construction activities at a typical site are shown in Table 3.1. The List of Waste (LoW) code (as effected from 1 June 2015) (also referred to as the European Waste Code or EWC) for each waste stream is also shown.

Table 3.1 Typical waste types generated and LoW codes (individual waste types may contain hazardous substances)

Waste Material	LoW/EWC Code
Concrete, bricks, tiles, ceramics	17 01 01-03 & 07
Wood, glass and plastic	17 02 01-03
Treated wood, glass, plastic, containing hazardous substances	17-02-04*
Bituminous mixtures, coal tar and tarred products	17 03 01*, 02 & 03*
Metals (including their alloys) and cable	17 04 01-11
Soil and stones	17 05 03* & 04
Gypsum-based construction material	17 08 01* & 02
Paper and cardboard	20 01 01
Mixed C&D waste	17 09 04
Green waste	20 02 01
Electrical and electronic components	20 01 35 & 36
Batteries and accumulators	20 01 33 & 34
Liquid fuels	13 07 01-10
Chemicals (solvents, pesticides, paints, adhesives, detergents etc.)	20 01 13, 19, 27-30
Insulation materials	17 06 04
Organic (food) waste	20 01 08
Mixed Municipal Waste	20 03 01

* individual waste type may contain hazardous substances

4.0 WASTE MANAGEMENT

4.1 Demolition Waste Generation

The demolition stage will involve the demolition of the existing warehouse buildings and hardstanding on site. The demolition areas are identified in the planning drawings provided with this application. The anticipated demolition waste and rates of reuse, recycling / recovery and disposal are shown in

Table ***4.1***, below.

Table 4.1 Estimated off-site reuse, recycle and disposal rates for demolition waste

Waste Type	Tonnes	Reuse		Recycle / Recovery		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Glass	8.8	0	0.0	85	7.5	15	1.3
Concrete, Bricks, Tiles, Ceramics	965.3	30	289.6	65	627.4	5	48.3
Plasterboard	52.7	30	15.8	60	31.6	10	5.3
Asphalts	105.3	0	0.0	25	26.3	75	79.0
Metals	394.9	5	19.7	80	315.9	15	59.2
Slate	17.6	0	0.0	85	14.9	15	2.6
Timber	210.6	10	21.1	60	126.4	30	63.2
Total	**1755.0**		**346.2**		**1150.0**		**258.9**

4.2 Construction Waste Generation

The below Table 4.2 shows the breakdown of C&D waste types produced on a typical site based on data from the EPA *National Waste Reports* [15]*, the GMIT* [16] and other research reports.

Table 4.2 Waste materials generated on a typical Irish construction site

Waste Types	%
Mixed C&D	33
Timber	28
Plasterboard	10
Metals	8
Concrete	6
Other	15
Total	**100**

The

Table ***4.3*** below shows the estimated construction waste generation for the development based on the gross floor area of construction and other information available to date, along with indicative targets for management of the waste streams. The estimated waste amounts for the main waste types (with the exception of soils and stones) are based on an average large-scale development waste generation rate per m^2, using the waste breakdown rates shown in Table 4.2.

Table 4.3 Predicted on and off-site reuse, recycle and disposal rates for construction waste

Waste Type	Tonnes	Reuse		Recycle/Recovery		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Mixed C&D	1093.2	10	109.3	80	874.5	10	109.3
Timber	927.5	40	371.0	55	510.1	5	46.4
Plasterboard	331.3	30	99.4	60	198.8	10	33.1
Metals	265.0	5	13.3	90	238.5	5	13.3
Concrete	198.8	30	59.6	65	129.2	5	9.9
Other	496.9	20	99.4	60	298.1	20	99.4
Total	**3312.6**		**752.0**		**2249.3**		**311.4**

In addition to the information in Table 4.2, the quantity of excavated material that will be generated has been estimated to be c. 24,008m^3. It is expected that c. 1,200m^3, of the excavated material will be re-used on site with the remaining c. 22,808m^3 will be taken for appropriate offsite reuse, recovery, recycling and/or disposal.

It should be noted that until final materials and detailed construction methodologies have been confirmed, it is difficult to predict with a high level of accuracy the construction waste that will be generated from the works as the exact materials and quantities may be subject to some degree of change and variation during the construction process.

4.3 Proposed Waste Management Options

Waste materials generated will be segregated on site, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source where feasible. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled. There are numerous waste contractors in the local area that provide this service.

All waste arisings will be handled by an approved waste contractor holding a current waste collection permit. All waste arisings requiring disposal off-site will be reused, recycled, recovered or disposed of at a facility holding the appropriate registration, permit or licence, as required.

Written records will be maintained by the contractor(s) detailing the waste arising throughout the C&D phases, the classification of each waste type, waste collection permits for all waste contactors who collect waste from the site and COR/permit or licence for the receiving waste facility for all waste removed off site for appropriate reuse, recycling, recovery and/or disposal

Dedicated bunded storage containers will be provided for hazardous wastes which may arise such as batteries, paints, oils, chemicals etc, if required.

The anticipated management of the main waste streams is outlined as follows:

Soil, Stone, Gravel and Clay

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

It is anticipated that c. 22,808 m^3 of excavated material will be taken off site. When material is removed off-site it could be reused as a by-product (and not as a waste), if this is done, it will be done in accordance with Article 27 of the *European Communities (Waste Directive) Regulations 2011*. Article 27 requires that certain conditions are met and that by-product notifications are made to the EPA via their online notification form. Excavated material will be removed from site until approval from the EPA has been received. The potential to reuse material as a by-product will be confirmed during the course of the excavation works, with the objective of eliminating any unnecessary disposal of material.

The next option (beneficial reuse) may be appropriate for the excavated material pending environmental testing to classify the material as hazardous or non-hazardous in accordance with the EPA *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* publication. Clean inert material may be used as fill material in other construction projects or engineering fill for waste licensed sites. Beneficial reuse of surplus excavation material as engineering fill may be subject to further testing to determine if materials meet the specific engineering standards for their proposed end-use.

If any soils/stones are imported onto the site from another construction site as a by-product, this will also be done in accordance with Article 27. Where practicable and appropriately processed, Article 27 material will be used onsite instead of using virgin material.

If the material is deemed to be a waste, then removal and reuse/recovery/disposal of the material will be carried out in accordance with the *Waste Management Act 1996* as amended, the *Waste Management (Collection Permit) Regulations 2007* as amended and the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended. Once all available beneficial reuse options have been exhausted, the options of recycling and recovery at waste permitted and licensed sites will be considered.

In the event that contaminated material is encountered and subsequently classified as hazardous, this material will be stored separately to any non-hazardous material. It will require off-site treatment at a suitable facility or disposal abroad by a licensed contractor via Transfrontier Shipment of Wastes (TFS).

Bedrock

While it is not envisaged that bedrock will be encountered, if bedrock is encountered, it is anticipated that it will not be crushed on site. Any excavated rock is expected to be removed off- site for appropriate reuse, recovery and / or disposal. If bedrock is to be crushed on- site, the appropriate waste facility permit will be obtained from SDCC.

Silt & Sludge

During the construction phase, silt and petrochemical interception will be carried out on runoff and pumped water from site works, where required. Sludge and silt will then be collected by a suitably licensed contractor and removed offsite.

Concrete Blocks, Bricks, Tiles & Ceramics

The majority of concrete blocks, bricks, tiles and ceramics generated as part of the construction works are expected to be clean, inert material and will be recycled, where possible.

Hard Plastic

As hard plastic is a highly recyclable material, much of the plastic generated will be primarily from material off-cuts. All recyclable plastic will be segregated and recycled, where possible.

Timber

Timber that is uncontaminated, i.e. free from paints, preservatives, glues etc., will be disposed of in a separate skip and recycled off-site.

Metal

Metals will be segregated where practical and stored in skips. Metal is highly recyclable and there are numerous companies that will accept these materials.

Plasterboard

There are currently a number of recycling services for plasterboard in Ireland. Plasterboard from the construction phases will be stored in a separate skip, pending collection for recycling. The site manager will ensure that oversupply of new plasterboard is carefully monitored to minimise waste.

Glass

Glass materials will be segregated for recycling, where possible.

Waste Electrical and Electronic Equipment (WEEE)

Any WEEE will be stored in dedicated covered cages/receptacles/pallets pending collection for recycling.

Other Recyclables

Where any other recyclable wastes such as cardboard and soft plastic are generated, these will be segregated at source into dedicated skips and removed off-site.

Non-Recyclable Waste

C&D waste which is not suitable for reuse or recovery, such as polystyrene, some plastics and some cardboards, will be placed in separate skips or other receptacles. Prior to removal from site, the non-recyclable waste skip/receptacle will be examined by a member of the waste team (see Section 7.0) to determine if recyclable materials have been placed in there by mistake. If this is the case, efforts will be made to determine the cause of the waste not being segregated correctly and recyclable waste will be removed and placed into the appropriate receptacle.

Asbestos Containing Materials

If any asbestos or ACM found on site, they will be removed by a suitably competent contractor and disposed of as asbestos waste before the demolition works begin. All asbestos removal work or encapsulation work must be carried out in accordance with S.I. No. 589 of 2010 Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010.

Other Hazardous Wastes

On-site storage of any hazardous wastes produced (i.e. contaminated soil if encountered and/or waste fuels) will be kept to a minimum, with removal off-site organised on a regular basis. Storage of all hazardous wastes on-site will be undertaken so as to minimise exposure to on-site personnel and the public and to also minimise potential for environmental impacts. Hazardous wastes will be recovered, wherever possible, and failing this, disposed of appropriately.

4.4 Tracking And Documentation Procedures For Off-Site Waste

All waste will be documented prior to leaving the site. Waste will be weighed by the contractor, either by weighing mechanism on the truck or at the receiving facility. These waste records will be maintained on site by the nominated project Waste Manager (see Section 7.0).

All movement of waste and the use of waste contractors will be undertaken in accordance with the *Waste Management Act 1996* as amended, *Waste Management (Collection Permit) Regulations 2007* as amended and *Waste Management (Facility Permit & Registration) Regulations 2007* and amended. This includes the requirement for all waste contractors to have a waste collection permit issued by the NWCPO. The nominated project waste manager (see Section 7.0) will maintain a copy of all waste collection permits on-site.

If the waste is being transported to another site, a copy of the Local Authority waste COR/permit or EPA Waste/IE Licence for that site will be provided to the nominated project waste manager (see Section 7.0). If the waste is being shipped abroad, a copy of the Transfrontier Shipping (TFS) notification document will be obtained from DCC (as the relevant authority on behalf of all local authorities in Ireland) and kept on-site along with details of the final destination (COR, permits, licences etc.). A receipt from the final destination of the material will be kept as part of the on-site waste management records.

All information will be entered in a waste management recording system to be maintained on site.

5.0 ESTIMATED COST OF WASTE MANAGEMENT

An outline of the costs associated with different aspects of waste management is provided below. The total cost of C&D waste management will be measured and will take into account handling costs, storage costs, transportation costs, revenue from rebates and disposal costs.

5.1 Reuse

By reusing materials on site, there will be a reduction in the transport and recycle/recovery/disposal costs associated with the requirement for a waste contractor to take the material off-site.

Clean and inert soils, gravel, stones etc. which cannot be reused on site may be used as access roads or capping material for landfill sites etc. This material is often taken free of charge or a reduced fee for such purposes, reducing final waste disposal costs.

5.2 Recycling

Salvageable metals will earn a rebate which can be offset against the costs of collection and transportation of the skips.

Clean uncontaminated cardboard and certain hard plastics can also 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.

5.3 Disposal

Landfill charges are currently at around €130 - €150 per tonne which includes a €75 per tonne landfill levy specified in the *Waste Management (Landfill Levy) Regulations 2015*. 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.

6.0 DEMOLITION PROCEDURES

The demolition stage will involve the demolition of multiple warehouse style buildings and hard stand area. The demolition areas are identified in the planning drawings submitted as part of this application. The following sequence of works will be followed during the demolition stage:

Check for Hazards
Prior to commencing works, buildings and structures to be demolished will be checked for any likely hazards including asbestos, ACMs, electrical power lines or cables, gas reticulation systems, telecommunications, unsafe structures and fire / explosion hazards, e.g. combustible dust, chemical hazards, oil, fuels and contamination.

Removal of Components
All hazardous materials will be removed first. All components from within the buildings that can be salvaged will be removed next. This will primarily be comprised of metal; however, may also include timbers, doors, windows, wiring and metal ducting, etc.

Removal of Roofing
Steel roof supports, beams, etc., will be dismantled and taken away for recycling / salvage.

Excavation of Services, Demolition of Walls and Concrete
Services will be removed from the ground and the breakdown of walls will be carried out once all salvageable or reusable materials have been taken from the buildings. Finally, any existing foundations and hard standing areas will be excavated.

7.0 TRAINING PROVISIONS

A member of the construction team will be appointed as the project waste manager to ensure commitment, operational efficiency and accountability during the C&D phases of the project.

7.1 Waste Manager Training And Responsibilities

The nominated waste manager will be given responsibility and authority to select a waste team if required, i.e. members of the site crew that will aid them in the organisation, operation and recording of the waste management system implemented on site. The waste manager will have overall responsibility to oversee, record and provide feedback to the client on everyday waste management at the site. Authority will be given to the waste manager to delegate responsibility to sub-contractors, where necessary, and to coordinate with suppliers, service providers and sub-contractors to prioritise waste prevention and material salvage.

The waste manager will be trained in how to set up and maintain a record keeping system, how to perform an audit and how to establish targets for waste management on site. The waste manager will also be trained in the best methods for segregation and storage of recyclable materials, have information on the materials that can be reused on site and be knowledgeable in how to implement this C&D WMP.

7.2 Site Crew Training

Training of site crew is the responsibility of the waste manager and, as such, a waste training program will be organised. A basic awareness course will be held for all site crew to outline the C&D WMP and to detail the segregation of waste materials at source. This may be incorporated with other site training needs such as general site induction, health and safety awareness and manual handling.

This basic course will describe the materials to be segregated, the storage methods and the location of the Waste Storage Areas (WSAs). A sub-section on hazardous wastes will be incorporated into the training program and the particular dangers of each hazardous waste will be explained.

8.0 RECORD KEEPING

Records will be kept for all waste material which leaves the site, either for reuse on another site, recycling or disposal. A recording system will be put in place to record the waste arisings on site.

A waste tracking log will be used to track each waste movement from the site. On exit from the site the waste collection vehicle driver should stop at the site office and sign out as a visitor and provide the security personnel or waste manager with a waste docket (or WTF for hazardous waste) for the waste load collected. At this time, the security personnel should complete and sign the Waste Tracking Register with the following information:

- Date
- Time
- Waste Contractor

- Company waste contractor appointed by e.g. Contractor or subcontractor name
- Collection Permit No.
- Vehicle Reg.
- Driver Name
- Docket No.
- Waste Type
- EWC/LoW

The waste vehicle will be checked by security personal or the Waste Manager to ensure it has the waste collection permit no. displayed and a copy of the waste collection permit in the vehicle before they are allowed to remove the waste from the site.

The waste transfer dockets will be transferred to the Waste Manager on a weekly basis and can be placed in the Waste Tracking Log file. This information will be forwarded onto the DCC Waste Regulation Unit when requested.

Alternatively, each subcontractor that has engaged their own waste contractor will be required to maintain a similar waste tracking log with the waste dockets / WTF maintained on file and available for inspection on site by the main contractor as required.

Waste receipts from the receiving waste facility will also be obtained by the site contractor(s) and retained. A copy of the Waste Collection Permits, CORs, Waste Facility Permits and Waste Licences will be maintained on site at all times. Subcontractors who have engaged their own waste contractors, should provide the main contractor with a copy of the waste collection permits and COR / permit / licence for the receiving waste facilities and maintain a copy on file, available for inspection on site as required.

9.0 OUTLINE WASTE AUDIT PROCEDURE

9.1 Responsibility For Waste Audit

The appointed Waste Manager will be responsible for conducting a waste audit at the site during the C&D phase of the proposed Project. Contact details for the nominated Waste Manager will be provided to the SDCC Waste Regulation Unit after the main contractor is appointed and prior to any material being removed from site.

9.2 Review Of Records And Identification Of Corrective Actions

A review of all waste management costs and the records for the waste generated and transported off-site should be undertaken mid-way through the demolition and construction phase of the proposed Project.

If waste movements are not accounted for, the reasons for this should be established in order to see if and why the record keeping system has not been maintained. The waste records will be compared with the established recovery / reuse / recycling targets for the site. Each material type will be examined, in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how the targets can be achieved.

Upon completion of the C&D phase, a final report will be prepared, summarising the outcomes of waste management processes adopted and the total recycling / reuse / recovery figures for the development.

10.0 CONSULTATION WITH RELEVANT BODIES

10.1 Local Authority

Once construction contractors have been appointed and have appointed waste contractors, and prior to removal of any C&D waste materials off-site, details of the proposed destination of each waste stream will be provided to the SDCC Waste Regulation Unit.

SDCC will also be consulted, as required, throughout the C&D phases in order to ensure that all available waste reduction, reuse and recycling opportunities are identified and utilised and that compliant waste management practices are carried out.

10.2 Recycling/Salvage Companies

The appointed waste contractor for the main waste streams managed by the demolition and construction contractors will be audited in order to ensure that relevant and up-to-date waste collection permits and facility registrations/permits/licences are held. In addition, information will be obtained regarding the feasibility of recycling each material, the costs of recycling/reclamation, the means by which the wastes will be collected and transported off-site and the recycling/reclamation process each material will undergo off site.

11.0 REFERENCES

1. Waste Management Act 1996 (No. 10 of 1996) as amended. Sub-ordinate and associated legislation includes:
    - European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended.
    - Waste Management (Collection Permit) Regulations 2007 (S.I. No. 820 of 2007) as amended.
    - Waste Management (Facility Permit and Registration) Regulations 2007 (S.I No. 821 of 2007) as amended.
    - Waste Management (Licensing) Regulations 2000 (S.I No. 185 of 2000) as amended.
    - European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014) as amended.
    - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997) as amended.
    - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
    - European Union (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
    - European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended.
    - Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended.
    - European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 430 of 2015)
    - Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended.
    - Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended.
    - European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011)
    - European Union (Properties of Waste which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015) as amended
2. Environmental Protection Agency Act 1992 (No. 7 of 1992) as amended.
3. Litter Pollution Act 1997 (No. 12 of 1997) as amended
4. Eastern-Midlands Region Waste Management Plan 2015 – 2021 (2015).
5. Department of Environment and Local Government (DoELG) *Waste Management – Changing Our Ways, A Policy Statement* (1998).
6. Forum for the Construction Industry – *Recycling of Construction and Demolition Waste.*
7. Department of Communications, Climate Action and Environment (DCCAE), *Waste Action Plan for the Circular Economy - Ireland's National Waste Policy 2020-2025* (Sept 2020).
8. Department of Environment, Heritage and Local Government, *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects* (2006).
9. FÁS and the Construction Industry Federation (CIF), *Construction and Demolition Waste Management – a handbook for Contractors and Site Managers* (2002).
10. Dún Laoghaire–Rathdown County Council (DLRCC), Dún Laoghaire–Rathdown County Council Development Plan 2016-2022 (2016)
11. Planning and Development Act 2000 (No. 30 of 2000) as amended

12. DLRCC, Guidance Notes for Environmental Management of Construction Projects (2020)

13. EPA, *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* (2015)

14. Council Decision 2003/33/EC, establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.

15. Environmental Protection Agency (EPA), *National Waste Database Reports 1998 – 2012*.

16. EPA and Galway-Mayo Institute of Technology (GMIT), *EPA Research Report 146 – A Review of Design and Construction Waste Management Practices in Selected Case Studies – Lessons Learned* (2015).

OPERATIONAL WASTE MANAGEMENT PLAN FOR A PROPOSED STRATEGIC HOUSING DEVELOPMENT

AT

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CONTENTS

1.0 INTRODUCTION

AWN Consulting Ltd. (AWN) has prepared this Operational Waste Management Plan (OWMP) on behalf of Steeplefield Limited The proposed development will consist of the demolition of existing warehouses and the construction of 633 no. build-to-rent apartment units in 4 no. blocks, along with the construction of a childcare facility, 8 no. commercial units and all ancillary works at the former Chadwick's site, Greenhills Road, Walkinstown, Dublin 12.

This OWMP has been prepared to ensure that the management of waste during the operational phase of the proposed residential development is undertaken in accordance with the current legal and industry standards including, the *Waste Management Act 1996* as amended and associated Regulations [1], *Environmental Protection Agency Act 1992* as amended [2], *Litter Pollution Act 1997* as amended [3], the *'Eastern-Midlands Region (EMR) Waste Management Plan 2015 – 2021'* [4], The South Dublin County Council *(SDCC) South Dublin County Council Household & Commercial Waste Bye-Laws (2018)* [5]. In particular, this OWMP aims to provide a robust strategy for storing, handling, collection and transport of the wastes generated at site.

This OWMP aims to ensure maximum recycling, reuse and recovery of waste with diversion from landfill, wherever possible. The OWMP also seeks to provide guidance on the appropriate collection and transport of waste to prevent issues associated with litter or more serious environmental pollution (e.g. contamination of soil or water resources). The plan estimates the type and quantity of waste to be generated from the proposed development during the operational phase and provides a strategy for managing the different waste streams.

At present, there are no specific guidelines in Ireland for the preparation of OWMPs. Therefore, in preparing this document, consideration has been given to the requirements of national and regional waste policy, legislation and other guidelines.

2.0 OVERVIEW OF WASTE MANAGEMENT IN IRELAND

2.1 National Level

The Irish Government issued a policy statement in September 1998 titled as *'Changing Our Ways'* [6] which identified objectives for the prevention, minimisation, reuse, recycling, recovery and disposal of waste in Ireland. A heavy emphasis was placed on reducing reliance on landfill and finding alternative methods for managing waste. Amongst other things, Changing Our Ways stated a target of at least 35% recycling of municipal (i.e. household, commercial and non-process industrial) waste.

A further policy document *'Preventing and Recycling Waste – Delivering Change'* was published in 2002 [7]. This document proposed a number of programmes to increase recycling of waste and allow diversion from landfill. The need for waste minimisation at source was considered a priority.

This view was also supported by a review of sustainable development policy in Ireland and achievements to date, which was conducted in 2002, entitled *'Making Irelands Development Sustainable – Review, Assessment and Future Action'* [8]. This document also stressed the need to break the link between economic growth and waste generation, again through waste minimisation and reuse of discarded material.

In order to establish the progress of the Government policy document *Changing Our Ways*, a review document was published in April 2004 entitled *'Taking Stock and Moving Forward'* [9]. Covering the period 1998 – 2003, the aim of this document was to assess progress to date with regard to waste management in Ireland, to consider developments since the policy framework and the local authority waste management plans were put in place, and to identify measures that could be undertaken to further support progress towards the objectives outlined in *Changing Our Ways*.

In particular, *Taking Stock and Moving Forward* noted a significant increase in the amount of waste being brought to local authority landfills. The report noted that one of the significant challenges in the coming years was the extension of the dry recyclable collection services.

In September 2020 the Irish Government released a national policy document outlining a new action plan for Ireland and its waste to cover the period of 2020-2025. This plan *'A Waste Action Plan for a Circular Economy'* [10] was prepared in response to the 'European Green Deal' which sets a roadmap for a transition to a new economy, where climate and environmental challenges are turned into opportunities. Replacing the previous national waste management plan *"A Resource Opportunity (2012)".*

It aims to fulfil the commitment in the Programme for Government to publish and start implementing a new National Waste Action Plan. It is intended that this new national waste policy will inform and give direction to waste planning and management in Ireland over the coming years. It will be followed later this year by an All of Government Circular Economy Strategy. The policy document shifts focus away from waste disposal and moves it back up the production chain. To support the policy, regulation is already being used (Circular Economy Legislative Package) or in the pipeline. The policy document contains over 200 measures across various waste areas including Circular Economy, Municipal Waste, Consumer Protection & Citizen Engagement, Plastics and Packaging, Construction and Demolition, Textiles, Green Public Procurement and Waste Enforcement.

One of the first actions to be taken is the development of a high-level, whole of Government Circular Economy Strategy to set a course for Ireland to transition across all sectors and at all levels of Government toward circularity. This strategy was issued for public consultation in April 2021.

Since 1998, the Environmental Protection Agency (EPA) has produced periodic 'National Waste (Database) Reports' [12] detailing, among other things, estimates for household and commercial (municipal) waste generation in Ireland and the level of recycling, recovery and disposal of these materials. The 2019 National Waste Statistics, which is the most recent study published, along with the national waste statistics web resource (November 2021) reported the following key statistics for 2019:

- **Generated** – Ireland produced 3,085,652 t of municipal waste in 2019. This is almost a 6% increase since 2018. This means that the average person living in Ireland generated 628 kg of municipal waste in 2019.
- **Managed –** Waste collected and treated by the waste industry. In 2019, a total of 3,036,991 t of municipal waste was managed and treated.
- **Unmanaged** –Waste that is not collected or brought to a waste facility and is, therefore, likely to cause pollution in the environment because it is burned, buried or dumped. The EPA estimates that 48,660 t was unmanaged in 2019.
- **Recovered** – The amount of waste recycled, used as a fuel in incinerators, or used to cover landfilled waste. In 2019, around 83% of municipal waste was recovered – a decrease from 84% in 2018.
- **Recycled** – The waste broken down and used to make new items. Recycling also includes the breakdown of food and garden waste to make compost. The recycling rate in 2019 was 37%, which is down from 38% in 2018.
- **Disposed** – Less than a sixth (15%) of municipal waste was landfilled in 2019. This is an increase from 14% in 2018.

2.2 Regional Level

The proposed development is located in the Local Authority area of South Dublin County Council (SDCC).

The *EMR Waste Management Plan 2015 – 2021* is the regional waste management plan for the SDCC area published in May 2015.

The regional plan sets out the following strategic targets for waste management in the region:

- A 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
- Achieve a recycling rate of 50% of managed municipal waste by 2020; and
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.

Municipal landfill charges in Ireland are based on the weight of waste disposed. In the Leinster Region, charges are approximately €130 - €150 per tonne of waste which includes a €75 per tonne landfill levy specified in the Waste Management (Landfill Levy) Regulations 2015.

The South Dublin County Council Development Plan 2016 – 2022 [13] sets out a number of objectives and actions for the South Dublin area in line with the objectives of the waste management plan.

Waste objectives and actions with a particular relevance to the proposed development are as follows:

Objectives:

- **IE5 Objective 1:** To support the implementation of the Eastern–Midlands Region Waste Management Plan 2015-2021 by adhering to overarching performance targets, policies and policy actions.
- **IE5 Objective 2:** To support waste prevention through behavioural change activities to de-couple economic growth and resource use.
- **IE5 Objective 3:** To encourage the transition from a waste management economy to a green circular economy to enhance employment and increase the value recovery and recirculation of resources.
- **IE5 Objective 8:** To secure appropriate provision for the sustainable management of waste within developments, including the provision of facilities for the storage, separation and collection of such waste.

Actions:

- Support and facilitate the separation of waste at source into organic and non-organic streams or other waste management systems that divert waste from landfill and maximise the potential for each waste type to be re-used and recycled or composted and divert organic waste from landfill, in accordance with the National Strategy on Biodegradable Waste (2006).
- Implement the objectives of the National Waste Prevention Programme at a local level with businesses, schools, householders, community groups and within the Council's own activities.
- Promote an increase in the amount of waste re-used and recycled consistent with the Regional Waste Management Plan and Waste Hierarchy and facilitate recycling of waste through adequate provision of facilities and good design in new developments.

- Implement the South Dublin Litter Management Plan 2015 – 2019.

The *Draft South Dublin County Development Plan 2022 – 2028* [14] will supersede the current development plan and is due to be complete and come into effect in August 2022. The following policy and objectives has thus far been incorporated into the draft plan:

<u>*Policy and Objectives*</u>

- **Policy IE6: Waste Management**
  Implement European Union, National and Regional waste and related environmental policy, legislation, guidance and codes of practice to improve management of material resources and wastes.
- **IE6 Objective 1**
  To encourage a just transition from a waste management economy to a green circular economy to enhance employment and increase the value, recovery and recirculation of resources through compliance with the provisions of the Waste Action Plan for a Circular Economy 2020 – 2025 and to promote the use of, but not limited to, reverse vending machines and deposit return schemes or similar to ensure a wider and varying ways of recycling.
- **IE6 Objective 2**
  To support the implementation of the Eastern Midlands Region Waste Management Plan 2015-2021 or as amended by adhering to overarching performance targets, policies and policy actions.
- **IE6 Objective 3**
  To provide for, promote and facilitate high quality sustainable waste recovery and disposal infrastructure/technology in keeping with the EU waste hierarchy and to adequately cater for a growing residential population and business sector.
- **IE6 Objective 4**
  To provide for and maintain the network of bring infrastructure (e.g. civic amenity facilities, bring banks) in the County to facilitate the recycling and recovery of hazardous and non-hazardous municipal wastes.
- **IE6 Objective 5**
  To ensure the provision of adequately sized public recycling facilities in association with new commercial developments and in tandem with significant change of use/extensions of existing commercial developments where appropriate.
- **IE6 Objective 6**
  To continue to roll out a countywide network of green waste centres in suitable locations to expand the collection system for compostable waste
- **IE6 Objective 7**
  To require the appropriate provision for the sustainable management of waste within all developments, ensuring it is suitably designed into the development, including the provision of facilities for the storage, separation and collection of such waste.
- **IE6 Objective 8**
  To adhere to the recommendations of the National Hazardous Waste Management Plan 2014-2020 and any subsequent plan, and to co-operate with other agencies including the EPA in the planning, organisation and supervision of the disposal of hazardous waste streams, including hazardous waste identified during construction and demolition projects.
- **IE6 Objective 9**
  To support the development of indigenous capacity for the treatment of non-hazardous and hazardous wastes where technically, economically and environmentally practicable subject to the relevant environmental protection criteria for the planning and development of such activities being applied.

2.3 Legislative Requirements

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

- Waste Management Act 1996 as amended. Sub-ordinate and associated legislation includes:
    - European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended
    - Waste Management (Collection Permit) Regulations 2007 (S.I. No. 820 of 2007) as amended
    - Waste Management (Facility Permit and Registration) Regulation 2007 (S.I No. 821 of 2007) as amended
    - Waste Management (Licensing) Regulations 2000 (S.I No. 185 of 2000) as amended
    - European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014) as amended.
    - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997) as amended
    - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
    - European Communities (Waste Electrical and Electronic Equipment) Regulations 2014 as amended
    - Waste Management (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended
    - Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended
    - European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 430 of 2015)
    - Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended
    - Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended
    - *European Communities (Transfrontier Shipment of Waste) Regulations 1994 (SI 121 of 1994)*
    - European Union (Properties of Waste Which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015) as amended
- Environmental Protection Agency Act 1992 as amended;
- Litter Pollution Act 1997 as amended and
- Planning and Development Act 2000 as amended [15]

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

One of the guiding principles of European waste legislation, which has in turn been incorporated into the *Waste Management Act 1996* as amended and subsequent Irish legislation, is the principle of *"Duty of Care"*. This implies that the waste producer is responsible for waste from the time it is generated through until its legal disposal (including its method of disposal). As it is not practical in most cases for the waste producer to physically transfer all waste from where it is produced to the final disposal area, waste contractors will be employed to physically transport waste to the final waste disposal site.

It is therefore imperative that the residents, tenants and the facilities management company undertake on-site management of waste in accordance with all legal requirements and employ suitably permitted/licenced contractors to undertake off-site management of their waste in accordance with all legal requirements. This includes the requirement that a waste contractor handle, transport and reuse/recover/recycle/dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities.

A collection permit to transport waste must be held by each waste contractor which is issued by the National Waste Collection Permit Office (NWCPO). Waste receiving facilities must also be appropriately permitted or licensed. Operators of such facilities cannot receive any waste, unless in possession of a Certificate of Registration (COR) or waste permit granted by the relevant Local Authority under the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended or a waste or IED (Industrial Emissions Directive) licence granted by the EPA. The COR/permit/licence held will specify the type and quantity of waste able to be received, stored, sorted, recycled, recovered and/or disposed of at the specified site.

2.3.1 South Dublin County Council Waste Bye-Laws

The SDCC *"South Dublin County Council Household & Commercial Waste Bye-Laws 2018"* came into effect in December 2018. These Bye-laws repeal the previous SDCC bye-laws*; South Dublin County Council Household Waste Bye-Laws 2012* and *South Dublin County Council (Storage, Separation at Source, Presentation and Collection of Commercial Waste) Bye-Laws 2007*. The Bye-Laws set a number of enforceable requirements on waste holders and collectors with regard to storage, separation, presentation and collection of waste within the SDCC functional area. Key requirements under these Bye-laws are:

- Kerbside waste presented for collection shall not be presented for collection earlier than 8.00pm on the day immediately preceding the designated waste collection day;
- All containers used for the presentation of kerbside waste and any uncollected waste shall be removed from any roadway, footway, footpath or any other public place no later than 8:00am on the day following the designated waste collection day;
- Neither recyclable household kerbside waste nor food waste arising from households shall be contaminated with any other type of waste before or after it has been segregated; and
- A management company, or another person if there is no such company, who exercises control and supervision of residential and/or commercial activities in multi-unit developments, mixed-use developments, flats or apartment blocks, combined living/working spaces or other similar complexes shall ensure that:
  - separate receptacles of adequate size and number are provided for the proper segregation, storage and collection of recyclable household kerbside waste and residual household kerbside waste;
  - additional receptacles are provided for the segregation, storage and collection of food waste where this practice is a requirement of the national legislation on food waste;
  - the receptacles referred to in paragraphs (a) and (b) are located both within any individual apartment and at the place where waste is stored prior to its collection;
  - any place where waste is to be stored prior to collection is secure, accessible at all times by tenants and other occupiers and is not accessible by any other person other than an authorised waste collector,
  - written information is provided to each tenant or other occupier about the arrangements for waste separation, segregation, storage and presentation prior to collection; and
  - an authorised waste collector is engaged to service the receptacles referred to in this section of these bye-laws, with documentary evidence, such as receipts, statements or other proof of payment, demonstrating

the existence of this engagement being retained for a period of no less than two years. Such evidence shall be presented to an authorised person within a time specified in a written request from either that person or from another authorised person employed by South Dublin County Council.

The full text of the Waste Bye-Laws is available from the SDCC website

2.4 Regional Waste Management Service Providers and Facilities

Various contractors offer waste collection services for the residential and commercial sectors in the SDCC region. Details of waste collection permits (granted, pending and withdrawn) for the region are available from the NWCPO.

As outlined in the regional waste management plan, there is a decreasing number of landfills available in the region. Only three municipal solid waste landfills remain operational and are all operated by the private sector. There are a number of other licensed and permitted facilities in operation in the region including waste transfer stations, hazardous waste facilities and integrated waste management facilities. There are two existing thermal treatment facilities, one in Duleek, Co. Meath and a second facility in Poolbeg in Dublin.

The SDCC Ballymount Civic Amenity Centre, located c. 920m to the southwest of the development, can be utilised by the residents of the development for certain household waste streams. This centre can accept batteries, metal, paper, clothes and textiles, electrical items, glass bottles and jars, wood and soft plastic. There is also a bring bank located c. 690m to the north of the development at The Walkinstown Green, where glass and aluminium cans can be deposited.

A copy of all CORs and waste permits issued by the Local Authorities are available from the NWCPO website and all waste/IE licenses issued are available from the EPA.

3.0 DESCRIPTION OF THE PROJECT

3.1 Location, Size and Scale of the Development

The proposed development comprises the following:

(i) The demolition of the former Chadwicks Builders Merchant development comprising 1 no. two storey office building and 9 no. storage/warehouse buildings ranging in height from 3 m – 9.9 m as follows: Building A (8,764 sq.m.), Building B (1,293 sq.m.), Building C (two-storey office building) (527 sq.m.), Building D (47 sq.m.), Building E (29 sq.m.), Building F (207 sq.m.), Building G (101 sq.m.), Building H (80 sq.m.), Building I (28 sq.m.), and Building J (44 sq.m.), in total comprising 11,120 sq.m.;

(ii) the construction of a mixed-use Build-to-Rent residential and commercial development comprising 633 no. build-to-rent apartment units (292 no. one-beds, 280 no. two-beds and 61 no. three-beds), 1 no. childcare facility and 10 no. commercial units in 4 no. blocks (A-D) ranging in height from 5 to 12 storeys as follows:

(a) Block A comprises 209 no. apartments (102 no. 1 bed-units, 106 no. 2 bed-units and 1 no. 3-bed units) measuring 5 - 10 storeys in height. (b) Block B comprises 121 no. apartments (53 no. 1 bed-units, 45 no. 2 bed-units and 23 no. 3 bed-units) measuring 8 - 10 storeys in height. (c) Block C comprises 130 no. apartments (38 no. 1-bed units, 71 no. 2-bed units and 21 no. 3-bed units) measuring 8 - 12 storeys in height. (d) Block D comprises 173 no. apartments (99 no. 1 bed-units, 58 no. 2 bed-units and 16 no. 3 bed-units) measuring 6 - 10 storeys in height. All apartments will be provided with private balconies/terraces;

(iii) provision of indoor communal residential amenity/management facilities including a co-working space, communal meeting room/ work space, foyer, toilets at ground floor of Block A; gym, changing rooms, toilets, resident's lounge, studio, laundry room, communal meeting room/ work space, multi-function space with kitchen at ground floor of Block B; games room with kitchenette, media room, co-working space, resident's lounge, communal meeting room/ work space, reception area, management office with ancillary staff room and toilets, toilets, parcel room at ground floor of Block C;

(iv) the construction of 1 no. childcare facility with dedicated outdoor play area located at ground floor of Block A;

(v) the construction of 8 no. commercial units at ground floor level of Blocks A, B and D, and 2 no. commercial units at second floor level (fronting Greenhills Road) of Block C as follows: Block A has 3 no. units at ground floor comprising 79.46 sq.m., 90.23 sq.m., and 121.39 sq.m., Block B has 1 no. unit at ground floor comprising 127.03 sq.m., Block C has two units at second floor comprising 120.85 sq.m. and 125.45 sq.m., and Block D has 4 no. units at ground floor comprising 84.45 sq.m., 149.77 sq.m., 155.48 sq.m. and 275.59 sq.m.;

(vi) the construction of 3 no. vehicular entrances; a primary entrance via vehicular ramp from the north (access from Greenhills Road) and 2 no. secondary entrances from the south for emergency access and services (access from existing road to the south of the site) with additional pedestrian accesses proposed along Greenhills Road;

(vii) provision of 424 no. car parking spaces comprising 398 no. standard spaces, 21 no. mobility spaces and 5 no. car club spaces located at ground floor level car park located within Block A and accessed via the proposed entrance at Greenhills Road, a two-storey car park located within Blocks C and D also accessed from the proposed entrance at Greenhills Road and on-street parking at ground floor level adjacent to Blocks A and C. Provision of an additional 15 no. commercial/ unloading/ drop-off on-street parking spaces at ground floor level (providing for an overall total of 439 car parking spaces). Provision of 4 no. dedicated motorcycle spaces at ground floor level parking area within Blocks C and D;

(viii) provision of 1363 no. bicycle parking spaces comprising 1035 no. residents' bicycle spaces, 5 no. accessible bicycle spaces and 7 no. cargo bicycle spaces in 9 no. bicycle storerooms in ground and first floor parking areas within Blocks A, C and D, and 316 no. visitors' bicycle spaces located externally at ground floor level throughout the development;

(ix) provision of outdoor communal amenity space (5,020 sq.m.) comprising landscaped courtyards that include play areas, seating areas, grass areas, planting, and scented gardens located on podiums at first and second floor levels; provision of a communal amenity roof garden in Block C with seating area and planting (176 sq.m.); and inclusion of centrally located public open space (3,380 sq.m.) adjacent to Blocks B and C comprising grassed areas, planting, seating areas, play areas, water feature, flexible use space; and incidental open space/public realm;

(x) development also includes landscaping and infrastructural works, foul and surface water drainage, bin storage, ESB substations, plant rooms, boundary treatments, internal roads, cycle paths and footpaths and all associated site works to facilitate the development.

This application is accompanied by an Environmental Impact Assessment Report (EIAR).

3.2 Typical Waste Categories

The typical non-hazardous and hazardous wastes that will be generated at the proposed development will include the following:

- Dry Mixed Recyclables (DMR) - includes waste paper (including newspapers, magazines, brochures, catalogues, leaflets), cardboard and plastic packaging, metal cans, plastic bottles, aluminium cans, tins and Tetra Pak cartons;
- Organic waste – food waste and green waste generated from internal plants/flowers;
- Glass; and
- Mixed Non-Recyclable (MNR)/General Waste.

In addition to the typical waste materials that will be generated at the development on a daily basis, there will be some additional waste types generated in small quantities which will need to be managed separately including:

- Green/garden waste may be generated from internal plants or external landscaping;
- Batteries (both hazardous and non-hazardous);
- Waste electrical and electronic equipment (WEEE) (both hazardous and non-hazardous);
- Printer cartridges/toners;
- Chemicals (paints, adhesives, resins, detergents, etc.) ;
- Lightbulbs;
- Textiles (rags);
- Waste cooking oil (if any generated by the residents or commercial tenants);
- Furniture (and from time to time other bulky wastes); and
- Abandoned bicycles.

Wastes will be segregated into the above waste types to ensure compliance with waste legislation and guidance while maximising the re-use, recycling and recovery of waste with diversion from landfill wherever possible.

3.3 European Waste Codes

In 1994, the *European Waste Catalogue* [16] and *Hazardous Waste List* [17] were published by the European Commission. In 2002, the EPA published a document titled the *European Waste Catalogue and Hazardous Waste List* [18], which was a condensed version of the original two documents and their subsequent amendments. This document has recently been replaced by the EPA '*Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous'* [19] which became valid from the 1st June 2015. This waste classification system applies across the EU and is the basis for all national and international waste reporting, such as those associated with waste collection permits, COR's, permits and licences and EPA National Waste Database.

Under the classification system, different types of wastes are fully defined by a code. The List of Waste (LoW) code (also referred to as European Waste Code or EWC) for typical waste materials expected to be generated during the operation of the proposed development are provided in Table 3.1 below.

Waste Material	LoW/EWC Code
Paper and Cardboard	20 01 01
Plastics	20 01 39
Metals	20 01 40
Mixed Non-Recyclable Waste	20 03 01
Glass	20 01 02
Biodegradable Kitchen Waste	20 01 08
Oils and Fats	20 01 25

Textiles	20 01 11
Batteries and Accumulators*	20 01 33* - 34
Printer Toner/Cartridges*	20 01 27* - 28
Green Waste	20 02 01
WEEE*	20 01 35*-36
Chemicals (solvents, pesticides, paints & adhesives, detergents, etc.) *	20 01 13*/19*/27*/28/29*30
Fluorescent tubes and other mercury containing waste*	20 01 21*
Bulky Wastes	20 03 07

** Individual waste type may contain hazardous materials*

Table 3.1 Typical Waste Types Generated and LoW Codes

4.0 ESTIMATED WASTE ARISINGS

A waste generation model (WGM) developed by AWN, has been used to predict waste types, weights and volumes arising from operations within the proposed development. The WGM incorporates building area and use and combines these with other data including Irish and US EPA waste generation rates.

The estimated quantum/volume of waste that will be generated from the residential units has been determined based on the predicted occupancy of the units. The waste generation for the commercial units is based on waste generation rates per m^2 floor area for the proposed area uses.

The estimated waste generation for the development for the main waste types is presented in Table 4.1 and 4.2.

Waste type	Waste Volume (m^3/week)			
	Residential Block A	Residential Block B	Residential Block C	Residential Block D
Organic Waste	2.92	2.07	2.35	2.67
DMR	19.97	14.19	16.08	19.55
Glass	0.57	0.40	0.46	0.52
MNR	11.61	8.25	9.35	9.30
Total	**35.07**	**24.91**	**28.24**	**32.04**

Table 4.1 Estimated waste generation for the proposed development for the main waste types

Waste type	Waste Volume (m^3/week)	
	Childcare Facility (Commercial)	Retail Units (Commercial)
Organic Waste	0.02	0.18
DMR	0.64	2.49
Glass	0.00	0.10
MNR	0.35	2.51
Total	**1.01**	**5.28**

Table 4.2 Estimated waste generation for the proposed development for the main waste type

BS5906:2005 Waste Management in Buildings – Code of Practice [20] has been considered in the calculations of waste estimates. AWN's modelling methodology is based on recently published data and data from numerous other similar developments in Ireland and is based on AWN's experience, it provides a more representative estimate of the likely waste arisings from the proposed development

5.0 WASTE STORAGE AND COLLECTION

This section provides information on how waste generated within the development will be stored and how the waste will be collected from the development. This has been prepared with due consideration of the proposed site layout as well as best practice standards, local and national waste management requirements including those of SDCC. In particular, consideration has been given to the following documents:

- BS 5906:2005 Waste Management in Buildings – Code of Practice;
- EMR Waste Management Plan 2015 – 2021;
- SDCC 'South Dublin County Council Household & Commercial Waste Bye-Laws 2018' (2018); and
- DoHLGH, Sustainable Urban Housing: Design Standards for New Apartments, Guidelines for Planning Authorities (2020) [21].

6 no. dedicated shared Waste Storage Areas (WSAs) have been allocated within the development design for the residential units in the apartment. These shared residential WSAs are located on the ground floor and are in close proximity to the access cores.

3 no. dedicated WSAs have been allocated within the development design for the commercial units. The shared commercial WSAs are located on the ground floor.

The waste receptacles from the shared WSAs will be collected directly from the WSAs by facilities management or the waste contractor and taken to the dedicated staging areas for emptying. Following this, the waste receptacles will be promptly returned to the WSAs.

The staging areas can be viewed on the drawings submitted with planning and are such that they will not obstruct traffic or pedestrians (allowing a footway path of at least 1.8m, the space needed for two wheelchairs to pass each other) as is recommended in the Design Manual for Urban Roads and Streets (2019) [22].

Using the estimated waste generation volumes in Table 4.1 and 4.2 the waste receptacle requirements, compactor and associated FIBCs (Flexible Intermediate Bulk Containers) for MNR, DMR, organic waste, glass have been established for the WSAs. These are presented in Table 5.1.

Area/User	Bins Required					Equipment
	MNR*	DMR**	Organic	Glass	FIBC***	Epac Lodestone compactors
Block A WSA (Residential)	-	-	13 x 240L	3 x 240L	-	2
Block A FIBC WSA (Residential)	-	-	-	-	2 x $2m^3$ 2 x $3m^3$	-
Block B1 WSA (Residential)	3 x 1100L	5 x 1100L	4 x 240L	1 x 240L	-	-
Block A & B WSA (Commercial)	3 x 1100L	3 x 1100L	1 x 240L	1 x 240L	-	-
Block C WSA (Residential)	8 x 1100L	13 x 1100L	9 x 240L	2 x 240L	-	-
Block C WSA (Commercial)	1 x 1100L 1 x 240L	1 x 1100L 1 x 240L	1 x 240L	1 x 240L	-	-
Block B2 & D WSA (Residential)	-	-	19 x 240L	4 x 240L	-	2

Area/User	Bins Required					Equipment
	MNR*	DMR**	Organic	Glass	FIBC***	Epac Lodestone compactors
Block B2 & D FIBC WSA (Residential)	-	-	-	-	3 x $2m^3$ 2 x $3m^3$	-
Block D WSA (Commercial)	3 x 1100L	3 x 1100L	2 x 240L	1 x 240L	-	-

Note: * = *Mixed Non-Recyclables*
** = *Dry Mixed Recyclables*
*** = *Flexible Intermediate Bulk Containers*

Table 5.1 Waste storage requirements for the proposed development

The waste receptacle and FIBC requirements have been established from distribution of the total weekly waste generation estimate into the holding capacity of each receptacle type.

Waste storage receptacles and FIBCs as per Table 5.1 above (or similar appropriate approved containers and/or compactors) will be provided by the facilities management company in the residential and commercial WSAs.

The types of bins used will vary in size, design and colour dependent on the appointed waste contractor. However, examples of typical receptacles to be provided in the WSAs are shown in Figure 5.1. All waste receptacles used will comply with the IS EN 840 2012 standard for performance requirements of mobile waste containers, where appropriate.

Figure 5.1 Typical waste receptacles of varying size (240L and 1100L)

It is proposed that facilities management will avail of a commercially available mini compactor for the DMR and MNR waste streams for the WSAs for Blocks A and B2 & D, referred to as an Epac compactor in this OWMP.

This option will reduce the space needed for the storage of these waste streams, reduce the number of bins stored on site and the number of bins that will need to be transported to the ground floor / staging area for collection. It compresses/compacts the waste into 2 and $3m^3$ bags.

Alternative options can be considered in future by the facilities management company, as technologies are developed. Solely for the purpose of ensuring the WSA is sufficiently sized, this plan assumes that the Epac option will be utilised. An image of the Epac mini compactor is provided as Figure 5.2.

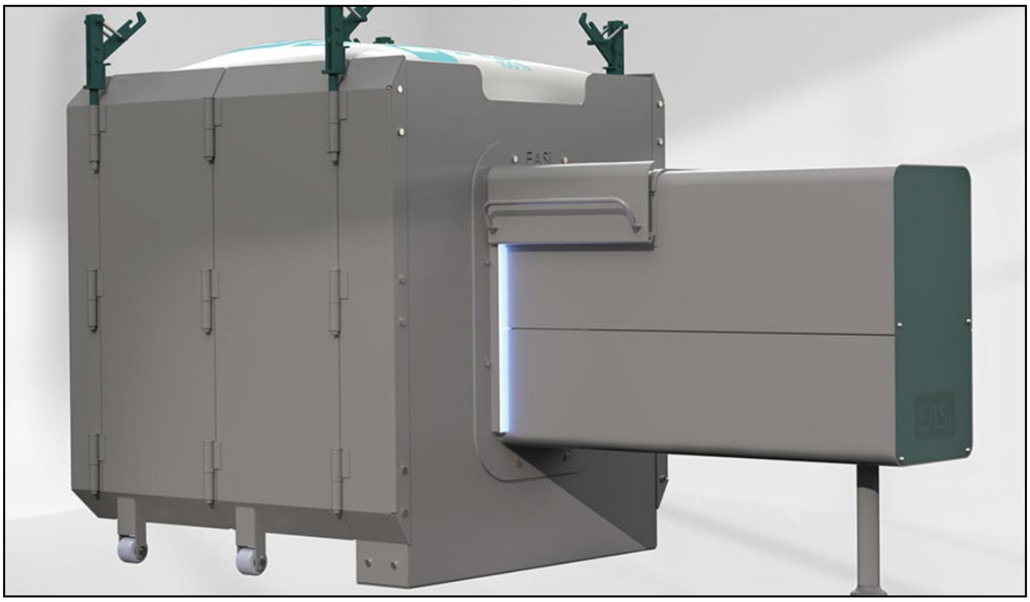

Figure 5.2 Photo of an Epac Mini Compactor (*Source:* bnmrecyling Website)

5.1 Waste Storage – Residential Units

Residents will be required to segregate waste into the following main waste streams:

- DMR;
- MNR;
- Organic waste; and
- Glass.

Residents will be required to take their segregated waste materials to their designated residential WSA and dispose of their segregated waste into the appropriate bins and/or compactor. Locations of all WSAs can found on the plans submitted with the application.

Space will be provided in the residential units to accommodate 3 no. bin types to facilitate waste segregation at source.

Each bin/container/compactor in the WSAs will be clearly labelled and colour coded to avoid cross contamination of the different waste streams. Signage will be posted above or on the bins/compactors to show exactly which waste types can be placed in each bin/compactor.

Filled FIBCs will be ejected from the compactor onto pallets to ensure easy manoeuvrability. A filled FIBC will be transported using a pallet truck to the appropriate FIBC WSA.

Access to the residential WSAs will be restricted to authorised residents, facilities management and waste contractors by means of a key or electronic fob access. Using the estimated figures in Table 4.1 DMR, MNR, organic waste and glass will be collected on a weekly basis.

Other waste materials such as textiles, batteries, lightbulbs, cooking oil, printer toner/cartridges and WEEE may be generated infrequently by the residents. Residents will be required to identify suitable temporary storage areas for these waste items within their own units and dispose of them appropriately. Further details on additional waste types can be found in Section 5.4.

5.2 Waste Storage – Commercial Units

The tenants will be required to segregate waste within their unit, into the following main waste types:

- DMR;
- MNR;
- Organic waste; and
- Glass.

Tenants will take their waste their allocated commercial WSA.

Suppliers for the tenants should be requested by the tenants to make deliveries in reusable containers, minimize packaging or to remove any packaging after delivery where possible, to reduce waste generated by the development.

If any kitchens/food preparation areas are allocated in unit areas, this will contribute a significant portion of the volume of waste generated on a daily basis, and as such it is important that adequate provision is made for the storage and transfer of waste from these areas to the WSA.

If kitchens are required it is anticipated that waste will be generated in kitchens throughout the day, primarily at the following locations:

- Food Storage Areas (i.e. cold stores, dry store, freezer stores and stores for decanting of deliveries);
- Meat Preparation Area;
- Vegetable Preparation Area;
- Cooking Area;

All bins/containers in the tenant's areas as well as in the WSA will be clearly labelled and colour coded to avoid cross contamination of the different waste streams. Signage will be posted above or on the bins to show exactly which wastes can be put in each.

Based on the recommended bin requirements in Table 5.1, DMR, MNR, organic and glass bins will be collected on a weekly basis.

Other waste materials such as textiles, batteries, printer toner/cartridges, lightbulbs and WEEE may be generated infrequently by the tenants. Tenants will be required to identify suitable temporary storage areas for these waste items within their own units and dispose of them appropriately. Further details on additional waste types can be found in Section 5.4.

5.3 Waste Collection

There are numerous private contractors that provide waste collection services in the South Dublin area. All waste contractors servicing the proposed development must hold a valid waste collection permit for the specific waste types collected. All waste collected must be transported to registered/permitted/licensed facilities only.

The facilities management company or waste contractor (depending on the agreement) will be responsible for conveying the bins from shared WSAs to their respective designated staging areas for collection. Following this, the waste receptacles will be promptly returned to the WSAs.

The FIBCs will be brought from the FIBC WSAs using a Moffett truck mounted forklift to the waste collection vehicle. Pallets will be returned to the WSAs for reuse.

It is recommended that bin collection times/days are staggered to reduce the number of bins required to be emptied at once and the time the waste vehicle is onsite. This will be determined during the process of appointment of a waste contractor.

5.4 Additional Waste Materials

In addition to the typical waste materials that are generated on a daily basis, there will be some additional waste types generated from time to time that will need to be managed separately. A non-exhaustive list is presented below.

Green waste
Green waste may be generated from gardens, external landscaping and internal plants/flowers. Green waste generated from landscaping of external areas will be removed by external landscape contractors. Green waste generated from gardens internal plants/flowers can be placed in the organic waste bins.

Batteries
A take-back service for waste batteries and accumulators (e.g. rechargeable batteries) is in place in order to comply with the Waste Management Batteries and Accumulators Regulations 2014 as amended. In accordance with these regulations consumers are able to bring their waste batteries to their local civic amenity centre or can return them free of charge to retailers which supply the equivalent type of battery, regardless of whether or not the batteries were purchased at the retail outlet and regardless of whether or not the person depositing the waste battery purchases any product or products from the retail outlet.

The commercial tenants cannot use the civic amenity centre. They must segregate their waste batteries and either avail of the take-back service provided by retailers or arrange for recycling/recovery of their waste batteries by a suiltably permited/licenced contractor. Facilties management may arrange collection depending on the agreement.

Waste Electrical and Electronic Equipment (WEEE)
The WEEE Directive 2002/96/EC and associated Waste Management (WEEE) Regulations have been enacted to ensure a high level of recycling of electronic and electrical equipment. In accordance with the regulations, consumers can bring their waste electrical and electronic equipment to their local recycling centre. In addition consumers can bring back WEEE within 15 days to retailers when they purchase new equipment on a like for like basis. Retailers are also obliged to collect WEEE within 15 days of delivery of a new item, provided the item is disconnected from all mains, does not pose a health and safety risk and is readily available for collection.

As noted above, the commercial tenants cannot use the civic amenity centre. They must segregate their WEEE and either avail of the take-back/collection service provided by retailers or arrange for recycling/recovery of their WEEE by a suitably permitted/licenced contractor. Facilities management may arrange collection depending on the agreement.

Printer Cartridge/Toners
It is recommended that a printer cartridge/toner bin is provided in relevant commercial units. The commercial tenants will be required to store this waste within their unit and arrange for return to retailers or collection by an authorised waste contractor, as required.

Waste printer cartridge/toners generated by residents can usually be returned to the supplier free of charge or can be brought to a civic amenity centre.

Chemicals (solvents, paints, adhesives, resins, detergents etc)

Chemicals (such as solvents, paints etc) are largely generated from building maintenance works. Such works are usually completed by external contractors who are responsible for the off-site removal and appropriate recovery/recycling/disposal of any waste materials generated.

Any waste cleaning products or waste packaging from cleaning products generated in the commercial units that is classed as hazardous (if they arise) will be appropriately stored within the tenant's own space. Facilities management or the tenant will arrange collection depending on the agreement.

Any waste cleaning products or waste packaging from cleaning products that are classed as hazardous (if they arise) generated by the residents should be brought to a civic amenity centre.

Light Bulbs (Fluorescent Tubes, Long Life, LED and Lilament bulbs)
Waste light bulbs may be generated by lighting in the commercial units. It is anticipated that commercial tenants will be responsible for the off-site removal and appropriate recovery/disposal of these wastes. Facilities management may arrange collection depending on the agreement.

Waste light bulbs may be generated from building maintenance works. Such works are usually completed by external contractors or facilities management who are responsible for the off-site removal and appropriate recovery/recycling/disposal of any waste materials generated.

Light bulbs generated by residents should be taken to the nearest civic amenity centre for appropriate storage and recovery/disposal.

Textiles
Where possible, waste textiles should be recycled or donated to a charity organisation for reuse.

Waste Cooking Oil
If the commercial tenants use cooking oil, waste cooking oil will need to be stored within the unit on a bunded area or spill pallet and regular collections by a dedicated waste contractor will need to be organised as required.

If the residents generate waste cooking oil, this can be brought to a civic amenity centre or placed in the organic waste bin.

Furniture (and other bulky wastes)
Furniture and other bulky waste items (such as carpet etc.) may occasionally be generated by the residents and commercial tenants. If residents wish to dispose of furniture, this can be brought a civic amenity centre. If commercial tenants require collection of bulky waste, it will be arranged as required by the tenant.

Abandoned Bicycles
Bicycle parking areas are planned for the development. As happens in other developments, residents sometimes abandon faulty or unused bicycles, and it can be difficult to determine their ownership. Abandoned bicycles should be donated to charity if they arise.

COVID-19 Waste
Any waste generated by residents, tenants and staff of the development that have tested positive for COVID-19 should be managed in accordance with the current COVID-19 HSE Guidelines at the time that that waste arises. At the time this report was prepared, the HSE Guidelines require the following procedure for any waste from a person that tests positive for COVID-19:

- Put all waste (gloves, tissues, wipes, masks) from that person in a bin bag and tie when almost full;
- Put this bin bag into a second bin bag and tie a knot;
- Store this bag safely for 3 days, then put the bag into the non-recyclable waste/general waste wheelie bin for collection/emptying.

Please note that this guidance is likely to be updated by the time the development is open and occupied and the relevant guidance at the time will need to be reviewed.

5.5 Waste Storage Area Design

The WSAs will be designed and fitted-out to meet the requirements of relevant design standards, including:

- Be fitted with a non-slip floor surface;
- Provide ventilation to reduce the potential for generation of odours with a recommended 6-10 air changes per hour for a mechanical system for internal WSAs;
- Provide suitable lighting – a minimum Lux rating of 220 is recommended;
- Be easily accessible for people with limited mobility;
- Be restricted to access by nominated personnel only;
- Be supplied with hot or cold water for disinfection and washing of bins;
- Be fitted with suitable power supply for power washers;
- Have a sloped floor to a central foul drain for bins washing run-off;
- Have appropriate signage placed above and on bins indicating correct use;
- Have access for potential control of vermin, if required; and
- Be fitted with CCTV for monitoring.

The facilities company will be required to maintain the waste storage areas in good condition as required by the SDCC Waste Bye-Laws.

6.0 CONCLUSIONS

In summary, this OWMP presents a waste strategy that complies with all legal requirements, waste policies and best practice guidelines and demonstrates that the required storage areas have been incorporated into the design of the development.

Implementation of this OWMP will ensure a high level of recycling, reuse and recovery at the development. All recyclable materials will be segregated at source to reduce waste contractor costs and ensure maximum diversion of materials from landfill, thus achieving the targets set out in the *EMR Waste Management Plan 2015 – 2021*.

Adherence to this plan will also ensure that waste management at the development is carried out in accordance with the requirements of the *SDCC Waste Bye-Laws.*

The waste strategy presented in this document will provide sufficient storage capacity for the estimated quantity of segregated waste. The designated area for waste storage will provide sufficient room for the required receptacles in accordance with the details of this strategy.

7.0 REFERENCES

1. Waste Management Act 1996 (No. 10 of 1996) as amended. Sub-ordinate and associated legislation includes:
    - European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended
    - Waste Management (Collection Permit) Regulations 2007 (S.I. No. 820 of 2007) as amended
    - Waste Management (Facility Permit and Registration) Regulations 2007 (S.I No. 821 of 2007) as amended
    - Waste Management (Licensing) Regulations 2000 (S.I No. 185 of 2000) as amended
    - European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014)
    - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997)
    - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
    - European Communities (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
    - Waste Management (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended
    - Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended 2015 (S.I. No. 430 of 2015)
    - European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 191 of 2015)
    - Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended 2000 (S.I. No. 73 of 2000)
    - Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended
    - *European Communities (Transfrontier Shipment of Waste) Regulations 1994 (SI 121 of 1994)*
    - European Union (Properties of Waste which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015) as amended.
2. Environmental Protection Agency Act 1992 (Act No. 7 of 1992) as amended;
3. Litter Pollution Act 1997 (Act No. 12 of 1997) as amended;
4. Eastern-Midlands Waste Region, *Eastern-Midlands Region (EMR) Waste Management Plan 2015 – 2021* (2015)
5. The South Dublin County (SDCC) *'South Dublin County Council Household & Commercial Waste Bye-Laws'(2018).*
6. Department of Environment and Local Government (DoELG) *Waste Management – Changing Our Ways, A Policy Statement* (1998)
7. Department of Environment, Heritage and Local Government (DoEHLG) *Preventing and Recycling Waste - Delivering Change* (2002)
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10. DoECLG, *A Resource Opportunity - Waste Management Policy in Ireland* (2012)
11. Department of Communications, Climate Action and Environment (DCCAE), *Waste Action Plan for the Circular Economy - Ireland's National Waste Policy 2020-2025* (Sept 2020).
12. Environmental Protection Agency (EPA), *National Waste Database Reports 1998 – 2012*.
13. SDCC*, South Dublin County Development Plan 2016 – 2022* (2016)
14. SDCC, *Draft South Dublin County Development Plan 2022 – 2028* (2021)
15. Planning and Development Act 2000 (No. 30 of 2000) as amended.
16. European Waste Catalogue - Council Decision 94/3/EC (as per Council Directive 75/442/EC).
17. Hazardous Waste List - Council Decision 94/904/EC (as per Council Directive 91/689/EEC).

18. EPA, *European Waste Catalogue and Hazardous Waste List* (2002)
19. EPA, *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* (2015)
20. BS 5906:2005 Waste Management in Buildings – Code of Practice.
21. DoHLGH, Sustainable Urban Housing: Design Standards for New Apartments, Guidelines for Planning Authorities (2020).
22. Department of Transport, Tourism and Sport and Department of Housing, Planning and Local Government, *Design Manual for Urban Roads and Streets* (2019).

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Ground Investigation Report

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DOCUMENT CONTROL SHEET

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Engineer	Lohan & Donnelly Consulting Engineers
Project No	10299-12-20
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
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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

1.0 Preamble

On the instructions of Lohan & Donnelly Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd. in January 2021 at the site of the proposed residential development on the Greenhills Road, Dublin 12.

2.0 Overview

2.1. Background

It is proposed to construct new residential development with associated services, access roads and car parking at the proposed site. The site was historically used as a gravel quarry, with a large retaining wall structure marking the southwestern boundary of the site. The site is currently occupied by several derelict industrial/commercial buildings and is situated near the Walkinstown Roundabout, on the southern side of Greenhills Road (R918), Dublin 12. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant.

2.2. Purpose and Scope

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

- Visit project site to observe existing conditions
- Carry out 14 No. Window Sample Boreholes to recover soil samples
- Carry out 10 No. Cable Percussion boreholes to a maximum depth of 4.50m BGL
- Installation of 3 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. Window Sampling

The window sampling was carried out at the locations shown in Figure 2 in Appendix 1 using a Tecopsa SPT Tec 10 percussion drilling rig. The window sampling consists of a 1m long steel tube with a cutting edge and an internal plastic liner which is mechanically driven into the ground utilising a 50kg weight falling a height of 500mm. Upon completion of the 1m sample, the tube is withdrawn and the plastic liner removed and sealed for logging and sub sampling by a Geotechnical Engineer/Engineering Geologist. The tube is replaced in the borehole and a subsequent 1m sample can be recovered. Occasionally outer casing or a reduced diameter tube is utilised to enable the window sample to progress in difficult drilling conditions. Geotechnical or environmental soil samples can be recovered from each of the liners following logging. The window sample records are provided in Appendix 2 of this Report.

3.3. Cable Percussion Boreholes

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

The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata.

Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 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 3 of this Report.

3.4. Surveying

The exploratory hole locations have been recorded using a Trimble R10 GNSS System which records the coordinates and elevation of the locations to ITM, as required by the project specification. In areas where the Trimble R10 GNSS System was unable to record the data due to building interference, observation

methods were used to estimate the exploratory hole location. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.5. 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 on soil samples, as required by the specification, including the Rilta Suite, pH and sulphate testing was carried out by Element Materials Technology Laboratory in the UK. The Rilta Suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria. A number of groundwater samples were also tested by Element, using an indicator parameter suite.
Geotechnical testing consisting of moisture content, Atterberg limits and, Particle Size Distribution (PSD), tests were carried out in NMTL's Geotechnical Laboratory in Carlow.
The results of the completed laboratory are included in Appendix 4 of this Report.

4.0 Ground Conditions

4.1. General

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

The sequence of strata encountered were variable across the site but generally comprised;

- Surfacing
- Made Ground
- Cohesive Deposits
- Granular Deposits

SURFACING: Tarmacadam or Concrete surfacing was present in all exploratory holes and was present to a maximum depth of 0.30m BGL.

MADE GROUND: Made Ground and suspected Made Ground deposits were encountered beneath the surfacing and were present to a depth of between 0.40m and 2.40m BGL, with the full extent of these deposits not determined at BH02, BH02A, BH03, WS02, WS02A, WS02B, WS08, and WS08A. These deposits varied across the site but were generally were described as either a *brown clayey sandy subangular to subrounded fine to coarse Gravel* or a *greyish brown sandy gravelly Clay* and contained *rare fragments of red brick.*

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the made ground and/or surfacing at BH03A, BH04, BH05, BH06, WS03, WS04, WS05, WS09, WS10, and WS11. These deposits were described typically as *dark brown/grey slightly sandy gravelly CLAY with occasional cobbles.* The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had occasional, some or many cobble and boulder content were noted on the exploratory hole logs.

GRANULAR DEPOSITS: Granular deposits were encountered beneath the made ground and/or cohesive deposits at BH01, BH04, BH05, BH06, BH07, BH08, WS01, WS06, and WS07. These deposits were generally described as *grey/brown clayey subangular to subrounded fine to coarse GRAVEL with occasional cobbl*es and *brown clayey gravelly fine to coarse SAND*. The secondary sand/gravel and silt/clay constituents varied across the site and with depth while occasional, some or many cobble and boulder content also present where noted on the exploratory hole logs.
Based on the SPT N values the deposits are typically medium dense and become dense with depth.

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 BH04, BH06 and BH08 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 5 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 low to intermediate plasticity.
The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 19% and 46.2% generally with fines contents of 25.5% to 45%.
The Particle Size Distribution tests confirm that generally the granular deposits are well-graded with percentages of sands and silt/clay typically between 0.3% and 32.7% with a gravel content of typically 46% to 81.2%.

4.3.2. Chemical Laboratory Testing

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water-soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

4.3.3. 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 environmental assessment report is included under the cover of a sperate report by Ground Investigations Ireland.

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

5.0 Recommendations & Conclusions

5.1. General

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

5.2. Foundations

An allowable bearing capacity of 125 kN/m^2 is recommended for conventional strip or pad foundations on the stiff cohesive deposits and medium dense granular deposits at a depth of 2.20m BGL. If a higher bearing capacity is required, an allowable bearing capacity of 250 kN/m^2 is recommended for conventional strip or pad foundations on the very stiff cohesive deposits and dense granular deposits at a depth of 3.00m BGL. For each unit, where granular and cohesive deposits are encountered at foundation level, we recommend that all foundations of the unit in question be lowered to the same stratum to avoid differential settlement. The possibility for variation in the depth of the made ground in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete.

A ground bearing floor slab is recommended to be based on the stiff cohesive deposits or medium dense granular deposits with an appropriate depth of compacted hardcore specified by the consulting engineer and in accordance with the limits and guidelines in SR21:2014+A1:2016 and/or NRA SRW CL808 Type E granular stone fill. Where the depth of Made Ground/Soft deposits exceeds 0.90m then suspended floor slabs should be considered.

The pH and sulphate testing completed on samples recovered from the exploratory holes indicates the pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. No special precautions are required for concrete foundations to prevent sulphate attack. The samples tested were below the limits of DS1 in the BRE Special Digest 1:2005.

Due to the high loading anticipated, piled foundations may be more economically advantageous for the proposed buildings. 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.

5.3. Excavations

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

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

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.

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 Environmental Assessment Report.

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 - Figures

Site Location

Indicative Site Boundary

Client:

Project Code:
10299-12-20

Project Title:
Greenhills Road

Drawing Title:
Figure 1 Site Location

GROUND INVESTIGATIONS IRELAND
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0 15 30 45 60 75 m

Drawn By:	Date:
BS	14-01-2021

Indicative Site Boundary

Borehole

Window Sample

Client:

L&D

Project Code:

10299-12-20

Project Title:

Greenhills Road

Drawing Title:

Figure 5 SI Points

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0 15 30 45 60 75 m

Drawn By:	Date:
SG	21-01-2021

APPENDIX 2 – Window Sample Records

Ground Investigations Ireland Ltd
www.gii.ie

Site	Number
Greenhills Road	WS01

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	85mm to 2.00m 65mm to 3.00m	58.28	Lohan and Donnelly	10299-12-20
	Location	**Dates**	**Project Contractor**	**Sheet**
	710701.7 E 730493.4 N	18/01/2021	GII	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				58.16	(0.12) 0.12	TARMACADAM		
				58.08	(0.08) 0.20	MADE GROUND: Grey silty sandy subangular to subrounded fine to coarse Gravel		
				57.88	(0.20) 0.40	MADE GROUND: Brown slightly clayey sandy subangular fine to coarse Gravel		
0.50	ES01			57.48	(0.40) 0.80	MADE GROUND: Brown slightly gravelly clayey fine to coarse Sand with rare fragments of red brick		
1.50	ES02			55.88	(1.60) 2.40	Possible MADE GROUND: Brown slightly sandy slightly gravelly Clay with occasional cobbles		
2.80	ES03			55.28	(0.60) 3.00	Brown gravelly very clayey fine to coarse SAND. Gravel is subrounded fine to coarse		
						Complete at 3.00m		

Remarks	Scale (approx)	Logged By
Borehole backfilled upon completion	1:25	SG
	Figure No.	
	10299-12-20.WS01	

Ground Investigations Ireland Ltd www.gii.ie		Site Greenhills Road	Number **WS02**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 0.40m	**Ground Level (mOD)** 57.98	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710696.6 E 730528.8 N	**Dates** 18/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				57.86	(0.12) 0.12	TARMACADAM		
				57.68	(0.18) 0.30	TARMACADAM		
				57.58	(0.10) 0.40	MADE GROUND: Grey silty sandy Subangular fine to coarse Gravel		
						Complete at 0.40m		

Remarks	Scale (approx)	Logged By
Unable to advance borehole due to possible boulder	1:25	SG
	Figure No. 10299-12-20.WS02	

Ground Investigations Ireland Ltd www.gii.ie			Site Greenhills Road	Number **WS02A**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 0.40m	**Ground Level (mOD)** 57.94	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710700.6 E 730527.3 N	**Dates** 18/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				57.82	(0.12) 0.12	TARMACADAM		
				57.64	(0.18) 0.30	TARMACADAM		
				57.54	(0.10) 0.40	MADE GROUND: Grey silty sandy Subangular fine to coarse Gravel		
						Complete at 0.40m		

Remarks
Unable to advance borehole due to possible boulder

Scale (approx)	Logged By
1:25	SG

Figure No.
10299-12-20.WS02a

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Number: WS02B
Excavation Method: Drive-in Windowless Sampler	Dimensions: 85mm to 0.40m	Ground Level (mOD): 57.98
Client: Lohan and Donnelly	Job Number: 10299-12-20	
Location: 710691.4 E 730524.3 N	Dates: 20/01/2021	Project Contractor: GII
Sheet: 1/1		

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				57.86	(0.12) 0.12	TARMACADAM		
				57.68	(0.18) 0.30	TARMACADAM		
				57.58	(0.10) 0.40	MADE GROUND: Grey silty sandy Subangular fine to coarse Gravel		
						Complete at 0.40m		

Remarks
Unable to advance borehole due to possible boulder

Scale (approx)	Logged By
1:25	SG

Figure No.
10299-12-20.WS02b

Ground Investigations Ireland Ltd
www.gii.ie

Site	Number
Greenhills Road	WS03

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	85mm to 2.00m 65mm to 3.00m		Lohan and Donnelly	10299-12-20
	Location	**Dates**	**Project Contractor**	**Sheet**
	710717.6 E 730562.5 N	18/01/2021	GII	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.23) 0.23	CONCRETE		
0.50	ES04				(0.47) 0.70	Possible MADE GROUND: Brown very clayey very sandy subangular to subrounded fine to coarse Gravel		
					(0.50) 1.20	Possible MADE GROUND: Dark brown slightly sandy slightly gravelly Clay		
1.50	ES05				(1.30) 2.50	Grey slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse Moderate hydrocarbon odour		
					(0.50) 3.00	Brown clayey sandy subangular to subrounded fine to coarse GRAVEL		
3.00	ES06					Complete at 3.00m		

Remarks
Borehole backfilled upon completion

Scale (approx)	Logged By
1:25	SG

Figure No.
10299-12-20.WS03

Ground Investigations Ireland Ltd www.gii.ie		Site: Greenhills Road	Number: **WS04**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m 65mm to 3.00m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710707.6 E 730590.2 N	**Dates** 18/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.22) 0.22	CONCRETE		
0.30	ES07					Possible MADE GROUND: Brown clayey very sandy subangular fine to coarse Gravel with occassional cobbles Mild hydrocarbon odour		
1.30	ES08				(1.28) 1.50			
					(0.50) 2.00	Dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse		
					(0.80) 2.80	Light brown slightly clayey very sandy subangular to subrounded fine to coarse GRAVEL		
					(0.20) 3.00	Light brown slightly clayey very sandy subrounded fine to coarse GRAVEL		
						Complete at 3.00m		

Remarks
Borehole backfilled upon completion

Scale (approx)	Logged By
1:25	SG

Figure No. 10299-12-20.WS04

Ground Investigations Ireland Ltd www.gii.ie			Site: Greenhills Road	Number: WS05
Excavation Method: Drive-in Windowless Sampler	Dimensions: 85mm to 2.00m 65mm to 2.80m	Ground Level (mOD):	Client: Lohan and Donnelly	Job Number: 10299-12-20
	Location: 710747.7 E 730588.6 N	Dates: 18/01/2021	Project Contractor: GII	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.22) 0.22	CONCRETE		
					(0.28) 0.50	Possible MADE GROUND: Brown clayey sandy subangular fine to coarse Gravel		
1.50	ES09				(1.50) 2.00	Possible MADE GROUND: Dark brown clayey very sandy subangular fine to coarse Gravel		
2.10	ES10				(0.40) 2.40	Brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse		
					(0.40) 2.80	Black slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse		
						Complete at 2.80m		

Remarks	Scale (approx)	Logged By
Refusal at 2.80m BGL Borehole backfilled upon completion	1:25	SG
	Figure No. 10299-12-20.WS05	

Ground Investigations Ireland Ltd www.gii.ie	Site Greenhills Road		Number **WS06**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710784.5 E 730591.2 N	**Dates** 19/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	TARMACADAM		
					(0.25) 0.30	MADE GROUND: Red clayey very sandy subangular to subrounded fine to coarse Gravel		
					(0.15) 0.45	Possible MADE GROUND: Brown slightly sandy slightly gravelly Clay		
					(0.55) 1.00	Possible MADE GROUND: Brown clayey very gravelly fine to coarse Sand		
1.00	ES12				(1.00) 2.00	Dark brown clayey very gravelly fine to coarse SAND. Gravel is aubangular to subrounded fine to coarse		
2.00	ES13					Complete at 2.00m		

Remarks
Refusal at 2.00m BGL
Borehole backfilled upon completion

Scale (approx)	Logged By
1:25	SG

Figure No.
10299-12-20.WS06

Ground Investigations Ireland Ltd www.gii.ie			Site Greenhills Road	Number **WS07**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m 65mm to 2.30m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710772.3 E 730620.9 N	**Dates** 19/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	CONCRETE		
0.20-1.00	ES11				(1.80) 2.00	Recovered as; MADE GROUND: Brown sandy gravelly Clay with rare fragments of red brick		
					(0.30) 2.30	Recovered as; Dark brown clayey sandy subangular to subrounded fine to coarse GRAVEL		
						Complete at 2.30m		

Remarks Refusal at 2.30 Borehole backfilled upon completion	**Scale (approx)** 1:25	**Logged By** SG
	Figure No. 10299-12-20.WS07	

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Number: **WS08**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler	85mm to 1.00m		Lohan and Donnelly	10299-12-20
	Location: 710801.2 E 730635.6 N	**Dates**: 20/01/2021	**Project Contractor**: GII	**Sheet**: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.18) 0.18	CONCRETE		
					(0.42) 0.60	MADE GROUND: Brown slightly sandy slightly gravelly Clay with rare fragments of red brick		
					(0.40) 1.00	Possible MADE GROUND: Grey clayey sandy subangular to subrounded fine to coarse Gravel with occasional cobbles		
						Complete at 1.00m		

Remarks	Scale (approx)	Logged By
Refusal at 1.00m BGL Borehole backfilled upon completion	1:25	SG
	Figure No. 10299-12-20.WS08	

Ground Investigations Ireland Ltd www.gii.ie			Site: Greenhills Road	Number: **WS08A**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 1.40m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710806.2 E 730632.5 N	**Dates** 20/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	CONCRETE		
					0.20	MADE GROUND: Brown slightly sandy slightly gravelly Clay with rare fragments of red brick		
					(0.55)			
					0.75	MADE GROUND: Grey clayey very sandy subrounded fine to coarse Gravel with rare fragments of red brick		
1.00	ES21				(0.65)			
					1.40	Complete at 1.40m		

Remarks
Refusal at 1.40m BGL
Borehole backfilled upon completion

Scale (approx)	Logged By
1:25	SG

Figure No. 10299-12-20.WS08a

Ground Investigations Ireland Ltd www.gii.ie			Site: Greenhills Road	Number: **WS09**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m 65mm to 3.00m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710829.4 E 730651.4 N	**Dates** 19/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	CONCRETE		
					(0.55) 0.75	Possible MADE GROUND: Brown slightly sandy gravelly Clay		
					(0.25) 1.00	Possible MADE GROUND: Greyish brown slightly clayey sandy subrounded fine to coarse Gravel		
					(0.70) 1.70	Possible MADE GROUND: Brown slightly sandy gravelly Clay		
1.70	ES14				(0.50) 2.20	Possible MADE GROUND: Dark brown clayey gravelly fine to coarse Sand		
2.50	ES15				(0.50) 2.70	Brown slightly gravelly very sandy SILT. Gravel is subrounded fine to coarse		
					(0.30) 3.00	Brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse		
						Complete at 3.00m		

Remarks	**Scale (approx)**	**Logged By**
Borehole backfilled upon completion	1:25	SG
	Figure No. 10299-12-20.WS09	

Ground Investigations Ireland Ltd www.gii.ie			Site Greenhills Road	Number **WS10**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m 65mm to 2.60m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710808 E 730604.9 N	**Dates** 19/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	TARMACADAM		
0.50	ES16				(1.05)	MADE GROUND: Dark brown slightly sandy slightly gravelly Clay with rare fragments of red brick		
					1.10			
2.00	ES17				(1.50)	Dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse		
					2.60	Complete at 2.60m		

Remarks	Scale (approx)	Logged By
Refusal at 2.60m BGL Borehole backfilled upon completion	1:25	SG
	Figure No. 10299-12-20.WS10	

Ground Investigations Ireland Ltd www.gii.ie			Site: Greenhills Road	Number: **WS11**
Excavation Method Drive-in Windowless Sampler	**Dimensions** 85mm to 2.00m 65mm to 2.80m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710835.1 E 730616.7 N	**Dates** 20/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	TARMACADAM		
					(0.45) 0.50	MADE GROUND: Brown clayey sandy subangular to subrounded fine to coarse Gravel		
					(0.30) 0.80	Possible MADE GROUND: Brown slightly sandy slightly gravelly Clay		
0.80	ES18				(0.40) 1.20	Possible MADE GROUND: Brown gravelly very clayey fine to coarse Sand		
					(0.10) 1.30	Brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse		
1.50	ES19				(0.35) 1.65	Greyish brown slightly gravelly silty fine to coarse SAND. Gravel subrounded fine to medium		
					(0.35) 2.00	Brown slightly gravelly silty sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to medium		
2.50	ES20				(0.80) 2.80	Brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse Moderate hydrocarbon odour		
						Complete at 2.80m		

Remarks
Refusal at 2.80m BGL
Borehole backfilled upon completion

Scale (approx)	Logged By
1:25	SG

Figure No. 10299-12-20.WS11

Greenhills Road – Window Sample Core Photographs

WS01

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 3.00m BGL)

WS03

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 3.00m BGL)

Greenhills Road – Window Sample Core Photographs

WS04

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 3.00m BGL)

WS05

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 2.80m BGL)

Greenhills Road – Window Sample Core Photographs

WS06

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

WS07

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 2.30m BGL)

Greenhills Road – Window Sample Core Photographs

WS08

(0.00 – 1.00m BGL)

WS08a

(0.00 – 1.00m BGL)

(1.00 – 1.40m BGL)

WS09

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

Greenhills Road – Window Sample Core Photographs

(2.00 – 3.00m BGL)

WS10

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 2.60m BGL)

WS11

(0.00 – 1.00m BGL)

(1.00 – 2.00m BGL)

(2.00 – 2.80m BGL)

APPENDIX 3 – Cable Percussion Borehole Records

Ground Investigations Ireland Ltd www.gii.ie		Site: Greenhills Road	Borehole Number: BH-01
Machine : Dando 2000 Method : Cable Percussion	Casing Diameter: 200mm cased to 4.50m Ground Level (mOD): 58.84	Client: Lohan and Donnelly	Job Number: 10299-12-20
	Location (dGPS): 710668.2 E 730490.5 N Dates: 20/01/2021-25/01/2021	Project Contractor: GII	Sheet: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					58.74	0.10	TARMACADAM		
0.10 0.20	B01 ES01				58.64	0.20	MADE GROUND: Brown slightly silty slightly gravelly fine to coarse Sand		
					58.54	0.30 (0.50)	Drillers note: MADE GROUND: 804 fill		
					58.04	0.80	Drillers Note: Brown clayey fine Sand		
1.00-1.21 1.00	SPT(C) 50/60 B02			7,9/50		(2.20)	Dense grey very sandy subangular to subrounded fine to coarse GRAVEL		
2.00-2.45 2.00	SPT(C) N=41 B03			7,7/9,10,10,12					
3.00-3.45 3.00	SPT(C) N=49 B04			7,10/19,9,9,12	55.84	3.00 (1.00)	Dense grey sandy subangular to subrounded fine to coarse GRAVEL with occasional subrounded cobbles and some bands of brown slightly sandy slightly gravelly Clay		▼1
4.00-4.06 4.00	SPT(C) 25*/20 50/40 B05			25/50	54.84	4.00 (0.50)	Dense grey slightly sandy subangular fine to coarse GRAVEL with some subangular to subrounded cobbles		
				Water strike(1) at 4.50m, rose to 3.00m in 20 mins.	54.34	4.50	Complete at 4.50m		∇1

Remarks
BH-01 terminated at 4.50m BGL due to obstruction.
Chiselling from 4.50m to 4.50m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No. 10299-12-20.BH-01

Ground Investigations Ireland Ltd www.gii.ie				Site: Greenhills Road		Borehole Number: BH-02
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 0.70m	**Ground Level (mOD)** 58.02		**Client** Lohan and Donnelly		**Job Number** 10299-12-20
	Location (dGPS) 710724.1 E 730510.2 N	**Dates** 25/01/2021		**Project Contractor** GII		**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					57.89	(0.13) 0.13	TARMACADAM		
0.50	B01				57.32	(0.57) 0.70	MADE GROUND: Brown slightly clayey very sandy subangular to subrounded fine to coarse GRAVEL with occasional subangular to subrounded cobbles		
							Complete at 0.70m		

Remarks
BH-02 terminated at 0.70m BGL due to obstruction.
Offset location and re-drill BH-02a
Chiselling from 0.70m to 0.70m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No. 10299-12-20.BH-02

Ground Investigations Ireland Ltd www.gii.ie	Site Greenhills Road	Borehole Number BH-02A

Machine : Dando 2000 Method : Cable Percussion	Casing Diameter 200mm cased to 0.80m	Ground Level (mOD) 58.00	Client Lohan and Donnelly	Job Number 10299-12-20
	Location	Dates 28/01/2021	Project Contractor GII	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES01				57.90	0.10	TARMACADAM		
0.50	B01					(0.70)	MADE GROUND: Light brown slightly sandy gravelly Clay with occasional subangular to suborunded cobbles		
					57.20	0.80	Complete at 0.80m		

Remarks
BH-02A terminated at 1.20m BGL due to obstruction.
Chiselling from 0.80m to 0.80m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No.
10299-12-20.BH-02A

Ground Investigations Ireland Ltd www.gii.ie		Site Greenhills Road	Borehole Number **BH-03**
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 1.80m	**Ground Level (mOD)** 56.81	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location (dGPS) 710761.6 E 730546.6 N	**Dates** 25/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					56.65	0.16 (0.16)	CONCRETE		
0.50	B01					(1.04)	MADE GROUND: Brown clayey gravelly fine to coarse Sand with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
1.00-1.29 1.00 1.00	SPT(C) 50/135 B02 ES01			1,2/19,31	55.61	1.20			
						(0.60)	Drillers note: Pushing cobble in front of casing. No recovery		
					55.01	1.80	Complete at 1.80m		

Remarks
BH-03 terminated at 1.80m BGL due to obstruction.
Offset location and re-drill BH-03a
Chiselling from 1.20m to 1.80m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No.
10299-12-20.BH-03

Ground Investigations Ireland Ltd www.gii.ie		Site Greenhills Road	Borehole Number BH-03A
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 1.20m	**Ground Level (mOD)**	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location	**Dates** 28/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.20	ES01					0.10	TARMACADAM		
0.50 0.50	B01 ES02					(0.90)	Possible MADE GROUND: Light brown slightly sandy slightly gravelly silty CLAY with occasional subangular to suborunded cobbles. Gravel is subangular to subrounded fine to coarse		
1.00-1.45 1.00	SPT(C) N=50 B02			6,7/14,22,14		1.00 (0.20) 1.20	Very stiff light brown slightly sandy slightly gravelly silty CLAY with occasional subangular to suborunded cobbles. Gravel is subangular to subrounded fine to coarse		
							Complete at 1.20m		

Remarks	Scale (approx)	Logged By
BH-03A terminated at 1.20m BGL due to obstruction. Chiselling from 1.20m to 1.20m for 1 hour.	1:50	PM
	Figure No. 10299-12-20.BH-03A	

Ground Investigations Ireland Ltd
www.gii.ie

Site Greenhills Road				**Borehole Number** BH-04
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 3.30m	**Ground Level (mOD)** 56.50	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location 710728.4 E 730621.4 N	**Dates** 27/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.70	ES01				56.30	(0.20) 0.20	TARMACADAM			
0.50	B01						Soft to firm light brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
1.00-1.45 1.00	SPT(C) N=8 B02			1,1/1,2,2,3		(1.50)				
1.70-3.00	ES02				54.80	1.70	Medium dense dark brown slightly clayey slightly gravelly SAND. Gravel is subangular to subrounded fine to coarse			
2.00-2.45 2.00	SPT(C) N=32 B03			3,3/6,7,10,9		(0.50)				
					54.30	2.20	Very stiff dark brown gravelly very sandy CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		▼1	
						(0.80)				
3.00-3.45 3.00 3.30	SPT(C) N=50 B04 B05			17,9/19,31 Water strike(1) at 3.20m, rose to 2.50m in 20 mins.	53.50	3.00 (0.30)	Dense grey slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL		∇1	
					53.20	3.30	Complete at 3.30m			

Remarks
BH-04 terminated at 3.30m BGL due to obstruction.
50mm slotted standpipe installed from 3.80m to 1.00m BGL with pea gravel surrond, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover
Chiselling from 3.30m to 3.30m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 10299-12-20.BH-04

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Borehole Number: BH-05
Machine : Dando 2000; Method : Cable Percussion	Casing Diameter: 200mm cased to 3.20m; Ground Level (mOD): 56.30; Client: Lohan and Donnelly	Job Number: 10299-12-20
	Location: 710790.6 E 730600.4 N; Dates: 27/01/2021; Project Contractor: GII	Sheet: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES01				56.10	(0.20) 0.20	CONCRETE		
					55.80	(0.30) 0.50	POSSIBLE MADE GROUND: Dark brown slightly silty slightly sandy slightly gravelly Clay		
0.50 0.50-2.40	B01 ES02								
1.00-1.45 1.00	SPT(C) N=5 B02			1,0/1,1,1,2	54.30	(1.50) 2.00	Soft dark brown mottled grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		
2.00-2.45 2.00	SPT(C) N=17 B03			1,2/3,4,4,6	53.90	(0.40) 2.40	Stiff dark brown mottled grey slightly silty slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse		▼1
2.40-3.00	ES03				53.30	(0.60) 3.00	Stiff dark grey mottled brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse		
3.00-3.40 3.00	SPT(C) 50*/100 N=50 B04			50/50 Water strike(1) at 3.20m, rose to 2.20m in 20 mins.	53.10	(0.20) 3.20	Dense grey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles		∇1
							Complete at 3.20m		

Remarks
BH-05 terminated at 3.20m BGL due to obstruction.
Chiselling from 3.00m to 3.20m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 10299-12-20.BH-05

Ground Investigations Ireland Ltd www.gii.ie	Site: Greenhills Road	Borehole Number: BH-06

Machine : Dando 2000 / Method : Cable Percussion	Casing Diameter: 200mm cased to 3.30m	Ground Level (mOD): 55.97	Client: Lohan and Donnelly	Job Number: 10299-12-20
	Location: 710836.6 E 730597.5 N	Dates: 27/01/2021	Project Contractor: GII	Sheet: 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.30	ES01				55.87	0.10	TARMACADAM			
0.30-0.80	ES02				55.67	(0.20) 0.30	MADE GROUND: Dark brown slightly silty sandy fine to coarse subangular to subrounded Gravel			
0.50	B01					(0.50)				
0.80-3.00	ES03				55.17	0.80	POSSIBLE MADE GROUND: Greyish brown slightly silty slightly gravelly sandy Clay with occasional subangular to subrounded cobbles. (reworked)			
1.00-1.45 1.00	SPT(C) N=5 B02			1,0/1,1,1,2		(1.20)	Soft dark brown slightly sandy slightly gravelly silty CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
2.00-2.45 2.00	SPT(C) N=17 B03			1,2/3,4,4,6	53.97	2.00 (0.70)	Stiff dark brown slightly sandy slightly gravelly silty CLAY with occasional subangular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse			
				Water strike(1) at 2.70m, fell to 3.20m in 20 mins.	53.27	2.70 (0.60)	Dense grey slightly sandy silty subangular to subrounded fine to coarse GRAVEL Strong hydrocarbon odour odour noted at 3.30m BGL		∇1 ▼1	
3.00 3.00-3.40 3.00-3.30	B04 SPT(C) 50*/100 N=50 ES04			50/50	52.67	3.30	Complete at 3.30m			

Remarks
Strong hydrocarbon odour noted at 3.30m BGL.
BH-06 terminated at 3.30m BGL due to obstruction.
50mm slotted standpipe installed from 3.30m to 1.00m BGL with pea gravel surrond, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover
Chiselling from 1.20m to 1.20m for 1 hour.

Scale (approx)	Logged By
1:50	PM

Figure No. 10299-12-20.BH-06

Ground Investigations Ireland Ltd www.gii.ie		Site: Greenhills Road	Borehole Number: **BH-07**
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter:** 200mm cased to 3.10m **Ground Level (mOD):** 55.57	**Client:** Lohan and Donnelly	**Job Number:** 10299-12-20
	Location (dGPS): 710845.7 E 730676.7 N **Dates:** 26/01/2021	**Project Contractor:** GII	**Sheet:** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					55.52	0.05	TARMACADAM		
0.50	B01					(1.25)	Possible MADE GROUND: Brown gravelly very clayey fine to coarse Sand		
1.00-1.45 1.00 1.00	SPT(C) N=15 B02 ES01			3,3/4,3,4,4					
					54.27	1.30 (0.70)	Medium dense grey sandy subangular to subrounded fine to coarse GRAVEL		
2.00-2.44 2.00	SPT(C) 50/285 B03			6,9/10,12,14,14	53.57	2.00 (0.60)	Dense grey sandy subangular to subrounded fine to coarse GRAVEL		
					52.97	2.60 (0.50)	Dense grey subangular to subrounded coarse GRAVEL with some to many subangular to subrounded cobbles		
3.00-3.12 3.00	SPT(C) 25*/100 50/20 B04			17,8/50	52.47	3.10	Complete at 3.10m		

Remarks
BH-07 terminated at 3.10m BGL due to obstruction.
Chiselling from 3.10m to 3.10m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No. 10299-12-20.BH-07

Ground Investigations Ireland Ltd www.gii.ie			Site Greenhills Road	Borehole Number **BH-08**
Machine : Dando 2000 **Method :** Cable Percussion	**Casing Diameter** 200mm cased to 3.80m	**Ground Level (mOD)** 55.36	**Client** Lohan and Donnelly	**Job Number** 10299-12-20
	Location (dGPS) 710867.4 E 730633.6 N	**Dates** 26/01/2021	**Project Contractor** GII	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					55.26	0.10	TARMACADAM			
					55.06	(0.20) 0.30	Drillers Note: MADE GROUND: Gravel			
0.50	B01					(0.60)	MADE GROUND: Orangish brown slightly sandy slightly gravelly CLAY with organic odour			
1.00-1.45 1.00	SPT(C) N=20 B02			2,2/3,5,6,6	54.46	0.90 (0.70)	Medium dense dark brown clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse			
					53.76	1.60 (0.50)	Medium dense brown slightly gravelly very silty fine to coarse SAND. Gravel is subrounded fine to coarse			
2.00-2.45 2.00 2.00	SPT(C) N=14 B03 ES01			2,2/3,3,4,4	53.26	2.10 (0.40)	Drillers note: Brown sandy gravelly Clay (stiff)			
					52.86	2.50 (0.20)	Drillers note: pushing cobble in front of casing. No recovery			
3.00 3.00-3.29	B04 SPT(C) 50/135			Water strike(1) at 3.00m, rose to 2.90m in 20 mins, sealed at 3.20m. 6,9/17,33	52.66	2.70 (1.10)	Very stiff grey slightly sandy slightly gravelly CLAY. Gravely is subangular to subrounded fine to coarse		1 1	
3.80 3.80	B05 ES02				51.56	3.80	Complete at 3.80m			

Remarks
50mm slotted standpipe installed from 3.80m to 1.00m BGL with pea gravel surrond, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover
BH-08 terminated at 3.80m BGL due to obstruction.
Chiselling from 3.80m to 3.80m for 1 hour.

Scale (approx)	Logged By
1:50	SG

Figure No.
10299-12-20.BH-08

APPENDIX 4 – Laboratory Testing

National Materials Testing Laboratory Ltd.

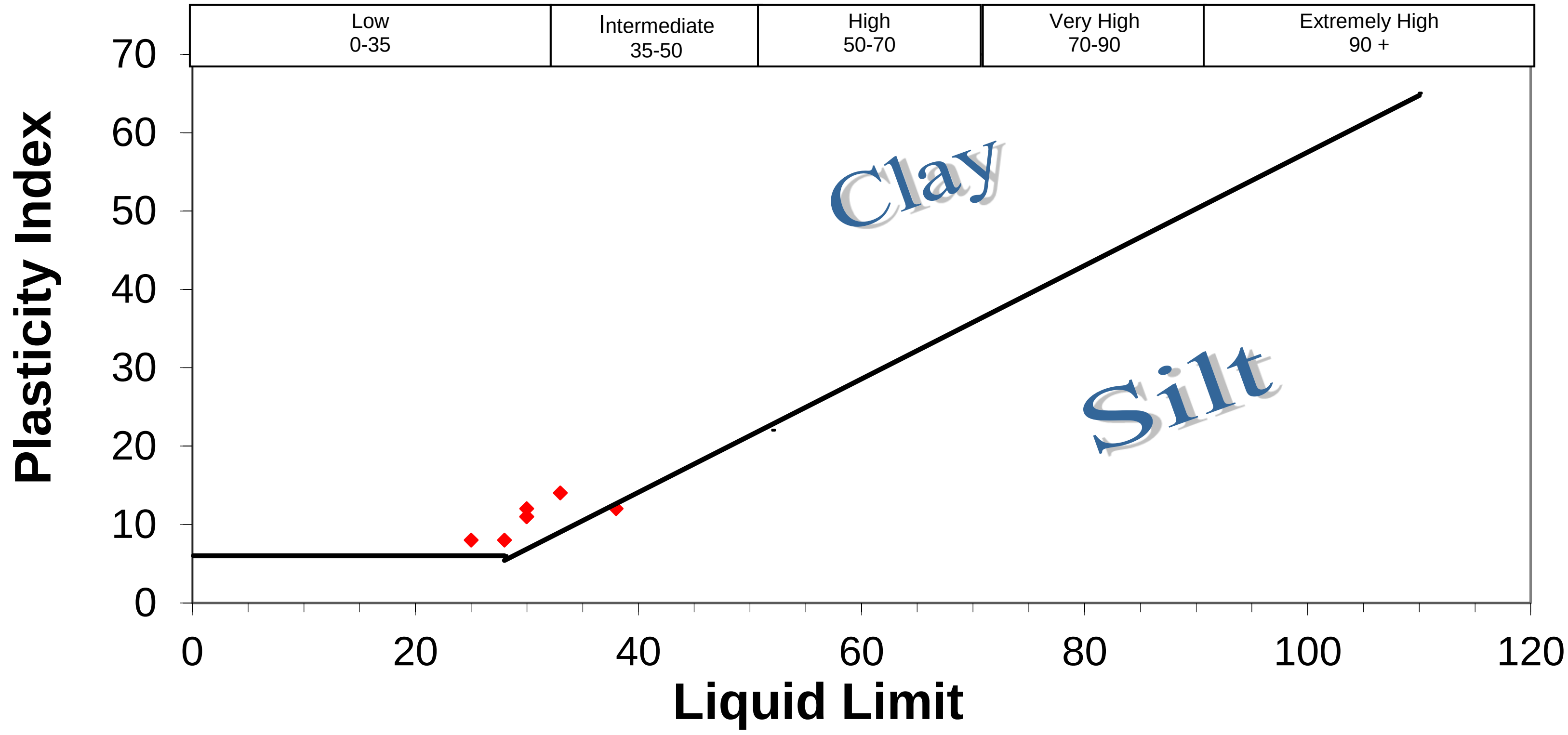
SUMMARY OF TEST RESULTS

BH/TP No	Depth m	sample No.	Moisture %	Particle Density Mg/m3	<425um %	LL %	Index Properties PL %	PI %	Bulk Density Mg/m3	Cell Presssure kPa	Undrained Triaxial Tests Compressive Stress kPa	Strain at Failure %	Lab Vane kPa	Remarks
BH01	2.00	B	4.0											
BH04	1.00	B	13.0		19.8	38	26	12						
BH04	2.00	B	11.4		29.8	25	17	8						
BH05	1.00	B	15.2		43.4	30	19	11						
BH05	2.00	B	14.9		63.3	30	19	11						
BH06	1.00	B	12.6		51.5	30	18	12						
BH06	2.00	B	15.1		58.2	33	19	14						
BH07	2.00	B	2.6											
BH08	1.00	B	13.2											
BH08	3.00	B	15.2		46.2	28	20	8						

NMTL		Notes :	Job ref No.	NMTL 3351	GII Project ID:	10299-12-20
		1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Greenhills Road		

Revision-02

NMTL LTD	**Contract:**	**Greenhills Road**	
Unit 18c, Tullow Industrial Estate	**Client:**	**Ground Investigations Ireland Ltd**	
Tullow	**Engineer:**	**James Cashen**	
County Carlow	**GII Project ID**	**10299-12-20**	
Tel: 00353 59 9180822	**Date:**	**01/03/2021**	
Mob: 00353 872575508	**Tested By:**	**Sb/Tch/Ms**	**Checked: Bc**
billa@nmtl.ie	**Job ref No.**	**NMTL 3351**	



NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	77.7
50.000	70.7
37.500	59.9
28.000	59.2
20.000	53.8
14.000	47.8
10.000	41.7
6.300	32.8
5.000	28.9
3.350	23.8
2.000	16.8
1.180	10.4
0.600	5.1
0.425	3.0
0.300	1.7
0.212	1.0
0.150	0.7
0.063	0.3

Determination of Particle Size Distribution

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

Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	0.3			16.4			61.0			22.3	0.0

Sample Description Grey sandy fine to coarse GRAVEL.

Project No. NMTL 3351

BH/TP No. BH01

Project Greenhills Road

GII PROJECT ID:10299-12-20

Sample No. B

NM TL Ltd

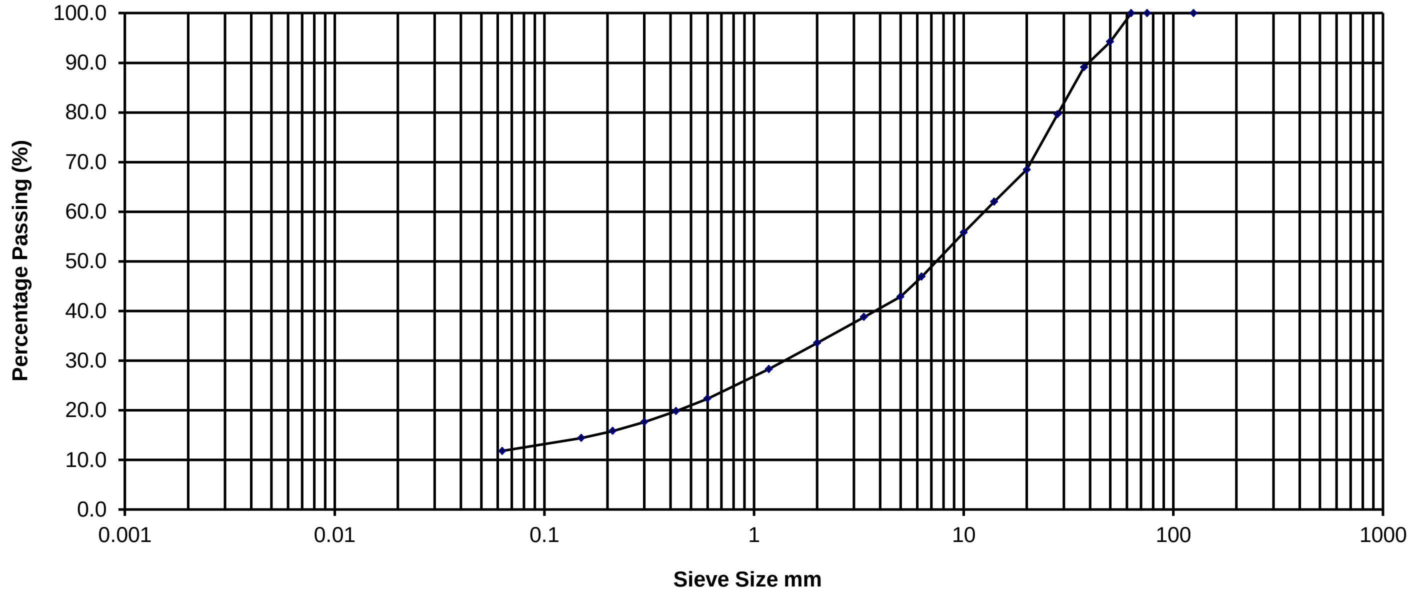
Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021	Depth	2.0m

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	94.2
37.500	89.1
28.000	79.6
20.000	68.5
14.000	62.0
10.000	55.8
6.300	46.9
5.000	42.9
3.350	38.8
2.000	33.6
1.180	28.3
0.600	22.4
0.425	19.8
0.300	17.6
0.212	15.8
0.150	14.4
0.063	11.8

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	11.8			21.8			66.4			0.0	0.0

Sample Description Brown clayey silty sandy GRAVEL.

Project Greenhills Road GII PROJECT ID:10299-12-20

Project No.	NMTL 3351
BH/TP No.	BH04
Sample No.	B
Depth	1.0m

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021

NM TL Ltd

NMTL Ltd

Determination of Particle Size Distribution

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

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	92.6
50.000	80.0
37.500	76.2
28.000	71.5
20.000	66.8
14.000	63.6
10.000	60.0
6.300	55.5
5.000	53.6
3.350	51.6
2.000	46.6
1.180	40.9
0.600	33.3
0.425	29.8
0.300	26.5
0.212	23.6
0.150	21.1
0.063	16.3

Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	16.3	30.3	46.0	7.4	0.0

Sample Description Brown silty clayey very sandy GRAVEL.

Project No. NMTL 3351

BH/TP No. BH04

Project Greenhills Road

GII PROJECT ID:10299-12-20

Sample No. B

NM TL Ltd

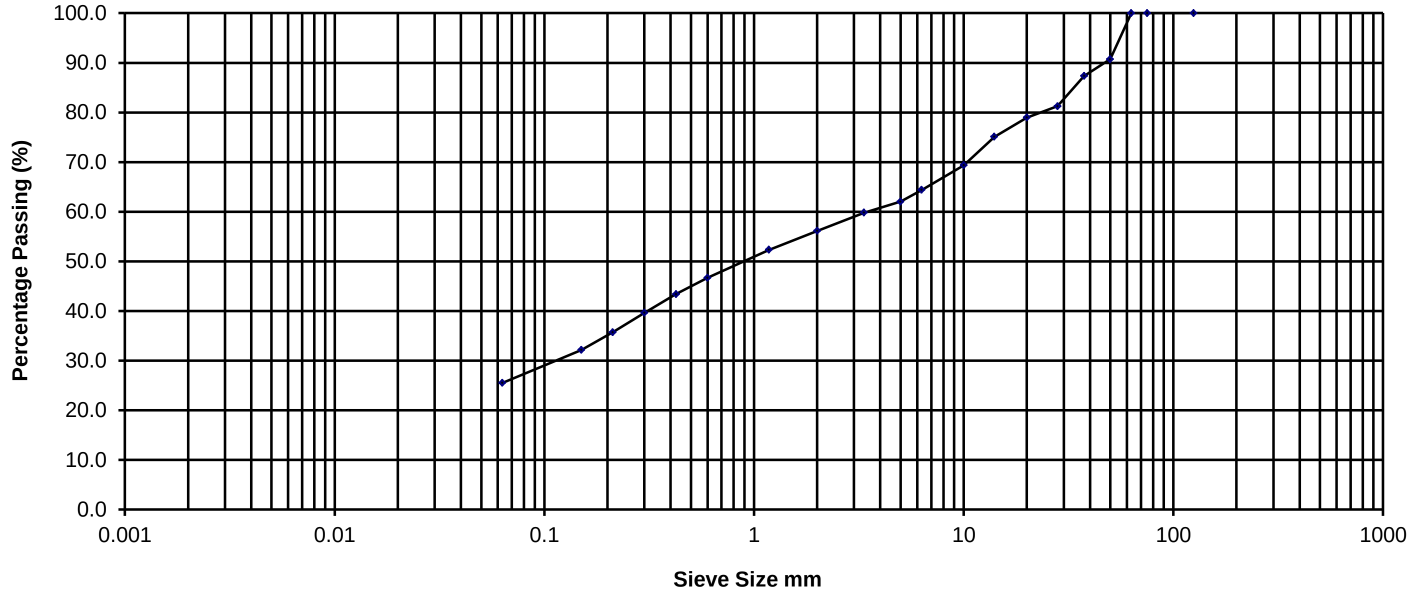
Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021	Depth	3.0m

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	90.7
37.500	87.3
28.000	81.3
20.000	79.0
14.000	75.1
10.000	69.3
6.300	64.4
5.000	62.0
3.350	59.8
2.000	56.1
1.180	52.3
0.600	46.7
0.425	43.4
0.300	39.6
0.212	35.7
0.150	32.1
0.063	25.5

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
		25.5			30.7			43.9		0.0	0.0

Sample Description Brown slightly sandy gravelly silty CLAY.

Project Greenhills Road GII PROJECT ID:10299-12-20

Project No.	NMTL 3351
BH/TP No.	BH05
Sample No.	B
Depth	1.00m

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021

NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	98.5
28.000	96.2
20.000	94.9
14.000	89.5
10.000	88.5
6.300	84.6
5.000	82.5
3.350	79.6
2.000	75.5
1.180	71.3
0.600	66.0
0.425	63.3
0.300	60.6
0.212	57.5
0.150	54.0
0.063	45.0

Determination of Particle Size Distribution

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

Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	45.0	30.5	24.5	0.0	0.0

Sample Description Brown slightly gravelly slightly sandy silty CLAY.

Project No. NMTL 3351

BH/TP No. BH05

Project Greenhills Road GII PROJECT ID:10299-12-20

Sample No. B

NM TL Ltd

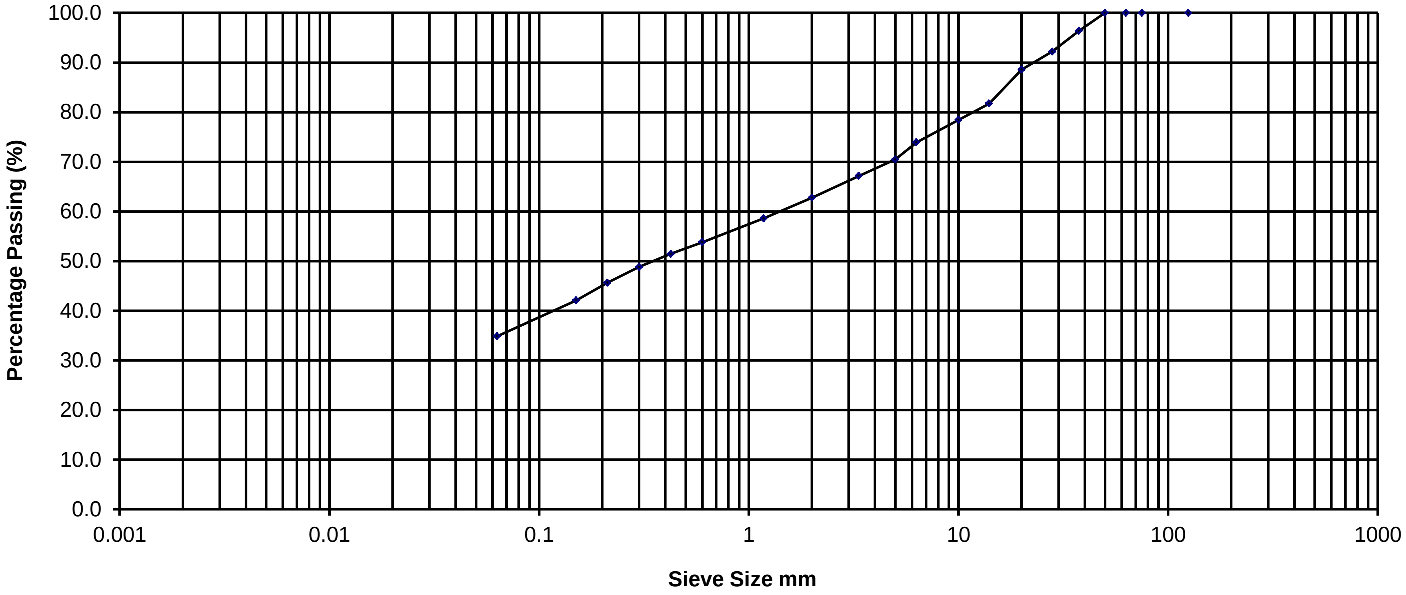
Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021	Depth	2.00m

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	96.4
28.000	92.2
20.000	88.6
14.000	81.7
10.000	78.5
6.300	73.9
5.000	70.5
3.350	67.2
2.000	62.8
1.180	58.6
0.600	53.8
0.425	51.5
0.300	48.8
0.212	45.7
0.150	42.1
0.063	34.9

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	34.9			27.9			37.2			0.0	0.0

Sample Description: Brown slightly sandy slightly gravelly silty CLAY.

Project: Greenhills Road — GII PROJECT ID:10299-12-20

Project No.	NMTL 3351	BH/TP No.	BH06
Sample No.	B	Depth	1.0m

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021

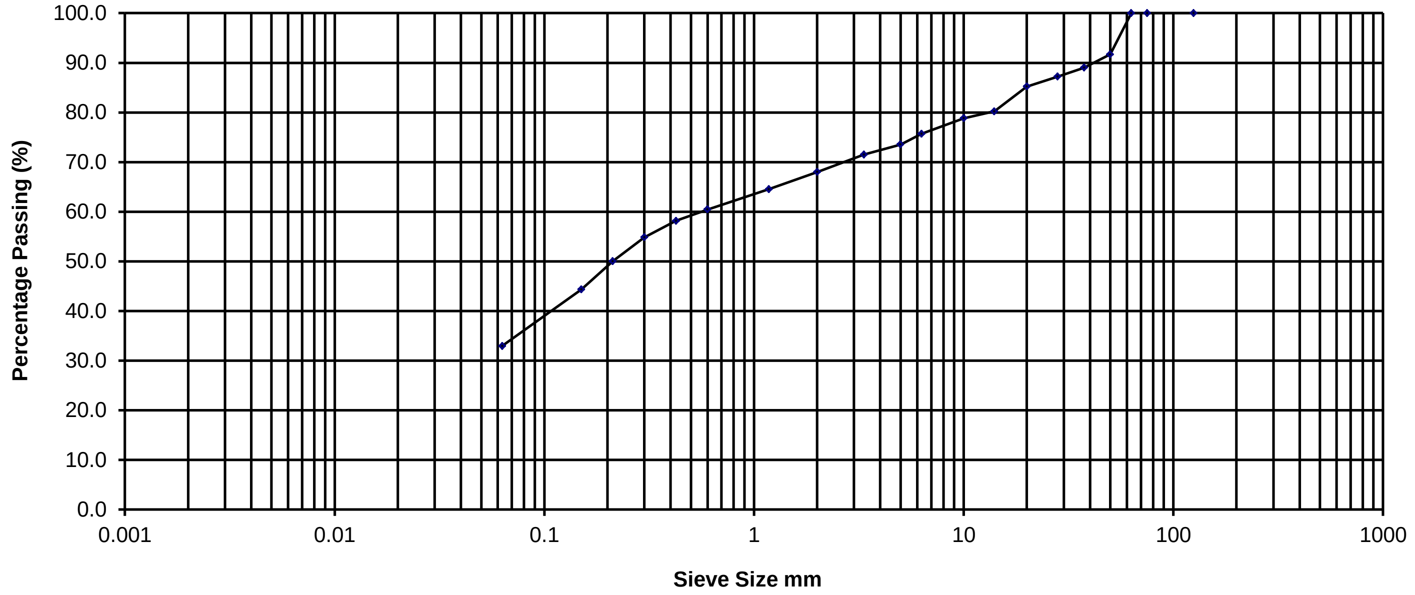
NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	91.7
37.500	89.0
28.000	87.2
20.000	85.2
14.000	80.2
10.000	78.8
6.300	75.7
5.000	73.6
3.350	71.5
2.000	68.0
1.180	64.6
0.600	60.4
0.425	58.2
0.300	54.8
0.212	50.0
0.150	44.3
0.063	32.9

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	32.9	35.0	32.0	0.0	0.0

Sample Description	Brown slightly gravelly sandy silty CLAY.	Project No.	NMTL 3351
		BH/TP No.	BH06
Project	Greenhills Road GII PROJECT ID:10299-12-20	Sample No.	B

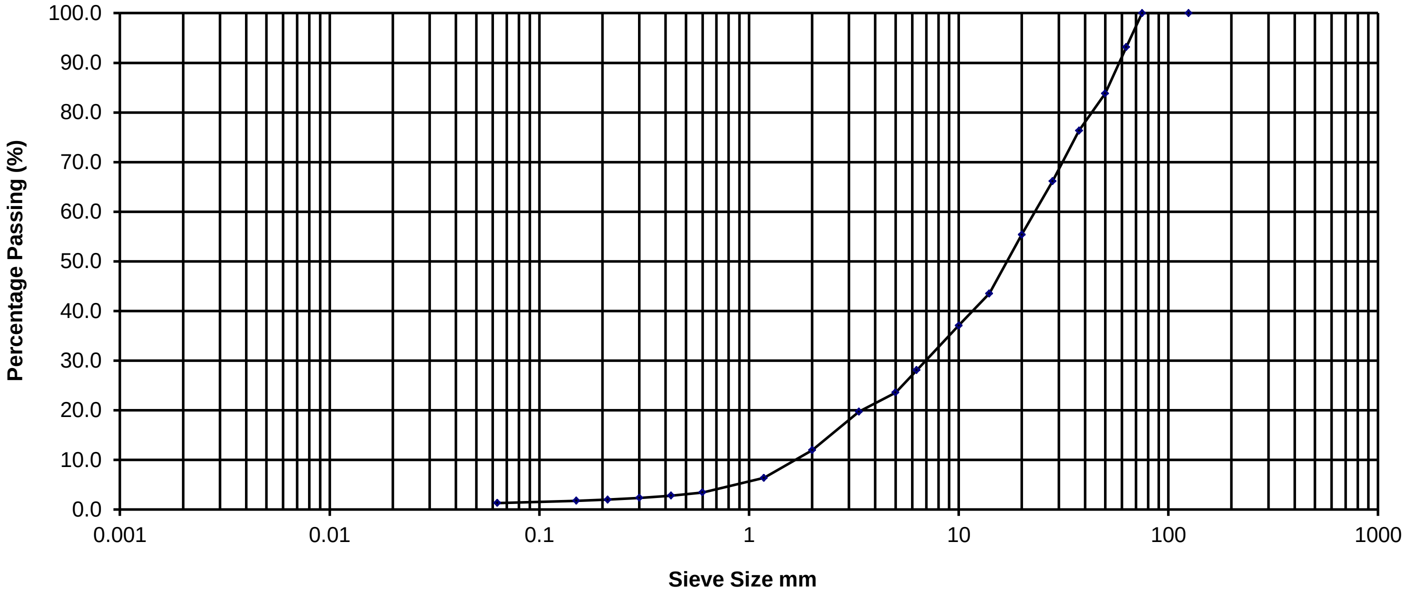
NM TL Ltd	Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested 25/02/2021	Depth	2.0m

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	93.2
50.000	83.8
37.500	76.4
28.000	66.1
20.000	55.4
14.000	43.5
10.000	37.1
6.300	28.1
5.000	23.6
3.350	19.7
2.000	12.0
1.180	6.4
0.600	3.5
0.425	2.8
0.300	2.4
0.212	2.0
0.150	1.8
0.063	1.3

Determination of Particle Size Distribution

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



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	1.3	10.6	81.2	6.8	0.0

Sample Description	Grey slightly silty sandy GRAVEL.	Project No.	NMTL 3351
		BH/TP No.	BH07
Project	Greenhills Road — GII PROJECT ID:10299-12-20	Sample No.	B

NM TL Ltd

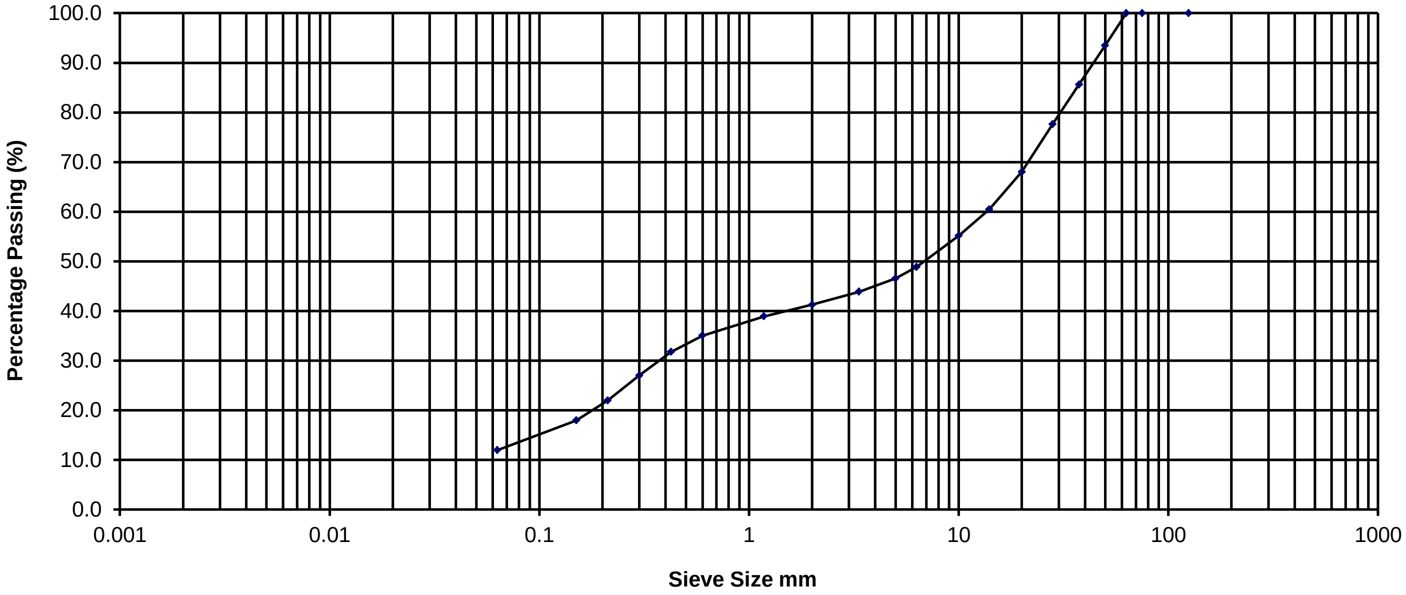
Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021	Depth	2.0m

NMTL Ltd

Determination of Particle Size Distribution

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

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	93.5
37.500	85.6
28.000	77.6
20.000	68.0
14.000	60.5
10.000	55.2
6.300	48.9
5.000	46.6
3.350	43.9
2.000	41.3
1.180	38.9
0.600	35.1
0.425	31.8
0.300	27.0
0.212	22.0
0.150	18.0
0.063	12.0



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	12.0			29.3			58.7			0.0	0.0

Sample Description: Grey/brown silty very sandy GRAVEL.

Project: Greenhills Road

GII PROJECT ID:10299-12-20

Project No.	NMTL 3351
BH/TP No.	BH08
Sample No.	B
Depth	1.00m

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021

NM TL Ltd

NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	96.9
37.500	89.4
28.000	85.2
20.000	84.0
14.000	74.3
10.000	68.8
6.300	62.7
5.000	59.8
3.350	57.6
2.000	53.8
1.180	50.8
0.600	47.6
0.425	46.2
0.300	44.8
0.212	43.1
0.150	41.2
0.063	34.9

Determination of Particle Size Distribution

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

Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	34.9	19.0	46.2	0.0	0.0

Sample Description Brown/grey slightly sandy gravelly silty CLAY.

Project No. NMTL 3351

BH/TP No. BH08

Project Greenhills Road GII PROJECT ID:10299-12-20

Sample No. B

NM TL Ltd

Operator	Bc	Checked	Nc	Approved	Bc	Date sample tested	25/02/2021	Depth	3.0m

Element Materials Technology
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Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

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

4225

Attention :	Barry Sexton
Date :	8th February, 2021
Your reference :	10299-12-20
Our reference :	Test Report 21/925 Batch 1
Location :	Greenhills Road
Date samples received :	25th January, 2021
Status :	Final report
Issue :	1

Twenty one samples were received for analysis on 25th January, 2021 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.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	1-3	13-15	22-24	28-29,63	33-35	39-41	45-47	57-59	60-62				
Sample ID	WS01	WS03	WS04	WS05	WS06	WS09	WS10	WS11	WS08A				
Depth	0.50	1.5	1.30	2.10	1.00	1.70	0.50	2.50	1.00				
COC No / misc													
Containers	V J T	V J T	V J T	J T V	V J T	V J T	V J T	V J T	V J T				
Sample Date	18/01/2021	18/01/2021	18/01/2021	19/01/2021	19/01/2021	19/01/2021	20/01/2021	20/01/2021	20/01/2021				
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	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021				
Antimony	2	1	2	2	2	2	2	2	1		<1	mg/kg	TM30/PM15
Arsenic #	11.7	6.2	8.5	7.4	5.8	9.4	12.1	9.1	4.0		<0.5	mg/kg	TM30/PM15
Barium #	67	51	49	43	40	50	66	64	30		<1	mg/kg	TM30/PM15
Cadmium #	2.1	1.0	1.5	1.6	1.5	1.5	2.2	1.6	1.0		<0.1	mg/kg	TM30/PM15
Chromium #	51.0	30.9	37.9	24.6	66.4	67.7	42.6	34.8	71.7		<0.5	mg/kg	TM30/PM15
Copper #	27	14	19	21	15	25	29	22	11		<1	mg/kg	TM30/PM15
Lead #	35	23	13	12	8	13	18	11	11		<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM30/PM15
Molybdenum #	4.6	2.4	3.3	3.1	5.4	5.9	5.1	4.7	5.8		<0.1	mg/kg	TM30/PM15
Nickel #	34.0	17.6	26.1	25.6	21.7	44.4	37.9	31.3	13.4		<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1	<1	5	<1	1	1	<1	<1		<1	mg/kg	TM30/PM15
Zinc #	94	47	72	64	62	87	102	83	45		<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	0.08	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.08	<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	0.18	<0.04	<0.04	<0.04	<0.04	<0.04	0.06	<0.04		<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	0.27	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	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	0.11	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05		<0.03	mg/kg	TM4/PM8
Pyrene #	0.03	0.11	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.04		<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	0.08	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	mg/kg	TM4/PM8
Chrysene #	0.02	0.07	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	0.12	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07		<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<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	<0.04		<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	<0.04		<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	0.23	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22		<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	1.10	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64		<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<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	91	95	96	100	97	98	93	108	111		<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30	116	<30	<30	<30	<30	<30	225	<30		<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.

Element Materials Technology

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	10299-12-20		
Location:	Greenhills Road	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Barry Sexton		
EMT Job No:	21/925		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	13-15	22-24	28-29,63	33-35	39-41	45-47	57-59	60-62		LOD/LOR	Units	Method No.
Sample ID	WS01	WS03	WS04	WS05	WS06	WS09	WS10	WS11	WS08A				
Depth	0.50	1.5	1.30	2.10	1.00	1.70	0.50	2.50	1.00				
COC No / misc													
Containers	V J T	V J T	V J T	J T V	V J T	V J T	V J T	V J T	V J T				
Sample Date	18/01/2021	18/01/2021	18/01/2021	19/01/2021	19/01/2021	19/01/2021	20/01/2021	20/01/2021	20/01/2021				
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	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021				
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	9.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.3	<0.1		<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	18.2	<0.2	<0.2	<0.2	<0.2	<0.2	21.8	<0.2		<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	49	<4	<4	<4	<4	<4	90	<4		<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	49	<7	<7	<7	<7	<7	85	<7		<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<7	<7	<7	<7	<7	<7	28	<7		<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	126	<26	<26	<26	<26	<26	227	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	9.6	<0.1	<0.1	<0.1	<0.1	<0.1	2.3	<0.1		<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	126	<10	<10	<10	<10	<10	206	<10		<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	<10	<10	<10	<10	<10	<10	<10	<10		<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	14.8	<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	50	<4	<4	<4	<4	<4	31	<4		<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	49	<7	<7	<7	<7	<7	52	<7		<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	<7	15	<7	<7	<7	<7	<7	16	<7		<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	129	<26	<26	<26	<26	<26	99	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	255	<52	<52	<52	<52	<52	326	<52		<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	<10	141	<10	<10	<10	<10	<10	84	<10		<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	<10	<10	<10	<10	<10	<10	<10	<10		<10	mg/kg	TM5/PM8/PM16
MTBE#	<5	11	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Benzene#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Toluene#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	46	<5	<5	<5	<5	<5	15	<5		<5	ug/kg	TM36/PM12
m/p-Xylene#	<5	182	<5	<5	<5	<5	<5	42	<5		<5	ug/kg	TM36/PM12
o-Xylene#	<5	188	<5	<5	<5	<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

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	1-3	13-15	22-24	28-29,63	33-35	39-41	45-47	57-59	60-62				
Sample ID	WS01	WS03	WS04	WS05	WS06	WS09	WS10	WS11	WS08A				
Depth	0.50	1.5	1.30	2.10	1.00	1.70	0.50	2.50	1.00				
COC No / misc													
Containers	V J T	V J T	V J T	J T V	V J T	V J T	V J T	V J T	V J T				
Sample Date	18/01/2021	18/01/2021	18/01/2021	19/01/2021	19/01/2021	19/01/2021	20/01/2021	20/01/2021	20/01/2021				
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	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021				
Natural Moisture Content	14.2	18.4	7.2	12.5	11.9	8.7	14.3	13.8	6.6		<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	12.4	15.5	6.8	11.1	10.7	8.0	12.5	12.1	6.2		<0.1	%	PM4/PM0
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
Chromium III	51.0	30.9	37.9	24.6	66.4	67.7	42.6	34.8	71.7		<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.89	0.61	0.38	0.38	0.36	0.45	0.67	0.35	0.34		<0.02	%	TM21/PM24
pH #	8.21	7.73	8.61	8.77	8.27	8.41	8.19	8.18	8.55		<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1016	0.1129	0.0989	0.1031	0.1029	0.1011	0.1136	0.1002	0.0964			kg	NONE/PM17
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

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 :**	**CEN 10:1 1 Batch**
Reference:	10299-12-20		
Location:	Greenhills Road	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Barry Sexton		
EMT Job No:	21/925		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	13-15	22-24	28-29,63	33-35	39-41	45-47	57-59	60-62				
Sample ID	WS01	WS03	WS04	WS05	WS06	WS09	WS10	WS11	WS08A				
Depth	0.50	1.5	1.30	2.10	1.00	1.70	0.50	2.50	1.00				
COC No / misc													
Containers	V J T	V J T	V J T	J T V	V J T	V J T	V J T	V J T	V J T				
Sample Date	18/01/2021	18/01/2021	18/01/2021	19/01/2021	19/01/2021	19/01/2021	20/01/2021	20/01/2021	20/01/2021				
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	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021				
Dissolved Antimony #	<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 Antimony (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 Arsenic #	<0.0025	0.0127	0.0026	<0.0025	<0.0025	0.0027	<0.0025	<0.0025	<0.0025		<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	0.127	0.026	<0.025	<0.025	0.027	<0.025	<0.025	<0.025		<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.007	0.053	0.021	0.006	0.003	0.004	0.017	0.005	0.005		<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.07	0.53	0.21	0.06	<0.03	0.04	0.17	0.05	0.05		<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	<0.0015	<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	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 #	0.007	0.047	0.008	0.008	<0.002	0.006	0.012	0.016	0.010		<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.07	0.47	0.08	0.08	<0.02	0.06	0.12	0.16	0.10		<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	0.004	<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	0.04	<0.03	<0.03		<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	0.004	0.003	0.004	0.005	0.003	<0.003	<0.003	<0.003		<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	0.04	<0.03	0.04	0.05	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	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	<0.3	<0.3	<0.3	<0.3	<0.3		<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	4	<3	<3	<3	<3	<3		<3	mg/kg	TM173/PM0
Sulphate as SO4 #	24.8	<0.5	3.8	2.2	2.6	3.1	20.2	1.4	15.7		<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	248	<5	38	22	26	31	202	14	157		<5	mg/kg	TM38/PM0
Chloride #	0.5	2.9	0.6	0.4	0.5	2.8	1.4	<0.3	0.5		<0.3	mg/l	TM38/PM0
Chloride #	5	29	6	4	5	28	14	<3	5		<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	4	14	4	3	3	3	5	2	7		<2	mg/l	TM60/PM0
Dissolved Organic Carbon	40	140	40	30	30	30	50	20	70		<20	mg/kg	TM60/PM0
pH	8.38	8.29	8.52	8.65	8.44	8.44	8.05	8.13	8.01		<0.01	pH units	TM73/PM0
Total Dissolved Solids #	103	148	57	41	46	88	245	<35	72		<35	mg/l	TM20/PM0
Total Dissolved Solids #	1030	1480	570	410	460	880	2451	<350	720		<350	mg/kg	TM20/PM0

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Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	1-3	13-15	22-24	28-29,63	33-35	39-41	45-47	57-59	60-62							
Sample ID	WS01	WS03	WS04	WS05	WS06	WS09	WS10	WS11	WS08A							
Depth	0.50	1.5	1.30	2.10	1.00	1.70	0.50	2.50	1.00							
COC No / misc																
Containers	V J T	V J T	V J T	J T V	V J T	V J T	V J T	V J T	V J T							
Sample Date	18/01/2021	18/01/2021	18/01/2021	19/01/2021	19/01/2021	19/01/2021	20/01/2021	20/01/2021	20/01/2021							
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	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021	25/01/2021							
Solid Waste Analysis																
Total Organic Carbon #	0.89	0.61	0.38	0.38	0.36	0.45	0.67	0.35	0.34		3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	0.416	<0.025	<0.025	<0.025	<0.025	<0.025	0.057	<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	116	<30	<30	<30	<30	<30	225	<30		500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	0.23	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22		-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	1.10	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64		100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	0.127	0.026	<0.025	<0.025	0.027	<0.025	<0.025	<0.025		0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.07	0.53	0.21	0.06	<0.03	0.04	0.17	0.05	0.05		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	<0.015	<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		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 #	0.07	0.47	0.08	0.08	<0.02	0.06	0.12	0.16	0.10		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	<0.02	<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	0.04	<0.03	<0.03		0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	0.04	<0.03	0.04	0.05	0.03	<0.03	<0.03	<0.03		4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	1030	1480	570	410	460	880	2451	<350	720		4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	40	140	40	30	30	30	50	20	70		500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	88.7	79.8	91.2	87.7	87.5	88.8	79.5	89.6	93.4		-	-	-	<0.1	%	NONE/PM4
pH #	8.21	7.73	8.61	8.77	8.27	8.41	8.19	8.18	8.55		-	-	-	<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	<3	<3	<3	<3	<3		-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	248	<5	38	22	26	31	202	14	157		1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	5	29	6	4	5	28	14	<3	5		800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland

Reference: 10299-12-20

Location: Greenhills Road

Contact: Barry Sexton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
21/925	1	WS01	0.50	1-3	No interpretation possible
21/925	1	WS03	1.5	13-15	Possible degraded diesel
21/925	1	WS04	1.30	22-24	No interpretation possible
21/925	1	WS05	2.10	28-29,63	No interpretation possible
21/925	1	WS06	1.00	33-35	No interpretation possible
21/925	1	WS09	1.70	39-41	No interpretation possible
21/925	1	WS10	0.50	45-47	No interpretation possible
21/925	1	WS11	2.50	57-59	Possible degraded diesel
21/925	1	WS08A	1.00	60-62	No interpretation possible

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

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). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

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

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/925	1	WS01	0.50	2	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS03	1.5	14	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS04	1.30	23	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS05	2.10	28	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS06	1.00	34	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS09	1.70	40	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS10	0.50	46	27/01/2021	**General Description (Bulk Analysis)**	Soil/Stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/925	1	WS10	0.50	46	27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS11	2.50	58	27/01/2021	**General Description (Bulk Analysis)**	soil/stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD
21/925	1	WS08A	1.00	61	27/01/2021	**General Description (Bulk Analysis)**	soil/stones
					27/01/2021	**Asbestos Fibres**	NAD
					27/01/2021	**Asbestos ACM**	NAD
					27/01/2021	**Asbestos Type**	NAD
					27/01/2021	**Asbestos Level Screen**	NAD

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 21/925						

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.

EMT Job No.: 21/925

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an 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 or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

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 extracted.
#2	EU_Total but with fatty acids extracted.
_	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: 21/925

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, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

EMT Job No: 21/925

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	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	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	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 (comparabl	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 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
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: 21/925

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 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	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.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

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Ground Investigations Ireland
Catherinestown House
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Ireland

Attention :	Barry Sexton
Date :	17th February, 2021
Your reference :	10299-12-20
Our reference :	Test Report 21/925 Batch 2
Location :	Greenhills Road
Date samples received :	28th January, 2021
Status :	Final report
Issue :	1

Five samples were received for analysis on 28th January, 2021 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	64-66	67-69	70-72	73-75	LOD/LOR	Units	Method No.
Sample ID	BH01	BH03	BH07	BH08			
Depth	0.20	1.00	1.00	2.00			
COC No / misc							
Containers	V J T	V J T	V J T	V J T			
Sample Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021			
Sample Type	Soil	Soil	Soil	Soil			
Batch Number	2	2	2	2			
Date of Receipt	28/01/2021	28/01/2021	28/01/2021	28/01/2021			
Antimony	1	1	1	2	<1	mg/kg	TM30/PM15
Arsenic #	14.0	7.0	6.1	7.4	<0.5	mg/kg	TM30/PM15
Barium #	53	58	58	49	<1	mg/kg	TM30/PM15
Cadmium #	1.4	2.1	1.8	2.2	<0.1	mg/kg	TM30/PM15
Chromium #	37.7	35.8	36.9	39.2	<0.5	mg/kg	TM30/PM15
Copper #	19	27	48	121	<1	mg/kg	TM30/PM15
Lead #	10	11	12	16	<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	3.6	4.5	3.8	3.6	<0.1	mg/kg	TM30/PM15
Nickel #	21.7	28.5	27.7	35.7	<0.7	mg/kg	TM30/PM15
Selenium #	1	1	1	7	<1	mg/kg	TM30/PM15
Zinc #	54	84	80	101	<5	mg/kg	TM30/PM15
PAH MS							
Naphthalene #	<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	mg/kg	TM4/PM8
Acenaphthene #	<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	mg/kg	TM4/PM8
Phenanthrene #	<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	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<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	mg/kg	TM4/PM8
Coronene	<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	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	93	88	93	94	<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_Total)	73	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	64-66	67-69	70-72	73-75							LOD/LOR	Units	Method No.
Sample ID	BH01	BH03	BH07	BH08									
Depth	0.20	1.00	1.00	2.00									
COC No / misc													
Containers	V J T	V J T	V J T	V J T									
Sample Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	2	2	2	2									
Date of Receipt	28/01/2021	28/01/2021	28/01/2021	28/01/2021									
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL) #	<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	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<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	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) #	<4	<4	<4	<4							<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) #	<7	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL) #	56	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	17	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	73	<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	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	<10	<10	<10							<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	46	<10	<10	<10							<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR) #	<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	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) #	<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	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) #	<4	<4	<4	<4							<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) #	12	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) #	106	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	40	<7	<7	<7							<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	158	<26	<26	<26							<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	231	<52	<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	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	25	<10	<10	<10							<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	90	<10	<10	<10							<10	mg/kg	TM5/PM8/PM16
MTBE #	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
Benzene #	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
Toluene #	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
m/p-Xylene #	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
o-Xylene #	<5	<5	<5	<5							<5	ug/kg	TM36/PM12
PCB 28 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5							<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35							<35	ug/kg	TM17/PM8

Please 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: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	64-66	67-69	70-72	73-75							LOD/LOR	Units	Method No.
Sample ID	BH01	BH03	BH07	BH08									
Depth	0.20	1.00	1.00	2.00									
COC No / misc													
Containers	V J T	V J T	V J T	V J T									
Sample Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	2	2	2	2									
Date of Receipt	28/01/2021	28/01/2021	28/01/2021	28/01/2021									
Natural Moisture Content	8.5	14.7	13.8	22.0							<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	7.8	12.8	12.1	18.0							<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3							<0.3	mg/kg	TM38/PM20
Chromium III	37.7	35.8	36.9	39.2							<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.34	0.32	0.30	0.29							<0.02	%	TM21/PM24
pH #	8.78	8.73	8.60	8.09							<0.01	pH units	TM73/PM11
Mass of raw test portion	0.0972	0.1015	0.1035	0.1221								kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09								kg	NONE/PM17

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: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	64-66	67-69	70-72	73-75			
Sample ID	BH01	BH03	BH07	BH08			
Depth	0.20	1.00	1.00	2.00			
COC No / misc							
Containers	V J T	V J T	V J T	V J T			
Sample Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021			
Sample Type	Soil	Soil	Soil	Soil			
Batch Number	2	2	2	2	LOD/LOR	Units	Method No.
Date of Receipt	28/01/2021	28/01/2021	28/01/2021	28/01/2021			
Dissolved Antimony #	<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	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	0.005	<0.003	0.004	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	0.05	<0.03	0.04	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<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	mg/kg	TM30/PM17
Dissolved Chromium #	<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	mg/kg	TM30/PM17
Dissolved Copper #	<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	mg/kg	TM30/PM17
Dissolved Lead #	<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	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.006	0.013	0.007	0.004	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.06	0.13	0.07	0.04	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<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	mg/kg	TM30/PM17
Dissolved Selenium #	<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	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	0.003	0.004	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	0.04	<0.03	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<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	mg/kg	TM61/PM0
Phenol	<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	mg/kg	TM26/PM0
Fluoride	<0.3	<0.3	<0.3	<0.3	<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	1.7	1.1	0.7	1.4	<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	17	11	7	14	<5	mg/kg	TM38/PM0
Chloride #	<0.3	0.3	0.5	<0.3	<0.3	mg/l	TM38/PM0
Chloride #	<3	<3	5	<3	<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	2	3	<2	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	<20	30	<20	<20	mg/kg	TM60/PM0
pH	8.58	8.47	8.17	8.06	<0.01	pH units	TM73/PM0
Total Dissolved Solids #	<35	<35	<35	52	<35	mg/l	TM20/PM0
Total Dissolved Solids #	<350	<350	<350	520	<350	mg/kg	TM20/PM0

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

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.	64-66	67-69	70-72	73-75	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	BH01	BH03	BH07	BH08						
Depth	0.20	1.00	1.00	2.00						
COC No / misc										
Containers	V J T	V J T	V J T	V J T						
Sample Date	27/01/2021	27/01/2021	27/01/2021	27/01/2021						
Sample Type	Soil	Soil	Soil	Soil						
Batch Number	2	2	2	2						
Date of Receipt	28/01/2021	28/01/2021	28/01/2021	28/01/2021						
Solid Waste Analysis										
Total Organic Carbon #	0.34	0.32	0.30	0.29	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<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	1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	73	<30	<30	<30	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	<0.22	<0.22	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64	100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate										
Arsenic #	<0.025	<0.025	<0.025	<0.025	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	0.05	<0.03	0.04	20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<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	0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<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	0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.06	0.13	0.07	0.04	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<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	0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<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	0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	0.04	<0.03	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	<350	<350	<350	520	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	<20	30	<20	500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	92.2	88.2	86.9	73.4	-	-	-	<0.1	%	NONE/PM4
pH #	8.78	8.73	8.60	8.09	-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	<3	<3	<3	-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	17	11	7	14	1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	<3	5	<3	800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland

Reference: 10299-12-20

Location: Greenhills Road

Contact: Barry Sexton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
21/925	2	BH01	0.20	64-66	Possible trace tarmac/bitumen
21/925	2	BH03	1.00	67-69	No interpretation possible
21/925	2	BH07	1.00	70-72	No interpretation possible
21/925	2	BH08	2.00	73-75	No interpretation possible

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

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). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

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

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/925	2	BH01	0.20	65	09/02/2021	**General Description (Bulk Analysis)**	Soil/Stone
					09/02/2021	**Asbestos Fibres**	NAD
					09/02/2021	**Asbestos ACM**	NAD
					09/02/2021	**Asbestos Type**	NAD
					09/02/2021	**Asbestos Level Screen**	NAD
21/925	2	BH03	1.00	68	09/02/2021	**General Description (Bulk Analysis)**	Soil/Stone
					09/02/2021	**Asbestos Fibres**	NAD
					09/02/2021	**Asbestos ACM**	NAD
					09/02/2021	**Asbestos Type**	NAD
					09/02/2021	**Asbestos Level Screen**	NAD
21/925	2	BH07	1.00	71	09/02/2021	**General Description (Bulk Analysis)**	Soil/Stone
					09/02/2021	**Asbestos Fibres**	NAD
					09/02/2021	**Asbestos ACM**	NAD
					09/02/2021	**Asbestos Type**	NAD
					09/02/2021	**Asbestos Level Screen**	NAD
21/925	2	BH08	2.00	74	09/02/2021	**General Description (Bulk Analysis)**	Soil/Stone
					09/02/2021	**Asbestos Fibres**	NAD
					09/02/2021	**Asbestos ACM**	NAD
					09/02/2021	**Asbestos Type**	NAD
					09/02/2021	**Asbestos Level Screen**	NAD

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 21/925						

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.

EMT Job No.: 21/925

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an 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 or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

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 extracted.
#2	EU_Total but with fatty acids extracted.
_	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: 21/925

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, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

EMT Job No: 21/925

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	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	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	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: 21/925

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 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	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.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
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Ireland

Attention :	Barry Sexton
Date :	3rd March, 2021
Your reference :	10299-12-20
Our reference :	Test Report 21/1882 Batch 1
Location :	Greenhills Road
Date samples received :	11th February, 2021
Status :	Final report
Issue :	2

Eleven samples were received for analysis on 11th February, 2021 of which six were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	4-6	7-9	16-18	28-30	31-33					LOD/LOR	Units	Method No.
Sample ID	BH-02A	BH-03A	BH-04	BH-05	BH-06	BH-06							
Depth	0.00-0.50	0.00-1.20	0.00-1.70	0.50-2.40	0.80-3.00	3.00-3.30							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Solid							
Batch Number	1	1	1	1	1	1							
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021							
Antimony	<1	-	1	2	-	1					<1	mg/kg	TM30/PM15
Arsenic	-	-	-	-	-	5.0					<0.5	mg/kg	TM30/PM15
Arsenic #	6.2	-	11.1	9.7	-	-					<0.5	mg/kg	TM30/PM15
Barium	-	-	-	-	-	50					<1	mg/kg	TM30/PM15
Barium #	41	-	52	60	-	-					<1	mg/kg	TM30/PM15
Cadmium	-	-	-	-	-	1.2					<0.1	mg/kg	TM30/PM15
Cadmium #	1.5	-	0.9	1.8	-	-					<0.1	mg/kg	TM30/PM15
Chromium	-	-	-	-	-	30.1					<0.5	mg/kg	TM30/PM15
Chromium #	32.6	-	51.1	35.9	-	-					<0.5	mg/kg	TM30/PM15
Copper	-	-	-	-	-	9					<1	mg/kg	TM30/PM15
Copper #	16	-	17	27	-	-					<1	mg/kg	TM30/PM15
Lead	-	-	-	-	-	7					<5	mg/kg	TM30/PM15
Lead #	12	-	16	16	-	-					<5	mg/kg	TM30/PM15
Mercury	-	-	-	-	-	<0.1					<0.1	mg/kg	TM30/PM15
Mercury #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM30/PM15
Molybdenum	-	-	-	-	-	2.7					<0.1	mg/kg	TM30/PM15
Molybdenum #	3.0	-	3.6	3.8	-	-					<0.1	mg/kg	TM30/PM15
Nickel	-	-	-	-	-	12.4					<0.7	mg/kg	TM30/PM15
Nickel #	19.4	-	22.2	33.6	-	-					<0.7	mg/kg	TM30/PM15
Selenium	-	-	-	-	-	<1					<1	mg/kg	TM30/PM15
Selenium #	<1	-	<1	1	-	-					<1	mg/kg	TM30/PM15
Zinc	-	-	-	-	-	61					<5	mg/kg	TM30/PM15
Zinc #	50	-	60	80	-	-					<5	mg/kg	TM30/PM15

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All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	4-6	7-9	16-18	28-30	31-33					LOD/LOR	Units	Method No.
Sample ID	BH-02A	BH-03A	BH-04	BH-05	BH-06	BH-06							
Depth	0.00-0.50	0.00-1.20	0.00-1.70	0.50-2.40	0.80-3.00	3.00-3.30							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Solid							
Batch Number	1	1	1	1	1	1							
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021							
PAH MS													
Naphthalene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Naphthalene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	-	<0.03	<0.03	-	<0.03					<0.03	mg/kg	TM4/PM8
Acenaphthene	-	-	-	-	-	<0.05					<0.05	mg/kg	TM4/PM8
Acenaphthene #	<0.05	-	<0.05	<0.05	-	-					<0.05	mg/kg	TM4/PM8
Fluorene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Fluorene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Phenanthrene	-	-	-	-	-	<0.03					<0.03	mg/kg	TM4/PM8
Phenanthrene #	<0.03	-	<0.03	0.07	-	-					<0.03	mg/kg	TM4/PM8
Anthracene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Anthracene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Fluoranthene	-	-	-	-	-	<0.03					<0.03	mg/kg	TM4/PM8
Fluoranthene #	<0.03	-	<0.03	0.11	-	-					<0.03	mg/kg	TM4/PM8
Pyrene	-	-	-	-	-	<0.03					<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	-	<0.03	0.11	-	-					<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene	-	-	-	-	-	<0.06					<0.06	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	-	<0.06	0.10	-	-					<0.06	mg/kg	TM4/PM8
Chrysene	-	-	-	-	-	<0.02					<0.02	mg/kg	TM4/PM8
Chrysene #	<0.02	-	<0.02	0.08	-	-					<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene	-	-	-	-	-	<0.07					<0.07	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	-	<0.07	0.14	-	-					<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	-	<0.04	0.06	-	-					<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene	-	-	-	-	-	<0.04					<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	-	<0.04	<0.04	-	-					<0.04	mg/kg	TM4/PM8
Coronene	<0.04	-	<0.04	<0.04	-	<0.04					<0.04	mg/kg	TM4/PM8
PAH 6 Total	-	-	-	-	-	<0.22					<0.22	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	-	<0.22	0.31	-	-					<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	-	<0.64	0.67	-	<0.64					<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	-	<0.05	0.10	-	<0.05					<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	-	<0.02	0.04	-	<0.02					<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	-	<1	<1	-	<1					<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	91	-	90	88	-	92					<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	42	-	<30	<30	-	160					<30	mg/kg	TM5/PM8/PM16

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Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	4-6	7-9	16-18	28-30	31-33					LOD/LOR	Units	Method No.
Sample ID	BH-02A	BH-03A	BH-04	BH-05	BH-06	BH-06							
Depth	0.00-0.50	0.00-1.20	0.00-1.70	0.50-2.40	0.80-3.00	3.00-3.30							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Solid							
Batch Number	1	1	1	1	1	1							
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021							
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>C5-C6 (HS_1D_AL) #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) #	<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	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)	-	-	-	-	-	10.2					<0.2	mg/kg	TM5/PM8/PM16
>C10-C12 (EH_CU_1D_AL) #	<0.2	-	<0.2	<0.2	-	-					<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)	-	-	-	-	-	62					<4	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) #	10	-	<4	<4	-	-					<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)	-	-	-	-	-	65					<7	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) #	20	-	<7	<7	-	-					<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)	-	-	-	-	-	23					<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL) #	12	-	<7	<7	-	-					<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	-	<7	<7	-	<7					<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	42	-	<26	<26	-	160					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	-	<0.1	<0.1	-	0.1					<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	35	-	<10	<10	-	167					<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	-	<10	<10	-	<10					<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>C5-EC7 (HS_1D_AR) #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)	-	-	-	-	-	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>EC10-EC12 (EH_CU_1D_AR) #	<0.2	-	<0.2	<0.2	-	-					<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)	-	-	-	-	-	28					<4	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) #	<4	-	<4	<4	-	-					<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)	-	-	-	-	-	52					<7	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) #	<7	-	<7	<7	-	-					<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)	-	-	-	-	-	15					<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) #	<7	-	<7	<7	-	-					<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	-	<7	<7	-	<7					<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	-	<26	<26	-	95					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	-	<52	<52	-	255					<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)	-	-	-	-	-	<0.1					<0.1	mg/kg	TM36/PM12
>EC6-EC10 (HS_1D_AR) #	<0.1	-	<0.1	<0.1	-	-					<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	<10	-	<10	<10	-	102					<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	-	<10	<10	-	<10					<10	mg/kg	TM5/PM8/PM16
MTBE	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12

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	**Report :**	**Solid**
Reference:	10299-12-20		
Location:	Greenhills Road	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Barry Sexton		
EMT Job No:	21/1882		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	16-18	28-30	31-33					LOD/LOR	Units	Method No.
Sample ID	BH-02A	BH-03A	BH-04	BH-05	BH-06	BH-06							
Depth	0.00-0.50	0.00-1.20	0.00-1.70	0.50-2.40	0.80-3.00	3.00-3.30							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Solid							
Batch Number	1	1	1	1	1	1							
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021							
MTBE #	<5	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
Benzene	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12
Benzene #	<5	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
Toluene	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12
Toluene #	14	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
Ethylbenzene	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
m/p-Xylene	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12
m/p-Xylene #	10	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
o-Xylene	-	-	-	-	-	<5					<5	ug/kg	TM36/PM12
o-Xylene #	<5	-	<5	<5	-	-					<5	ug/kg	TM36/PM12
PCB 28	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 28 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 52	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 52 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 101	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 101 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 118	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 118 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 138	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 138 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 153	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 153 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
PCB 180	-	-	-	-	-	<5					<5	ug/kg	TM17/PM8
PCB 180 #	<5	-	<5	<5	-	-					<5	ug/kg	TM17/PM8
Total 7 PCBs	-	-	-	-	-	<35					<35	ug/kg	TM17/PM8
Total 7 PCBs #	<35	-	<35	<35	-	-					<35	ug/kg	TM17/PM8
Natural Moisture Content	13.6	-	13.7	14.9	-	4.3					<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	12.0	-	12.0	13.0	-	4.1					<0.1	%	PM4/PM0
Hexavalent Chromium	-	-	-	-	-	<0.3					<0.3	mg/kg	TM38/PM20
Hexavalent Chromium #	<0.3	-	<0.3	<0.3	-	-					<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	-	0.0832	0.0166	-	0.6427	-					<0.0015	g/l	TM38/PM20
Chromium III	32.6	-	51.1	35.9	-	30.1					<0.5	mg/kg	NONE/NONE
Total Organic Carbon	-	-	-	-	-	0.34					<0.02	%	TM21/PM24
Total Organic Carbon #	0.38	-	0.24	0.35	-	-					<0.02	%	TM21/PM24
pH	-	-	-	-	-	8.75					<0.01	pH units	TM73/PM11
pH #	8.44	8.65	9.17	8.65	8.57	-					<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1538	-	0.103	0.1064	-	0.0956						kg	NONE/PM17

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	4-6	7-9	16-18	28-30	31-33							
Sample ID	BH-02A	BH-03A	BH-04	BH-05	BH-06	BH-06							
Depth	0.00-0.50	0.00-1.20	0.00-1.70	0.50-2.40	0.80-3.00	3.00-3.30							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Solid							
Batch Number	1	1	1	1	1	1					LOD/LOR	Units	Method No.
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021	11/02/2021							
Mass of dried test portion	0.09	-	0.09	0.09	-	0.09						kg	NONE/PM17

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	7-9	16-18	31-33							LOD/LOR	Units	Method No.
Sample ID	BH-02A	BH-04	BH-05	BH-06									
Depth	0.00-0.50	0.00-1.70	0.50-2.40	3.00-3.30									
COC No / misc													
Containers	V J T	V J T	V J T	V J T									
Sample Date	28/01/2021	28/01/2021	27/01/2021	27/01/2021									
Sample Type	Soil	Soil	Soil	Solid									
Batch Number	1	1	1	1									
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021									
Dissolved Antimony	-	-	-	<0.002							<0.002	mg/l	TM30/PM17
Dissolved Antimony #	<0.002	<0.002	<0.002	-							<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10)	-	-	-	<0.02							<0.02	mg/kg	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	-							<0.02	mg/kg	TM30/PM17
Dissolved Arsenic	-	-	-	<0.0025							<0.0025	mg/l	TM30/PM17
Dissolved Arsenic #	<0.0025	0.0046	<0.0025	-							<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10)	-	-	-	<0.025							<0.025	mg/kg	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	0.046	<0.025	-							<0.025	mg/kg	TM30/PM17
Dissolved Barium	-	-	-	0.006							<0.003	mg/l	TM30/PM17
Dissolved Barium #	0.007	0.005	0.005	-							<0.003	mg/l	TM30/PM17
Dissolved Barium (A10)	-	-	-	0.06							<0.03	mg/kg	TM30/PM17
Dissolved Barium (A10) #	0.07	0.05	0.05	-							<0.03	mg/kg	TM30/PM17
Dissolved Cadmium	-	-	-	<0.0005							<0.0005	mg/l	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	-							<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10)	-	-	-	<0.005							<0.005	mg/kg	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	-							<0.005	mg/kg	TM30/PM17
Dissolved Chromium	-	-	-	<0.0015							<0.0015	mg/l	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	-							<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10)	-	-	-	<0.015							<0.015	mg/kg	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	-							<0.015	mg/kg	TM30/PM17
Dissolved Copper	-	-	-	<0.007							<0.007	mg/l	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	-							<0.007	mg/l	TM30/PM17
Dissolved Copper (A10)	-	-	-	<0.07							<0.07	mg/kg	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	-							<0.07	mg/kg	TM30/PM17
Dissolved Lead	-	-	-	<0.005							<0.005	mg/l	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	-							<0.005	mg/l	TM30/PM17
Dissolved Lead (A10)	-	-	-	<0.05							<0.05	mg/kg	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	-							<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum	-	-	-	0.008							<0.002	mg/l	TM30/PM17
Dissolved Molybdenum #	0.006	0.004	0.007	-							<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10)	-	-	-	0.08							<0.02	mg/kg	TM30/PM17
Dissolved Molybdenum (A10) #	0.06	0.04	0.07	-							<0.02	mg/kg	TM30/PM17
Dissolved Nickel	-	-	-	<0.002							<0.002	mg/l	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	-							<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10)	-	-	-	<0.02							<0.02	mg/kg	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	-							<0.02	mg/kg	TM30/PM17
Dissolved Selenium	-	-	-	<0.003							<0.003	mg/l	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	-							<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10)	-	-	-	<0.03							<0.03	mg/kg	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	-							<0.03	mg/kg	TM30/PM17
Dissolved Zinc	-	-	-	<0.003							<0.003	mg/l	TM30/PM17
Dissolved Zinc #	<0.003	<0.003	<0.003	-							<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10)	-	-	-	<0.03							<0.03	mg/kg	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03	-							<0.03	mg/kg	TM30/PM17

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

Report : CEN 10:1 1 Batch

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

EMT Sample No.	1-3	7-9	16-18	31-33									
Sample ID	BH-02A	BH-04	BH-05	BH-06									
Depth	0.00-0.50	0.00-1.70	0.50-2.40	3.00-3.30									
COC No / misc													
Containers	V J T	V J T	V J T	V J T									
Sample Date	28/01/2021	28/01/2021	27/01/2021	27/01/2021									
Sample Type	Soil	Soil	Soil	Solid									
Batch Number	1	1	1	1									
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021							LOD/LOR	Units	Method No.
Mercury Dissolved by CVAF	-	-	-	<0.00001							<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	-							<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF	-	-	-	<0.0001							<0.0001	mg/kg	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	-							<0.0001	mg/kg	TM61/PM0
Phenol	<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	mg/kg	TM26/PM0
Fluoride	0.3	<0.3	<0.3	<0.3							<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3							<3	mg/kg	TM173/PM0
Sulphate as SO4	-	-	-	1.5							<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	31.7	4.4	<0.5	-							<0.5	mg/l	TM38/PM0
Sulphate as SO4	-	-	-	15							<5	mg/kg	TM38/PM0
Sulphate as SO4 #	317	44	<5	-							<5	mg/kg	TM38/PM0
Chloride	-	-	-	1.5							<0.3	mg/l	TM38/PM0
Chloride #	0.6	0.6	<0.3	-							<0.3	mg/l	TM38/PM0
Chloride	-	-	-	15							<3	mg/kg	TM38/PM0
Chloride #	6	6	<3	-							<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	3	<2	<2							<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	30	<20	<20							<20	mg/kg	TM60/PM0
pH	7.96	9.04	8.26	8.20							<0.01	pH units	TM73/PM0
Total Dissolved Solids	-	-	-	<35							<35	mg/l	TM20/PM0
Total Dissolved Solids #	106	40	44	-							<35	mg/l	TM20/PM0
Total Dissolved Solids	-	-	-	<350							<350	mg/kg	TM20/PM0
Total Dissolved Solids #	1060	400	440	-							<350	mg/kg	TM20/PM0

Please see attached notes for all abbreviations and acronyms

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All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name:	Ground Investigations Ireland	**Report :**	**EN12457_2**
Reference:	10299-12-20		
Location:	Greenhills Road	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Barry Sexton		
EMT Job No:	21/1882		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	7-9	16-18	31-33	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	BH-02A	BH-04	BH-05	BH-06						
Depth	0.00-0.50	0.00-1.70	0.50-2.40	3.00-3.30						
COC No / misc										
Containers	V J T	V J T	V J T	V J T						
Sample Date	28/01/2021	28/01/2021	27/01/2021	27/01/2021						
Sample Type	Soil	Soil	Soil	Solid						
Batch Number	1	1	1	1						
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021						
Solid Waste Analysis										
Total Organic Carbon #	0.38	0.24	0.35	-	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<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	-	1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	42	<30	<30	160	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	0.31	-	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	0.67	<0.64	100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate										
Arsenic #	<0.025	0.046	<0.025	-	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.07	0.05	0.05	-	20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	-	0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	-	0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	-	2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	-	0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.06	0.04	0.07	-	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	-	0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	-	0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	<0.02	-	0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	-	0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	<0.03	-	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	1060	400	440	-	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	30	<20	<20	500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	86.1	87.7	84.6	94.6	-	-	-	<0.1	%	NONE/PM4
PAH MS										
PAH 6 Total	-	-	-	<0.22	-	-	-	<0.22	mg/kg	TM4/PM8
Total 7 PCBs	-	-	-	<0.035	1	-	-	<0.035	mg/kg	TM17/PM8
Total Organic Carbon	-	-	-	0.34	3	5	6	<0.02	%	TM21/PM24
pH	-	-	-	8.75	-	-	-	<0.01	pH units	TM73/PM11
pH #	8.44	9.17	8.65	-	-	-	-	<0.01	pH units	TM73/PM11

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: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/1882

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.	1-3	7-9	16-18	31-33												
Sample ID	BH-02A	BH-04	BH-05	BH-06												
Depth	0.00-0.50	0.00-1.70	0.50-2.40	3.00-3.30												
COC No / misc																
Containers	V J T	V J T	V J T	V J T												
Sample Date	28/01/2021	28/01/2021	27/01/2021	27/01/2021												
Sample Type	Soil	Soil	Soil	Solid												
Batch Number	1	1	1	1												
Date of Receipt	11/02/2021	11/02/2021	11/02/2021	11/02/2021							Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Dissolved Antimony (A10)	-	-	-	<0.02							0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic (A10)	-	-	-	<0.025							0.5	2	25	<0.025	mg/kg	TM30/PM17
Dissolved Barium (A10)	-	-	-	0.06							20	100	300	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium (A10)	-	-	-	<0.005							0.04	1	5	<0.005	mg/kg	TM30/PM17
Dissolved Chromium (A10)	-	-	-	<0.015							0.5	10	70	<0.015	mg/kg	TM30/PM17
Dissolved Copper (A10)	-	-	-	<0.07							2	50	100	<0.07	mg/kg	TM30/PM17
Dissolved Lead (A10)	-	-	-	<0.05							0.5	10	50	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum (A10)	-	-	-	0.08							0.5	10	30	<0.02	mg/kg	TM30/PM17
Dissolved Nickel (A10)	-	-	-	<0.02							0.4	10	40	<0.02	mg/kg	TM30/PM17
Dissolved Selenium (A10)	-	-	-	<0.03							0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Dissolved Zinc (A10)	-	-	-	<0.03							4	50	200	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF	-	-	-	<0.0001							0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Phenol	<0.1	<0.1	<0.1	<0.1							1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	<3	<3	<3							-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO_4	-	-	-	15							1000	20000	50000	<5	mg/kg	TM38/PM0
Sulphate as SO_4 #	317	44	<5	-							1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride	-	-	-	15							800	15000	25000	<3	mg/kg	TM38/PM0
Chloride #	6	6	<3	-							800	15000	25000	<3	mg/kg	TM38/PM0
Total Dissolved Solids	-	-	-	<350							4000	60000	100000	<350	mg/kg	TM20/PM0

Client Name: Ground Investigations Ireland

Reference: 10299-12-20

Location: Greenhills Road

Contact: Barry Sexton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
21/1882	1	BH-02A	0.00-0.50	1-3	No interpretation possible
21/1882	1	BH-04	0.00-1.70	7-9	No interpretation possible
21/1882	1	BH-05	0.50-2.40	16-18	No interpretation possible
21/1882	1	BH-06	3.00-3.30	31-33	Degraded diesel

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

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). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

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

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/1882	1	BH-02A	0.00-0.50	2	12/02/2021	**General Description (Bulk Analysis)**	Soil/Stones
					12/02/2021	**Asbestos Fibres**	NAD
					12/02/2021	**Asbestos ACM**	NAD
					12/02/2021	**Asbestos Type**	NAD
					12/02/2021	**Asbestos Level Screen**	NAD
21/1882	1	BH-04	0.00-1.70	8	12/02/2021	**General Description (Bulk Analysis)**	soil.stones
					12/02/2021	**Asbestos Fibres**	NAD
					12/02/2021	**Asbestos ACM**	NAD
					12/02/2021	**Asbestos Type**	NAD
					12/02/2021	**Asbestos Level Screen**	NAD
21/1882	1	BH-05	0.50-2.40	17	12/02/2021	**General Description (Bulk Analysis)**	Soil/Stones
					12/02/2021	**Asbestos Fibres**	NAD
					12/02/2021	**Asbestos ACM**	NAD
					12/02/2021	**Asbestos Type**	NAD
					12/02/2021	**Asbestos Level Screen**	NAD
21/1882	1	BH-06	3.00-3.30	32	12/02/2021	**General Description (Bulk Analysis)**	Soil/Stones
					12/02/2021	**Asbestos Fibres**	NAD
					12/02/2021	**Asbestos ACM**	NAD
					12/02/2021	**Asbestos Type**	NAD
					12/02/2021	**Asbestos Level Screen**	NAD

Notification of Deviating Samples

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
21/1882	1	BH-02A	0.00-0.50	1-3	EPH, GRO, PAH, PCB	Sample holding time exceeded
21/1882	1	BH-04	0.00-1.70	7-9	EPH, PAH, PCB	Sample holding time exceeded
21/1882	1	BH-05	0.50-2.40	16-18	EPH, GRO, PAH, PCB	Sample holding time exceeded prior to receipt

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.

EMT Job No.: 21/1882

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an 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 or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

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 extracted.
#2	EU_Total but with fatty acids extracted.
_	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: 21/1882

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.			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.			AR	Yes

EMT Job No: 21/1882

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
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, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	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, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
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	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	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	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.			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	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

EMT Job No: 21/1882

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	PM0	No preparation is required.			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		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.			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.			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
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes

EMT Job No: 21/1882

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.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.			AR	No
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.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
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Ireland

4225

Attention :	Barry Sexton
Date :	17th February, 2021
Your reference :	10299-12-20
Our reference :	Test Report 21/925 Batch 3
Location :	Greenhills Road
Date samples received :	8th February, 2021
Status :	Final report
Issue :	1

Three samples were received for analysis on 8th February, 2021 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Client Name: Ground Investigations Ireland
Reference: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton
EMT Job No: 21/925

Report : **Liquid**

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	79-86	87-94	95-102	LOD/LOR	Units	Method No.
Sample ID	BH04	BH06	BH08			
Depth						
COC No / misc						
Containers	V H HNUF HCL Z P G	V H HNUF HCL Z P G	V H HNUF HCL Z P G			
Sample Date	04/02/2021	04/02/2021	04/02/2021			
Sample Type	Ground Water	Ground Water	Ground Water			
Batch Number	3	3	3			
Date of Receipt	08/02/2021	08/02/2021	08/02/2021			
Dissolved Arsenic #	<2.5	4.2	5.3	<2.5	ug/l	TM30/PM14
Dissolved Boron	19	25	24	<12	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5	<0.5	<0.5	<0.5	ug/l	TM30/PM14
Total Dissolved Chromium #	<1.5	<1.5	<1.5	<1.5	ug/l	TM30/PM14
Dissolved Copper #	<7	<7	<7	<7	ug/l	TM30/PM14
Dissolved Lead #	<5	<5	<5	<5	ug/l	TM30/PM14
Dissolved Manganese #	1166	3	714	<2	ug/l	TM30/PM14
Dissolved Mercury #	<1	<1	<1	<1	ug/l	TM30/PM14
Dissolved Nickel #	9	<2	9	<2	ug/l	TM30/PM14
Dissolved Phosphorus #	<5	7	<5	<5	ug/l	TM30/PM14
Dissolved Potassium #	8.1	1.4	2.5	<0.1	mg/l	TM30/PM14
Dissolved Zinc #	<3	<3	<3	<3	ug/l	TM30/PM14
PAH MS						
Naphthalene #	$<5.0_{AA}$	<0.1	<0.1	<0.1	ug/l	TM4/PM30
Acenaphthylene #	$<0.650_{AA}$	0.215	0.023	<0.013	ug/l	TM4/PM30
Acenaphthene #	0.975_{AA}	0.168	0.027	<0.013	ug/l	TM4/PM30
Fluorene #	1.712_{AA}	0.572	0.091	<0.014	ug/l	TM4/PM30
Phenanthrene #	4.311_{AA}	1.279	0.034	<0.011	ug/l	TM4/PM30
Anthracene #	$<0.650_{AA}$	0.121	<0.013	<0.013	ug/l	TM4/PM30
Fluoranthene #	0.617_{AA}	<0.012	<0.012	<0.012	ug/l	TM4/PM30
Pyrene #	1.769_{AA}	0.265	<0.013	<0.013	ug/l	TM4/PM30
Benzo(a)anthracene #	$<0.750_{AA}$	<0.015	<0.015	<0.015	ug/l	TM4/PM30
Chrysene #	$<0.550_{AA}$	<0.011	<0.011	<0.011	ug/l	TM4/PM30
Benzo(bk)fluoranthene #	$<0.900_{AA}$	<0.018	<0.018	<0.018	ug/l	TM4/PM30
Benzo(a)pyrene #	$<0.800_{AA}$	<0.016	<0.016	<0.016	ug/l	TM4/PM30
Indeno(123cd)pyrene #	$<0.550_{AA}$	<0.011	<0.011	<0.011	ug/l	TM4/PM30
Dibenzo(ah)anthracene #	$<0.50_{AA}$	<0.01	<0.01	<0.01	ug/l	TM4/PM30
Benzo(ghi)perylene #	$<0.550_{AA}$	<0.011	<0.011	<0.011	ug/l	TM4/PM30
PAH 16 Total #	$<9.750_{AA}$	2.620	<0.195	<0.195	ug/l	TM4/PM30
Benzo(b)fluoranthene	$<0.50_{AA}$	<0.01	<0.01	<0.01	ug/l	TM4/PM30
Benzo(k)fluoranthene	$<0.50_{AA}$	<0.01	<0.01	<0.01	ug/l	TM4/PM30
PAH Surrogate % Recovery	74_{AA}	74	82	<0	%	TM4/PM30
Methyl Tertiary Butyl Ether #	<0.1	<0.1	<0.1	<0.1	ug/l	TM15/PM10
Benzene #	<0.5	<0.5	<0.5	<0.5	ug/l	TM15/PM10
Toluene #	<5	<5	<5	<5	ug/l	TM15/PM10
Ethylbenzene #	<1	<1	<1	<1	ug/l	TM15/PM10
m/p-Xylene #	<2	<2	<2	<2	ug/l	TM15/PM10
o-Xylene #	<1	<1	<1	<1	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	104	104	104	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	99	96	97	<0	%	TM15/PM10

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	**Report :**	**Liquid**
Reference:	10299-12-20		
Location:	Greenhills Road		
Contact:	Barry Sexton	**Liquids/products:**	V=40ml vial, G=glass bottle, P=plastic bottle
EMT Job No:	21/925		$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HNO_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	79-86	87-94	95-102	LOD/LOR	Units	Method No.
Sample ID	BH04	BH06	BH08			
Depth						
COC No / misc						
Containers	V H HNUF HCL Z P G	V H HNUF HCL Z P G	V H HNUF HCL Z P G			
Sample Date	04/02/2021	04/02/2021	04/02/2021			
Sample Type	Ground Water	Ground Water	Ground Water			
Batch Number	3	3	3			
Date of Receipt	08/02/2021	08/02/2021	08/02/2021			
TPH CWG						
Aliphatics						
>C5-C6 #	<10	<10	<10	<10	ug/l	TM36/PM12
>C6-C8 #	<10	<10	<10	<10	ug/l	TM36/PM12
>C8-C10 #	<10	205	<10	<10	ug/l	TM36/PM12
>C10-C12 #	883	268	<5	<5	ug/l	TM5/PM16/PM30
>C12-C16 #	3880	1230	<10	<10	ug/l	TM5/PM16/PM30
>C16-C21 #	4270	1080	<10	<10	ug/l	TM5/PM16/PM30
>C21-C35 #	2410	350	<10	<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35 #	11443	3133	<10	<10	ug/l	TM5/TM36/PM12/PM16/PM30
Aromatics						
>C5-EC7 #	<10	<10	<10	<10	ug/l	TM36/PM12
>EC7-EC8 #	<10	<10	<10	<10	ug/l	TM36/PM12
>EC8-EC10 #	<10	<10	<10	<10	ug/l	TM36/PM12
>EC10-EC12 #	98	82	<5	<5	ug/l	TM5/PM16/PM30
>EC12-EC16 #	1390	630	<10	<10	ug/l	TM5/PM16/PM30
>EC16-EC21 #	3440	930	<10	<10	ug/l	TM5/PM16/PM30
>EC21-EC35 #	2270	470	<10	<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35 #	7198	2112	<10	<10	ug/l	TM5/TM36/PM12/PM16/PM30
Total aliphatics and aromatics(C5-35) #	18641	5245	<10	<10	ug/l	TM5/TM36/PM12/PM16/PM30
Phenol #	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Sulphate as SO4 #	20.6	29.0	21.0	<0.5	mg/l	TM38/PM0
Chloride #	7.4	8.3	9.5	<0.3	mg/l	TM38/PM0
Nitrate as NO3 #	4.9	<0.2	0.4	<0.2	mg/l	TM38/PM0
Nitrite as NO2 #	0.38	<0.02	<0.02	<0.02	mg/l	TM38/PM0
Total Cyanide #	<0.01	<0.01	<0.01	<0.01	mg/l	TM89/PM0
Ammoniacal Nitrogen as NH3 #	0.20	<0.03	<0.03	<0.03	mg/l	TM38/PM0
Hexavalent Chromium	<0.006	<0.006	<0.006	<0.006	mg/l	TM38/PM0
Electrical Conductivity @25C #	592	819	650	<2	uS/cm	TM76/PM0
pH #	7.88	7.36	7.65	<0.01	pH units	TM73/PM0

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All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name:	Ground Investigations Ireland	**VOC Report :**	**Liquid**
Reference:	10299-12-20		
Location:	Greenhills Road		
Contact:	Barry Sexton		
EMT Job No:	21/925		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	79-86	87-94	95-102	LOD/LOR	Units	Method No.
Sample ID	BH04	BH06	BH08			
Depth						
COC No / misc						
Containers	V H HNUF HCL Z P G	V H HNUF HCL Z P G	V H HNUF HCL Z P G			
Sample Date	04/02/2021	04/02/2021	04/02/2021			
Sample Type	Ground Water	Ground Water	Ground Water			
Batch Number	3	3	3			
Date of Receipt	08/02/2021	08/02/2021	08/02/2021			
VOC MS						
Dichlorodifluoromethane	<2	<2	<2	<2	ug/l	TM15/PM10
Methyl Tertiary Butyl Ether #	<0.1	<0.1	<0.1	<0.1	ug/l	TM15/PM10
Chloromethane #	<3	<3	<3	<3	ug/l	TM15/PM10
Vinyl Chloride #	<0.1	<0.1	<0.1	<0.1	ug/l	TM15/PM10
Bromomethane	<1	<1	<1	<1	ug/l	TM15/PM10
Chloroethane #	<3	<3	<3	<3	ug/l	TM15/PM10
Trichlorofluoromethane #	<3	<3	<3	<3	ug/l	TM15/PM10
1,1-Dichloroethene (1,1 DCE) #	<3	<3	<3	<3	ug/l	TM15/PM10
Dichloromethane (DCM) #	<5	<5	<5	<5	ug/l	TM15/PM10
trans-1-2-Dichloroethene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,1-Dichloroethane #	<3	<3	<3	<3	ug/l	TM15/PM10
cis-1-2-Dichloroethene #	<3	<3	<3	<3	ug/l	TM15/PM10
2,2-Dichloropropane	<1	<1	<1	<1	ug/l	TM15/PM10
Bromochloromethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Chloroform #	<2	<2	<2	<2	ug/l	TM15/PM10
1,1,1-Trichloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
1,1-Dichloropropene #	<3	<3	<3	<3	ug/l	TM15/PM10
Carbon tetrachloride #	<2	<2	<2	<2	ug/l	TM15/PM10
1,2-Dichloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Benzene #	<0.5	<0.5	<0.5	<0.5	ug/l	TM15/PM10
Trichloroethene (TCE) #	<3	13	<3	<3	ug/l	TM15/PM10
1,2-Dichloropropane #	<2	<2	<2	<2	ug/l	TM15/PM10
Dibromomethane #	<3	<3	<3	<3	ug/l	TM15/PM10
Bromodichloromethane #	<2	<2	<2	<2	ug/l	TM15/PM10
cis-1-3-Dichloropropene	<2	<2	<2	<2	ug/l	TM15/PM10
Toluene #	<5	<5	<5	<5	ug/l	TM15/PM10
trans-1-3-Dichloropropene	<2	<2	<2	<2	ug/l	TM15/PM10
1,1,2-Trichloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Tetrachloroethene (PCE) #	<3	<3	<3	<3	ug/l	TM15/PM10
1,3-Dichloropropane #	<2	<2	<2	<2	ug/l	TM15/PM10
Dibromochloromethane #	<2	<2	<2	<2	ug/l	TM15/PM10
1,2-Dibromoethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Chlorobenzene #	<2	<2	<2	<2	ug/l	TM15/PM10
1,1,1,2-Tetrachloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Ethylbenzene #	<1	<1	<1	<1	ug/l	TM15/PM10
m/p-Xylene #	<2	<2	<2	<2	ug/l	TM15/PM10
o-Xylene #	<1	<1	<1	<1	ug/l	TM15/PM10
Styrene	<2	<2	<2	<2	ug/l	TM15/PM10
Bromoform #	<2	<2	<2	<2	ug/l	TM15/PM10
Isopropylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,1,2,2-Tetrachloroethane	<4	<4	<4	<4	ug/l	TM15/PM10
Bromobenzene #	<2	<2	<2	<2	ug/l	TM15/PM10
1,2,3-Trichloropropane #	<3	<3	<3	<3	ug/l	TM15/PM10
Propylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
2-Chlorotoluene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,3,5-Trimethylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
4-Chlorotoluene #	<3	<3	<3	<3	ug/l	TM15/PM10
tert-Butylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,2,4-Trimethylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
sec-Butylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
4-Isopropyltoluene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,3-Dichlorobenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,4-Dichlorobenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
n-Butylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dichlorobenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dibromo-3-chloropropane	<2	<2	<2	<2	ug/l	TM15/PM10
1,2,4-Trichlorobenzene	<3	<3	<3	<3	ug/l	TM15/PM10
Hexachlorobutadiene	<3	<3	<3	<3	ug/l	TM15/PM10
Naphthalene	<2	<2	<2	<2	ug/l	TM15/PM10
1,2,3-Trichlorobenzene	<3	<3	<3	<3	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	104	104	104	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	99	96	97	<0	%	TM15/PM10

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: 10299-12-20
Location: Greenhills Road
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 21/925						

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.

EMT Job No.: 21/925

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an 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 or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x50 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 extracted.
#2	EU_Total but with fatty acids extracted.
_	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: 21/925

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
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5/TM36	please refer to TM5 and TM36 for method details	PM12/PM16/PM30	please refer to PM16/PM30 and PM12 for method details	Yes			
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.				
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.	Yes			
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes			
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE 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			

EMT Job No: 21/925

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	PM0	No preparation is required.				
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM0	No preparation is required.	Yes			
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM76	Modified US EPA method 120.1 (1982). Determination of Specific Conductance by Metrohm automated probe analyser.	PM0	No preparation is required.	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.	PM0	No preparation is required.	Yes			

APPENDIX 5 – Groundwater and Gas Monitoring

Ground Investigations Ireland Gas Monitoring Field Sheet (Revision V2 September 2020)

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Project Number	10299-12-20	Sample Date	04/02/2021
Client	Lohan Donnelly	Current Weather	Dry
Site Name	Greenhills Road	Weather Prev 24 hours	Wet
Sampler I.D.	NM	Gas Meter Model	Geotech GA 5000

Sample I.D.	BH04	BH06	BH08									
Casing Diameter (mm)	N/A	N/A	N/A									
Standpipe Diameter (mm)	50	50	50									
Stick Up (mm)	-	-	-									
Cover Condition	Good	Good	Good									
Standpipe Type uPVC etc.	PVC	PVC	PVC									
Total Well Depth (m)	3.33	3.2	3.42									
Water Level (mBBGL)	2.45	1.65	2.7									
Odour	HC Odour	None	HC Odour									
Gas Valve/Cap Condition	Good	Good	Good									
Flow (litre/hour)	0.5	0.6	0.3									
CH4 (%)	0.5	0.5	0.5									
CO2 (%)	1.4	1.4	0.1									
CO (%)	0	1	0									
H2S (ppm)	0	0	0									
O2 (%)	16.4	18.4	20.6									
Barometric Pressure	996	995	996									
Additional Comment												

Ground Investigations Ireland Gas Monitoring Field Sheet (Revision V2 September 2020)

Project Number	10299-12-20	Sample Date	12/02/2021
Client	Lohan Donnelly	Current Weather	Dry
Site Name	Greenhills Road	Weather Prev 24 hours	Dry
Sampler I.D.	NM	Gas Meter Model	Geotech GA 5000

Sample I.D.	BH04	BH06	BH08									
Casing Diameter (mm)	N/A	N/A	N/A									
Standpipe Diameter (mm)	50	50	50									
Stick Up (mm)	-	-	-									
Cover Condition	Good	Good	Good									
Standpipe Type uPVC etc.	PVC	PVC	PVC									
Total Well Depth (m)	3.33	3.2	3.42									
Water Level (mBBGL)	2.71	1.87	-									
Odour	HC Odour	None	-									
Gas Valve/Cap Condition	Good	Good	Good									
Flow (litre/hour)	0.5	0.5	0.4									
CH4 (%)	0.4	0.6	0.6									
CO2 (%)	1.1	5.7	0.1									
CO (%)	1	0	0									
H2S (ppm)	0	0	0									
O2 (%)	20.3	10.9	21.5									
Barometric Pressure	1018	1018	1018									
Additional Comment												

Ground Investigations Ireland Gas Monitoring Field Sheet (Revision V2 September 2020)

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Project Number	10299-12-20	Sample Date	15/02/2021
Client	Lohan Donnelly	Current Weather	Wet
Site Name	Greenhills Road	Weather Prev 24 hours	Wet
Sampler I.D.	NM	Gas Meter Model	Geotech GA 5000

Sample I.D.	BH04	BH06	BH08											
Casing Diameter (mm)	N/A	N/A	N/A											
Standpipe Diameter (mm)	50	50	50											
Stick Up (mm)	-	-	-											
Cover Condition	Good	Good	Good											
Standpipe Type uPVC etc.	PVC	PVC	PVC											
Total Well Depth (m)	3.33	3.2	3.42											
Water Level (mBBGL)	2.76	1.94	-											
Odour	HC Odour	None	-											
Gas Valve/Cap Condition	Good	Good	Good											
Flow (litre/hour)	0.6	0.6	0.6											
CH4 (%)	0.5	0.5	0.5											
CO2 (%)	1.7	5.5	0.5											
CO (%)	1	0	0											
H2S (ppm)	0	0	0											
O2 (%)	19	10.6	20.4											
Barometric Pressure	1002	1002	1002											
Additional Comment														

Ground Investigations Ireland Groundwater Monitoring Field Sheet

Project Number	10299-12-20	Sample Date	04/02/2021
Client	Lohan Donnelly	Current Weather	Dry
Site Name	Greenhills Road	Weather Prev 24 hours	Wet
Sampler I.D.	NM	Sampling Method/Type	Pump/Bailer

Sample I.D.	BH04	BH06	BH08									
Casing Diameter (mm)	N/A	N/A	N/A									
Standpipe Diameter (mm)	50	50	50									
Stick Up (mm)	-	-	-									
Cover Condition	Good	Good	Good									
Standpipe Type uPVC etc.	PVC	PVC	PVC									
Total Well Depth (m)	3.33	3.2	3.42									
Water Level (mBGL)	2.45	1.65	2.7									
Odour	HC Odour	None	HC Odour									
Time Purging Start	12:20	10:50	11:15									
Timer Purging End	12:20	10:55	11:15									
Purge Volume (litres)	0	2	0									
Sampling Time	12:30	11:10	11:30									
Litres Purged	0	2	0									
Ph (pH Units)	7.65	7.79	7.8									
EC (mS/cm)	0.57	0.88	0.69									
Temp (Degrees)	10.5	12.7	11.2									
ORP (mV)	166	173	`77									
DO (mg/l)												
Colour	Brown	Brown	Brown									
Odour	HC Odour	None	HC Odour									
Additional Comments												

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Groundwater Monitoring Field Sheet

Project Number	10299-12-20	Sample Date	12/02/2021
Client	Lohan Donnelly	Current Weather	Dry
Site Name	Greenhills Road	Weather Prev 24 hours	Dry
Sampler I.D.	NM	Sampling Method/Type	N/A

Sample I.D.	BH04	BH06	BH08									
Casing Diameter (mm)	N/A	N/A	N/A									
Standpipe Diameter (mm)	50	50	50									
Stick Up (mm)	-	-	-									
Cover Condition	Good	Good	Good									
Standpipe Type uPVC etc.	PVC	PVC	PVC									
Total Well Depth (m)	3.33	3.2	3.42									
Water Level (mBGL)	2.71	1.87	Gas Tap Sealed									
Odour	HC Odour	None										
Time Purging Start	N/A	N/A	N/A									
Timer Purging End	N/A	N/A	N/A									
Purge Volume (litres)	N/A	N/A	N/A									
Sampling Time	N/A	N/A	N/A									
Litres Purged	N/A	N/A	N/A									
Ph (pH Units)	N/A	N/A	N/A									
EC (mS/cm)	N/A	N/A	N/A									
Temp (Degrees)	N/A	N/A	N/A									
ORP (mV)	N/A	N/A	N/A									
DO (mg/l)	N/A	N/A	N/A									
Colour	N/A	N/A	N/A									
Odour	N/A	N/A	N/A									
Additional Comments												

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Groundwater Monitoring Field Sheet

Project Number	10299-12-20	Sample Date	15/02/2021
Client	Lohan Donnelly	Current Weather	Wet
Site Name	Greenhills Road	Weather Prev 24 hours	Wet
Sampler I.D.	NM	Sampling Method/Type	N/A

Sample I.D.	BH04	BH06	BH08												
Casing Diameter (mm)	N/A	N/A	N/A												
Standpipe Diameter (mm)	50	50	50												
Stick Up (mm)	-	-	-												
Cover Condition	Good	Good	Good												
Standpipe Type uPVC etc.	PVC	PVC	PVC												
Total Well Depth (m)	3.33	3.2	3.42												
Water Level (mBGL)	2.76	1.94	Gas Tap Sealed												
Odour	HC Odour	None													
Time Purging Start	N/A	N/A	N/A												
Timer Purging End	N/A	N/A	N/A												
Purge Volume (litres)	N/A	N/A	N/A												
Sampling Time	N/A	N/A	N/A												
Litres Purged	N/A	N/A	N/A												
Ph (pH Units)	N/A	N/A	N/A												
EC (mS/cm)	N/A	N/A	N/A												
Temp (Degrees)	N/A	N/A	N/A												
ORP (mV)	N/A	N/A	N/A												
DO (mg/l)	N/A	N/A	N/A												
Colour	N/A	N/A	N/A												
Odour	N/A	N/A	N/A												
Additional Comments															

APPENDIX 13

13.1 Traffic & Transport Assessment

13.2 Mobility Management Plan

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+353 (0)1 539 0710 info@hpdc.ie www.hpdc.ie

HUGHES PLANNING
& DEVELOPMENT CONSULTANTS

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Industrial Zone	1
Residential Zone	10
No Sub Category	2

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

E(f)	13 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 500m Range:
All Surveys Included
Population within 1 mile:

1,001 to 5,000	2 days
5,001 to 10,000	2 days
10,001 to 15,000	1 days
15,001 to 20,000	1 days
20,001 to 25,000	2 days
25,001 to 50,000	4 days
50,001 to 100,000	1 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,001 to 25,000	1 days
50,001 to 75,000	1 days
75,001 to 100,000	5 days
125,001 to 250,000	3 days
250,001 to 500,000	3 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	3 days
1.1 to 1.5	10 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	13 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	13 days

This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1 **BG-04-D-01** **NURSERY** **BRIDGEND**
GEORGE STREET
BRIDGEND
BRIDGEND IND. ESTATE
Edge of Town
Industrial Zone
Total Gross floor area: 210 sqm
Survey date: MONDAY *13/10/14* *Survey Type: MANUAL*

2 **CA-04-D-02** **NURSERY** **CAMBRIDGESHIRE**
EASTFIELD ROAD
PETERBOROUGH

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 400 sqm
Survey date: TUESDAY *18/10/16* *Survey Type: MANUAL*

3 **CH-04-D-01** **NURSERY** **CHESHIRE**
CHESTER ROAD
MACCLESFIELD

Edge of Town Centre
No Sub Category
Total Gross floor area: 500 sqm
Survey date: MONDAY *24/11/14* *Survey Type: MANUAL*

4 **DS-04-D-02** **NURSERY** **DERBYSHIRE**
MAXWELL AVENUE
DERBY
DARLEY ABBEY
Edge of Town
Residential Zone
Total Gross floor area: 415 sqm
Survey date: THURSDAY *12/07/18* *Survey Type: MANUAL*

5 **DU-04-D-01** **NURSERY** **DUNDEE CITY**
LONGTOWN TERRACE
DUNDEE

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 325 sqm
Survey date: MONDAY *24/04/17* *Survey Type: MANUAL*

6 **ES-04-D-01** **NURSERY** **EAST SUSSEX**
CONNAUGHT ROAD
BRIGHTON
HOVE
Neighbourhood Centre (PPS6 Local Centre)
Residential Zone
Total Gross floor area: 185 sqm
Survey date: FRIDAY *22/09/17* *Survey Type: MANUAL*

7 **LE-04-D-01** **NURSERY** **LEICESTERSHIRE**
WIGSTON ROAD
LEICESTER
OADBY
Edge of Town
Residential Zone
Total Gross floor area: 375 sqm
Survey date: THURSDAY *30/10/14* *Survey Type: MANUAL*

8 **RO-04-D-01** **NURSERY** **ROSCOMMON**
PARK VIEW
ROSCOMMON
CRUBY HILL
Edge of Town
Residential Zone
Total Gross floor area: 500 sqm
Survey date: FRIDAY *26/09/14* *Survey Type: MANUAL*

9 **SH-04-D-01** **NURSERY** **SHROPSHIRE**
OLD COLEHAM
SHREWSBURY

Edge of Town Centre
Residential Zone
Total Gross floor area: 326 sqm
Survey date: WEDNESDAY *28/05/14* *Survey Type: MANUAL*

LIST OF SITES relevant to selection parameters (Cont.)

10 SR-04-D-01 NURSERY **STIRLING**
HENDERSON STREET
STIRLING
BRIDGE OF ALLAN
Edge of Town
No Sub Category
Total Gross floor area: 250 sqm
Survey date: MONDAY 16/06/14 *Survey Type: MANUAL*

11 TV-04-D-01 NURSERY **TEES VALLEY**
COTSWOLD DRIVE
REDCAR

Edge of Town
Residential Zone
Total Gross floor area: 150 sqm
Survey date: FRIDAY 19/05/17 *Survey Type: MANUAL*

12 WK-04-D-01 NURSERY **WARWICKSHIRE**
THE RIDGEWAY
STRATFORD UPON AVON

Edge of Town
Residential Zone
Total Gross floor area: 340 sqm
Survey date: FRIDAY 29/06/18 *Survey Type: MANUAL*

13 WL-04-D-01 NURSERY **WILTSHIRE**
SHREWSBURY ROAD
SWINDON
WALCOT
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 500 sqm
Survey date: THURSDAY 22/09/16 *Survey Type: MANUAL*

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 04 - EDUCATION/D - NURSERY
TOTAL VEHICLES
Calculation factor: 100 sqm
Estimated TRIP rate value per 352 SQM shown in shaded columns
BOLD print indicates peak (busiest) period

	ARRIVALS				DEPARTURES				TOTALS			
Time Range	No. Days	Ave. GFA	Trip Rate	Estimated Trip Rate	No. Days	Ave. GFA	Trip Rate	Estimated Trip Rate	No. Days	Ave. GFA	Trip Rate	Estimated Trip Rate
00:00 - 01:00												
01:00 - 02:00												
02:00 - 03:00												
03:00 - 04:00												
04:00 - 05:00												
05:00 - 06:00												
06:00 - 07:00	1	400	0.000	0.000	1	400	0.000	0.000	1	400	0.000	0.000
07:00 - 08:00	13	344	2.458	8.651	13	344	1.318	4.640	13	344	3.776	13.291
08:00 - 09:00	**13**	**344**	**4.312**	**15.178**	13	344	3.329	11.718	**13**	**344**	**7.641**	**26.896**
09:00 - 10:00	13	344	1.899	6.685	13	344	1.810	6.370	13	344	3.709	13.055
10:00 - 11:00	13	344	0.782	2.752	13	344	0.581	2.045	13	344	1.363	4.797
11:00 - 12:00	13	344	0.916	3.224	13	344	0.626	2.202	13	344	1.542	5.426
12:00 - 13:00	13	344	1.519	5.348	13	344	1.743	6.134	13	344	3.262	11.482
13:00 - 14:00	13	344	1.050	3.696	13	344	1.452	5.112	13	344	2.502	8.808
14:00 - 15:00	13	344	1.095	3.853	13	344	1.028	3.618	13	344	2.123	7.471
15:00 - 16:00	13	344	0.938	3.303	13	344	1.408	4.954	13	344	2.346	8.257
16:00 - 17:00	13	344	1.832	6.449	13	344	2.011	7.078	13	344	3.843	13.527
17:00 - 18:00	13	344	2.703	9.516	**13**	**344**	**3.552**	**12.504**	13	344	6.255	22.020
18:00 - 19:00	12	361	0.208	0.732	12	361	0.717	2.522	12	361	0.925	3.254
19:00 - 20:00	1	400	0.000	0.000	1	400	0.000	0.000	1	400	0.000	0.000
20:00 - 21:00												
21:00 - 22:00												
22:00 - 23:00												
23:00 - 24:00												
Total Rates:			19.712	69.387			19.575	68.897			39.287	138.284

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	150 - 500 (units: sqm)
Survey date date range:	01/01/13 - 12/07/18
Number of weekdays (Monday-Friday):	13
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

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APPENDIX 5

ARCADY AND PICADY OUTPUT

ARCADY OUTPUT – WALKINSTOWN ROUNDABOUT

Junctions 9

ARCADY 9 - Roundabout Module

Version: 9.5.0.6896

For sales and distribution information, program advice and maintenance, contact TRL:
+44 (0)1344 379777 software@trl.co.uk www.trlsoftware.co.uk

The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution

Filename: walk rbout existing flows.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\ARCADY
Report generation date: 08/03/2021 14:41:53

»2021, AM
»2021, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2021									
Arm 1	3.6	17.65	0.79	C	-3 % [Arm 3]	6.5	26.83	0.89	D	2 % [Arm 1]
Arm 2	7.7	32.87	0.91	D		4.6	22.26	0.84	C	
Arm 3	11.3	49.46	0.94	E		2.4	13.46	0.71	B	
Arm 4	7.3	47.86	0.91	E		5.0	22.53	0.86	C	
Arm 5	1.5	9.74	0.60	A		1.4	8.67	0.58	A	
Arm 6	2.5	11.83	0.72	B		2.0	10.51	0.68	B	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	13/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2021	AM	DIRECT	08:00	09:00	60	15
D2	2021	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2021, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	29.27	D

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-3	Arm 3

Arms

Arms

Arm	Name	Description
1	Walkinstown Road	
2	Cromwellsfort Road	
3	St Peters Road	
4	Grenhills Road	
5	Ballymount Road	
6	Walkinstown Avenue	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	3.00	8.00	20.0	15.0	55.0	45.0	
2	3.00	8.00	20.0	15.0	55.0	45.0	

3	3.00	8.00	20.0	15.0	55.0	45.0	
4	3.00	7.50	20.0	15.0	55.0	45.0	
5	3.00	8.00	20.0	15.0	55.0	45.0	
6	3.00	8.00	20.0	15.0	55.0	45.0	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/TS)
1	0.553	407.752
2	0.553	407.752
3	0.553	407.752
4	0.545	396.355
5	0.553	407.752
6	0.553	407.752

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2021	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To					
		1	2	3	4	5	6
From	1	0.00	8.00	37.00	73.00	54.00	3.00
	2	6.00	0.00	10.00	40.00	97.00	31.00
	3	7.00	5.00	0.00	8.00	51.00	66.00
	4	68.00	58.00	14.00	0.00	14.00	38.00
	5	36.00	49.00	20.00	6.00	0.00	6.00
	6	6.00	63.00	58.00	37.00	16.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To					
		1	2	3	4	5	6
From	1	0.00	5.00	35.00	61.00	45.00	2.00
	2	3.00	0.00	17.00	45.00	110.00	42.00
	3	11.00	4.00	0.00	4.00	64.00	79.00
	4	60.00	58.00	9.00	0.00	12.00	33.00
	5	27.00	61.00	15.00	5.00	0.00	10.00
	6	6.00	85.00	48.00	38.00	16.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To					
		1	2	3	4	5	6
From	1	0.00	6.00	35.00	68.00	61.00	16.00
	2	7.00	0.00	18.00	38.00	121.00	35.00
	3	26.00	8.00	0.00	0.00	72.00	76.00
	4	46.00	45.00	5.00	0.00	15.00	22.00
	5	25.00	71.00	18.00	10.00	0.00	7.00
	6	5.00	66.00	54.00	20.00	16.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To					
		1	2	3	4	5	6
From	1	0.00	9.00	34.00	50.00	35.00	4.00
	2	9.00	12.00	0.00	20.00	100.00	47.00
	3	36.00	11.00	0.00	2.00	89.00	81.00
	4	50.00	36.00	12.00	0.00	20.00	28.00
	5	38.00	70.00	13.00	7.00	0.00	9.00
	6	2.00	63.00	46.00	20.00	7.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	0.79	17.65	3.6	C
2	0.91	32.87	7.7	D
3	0.94	49.46	11.3	E
4	0.91	47.86	7.3	E
5	0.60	9.74	1.5	A

6	0.72	11.83	2.5	B

Main Results for each time segment

08:00 - 08:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	175.00	321.03	230.23	0.760	172.04	3.0	14.802	B
2	184.00	313.23	234.54	0.785	180.65	3.4	15.845	C
3	137.00	356.97	210.36	0.651	135.20	1.8	11.714	B
4	192.00	330.71	216.22	0.888	185.87	6.1	25.947	D
5	117.00	288.57	248.18	0.471	116.12	0.9	6.771	A
6	180.00	263.43	262.08	0.687	177.89	2.1	10.446	B

08:15 - 08:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	148.00	338.16	220.76	0.670	148.85	2.1	12.667	B
2	217.00	274.90	255.74	0.849	215.40	5.0	21.345	C
3	162.00	366.20	205.25	0.789	160.38	3.4	19.361	C
4	172.00	373.54	192.89	0.892	171.21	6.9	38.728	E
5	118.00	298.96	242.44	0.487	117.94	0.9	7.226	A
6	193.00	252.22	268.28	0.719	192.64	2.5	11.826	B

08:30 - 08:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	186.00	314.13	234.05	0.795	184.55	3.6	17.646	C
2	219.00	302.10	240.70	0.910	216.28	7.7	32.873	D
3	182.00	388.58	192.88	0.944	176.32	9.1	43.506	E
4	133.00	429.31	162.51	0.818	134.81	5.1	34.454	D
5	131.00	283.67	250.89	0.522	130.86	1.1	7.488	A
6	161.00	260.70	263.59	0.611	161.86	1.6	8.921	A

08:45 - 09:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	132.00	296.33	243.89	0.541	134.36	1.2	8.386	A
2	188.00	230.14	280.49	0.670	193.57	2.1	10.978	B
3	219.00	318.02	231.90	0.944	216.78	11.3	49.458	E
4	146.00	433.93	160.00	0.913	143.76	7.3	47.859	E
5	137.00	324.06	228.56	0.599	136.62	1.5	9.745	A
6	138.00	291.69	246.45	0.560	138.31	1.3	8.347	A

2021, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS

1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	18.13	C

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	2	Arm 1

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2021	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To					
		1	2	3	4	5	6
From	1	0.00	21.00	40.00	82.00	53.00	5.00
	2	9.00	16.00	16.00	34.00	75.00	26.00
	3	26.00	14.00	0.00	10.00	46.00	61.00
	4	61.00	50.00	24.00	0.00	18.00	31.00
	5	20.00	39.00	26.00	16.00	0.00	15.00
	6	8.00	66.00	54.00	23.00	8.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To					
		1	2	3	4	5	6
From	1	0.00	12.00	40.00	60.00	69.00	5.00
	2	5.00	0.00	26.00	40.00	88.00	33.00
	3	19.00	14.00	0.00	9.00	54.00	47.00
	4	36.00	43.00	0.00	0.00	25.00	28.00
	5	34.00	57.00	34.00	17.00	0.00	20.00
	6	7.00	74.00	56.00	27.00	14.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To					
		1	2	3	4	5	6
From	1	0.00	15.00	38.00	57.00	53.00	17.00
	2	4.00	0.00	22.00	30.00	58.00	55.00
	3	21.00	12.00	0.00	19.00	54.00	50.00
	4	64.00	49.00	15.00	0.00	16.00	22.00
	5	21.00	53.00	32.00	16.00	0.00	12.00
	6	5.00	0.00	65.00	28.00	13.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To					
		1	2	3	4	5	6
From	1	0.00	14.00	33.00	61.00	58.00	12.00
	2	4.00	0.00	16.00	37.00	76.00	42.00
	3	22.00	7.00	0.00	27.00	51.00	43.00
	4	61.00	45.00	23.00	0.00	26.00	15.00
	5	25.00	53.00	26.00	9.00	0.00	6.00
	6	15.00	49.00	61.00	3.00	7.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	0.89	26.83	6.5	D
2	0.84	22.26	4.6	C
3	0.71	13.46	2.4	B
4	0.86	22.53	5.0	C
5	0.58	8.67	1.4	A
6	0.68	10.51	2.0	B

Main Results for each time segment

17:00 - 17:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	201.00	331.12	224.65	0.895	194.54	6.5	25.993	D
2	176.00	323.25	229.00	0.769	172.92	3.1	15.308	C
3	157.00	339.21	220.18	0.713	154.64	2.4	13.299	B
4	184.00	332.63	215.18	0.855	179.04	5.0	22.530	C
5	116.00	315.96	233.03	0.498	115.03	1.0	7.566	A
6	159.00	295.48	244.36	0.651	157.20	1.8	10.129	B

17:15 - 17:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	186.00	337.21	221.28	0.841	186.67	5.8	26.827	D
2	192.00	322.80	229.25	0.838	190.52	4.6	22.262	C
3	143.00	357.06	210.31	0.680	143.17	2.2	13.459	B
4	132.00	346.85	207.43	0.636	135.14	1.8	12.954	B
5	162.00	233.29	278.75	0.581	161.61	1.4	7.657	A
6	178.00	261.62	263.08	0.677	177.77	2.0	10.511	B

17:30 - 17:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	180.00	283.44	251.01	0.717	183.14	2.7	13.815	B
2	169.00	336.98	221.41	0.763	170.13	3.4	17.960	C
3	156.00	334.41	222.83	0.700	155.92	2.3	13.416	B
4	166.00	339.02	211.70	0.784	164.48	3.3	18.459	C
5	134.00	307.08	237.94	0.563	134.05	1.3	8.671	A
6	111.00	285.58	249.83	0.444	112.22	0.8	6.598	A

17:45 - 18:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	178.00	283.17	251.17	0.709	178.15	2.5	12.368	B
2	175.00	293.37	245.52	0.713	175.85	2.6	13.086	B
3	150.00	309.97	236.34	0.635	150.48	1.8	10.547	B
4	170.00	323.19	220.32	0.772	169.99	3.3	17.859	C
5	119.00	275.14	255.61	0.466	119.43	0.9	6.628	A
6	135.00	275.55	255.38	0.529	134.71	1.1	7.440	A

Junctions 9

ARCADY 9 - Roundabout Module

Filename: walk rbout 2024 wod.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\ARCADY
Report generation date: 08/03/2021 14:19:09

»2024 WOD, AM
»2024 WOD, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2024 WOD									
Arm 1	4.2	20.04	0.82	C	-7 % [Arm 3]	13.2	62.29	0.97	F	-4 % [Arm 1]
Arm 2	11.8	48.63	0.95	E		9.2	39.43	0.94	E	
Arm 3	27.1	99.37	1.04	F		3.2	18.13	0.77	C	
Arm 4	15.3	87.07	1.01	F		6.3	28.88	0.89	D	
Arm 5	1.7	11.01	0.64	B		1.8	10.23	0.65	B	
Arm 6	3.1	14.21	0.76	B		3.0	14.95	0.76	B	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	13/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2024 WOD	AM	DIRECT	08:00	09:00	60	15
D2	2024 WOD	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2024 WOD, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	48.66	E

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-7	Arm 3

Arms

Arms

Arm	Name	Description
1	Walkinstown Road	
2	Cromwellsfort Road	
3	St Peters Road	
4	Greenhills Road	
5	Ballymount Road	
6	Walkinstown Avenue	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	3.00	8.00	20.0	15.0	55.0	45.0	
2	3.00	8.00	20.0	15.0	55.0	45.0	

3	3.00	8.00	20.0	15.0	55.0	45.0	
4	3.00	7.50	20.0	15.0	55.0	45.0	
5	3.00	8.00	20.0	15.0	55.0	45.0	
6	3.00	8.00	20.0	15.0	55.0	45.0	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/TS)
1	0.553	407.752
2	0.553	407.752
3	0.553	407.752
4	0.545	396.355
5	0.553	407.752
6	0.553	407.752

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2024 WOD	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To					
		1	2	3	4	5	6
From	1	0.00	8.00	39.00	76.00	57.00	3.00
	2	6.00	0.00	11.00	42.00	102.00	31.00
	3	8.00	5.00	0.00	9.00	54.00	66.00
	4	70.00	61.00	15.00	0.00	15.00	38.00
	5	37.00	52.00	21.00	7.00	0.00	6.00
	6	6.00	66.00	61.00	38.00	17.00	0.00

08:15 - 08:30

Demand (PCU/TS)

		To					
		1	2	3	4	5	6
From	1	0.00	5.00	36.00	64.00	47.00	2.00
	2	3.00	0.00	18.00	48.00	116.00	44.00
	3	11.00	4.00	0.00	4.00	67.00	83.00
	4	63.00	61.00	9.00	0.00	13.00	35.00
	5	28.00	64.00	16.00	6.00	0.00	10.00
	6	6.00	89.00	50.00	40.00	16.00	0.00

08:30 - 08:45

Demand (PCU/TS)

		To					
		1	2	3	4	5	6
From	1	0.00	6.00	37.00	71.00	63.00	6.00
	2	7.00	0.00	19.00	40.00	126.00	36.00
	3	28.00	8.00	0.00	0.00	76.00	79.00
	4	48.00	47.00	5.00	0.00	16.00	23.00
	5	26.00	75.00	19.00	10.00	0.00	7.00
	6	6.00	69.00	57.00	20.00	17.00	0.00

08:45 - 09:00

Demand (PCU/TS)

		To					
		1	2	3	4	5	6
From	1	0.00	9.00	36.00	53.00	37.00	4.00
	2	9.00	13.00	0.00	21.00	105.00	49.00
	3	38.00	12.00	0.00	2.00	93.00	85.00
	4	52.00	38.00	13.00	0.00	21.00	30.00
	5	40.00	73.00	14.00	8.00	0.00	9.00
	6	2.00	66.00	49.00	21.00	7.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	0.82	20.04	4.2	C
2	0.95	48.63	11.8	E
3	1.04	99.37	27.1	F
4	1.01	87.07	15.3	F
5	0.64	11.01	1.7	B

6	0.76	14.21	3.1	B

Main Results for each time segment

08:00 - 08:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	183.00	336.20	221.84	0.825	178.84	4.2	19.397	C
2	192.00	327.49	226.66	0.847	187.25	4.8	20.851	C
3	142.00	370.61	202.81	0.700	139.78	2.2	13.836	B
4	199.00	341.88	210.13	0.947	189.71	9.3	35.196	E
5	123.00	292.19	246.17	0.500	122.02	1.0	7.194	A
6	188.00	273.90	256.29	0.734	185.39	2.6	12.282	B

08:15 - 08:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	154.00	352.56	212.79	0.724	155.40	2.8	16.053	C
2	229.00	287.34	248.86	0.920	225.45	8.3	33.487	D
3	169.00	383.81	195.51	0.864	165.99	5.2	27.936	D
4	181.00	387.99	185.02	0.978	176.35	13.9	71.544	F
5	124.00	308.10	237.38	0.522	123.91	1.1	7.923	A
6	201.00	261.30	263.26	0.764	200.55	3.1	14.209	B

08:30 - 08:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	183.00	329.78	225.39	0.812	181.84	3.9	20.042	C
2	228.00	304.72	239.25	0.953	224.53	11.8	48.635	E
3	191.00	392.26	190.84	1.001	181.68	14.5	62.827	F
4	139.00	433.18	160.41	0.867	144.92	8.0	63.498	F
5	137.00	286.50	249.32	0.549	136.88	1.2	7.993	A
6	169.00	274.79	255.80	0.661	170.06	2.0	10.627	B

08:45 - 09:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	139.00	311.13	235.70	0.590	141.45	1.5	9.784	A
2	197.00	243.70	272.99	0.722	206.05	2.7	15.101	C
3	230.00	337.21	221.28	1.039	217.44	27.1	99.368	F
4	154.00	447.14	152.80	1.008	146.75	15.3	87.075	F
5	144.00	331.08	224.67	0.641	143.47	1.7	11.007	B
6	145.00	301.98	240.77	0.602	145.46	1.6	9.492	A

2024 WOD, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS

1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	30.58	D

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-4	Arm 1

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2024 WOD	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To					
		1	2	3	4	5	6
From	1	0.00	22.00	42.00	86.00	56.00	5.00
	2	9.00	0.00	17.00	36.00	79.00	27.00
	3	27.00	15.00	0.00	10.00	48.00	64.00
	4	64.00	52.00	25.00	0.00	19.00	33.00
	5	21.00	41.00	27.00	17.00	0.00	15.00
	6	8.00	69.00	56.00	24.00	8.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To					
		1	2	3	4	5	6
From	1	0.00	13.00	42.00	63.00	72.00	5.00
	2	5.00	0.00	27.00	42.00	92.00	34.00
	3	20.00	15.00	0.00	9.00	57.00	49.00
	4	38.00	45.00	21.00	0.00	26.00	29.00
	5	35.00	60.00	36.00	18.00	0.00	21.00
	6	7.00	78.00	59.00	29.00	14.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To					
		1	2	3	4	5	6
From	1	0.00	1.00	39.00	60.00	56.00	17.00
	2	4.00	0.00	23.00	32.00	60.00	58.00
	3	22.00	13.00	0.00	20.00	56.00	52.00
	4	67.00	51.00	16.00	0.00	17.00	23.00
	5	22.00	56.00	34.00	17.00	0.00	13.00
	6	5.00	63.00	68.00	29.00	14.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To					
		1	2	3	4	5	6
From	1	0.00	15.00	45.00	64.00	60.00	13.00
	2	4.00	0.00	17.00	39.00	79.00	44.00
	3	23.00	7.00	0.00	28.00	53.00	45.00
	4	63.00	47.00	24.00	0.00	27.00	16.00
	5	26.00	55.00	27.00	9.00	0.00	6.00
	6	16.00	52.00	63.00	14.00	7.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	0.97	62.29	13.2	F
2	0.94	39.43	9.2	E
3	0.77	18.13	3.2	C
4	0.89	28.88	6.3	D
5	0.65	10.23	1.8	B
6	0.76	14.95	3.0	B

Main Results for each time segment

17:00 - 17:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	211.00	328.63	226.03	0.934	202.42	8.6	31.305	D
2	168.00	336.08	221.91	0.757	165.09	2.9	15.156	C
3	164.00	337.89	220.91	0.742	161.29	2.7	14.509	B
4	193.00	330.90	216.12	0.893	186.66	6.3	26.567	D
5	121.00	312.71	234.83	0.515	119.96	1.0	7.767	A
6	165.00	291.61	246.50	0.669	163.05	2.0	10.555	B

17:15 - 17:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	195.00	374.33	200.76	0.971	190.41	13.2	62.289	F
2	200.00	353.89	212.06	0.943	193.66	9.2	39.428	E
3	150.00	364.78	206.04	0.728	150.00	2.7	16.075	C
4	159.00	356.09	202.40	0.786	161.35	4.0	23.030	C
5	170.00	262.30	262.71	0.647	169.26	1.8	9.555	A
6	187.00	294.36	244.98	0.763	185.92	3.0	14.948	B

17:30 - 17:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	173.00	360.64	208.32	0.830	180.54	5.6	37.182	E
2	177.00	356.53	210.60	0.840	180.24	6.0	32.028	D
3	163.00	354.88	211.51	0.771	162.55	3.2	18.133	C
4	174.00	356.51	202.17	0.861	172.71	5.3	28.883	D
5	142.00	320.88	230.31	0.617	142.14	1.6	10.228	B
6	179.00	300.66	241.50	0.741	179.08	2.9	14.471	B

17:45 - 18:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	197.00	307.03	237.97	0.828	197.45	5.2	22.668	C
2	183.00	327.84	226.46	0.808	184.41	4.6	22.160	C
3	156.00	335.39	222.29	0.702	156.70	2.5	13.882	B
4	177.00	337.31	212.62	0.832	177.09	5.2	25.606	D
5	123.00	287.97	248.51	0.495	123.65	1.0	7.247	A
6	152.00	285.92	249.64	0.609	153.35	1.6	9.475	A

Junctions 9

ARCADY 9 - Roundabout Module

Version: 9.5.0.6896

For sales and distribution information, program advice and maintenance, contact TRL:
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Filename: walk rbout 2024 wdev 633 units.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\ARCADY
Report generation date: 31/12/2021 18:01:26

»2024 WDEV, AM
»2024 WDEV, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2024 WDEV									
Arm 1	4.8	23.11	0.85	C	-10 % [Arm 4]	21.1	90.42	1.02	F	-7 % [Arm 1]
Arm 2	14.7	59.02	0.97	F		12.0	48.83	0.98	E	
Arm 3	34.1	121.39	1.07	F		3.8	21.73	0.80	C	
Arm 4	46.0	234.65	1.10	F		8.6	39.41	0.94	E	
Arm 5	1.8	11.47	0.65	B		1.9	10.78	0.66	B	
Arm 6	3.3	15.08	0.78	C		3.4	16.68	0.79	C	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	13/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2024 WDEV	AM	DIRECT	08:00	09:00	60	15
D2	2024 WDEV	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2024 WDEV, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	81.45	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-10	Arm 4

Arms

Arms

Arm	Name	Description
1	Walkinstown Road	
2	Cromwellsfort Road	
3	St Peters Road	
4	Grenhills Road	
5	Ballymount Road	
6	Walkinstown Avenue	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	3.00	8.00	20.0	15.0	55.0	45.0	
2	3.00	8.00	20.0	15.0	55.0	45.0	

3	3.00	8.00	20.0	15.0	55.0	45.0	
4	3.00	7.50	20.0	15.0	55.0	45.0	
5	3.00	8.00	20.0	15.0	55.0	45.0	
6	3.00	8.00	20.0	15.0	55.0	45.0	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/TS)
1	0.553	407.752
2	0.553	407.752
3	0.553	407.752
4	0.545	396.355
5	0.553	407.752
6	0.553	407.752

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2024 WDEV	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To					
		1	**2**	**3**	**4**	**5**	**6**
From	**1**	0.00	9.00	39.00	80.00	57.00	3.00
	2	6.00	0.00	11.00	44.00	102.00	33.00
	3	8.00	5.00	0.00	9.00	54.00	70.00
	4	78.00	65.00	15.00	0.00	15.00	47.00
	5	37.00	52.00	21.00	7.00	0.00	6.00
	6	6.00	66.00	61.00	40.00	17.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To					
		1	2	3	4	5	6
From	1	0.00	5.00	36.00	68.00	47.00	2.00
	2	3.00	0.00	18.00	50.00	116.00	44.00
	3	11.00	4.00	0.00	4.00	67.00	83.00
	4	69.00	64.00	9.00	0.00	13.00	41.00
	5	28.00	64.00	16.00	6.00	0.00	10.00
	6	6.00	89.00	50.00	42.00	16.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To					
		1	2	3	4	5	6
From	1	0.00	6.00	37.00	75.00	63.00	6.00
	2	7.00	0.00	19.00	42.00	126.00	36.00
	3	28.00	8.00	0.00	0.00	76.00	79.00
	4	54.00	50.00	5.00	0.00	16.00	29.00
	5	26.00	75.00	19.00	10.00	0.00	7.00
	6	6.00	69.00	57.00	22.00	17.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To					
		1	2	3	4	5	6
From	1	0.00	9.00	36.00	57.00	37.00	4.00
	2	9.00	13.00	0.00	23.00	105.00	49.00
	3	38.00	12.00	0.00	2.00	93.00	85.00
	4	59.00	41.00	13.00	0.00	21.00	36.00
	5	40.00	73.00	14.00	8.00	0.00	9.00
	6	2.00	66.00	49.00	23.00	7.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	0.85	23.11	4.8	C
2	0.97	59.02	14.7	F
3	1.07	121.39	34.1	F
4	1.10	234.65	46.0	F
5	0.65	11.47	1.8	B

6	0.78	15.08	3.3	C

Main Results for each time segment

08:00 - 08:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	188.00	337.66	221.03	0.851	183.16	4.8	21.609	C
2	196.00	331.95	224.19	0.874	190.37	5.6	23.689	C
3	146.00	379.19	198.07	0.737	143.38	2.6	15.786	C
4	220.00	346.70	207.51	1.060	198.35	21.6	63.166	F
5	123.00	307.14	237.91	0.517	121.95	1.1	7.694	A
6	190.00	277.05	254.55	0.746	187.22	2.8	12.887	B

08:15 - 08:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	158.00	354.51	211.71	0.746	159.71	3.1	17.844	C
2	231.00	293.50	245.45	0.941	226.68	10.0	39.543	E
3	169.00	391.32	191.36	0.883	165.73	5.9	31.547	D
4	196.00	387.30	185.40	1.057	183.48	34.2	152.668	F
5	124.00	315.48	233.30	0.532	123.93	1.1	8.222	A
6	203.00	264.52	261.48	0.776	202.50	3.3	15.080	C

08:30 - 08:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	187.00	334.54	222.76	0.839	185.52	4.6	23.113	C
2	230.00	310.62	235.99	0.975	225.20	14.7	59.023	F
3	191.00	398.81	187.22	1.020	179.96	16.9	71.587	F
4	154.00	430.31	161.97	0.951	158.84	29.3	187.532	F
5	137.00	300.00	241.86	0.566	136.84	1.3	8.554	A
6	171.00	282.82	251.36	0.680	172.08	2.2	11.506	B

08:45 - 09:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	143.00	313.90	234.17	0.611	146.00	1.6	10.536	B
2	199.00	248.74	270.20	0.736	210.79	3.0	17.850	C
3	230.00	348.18	215.21	1.069	212.80	34.1	121.388	F
4	170.00	444.70	154.13	1.103	153.37	46.0	234.646	F
5	144.00	336.97	221.42	0.650	143.48	1.8	11.465	B
6	147.00	305.63	238.74	0.616	147.56	1.6	9.934	A

2024 WDEV, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS

1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	40.62	E

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-7	Arm 1

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2024 WDEV	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To					
		1	2	3	4	5	6
From	1	0.00	22.00	42.00	93.00	56.00	5.00
	2	9.00	0.00	17.00	39.00	79.00	27.00
	3	27.00	15.00	0.00	10.00	48.00	64.00
	4	68.00	54.00	25.00	0.00	19.00	37.00
	5	21.00	41.00	27.00	17.00	0.00	15.00
	6	8.00	69.00	56.00	28.00	8.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To					
		1	2	3	4	5	6
From	1	0.00	13.00	42.00	70.00	72.00	5.00
	2	5.00	0.00	27.00	46.00	92.00	34.00
	3	20.00	15.00	0.00	9.00	57.00	49.00
	4	42.00	47.00	21.00	0.00	26.00	33.00
	5	35.00	60.00	36.00	18.00	0.00	21.00
	6	7.00	78.00	59.00	32.00	14.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To					
		1	2	3	4	5	6
From	1	0.00	1.00	39.00	67.00	56.00	17.00
	2	4.00	0.00	23.00	35.00	60.00	58.00
	3	22.00	13.00	0.00	20.00	56.00	52.00
	4	71.00	53.00	16.00	0.00	17.00	27.00
	5	22.00	56.00	34.00	17.00	0.00	13.00
	6	5.00	63.00	68.00	33.00	14.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To					
		1	2	3	4	5	6
From	1	0.00	15.00	45.00	71.00	60.00	13.00
	2	4.00	0.00	17.00	42.00	79.00	44.00
	3	23.00	7.00	0.00	28.00	53.00	45.00
	4	67.00	49.00	24.00	0.00	27.00	20.00
	5	26.00	55.00	27.00	9.00	0.00	6.00
	6	16.00	52.00	63.00	17.00	7.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	1.02	90.42	21.1	F
2	0.98	48.83	12.0	E
3	0.80	21.73	3.8	C
4	0.94	39.41	8.6	E
5	0.66	10.78	1.9	B
6	0.79	16.68	3.4	C

Main Results for each time segment

17:00 - 17:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	218.00	333.55	223.31	0.976	206.06	11.9	39.385	E
2	171.00	343.63	217.73	0.785	167.65	3.3	16.995	C
3	164.00	348.94	214.80	0.764	161.01	3.0	15.953	C
4	203.00	329.49	216.88	0.936	194.37	8.6	32.609	D

5	121.00	320.26	230.65	0.525	119.92	1.1	8.051	A
6	169.00	295.86	244.15	0.692	166.84	2.2	11.348	B

17:15 - 17:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	202.00	379.40	197.95	1.020	192.88	21.1	90.417	F
2	204.00	359.49	208.96	0.976	195.36	12.0	48.232	E
3	150.00	373.30	201.32	0.745	150.02	3.0	17.577	C
4	169.00	352.73	204.23	0.828	172.23	5.4	30.291	D
5	170.00	272.68	256.96	0.662	169.19	1.9	10.158	B
6	190.00	300.98	241.32	0.787	188.73	3.4	16.682	C

17:30 - 17:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	180.00	366.29	205.20	0.877	191.82	9.2	69.790	F
2	180.00	371.27	202.45	0.889	182.29	9.7	48.832	E
3	163.00	371.03	202.58	0.805	162.22	3.8	21.735	C
4	184.00	356.90	201.96	0.911	181.78	7.6	39.413	E
5	142.00	328.91	225.87	0.629	142.16	1.7	10.780	B
6	183.00	305.76	238.67	0.767	183.05	3.4	16.239	C

17:45 - 18:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	204.00	312.31	235.05	0.868	205.71	7.5	32.616	D
2	186.00	339.36	220.10	0.845	189.48	6.2	31.843	D
3	156.00	351.41	213.43	0.731	156.90	2.9	16.191	C
4	187.00	339.51	211.43	0.884	187.00	7.6	36.789	E
5	123.00	299.16	242.33	0.508	123.69	1.0	7.628	A
6	155.00	292.01	246.28	0.629	156.63	1.7	10.214	B

Junctions 9

ARCADY 9 - Roundabout Module

Filename: walk rbout 2029 wod.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\ARCADY
Report generation date: 08/03/2021 14:26:28

»2029 WOD, AM
»2029 WOD, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2029 WOD									
Arm 1	10.0	46.71	0.95	E	-14 % [Arm 3]	51.9	239.12	1.15	F	-12 % [Arm 1]
Arm 2	51.5	168.74	1.10	F		22.0	103.15	1.05	F	
Arm 3	100.6	345.67	1.33	F		5.9	31.69	0.88	D	
Arm 4	67.7	363.49	1.16	F		18.2	89.25	1.02	F	
Arm 5	2.0	12.09	0.68	B		2.6	13.12	0.73	B	
Arm 6	5.1	21.90	0.85	C		5.9	26.62	0.88	D	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	13/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2029 WOD	AM	DIRECT	08:00	09:00	60	15
D2	2029 WOD	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2029 WOD, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	167.47	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-14	Arm 3

Arms

Arms

Arm	Name	Description
1	Walkinstown Road	
2	Cromwellsfort Road	
3	St Peters Road	
4	Greenhills Road	
5	Ballymount Road	
6	Walkinstown Avenue	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	3.00	8.00	20.0	15.0	55.0	45.0	
2	3.00	8.00	20.0	15.0	55.0	45.0	

3	3.00	8.00	20.0	15.0	55.0	45.0	
4	3.00	7.50	20.0	15.0	55.0	45.0	
5	3.00	8.00	20.0	15.0	55.0	45.0	
6	3.00	8.00	20.0	15.0	55.0	45.0	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/TS)
1	0.553	407.752
2	0.553	407.752
3	0.553	407.752
4	0.545	396.355
5	0.553	407.752
6	0.553	407.752

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2029 WOD	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To					
		1	2	3	4	5	6
From	1	0.00	9.00	42.00	83.00	62.00	3.00
	2	7.00	0.00	12.00	45.00	111.00	35.00
	3	8.00	5.00	0.00	9.00	58.00	76.00
	4	77.00	66.00	16.00	0.00	16.00	43.00
	5	40.00	56.00	22.00	7.00	0.00	7.00
	6	7.00	72.00	66.00	42.00	18.00	0.00

08:15 - 08:30

Demand (PCU/TS)

		To					
		1	2	3	4	5	6
From	1	0.00	6.00	39.00	70.00	51.00	2.00
	2	3.00	0.00	20.00	52.00	125.00	48.00
	3	12.00	5.00	0.00	5.00	72.00	89.00
	4	68.00	66.00	10.00	0.00	14.00	37.00
	5	30.00	69.00	17.00	6.00	0.00	11.00
	6	7.00	97.00	55.00	43.00	18.00	0.00

08:30 - 08:45

Demand (PCU/TS)

		To					
		1	2	3	4	5	6
From	1	0.00	7.00	40.00	77.00	69.00	6.00
	2	8.00	0.00	21.00	43.00	137.00	39.00
	3	30.00	9.00	0.00	0.00	82.00	86.00
	4	52.00	51.00	6.00	0.00	17.00	24.00
	5	28.00	81.00	20.00	11.00	0.00	8.00
	6	6.00	75.00	61.00	22.00	18.00	0.00

08:45 - 09:00

Demand (PCU/TS)

		To					
		1	2	3	4	5	6
From	1	0.00	10.00	39.00	57.00	40.00	5.00
	2	10.00	14.00	0.00	22.00	114.00	53.00
	3	41.00	13.00	0.00	2.00	101.00	92.00
	4	57.00	41.00	14.00	0.00	23.00	32.00
	5	43.00	79.00	15.00	8.00	0.00	10.00
	6	2.00	72.00	53.00	22.00	7.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	0.95	46.71	10.0	E
2	1.10	168.74	51.5	F
3	1.33	345.67	100.6	F
4	1.16	363.49	67.7	F
5	0.68	12.09	2.0	B

6	0.85	21.90	5.1	C

Main Results for each time segment

08:00 - 08:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	199.00	354.58	211.68	0.940	190.16	8.8	33.842	D
2	210.00	347.79	215.43	0.975	198.37	11.6	39.922	E
3	156.00	394.25	189.74	0.822	151.98	4.0	21.952	C
4	218.00	367.50	196.18	1.111	189.52	28.5	81.349	F
5	132.00	304.86	239.17	0.552	130.79	1.2	8.217	A
6	205.00	281.36	252.16	0.813	201.07	3.9	16.536	C

08:15 - 08:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	168.00	376.34	199.64	0.842	170.77	6.1	33.531	D
2	248.00	312.96	234.69	1.057	230.75	28.9	92.869	F
3	183.00	404.28	184.19	0.994	173.87	13.2	58.965	F
4	195.00	404.87	175.83	1.109	175.00	48.5	214.821	F
5	133.00	312.52	234.94	0.566	132.92	1.3	8.813	A
6	220.00	270.09	258.40	0.851	218.84	5.1	21.898	C

08:30 - 08:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	199.00	356.60	210.56	0.945	195.04	10.0	46.710	E
2	248.00	327.83	226.47	1.095	225.39	51.5	168.744	F
3	207.00	406.91	182.74	1.133	181.13	39.0	144.241	F
4	150.00	438.32	157.61	0.952	154.42	44.1	273.879	F
5	148.00	296.94	243.55	0.608	147.77	1.5	9.368	A
6	182.00	292.09	246.23	0.739	184.11	3.0	14.945	B

08:45 - 09:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	151.00	329.13	225.75	0.669	158.93	2.1	14.956	B
2	213.00	264.43	261.53	0.814	256.98	7.5	111.078	F
3	249.00	398.16	187.58	1.327	187.41	100.6	345.665	F
4	167.00	464.05	143.59	1.163	143.32	67.7	363.487	F
5	155.00	324.50	228.31	0.679	154.48	2.0	12.094	B
6	156.00	307.46	237.73	0.656	157.01	2.0	11.288	B

2029 WOD, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS

1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	90.48	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-12	Arm 1

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2029 WOD	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To					
		1	2	3	4	5	6
From	1	0.00	23.00	46.00	93.00	61.00	6.00
	2	10.00	0.00	19.00	39.00	86.00	29.00
	3	29.00	16.00	0.00	11.00	52.00	70.00
	4	69.00	56.00	27.00	0.00	20.00	36.00
	5	23.00	45.00	30.00	18.00	0.00	16.00
	6	9.00	74.00	61.00	26.00	9.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To					
		1	2	3	4	5	6
From	1	0.00	14.00	46.00	68.00	78.00	6.00
	2	6.00	0.00	29.00	46.00	100.00	37.00
	3	22.00	16.00	0.00	10.00	62.00	53.00
	4	41.00	48.00	23.00	0.00	28.00	31.00
	5	38.00	65.00	39.00	19.00	0.00	22.00
	6	8.00	84.00	64.00	31.00	15.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To					
		1	2	3	4	5	6
From	1	0.00	1.00	43.00	65.00	60.00	19.00
	2	4.00	0.00	25.00	34.00	66.00	63.00
	3	24.00	14.00	0.00	21.00	61.00	56.00
	4	72.00	55.00	17.00	0.00	19.00	25.00
	5	24.00	61.00	36.00	18.00	0.00	14.00
	6	6.00	68.00	74.00	32.00	15.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To					
		1	2	3	4	5	6
From	1	0.00	16.00	49.00	69.00	65.00	14.00
	2	5.00	0.00	19.00	42.00	86.00	47.00
	3	25.00	7.00	0.00	30.00	58.00	48.00
	4	69.00	51.00	26.00	0.00	29.00	17.00
	5	28.00	60.00	30.00	10.00	0.00	7.00
	6	17.00	56.00	69.00	15.00	8.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	1.15	239.12	51.9	F
2	1.05	103.15	22.0	F
3	0.88	31.69	5.9	D
4	1.02	89.25	18.2	F
5	0.73	13.12	2.6	B
6	0.88	26.62	5.9	D

Main Results for each time segment

17:00 - 17:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	229.00	351.50	213.38	1.073	204.88	24.1	66.789	F
2	183.00	351.18	213.56	0.857	177.99	5.0	22.843	C
3	178.00	354.91	211.49	0.842	173.44	4.6	21.609	C
4	208.00	353.10	204.02	1.019	192.01	16.0	51.771	F
5	132.00	328.91	225.87	0.584	130.63	1.4	9.321	A
6	179.00	308.69	237.06	0.755	176.11	2.9	14.170	B

17:15 - 17:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	212.00	402.89	184.96	1.146	184.18	51.9	197.544	F
2	218.00	361.05	208.10	1.048	201.64	21.4	74.002	F
3	163.00	370.71	202.75	0.804	163.21	4.3	23.059	C
4	171.00	370.79	194.39	0.880	177.92	9.1	59.510	F
5	183.00	286.40	249.38	0.734	181.75	2.6	13.067	B
6	202.00	321.47	229.99	0.878	199.00	5.9	26.619	D

17:30 - 17:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	188.00	388.06	193.16	0.973	189.02	50.9	239.117	F
2	192.00	376.39	199.62	0.962	191.83	21.5	103.148	F
3	176.00	374.00	200.94	0.876	174.49	5.9	31.690	D
4	188.00	379.20	189.81	0.990	181.88	15.2	72.662	F
5	153.00	335.25	222.37	0.688	153.33	2.3	13.119	B
6	195.00	319.42	231.12	0.844	195.17	5.7	25.424	D

17:45 - 18:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	213.00	334.84	222.59	0.957	218.30	45.6	199.624	F
2	199.00	364.97	205.93	0.966	198.58	22.0	102.513	F
3	168.00	368.39	204.04	0.823	168.75	5.1	26.286	D
4	192.00	368.46	195.66	0.981	188.95	18.2	89.248	F
5	135.00	311.79	235.34	0.574	135.91	1.4	9.134	A
6	165.00	309.73	236.48	0.698	168.31	2.4	13.786	B

Filename: walk rbout 2029 wdev 633 units.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\ARCADY
Report generation date: 01/01/2022 12:59:16

»2029 WDEV, AM
»2029 WDEV, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2029 WDEV									
Arm 1	11.9	51.85	0.97	F	-17 % [Arm 4]	74.4	333.20	1.20	F	-14 % [Arm 1]
Arm 2	57.2	184.33	1.11	F		29.7	136.32	1.07	F	
Arm 3	104.7	363.96	1.34	F		6.6	35.47	0.89	E	
Arm 4	120.4	636.71	1.24	F		31.7	141.27	1.06	F	
Arm 5	2.1	12.30	0.68	B		2.8	14.08	0.75	B	
Arm 6	5.3	22.71	0.86	C		7.3	31.81	0.91	D	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	13/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2029 WDEV	AM	DIRECT	08:00	09:00	60	15
D2	2029 WDEV	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2029 WDEV, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	224.98	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-17	Arm 4

Arms

Arms

Arm	Name	Description
1	Walkinstown Road	
2	Cromwellsfort Road	
3	St Peters Road	
4	Greenhills Road	
5	Ballymount Road	
6	Walkinstown Avenue	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	3.00	8.00	20.0	15.0	55.0	45.0	
2	3.00	8.00	20.0	15.0	55.0	45.0	

3	3.00	8.00	20.0	15.0	55.0	45.0	
4	3.00	7.50	20.0	15.0	55.0	45.0	
5	3.00	8.00	20.0	15.0	55.0	45.0	
6	3.00	8.00	20.0	15.0	55.0	45.0	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/TS)
1	0.553	407.752
2	0.553	407.752
3	0.553	407.752
4	0.545	396.355
5	0.553	407.752
6	0.553	407.752

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2029 WDEV	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To					
		1	**2**	**3**	**4**	**5**	**6**
From	**1**	0.00	9.00	42.00	70.00	62.00	3.00
	2	7.00	0.00	12.00	47.00	111.00	35.00
	3	8.00	5.00	0.00	9.00	58.00	76.00
	4	84.00	70.00	16.00	0.00	16.00	50.00
	5	40.00	56.00	22.00	7.00	0.00	7.00
	6	7.00	72.00	66.00	44.00	18.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To					
		1	2	3	4	5	6
From	1	0.00	6.00	39.00	73.00	51.00	2.00
	2	3.00	0.00	20.00	54.00	125.00	48.00
	3	12.00	5.00	0.00	5.00	72.00	89.00
	4	74.00	69.00	10.00	0.00	14.00	44.00
	5	30.00	69.00	17.00	6.00	0.00	11.00
	6	7.00	97.00	55.00	45.00	18.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To					
		1	2	3	4	5	6
From	1	0.00	7.00	40.00	81.00	69.00	6.00
	2	8.00	0.00	21.00	45.00	137.00	39.00
	3	30.00	9.00	0.00	0.00	82.00	86.00
	4	58.00	54.00	6.00	0.00	17.00	31.00
	5	28.00	81.00	20.00	11.00	0.00	8.00
	6	6.00	75.00	61.00	24.00	18.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To					
		1	2	3	4	5	6
From	1	0.00	10.00	39.00	61.00	40.00	5.00
	2	10.00	14.00	0.00	24.00	114.00	53.00
	3	41.00	13.00	0.00	2.00	101.00	92.00
	4	63.00	44.00	14.00	0.00	23.00	39.00
	5	43.00	79.00	15.00	8.00	0.00	10.00
	6	2.00	72.00	53.00	24.00	7.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	0.97	51.85	11.9	F
2	1.11	184.33	57.2	F
3	1.34	363.96	104.7	F
4	1.24	636.71	120.4	F
5	0.68	12.30	2.1	B

6	0.86	22.71	5.3	C

Main Results for each time segment

08:00 - 08:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	186.00	354.70	211.61	0.879	180.25	5.7	25.334	D
2	212.00	338.67	220.47	0.962	201.42	10.6	36.762	E
3	156.00	388.56	192.89	0.809	152.25	3.7	20.589	C
4	236.00	369.47	195.11	1.210	190.88	45.1	118.689	F
5	132.00	307.61	237.65	0.555	130.78	1.2	8.330	A
6	207.00	280.68	252.54	0.820	202.91	4.1	16.962	C

08:15 - 08:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	171.00	376.41	199.60	0.857	170.97	5.8	31.130	D
2	250.00	314.96	233.58	1.070	229.91	30.7	94.922	F
3	183.00	406.39	183.02	1.000	173.08	13.7	60.132	F
4	211.00	401.42	177.70	1.187	177.45	78.7	333.429	F
5	133.00	314.69	233.73	0.569	132.93	1.3	8.918	A
6	222.00	269.45	258.75	0.858	220.76	5.3	22.707	C

08:30 - 08:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	203.00	358.21	209.67	0.968	196.89	11.9	51.845	F
2	250.00	331.72	224.32	1.114	223.49	57.2	184.334	F
3	207.00	409.69	181.20	1.142	179.76	40.9	151.135	F
4	166.00	433.41	160.28	1.036	159.88	84.8	479.828	F
5	148.00	302.77	240.32	0.616	147.73	1.6	9.688	A
6	184.00	293.58	245.41	0.750	186.16	3.2	15.702	C

08:45 - 09:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	155.00	331.45	224.46	0.691	164.54	2.3	17.215	C
2	215.00	269.83	258.54	0.832	254.10	18.1	138.200	F
3	249.00	402.15	185.37	1.343	185.22	104.7	363.957	F
4	183.00	457.01	147.43	1.241	147.36	120.4	636.706	F
5	155.00	326.68	227.10	0.683	154.49	2.1	12.298	B
6	158.00	309.00	236.88	0.667	159.10	2.1	11.733	B

2029 WDEV, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS

1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	126.03	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-14	Arm 1

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2029 WDEV	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To					
		1	2	3	4	5	6
From	1	0.00	23.00	46.00	100.00	61.00	6.00
	2	10.00	0.00	19.00	42.00	86.00	29.00
	3	29.00	16.00	0.00	11.00	52.00	70.00
	4	73.00	58.00	27.00	0.00	20.00	40.00
	5	23.00	45.00	30.00	18.00	0.00	16.00
	6	9.00	74.00	61.00	30.00	9.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To					
		1	2	3	4	5	6
From	1	0.00	14.00	46.00	75.00	78.00	6.00
	2	6.00	0.00	29.00	49.00	100.00	37.00
	3	22.00	16.00	0.00	10.00	62.00	53.00
	4	45.00	50.00	23.00	0.00	28.00	35.00
	5	38.00	65.00	39.00	19.00	0.00	22.00
	6	8.00	84.00	64.00	35.00	15.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To					
		1	2	3	4	5	6
From	1	0.00	1.00	43.00	72.00	60.00	19.00
	2	4.00	0.00	25.00	38.00	66.00	63.00
	3	24.00	14.00	0.00	21.00	61.00	56.00
	4	76.00	57.00	17.00	0.00	19.00	29.00
	5	24.00	61.00	36.00	18.00	0.00	14.00
	6	6.00	68.00	74.00	35.00	15.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To					
		1	2	3	4	5	6
From	1	0.00	16.00	49.00	76.00	65.00	14.00
	2	5.00	0.00	19.00	45.00	86.00	47.00
	3	25.00	7.00	0.00	30.00	58.00	48.00
	4	73.00	53.00	26.00	0.00	29.00	21.00
	5	28.00	60.00	30.00	10.00	0.00	7.00
	6	17.00	56.00	69.00	18.00	8.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	1.20	333.20	74.4	F
2	1.07	136.32	29.7	F
3	0.89	35.47	6.6	E
4	1.06	141.27	31.7	F
5	0.75	14.08	2.8	B
6	0.91	31.81	7.3	D

Main Results for each time segment

17:00 - 17:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	236.00	355.10	211.39	1.116	204.82	31.2	81.880	F
2	186.00	354.93	211.48	0.880	180.23	5.8	25.407	D
3	178.00	362.89	207.08	0.860	172.94	5.1	23.693	C

4	218.00	350.36	205.52	1.061	196.42	21.6	63.202	F
5	132.00	333.12	223.54	0.590	130.59	1.4	9.546	A
6	183.00	310.53	236.03	0.775	179.80	3.2	15.246	C

17:15 - 17:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	219.00	407.49	182.42	1.201	182.02	68.2	255.164	F
2	221.00	362.43	207.33	1.066	202.17	24.6	83.009	F
3	163.00	375.19	200.28	0.814	163.36	4.7	24.855	C
4	181.00	365.63	197.20	0.918	187.62	15.0	89.214	F
5	183.00	295.95	244.10	0.750	181.58	2.8	14.079	B
6	206.00	327.47	226.67	0.909	201.90	7.3	31.806	D

17:30 - 17:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	195.00	392.29	190.82	1.022	190.06	73.1	333.199	F
2	196.00	379.67	197.80	0.991	193.55	27.0	128.072	F
3	176.00	380.70	197.23	0.892	174.14	6.6	35.468	E
4	198.00	374.74	192.24	1.030	188.48	24.5	107.541	F
5	153.00	338.92	220.34	0.694	153.46	2.4	13.567	B
6	198.00	322.34	229.51	0.863	198.42	6.9	29.856	D

17:45 - 18:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	220.00	339.03	220.28	0.999	218.72	74.4	308.185	F
2	202.00	370.00	203.15	0.994	199.33	29.7	136.324	F
3	168.00	376.38	199.62	0.842	168.68	5.9	30.132	D
4	202.00	365.30	197.38	1.023	194.75	31.7	141.270	F
5	135.00	318.64	231.55	0.583	135.93	1.4	9.504	A
6	168.00	312.57	234.91	0.715	172.24	2.6	15.229	C

Junctions 9

ARCADY 9 - Roundabout Module

Filename: walk rbout 2039 wod.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\ARCADY
Report generation date: 08/03/2021 14:32:27

»2039 WOD, AM
»2039 WOD, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2039 WOD									
Arm 1	35.5	137.76	1.07	F	-20 % [Arm 4]	138.9	564.20	1.30	F	-17 % [Arm 1]
Arm 2	107.7	393.48	1.20	F		51.8	217.10	1.11	F	
Arm 3	144.0	514.77	1.44	F		7.1	32.94	0.91	D	
Arm 4	107.6	569.76	1.23	F		38.7	162.49	1.13	F	
Arm 5	2.4	13.22	0.71	B		3.8	17.75	0.81	C	
Arm 6	8.2	33.40	0.92	D		15.3	69.24	0.97	F	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	13/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2039 WOD	AM	DIRECT	08:00	09:00	60	15
D2	2039 WOD	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2039 WOD, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	293.42	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-20	Arm 4

Arms

Arms

Arm	Name	Description
1	Walkinstown Road	
2	Cromwellsfort Road	
3	St Peters Road	
4	Greenhills Road	
5	Ballymount Road	
6	Walkinstown Avenue	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	3.00	8.00	20.0	15.0	55.0	45.0	
2	3.00	8.00	20.0	15.0	55.0	45.0	

3	3.00	8.00	20.0	15.0	55.0	45.0	
4	3.00	7.50	20.0	15.0	55.0	45.0	
5	3.00	8.00	20.0	15.0	55.0	45.0	
6	3.00	8.00	20.0	15.0	55.0	45.0	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/TS)
1	0.553	407.752
2	0.553	407.752
3	0.553	407.752
4	0.545	396.355
5	0.553	407.752
6	0.553	407.752

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2039 WOD	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To					
		1	**2**	**3**	**4**	**5**	**6**
From	**1**	0.00	10.00	45.00	88.00	66.00	4.00
	2	7.00	0.00	12.00	48.00	118.00	38.00
	3	9.00	5.00	0.00	10.00	62.00	81.00
	4	82.00	71.00	17.00	0.00	17.00	46.00
	5	43.00	60.00	24.00	8.00	0.00	7.00
	6	7.00	76.00	71.00	44.00	19.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To					
		1	2	3	4	5	6
From	1	0.00	6.00	42.00	74.00	55.00	2.00
	2	4.00	0.00	21.00	55.00	134.00	51.00
	3	13.00	5.00	0.00	5.00	77.00	95.00
	4	72.00	70.00	10.00	0.00	15.00	40.00
	5	32.00	74.00	18.00	6.00	0.00	12.00
	6	7.00	103.00	58.00	46.00	19.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To					
		1	2	3	4	5	6
From	1	0.00	7.00	43.00	82.00	73.00	7.00
	2	8.00	0.00	22.00	46.00	146.00	42.00
	3	32.00	10.00	0.00	0.00	87.00	92.00
	4	55.00	54.00	6.00	0.00	18.00	26.00
	5	30.00	86.00	22.00	12.00	0.00	8.00
	6	6.00	80.00	65.00	24.00	20.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To					
		1	2	3	4	5	6
From	1	0.00	11.00	41.00	61.00	43.00	5.00
	2	11.00	15.00	0.00	24.00	122.00	57.00
	3	44.00	14.00	0.00	2.00	107.00	98.00
	4	60.00	44.00	15.00	0.00	25.00	34.00
	5	46.00	84.00	16.00	9.00	0.00	11.00
	6	2.00	77.00	56.00	24.00	8.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	1.07	137.76	35.5	F
2	1.20	393.48	107.7	F
3	1.44	514.77	144.0	F
4	1.23	569.76	107.6	F
5	0.71	13.22	2.4	B

6	0.92	33.40	8.2	D

Main Results for each time segment

08:00 - 08:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	213.00	370.50	202.87	1.050	193.14	19.9	60.384	F
2	223.00	359.76	208.81	1.068	200.08	22.9	64.417	F
3	167.00	401.83	185.55	0.900	160.57	6.4	30.782	D
4	233.00	379.18	189.82	1.227	185.88	47.1	126.431	F
5	142.00	307.66	237.62	0.598	140.55	1.4	9.141	A
6	217.00	288.98	247.95	0.875	211.24	5.8	21.933	C

08:15 - 08:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	179.00	392.60	190.65	0.939	179.82	19.0	93.506	F
2	265.00	329.35	225.63	1.174	224.88	63.0	184.607	F
3	195.00	409.84	181.12	1.077	176.92	24.5	94.881	F
4	207.00	409.26	173.44	1.194	173.20	80.9	351.262	F
5	142.00	311.79	235.34	0.603	141.95	1.5	9.628	A
6	233.00	277.02	254.57	0.915	230.54	8.2	33.396	D

08:30 - 08:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	212.00	380.22	197.50	1.073	195.56	35.5	137.758	F
2	264.00	340.47	219.48	1.203	219.31	107.7	351.212	F
3	221.00	407.26	182.54	1.211	182.04	63.5	229.670	F
4	159.00	435.25	159.28	0.998	158.23	81.7	473.144	F
5	158.00	302.05	240.72	0.656	157.64	1.9	10.779	B
6	195.00	302.83	240.29	0.812	198.49	4.7	22.997	C

08:45 - 09:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	161.00	347.69	215.49	0.747	193.10	3.4	66.738	F
2	229.00	304.45	239.40	0.957	237.20	99.5	393.483	F
3	265.00	403.61	184.56	1.436	184.50	144.0	514.766	F
4	178.00	448.21	152.22	1.169	152.12	107.6	569.763	F
5	166.00	316.11	232.95	0.713	165.48	2.4	13.218	B
6	167.00	317.23	232.33	0.719	169.04	2.7	14.648	B

2039 WOD, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS

1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	195.11	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-17	Arm 1

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2039 WOD	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To					
		1	2	3	4	5	6
From	1	0.00	25.00	49.00	99.00	65.00	6.00
	2	11.00	0.00	20.00	41.00	91.00	31.00
	3	31.00	17.00	0.00	12.00	55.00	74.00
	4	74.00	60.00	29.00	0.00	22.00	38.00
	5	25.00	48.00	32.00	19.00	0.00	18.00
	6	10.00	79.00	65.00	28.00	10.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To					
		1	2	3	4	5	6
From	1	0.00	15.00	49.00	73.00	83.00	6.00
	2	6.00	0.00	31.00	49.00	107.00	40.00
	3	23.00	17.00	0.00	11.00	66.00	57.00
	4	43.00	52.00	24.00	0.00	30.00	33.00
	5	41.00	69.00	41.00	21.00	0.00	24.00
	6	8.00	90.00	68.00	33.00	16.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To					
		1	2	3	4	5	6
From	1	0.00	1.00	46.00	69.00	64.00	20.00
	2	4.00	0.00	27.00	37.00	70.00	67.00
	3	25.00	15.00	0.00	23.00	65.00	6.00
	4	77.00	59.00	18.00	0.00	20.00	26.00
	5	25.00	65.00	39.00	19.00	0.00	15.00
	6	6.00	73.00	79.00	34.00	16.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To					
		1	2	3	4	5	6
From	1	0.00	17.00	52.00	74.00	70.00	15.00
	2	5.00	0.00	20.00	45.00	92.00	50.00
	3	27.00	8.00	0.00	32.00	62.00	52.00
	4	73.00	55.00	27.00	0.00	31.00	18.00
	5	30.00	64.00	32.00	10.00	0.00	7.00
	6	18.00	60.00	73.00	16.00	8.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	1.30	564.20	138.9	F
2	1.11	217.10	51.8	F
3	0.91	32.94	7.1	D
4	1.13	162.49	38.7	F
5	0.81	17.75	3.8	C
6	0.97	69.24	15.3	F

Main Results for each time segment

17:00 - 17:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	244.00	368.33	204.07	1.196	199.58	44.4	113.491	F
2	194.00	355.05	211.41	0.918	186.51	7.5	30.336	D
3	189.00	362.26	207.43	0.911	181.88	7.1	29.823	D
4	223.00	366.05	196.97	1.132	191.00	32.0	87.904	F
5	142.00	334.85	222.59	0.638	140.30	1.7	10.729	B
6	192.00	318.89	231.41	0.830	187.71	4.3	19.061	C

17:15 - 17:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	226.00	421.94	174.43	1.296	174.27	96.1	372.480	F
2	233.00	359.27	209.08	1.114	206.07	34.4	106.755	F
3	174.00	370.77	202.73	0.858	174.45	6.7	32.937	D
4	182.00	378.32	190.29	0.956	183.66	30.3	149.492	F
5	196.00	298.75	242.55	0.808	193.88	3.8	17.748	C
6	215.00	338.49	220.57	0.975	206.98	12.3	48.274	E

17:30 - 17:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	200.00	418.64	176.25	1.135	176.14	120.0	531.022	F
2	205.00	373.82	201.04	1.020	199.08	40.3	178.653	F
3	134.00	371.21	202.48	0.662	138.63	2.0	15.028	C
4	200.00	338.62	211.91	0.944	206.09	24.2	124.002	F
5	163.00	306.91	238.04	0.685	164.57	2.3	12.502	B
6	208.00	349.50	214.49	0.970	205.04	15.3	69.244	F

17:45 - 18:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	228.00	358.97	209.25	1.090	209.12	138.9	564.202	F
2	212.00	372.84	201.58	1.052	200.55	51.8	217.096	F
3	181.00	371.43	202.36	0.894	176.67	6.4	30.865	D
4	204.00	376.93	191.05	1.068	189.50	38.7	162.493	F
5	143.00	320.00	230.80	0.620	143.58	1.7	10.392	B
6	175.00	319.63	231.00	0.758	186.89	3.4	24.844	C

Junctions 9

ARCADY 9 - Roundabout Module

Filename: walk rbout 2039 wdev 633 units.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\ARCADY
Report generation date: 01/01/2022 13:21:48

»2039 WDEV, AM
»2039 WDEV, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2039 WDEV									
Arm 1	43.2	163.12	1.10	F	-22 % [Arm 4]	172.7	698.28	1.34	F	-19 % [Arm 1]
Arm 2	117.7	456.17	1.22	F		62.9	258.73	1.13	F	
Arm 3	149.4	542.22	1.46	F		8.0	36.54	0.93	E	
Arm 4	162.3	830.22	1.31	F		61.4	249.05	1.17	F	
Arm 5	2.4	13.37	0.71	B		4.1	19.01	0.82	C	
Arm 6	8.8	35.45	0.92	E		19.2	84.71	1.00	F	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	13/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2039 WDEV	AM	DIRECT	08:00	09:00	60	15
D2	2039 WDEV	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2039 WDEV, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	363.34	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-22	Arm 4

Arms

Arms

Arm	Name	Description
1	Walkinstown Road	
2	Cromwellsfort Road	
3	St Peters Road	
4	Greenhills Road	
5	Ballymount Road	
6	Walkinstown Avenue	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	3.00	8.00	20.0	15.0	55.0	45.0	
2	3.00	8.00	20.0	15.0	55.0	45.0	

3	3.00	8.00	20.0	15.0	55.0	45.0	
4	3.00	7.50	20.0	15.0	55.0	45.0	
5	3.00	8.00	20.0	15.0	55.0	45.0	
6	3.00	8.00	20.0	15.0	55.0	45.0	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/TS)
1	0.553	407.752
2	0.553	407.752
3	0.553	407.752
4	0.545	396.355
5	0.553	407.752
6	0.553	407.752

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2039 WDEV	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To					
		1	2	3	4	5	6
From	1	0.00	10.00	45.00	92.00	66.00	4.00
	2	7.00	0.00	12.00	50.00	118.00	38.00
	3	9.00	5.00	0.00	10.00	62.00	81.00
	4	89.00	74.00	17.00	0.00	17.00	53.00
	5	43.00	60.00	24.00	8.00	0.00	7.00
	6	7.00	76.00	71.00	46.00	19.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To					
		1	2	3	4	5	6
From	1	0.00	6.00	42.00	78.00	55.00	2.00
	2	4.00	0.00	21.00	57.00	134.00	51.00
	3	13.00	5.00	0.00	5.00	77.00	95.00
	4	79.00	73.00	10.00	0.00	15.00	46.00
	5	32.00	74.00	18.00	6.00	0.00	12.00
	6	7.00	103.00	58.00	48.00	19.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To					
		1	2	3	4	5	6
From	1	0.00	7.00	43.00	86.00	73.00	7.00
	2	8.00	0.00	22.00	48.00	146.00	42.00
	3	32.00	10.00	0.00	0.00	87.00	92.00
	4	62.00	58.00	6.00	0.00	18.00	33.00
	5	30.00	86.00	22.00	12.00	0.00	8.00
	6	6.00	80.00	65.00	26.00	20.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To					
		1	2	3	4	5	6
From	1	0.00	11.00	41.00	65.00	43.00	5.00
	2	11.00	15.00	0.00	26.00	122.00	57.00
	3	44.00	14.00	0.00	2.00	107.00	98.00
	4	67.00	47.00	15.00	0.00	25.00	41.00
	5	46.00	84.00	16.00	9.00	0.00	11.00
	6	2.00	77.00	56.00	26.00	8.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	1.10	163.12	43.2	F
2	1.22	456.17	117.7	F
3	1.46	542.22	149.4	F
4	1.31	830.22	162.3	F
5	0.71	13.37	2.4	B

6	0.92	35.45	8.8	E

Main Results for each time segment

08:00 - 08:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	217.00	370.51	202.87	1.070	194.31	22.7	66.372	F
2	225.00	362.06	207.54	1.084	199.66	25.3	69.605	F
3	167.00	405.19	183.69	0.909	160.19	6.8	32.290	D
4	250.00	376.39	191.34	1.307	188.29	61.7	159.399	F
5	142.00	310.12	236.26	0.601	140.53	1.5	9.265	A
6	219.00	288.81	248.04	0.883	212.94	6.1	22.740	C

08:15 - 08:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	183.00	392.67	190.62	0.960	182.98	22.7	112.551	F
2	267.00	334.14	222.98	1.197	222.41	69.9	204.889	F
3	195.00	413.04	179.35	1.087	175.63	26.2	100.754	F
4	223.00	404.81	175.86	1.268	175.75	109.0	458.816	F
5	142.00	313.42	234.44	0.606	141.96	1.5	9.722	A
6	235.00	277.18	254.48	0.923	232.25	8.8	35.446	E

08:30 - 08:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	216.00	381.56	196.76	1.098	195.48	43.2	163.124	F
2	266.00	342.48	218.37	1.218	218.23	117.7	387.983	F
3	221.00	409.24	181.45	1.218	181.00	66.2	242.000	F
4	177.00	430.36	161.94	1.093	161.82	124.1	664.745	F
5	158.00	306.29	238.38	0.663	157.61	1.9	11.080	B
6	197.00	303.71	239.81	0.821	200.72	5.1	24.750	C

08:45 - 09:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	165.00	349.76	214.34	0.770	203.96	4.3	100.875	F
2	231.00	314.97	233.58	0.989	231.28	117.4	456.172	F
3	265.00	408.47	181.88	1.457	181.82	149.4	542.220	F
4	195.00	439.62	156.90	1.243	156.86	162.3	830.223	F
5	166.00	317.45	232.21	0.715	165.50	2.4	13.372	B
6	169.00	318.79	231.46	0.730	171.24	2.9	15.455	C

2039 WDEV, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS

1	untitled	Standard Roundabout		1, 2, 3, 4, 5, 6	249.07	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-19	Arm 1

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2039 WDEV	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
1		✓	100.000
2		✓	100.000
3		✓	100.000
4		✓	100.000
5		✓	100.000
6		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To					
		1	2	3	4	5	6
From	1	0.00	25.00	49.00	106.00	65.00	6.00
	2	11.00	0.00	20.00	45.00	91.00	31.00
	3	31.00	17.00	0.00	12.00	55.00	74.00
	4	78.00	62.00	29.00	0.00	22.00	42.00
	5	25.00	48.00	32.00	19.00	0.00	18.00
	6	10.00	79.00	65.00	31.00	10.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To					
		1	2	3	4	5	6
From	1	0.00	15.00	49.00	80.00	83.00	6.00
	2	6.00	0.00	31.00	52.00	107.00	40.00
	3	23.00	17.00	0.00	11.00	66.00	57.00
	4	47.00	54.00	24.00	0.00	30.00	37.00
	5	41.00	69.00	41.00	21.00	0.00	24.00
	6	8.00	90.00	68.00	37.00	16.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To					
		1	2	3	4	5	6
From	1	0.00	1.00	46.00	76.00	64.00	20.00
	2	4.00	0.00	27.00	40.00	70.00	67.00
	3	25.00	15.00	0.00	23.00	65.00	6.00
	4	81.00	61.00	18.00	0.00	20.00	30.00
	5	25.00	65.00	39.00	19.00	0.00	15.00
	6	6.00	73.00	79.00	37.00	16.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To					
		1	2	3	4	5	6
From	1	0.00	17.00	52.00	81.00	70.00	15.00
	2	5.00	0.00	20.00	48.00	92.00	50.00
	3	27.00	8.00	0.00	32.00	62.00	52.00
	4	77.00	57.00	27.00	0.00	31.00	22.00
	5	30.00	64.00	32.00	10.00	0.00	7.00
	6	18.00	60.00	73.00	19.00	8.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To					
		1	2	3	4	5	6
From	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	1.34	698.28	172.7	F
2	1.13	258.73	62.9	F
3	0.93	36.54	8.0	E
4	1.17	249.05	61.4	F
5	0.82	19.01	4.1	C
6	1.00	84.71	19.2	F

Main Results for each time segment

17:00 - 17:15

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	251.00	370.37	202.95	1.237	199.11	51.9	130.803	F
2	198.00	357.25	210.20	0.942	189.06	8.9	34.313	D
3	189.00	369.15	203.62	0.928	181.00	8.0	32.785	D

4	233.00	362.58	198.86	1.172	193.90	39.1	102.258	F
5	142.00	337.29	221.24	0.642	140.27	1.7	10.896	B
6	195.00	319.60	231.02	0.844	190.32	4.7	20.261	C

17:15 - 17:30

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	233.00	423.61	173.50	1.343	173.40	111.5	432.860	F
2	236.00	360.45	208.43	1.132	206.10	38.8	119.404	F
3	174.00	375.04	200.36	0.868	174.60	7.4	36.542	E
4	192.00	373.58	192.87	0.996	190.25	40.8	193.654	F
5	196.00	305.68	238.72	0.821	193.62	4.1	19.012	C
6	219.00	342.51	218.35	1.003	208.15	15.5	57.230	F

17:30 - 17:45

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	207.00	420.99	174.95	1.183	174.89	143.6	625.263	F
2	208.00	374.05	200.91	1.035	199.57	47.3	204.357	F
3	134.00	374.58	200.62	0.668	139.30	2.1	15.824	C
4	210.00	334.32	214.26	0.980	209.87	41.0	179.227	F
5	163.00	308.23	237.31	0.687	164.83	2.3	12.716	B
6	211.00	350.07	214.17	0.985	207.32	19.2	84.710	F

17:45 - 18:00

Arm	Total Demand (PCU/TS)	Circulating flow (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
1	235.00	364.96	205.94	1.141	205.88	172.7	698.283	F
2	215.00	375.65	200.03	1.075	199.40	62.9	258.728	F
3	181.00	375.50	200.11	0.905	176.29	6.8	32.761	D
4	214.00	371.28	194.12	1.102	193.55	61.4	249.045	F
5	143.00	324.89	228.09	0.627	143.55	1.7	10.718	B
6	178.00	321.19	230.14	0.773	193.45	3.8	32.021	D

PICADY OUTPUT – GREENHILS ROAD / BALLYMOUNT ROAD JUNCTION

Junctions 9

PICADY 9 - Priority Intersection Module

Filename: Greenhills Ballymount exist.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\PICADY
Report generation date: 07/03/2021 16:52:03

»2021, AM
»2021, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2021									
Stream B-ACD	0.0	16.14	0.02	C	-17 % [Stream D-ABC]	0.0	8.34	0.03	A	-15 % [Stream D-ABC]
Stream A-BCD	9.2	34.59	0.88	D		2.9	10.09	0.61	B	
Stream D-ABC	11.4	179.24	1.06	F		8.9	111.11	0.97	F	
Stream C-ABD	0.0	0.00	0.00	A		0.0	0.00	0.00	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	15/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units

m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2021	AM	DIRECT	08:00	09:00	60	15
D2	2021	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2021, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		30.05	D

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-17	Stream D-ABC

Arms

Arms

Arm	Name	Description	Arm type
A	Greenhils Road North		Major
B	Minor Road		Minor
C	Greenhills Road South		Major
D	Ballymount Road		Minor

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
A	7.00			50.0	✓	0.00
C	7.00			50.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)

B	One lane	3.00	50	50
D	One lane	3.00	50	50

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/TS)	Slope for A-B	Slope for A-C	Slope for A-D	Slope for B-A	Slope for B-D	Slope for C-A	Slope for C-B	Slope for C-D	Slope for D-B	Slope for D-C
1	A-D	150.730	-	-	-	0.223	0.223	0.223	-	0.223	-	-
1	B-AD	129.627	0.090	0.228	-	-	-	0.144	0.326	0.144	0.090	0.228
1	B-C	163.853	0.096	0.243	-	-	-	-	-	-	0.096	0.243
1	C-B	150.730	0.223	0.223	-	-	-	-	-	-	0.223	0.223
1	D-A	163.853	-	-	-	0.243	0.096	0.243	-	0.096	-	-
1	D-BC	129.627	0.144	0.144	0.326	0.228	0.090	0.228	-	0.090	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2021	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	173.00	27.00
	B	0.00	0.00	0.00	0.00
	C	185.00	0.00	0.00	62.00
	D	26.00	0.00	20.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	155.00	33.00
	B	0.00	0.00	0.00	0.00
	C	209.00	0.00	0.00	70.00
	D	30.00	0.00	33.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To			
		A	B	C	D
From	A	0.00	0.00	133.00	61.00
	B	1.00	0.00	0.00	0.00
	C	172.00	0.00	0.00	60.00
	D	28.00	0.00	33.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To			
		A	B	C	D
From	A	0.00	0.00	123.00	54.00
	B	0.00	0.00	0.00	0.00
	C	191.00	0.00	0.00	77.00
	D	30.00	0.00	27.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.02	16.14	0.0	C
A-BCD	0.88	34.59	9.2	D
A-B				
A-C				
D-ABC	1.06	179.24	11.4	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

08:00 - 08:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	70.14	0.000	0.00	0.0	0.000	A
A-BCD	106.42	231.81	0.459	104.46	2.0	7.084	A
A-B	0.00			0.00			
A-C	93.58			93.58			
D-ABC	46.00	71.24	0.646	44.35	1.6	31.826	D
C-ABD	0.00	107.61	0.000	0.00	0.0	0.000	A
C-D	62.00			62.00			
C-A	185.00			185.00			

08:15 - 08:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	66.27	0.000	0.00	0.0	0.000	A
A-BCD	123.06	214.12	0.575	122.15	2.9	10.011	B
A-B	0.00			0.00			
A-C	64.94			64.94			
D-ABC	63.00	59.19	1.064	54.80	9.8	123.490	F
C-ABD	0.00	108.23	0.000	0.00	0.0	0.000	A
C-D	70.00			70.00			
C-A	209.00			209.00			

08:30 - 08:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	56.74	0.018	0.98	0.0	16.135	C
A-BCD	179.98	204.15	0.882	173.70	9.2	29.980	D
A-B	0.00			0.00			
A-C	14.02			14.02			
D-ABC	61.00	62.75	0.972	59.45	11.4	179.243	F
C-ABD	0.00	112.02	0.000	0.00	0.0	0.000	A
C-D	60.00			60.00			
C-A	172.00			172.00			

08:45 - 09:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	75.41	0.000	0.02	0.0	0.000	A
A-BCD	162.41	193.85	0.838	162.40	9.2	34.587	D
A-B	0.00			0.00			
A-C	14.59			14.59			
D-ABC	57.00	62.16	0.917	57.00	11.4	178.636	F
C-ABD	0.00	114.48	0.000	0.00	0.0	0.000	A
C-D	77.00			77.00			
C-A	191.00			191.00			

2021, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		18.36	C

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-15	Stream D-ABC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2021	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To			
		A	B	C	D
From	A	0.00	0.00	146.00	44.00
	B	0.00	0.00	3.00	0.00
	C	143.00	0.00	0.00	50.00
	D	29.00	0.00	33.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To			
		A	B	C	D
From	A	0.00	1.00	166.00	35.00
	B	0.00	0.00	3.00	0.00
	C	153.00	0.00	0.00	50.00
	D	28.00	0.00	32.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To			
		A	B	C	D
From	A	0.00	0.00	187.00	27.00
	B	0.00	0.00	1.00	0.00
	C	162.00	0.00	0.00	40.00
	D	29.00	0.00	35.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To			
		A	B	C	D
From	A	0.00	0.00	182.00	39.00
	B	0.00	0.00	0.00	0.00
	C	131.00	0.00	0.00	43.00
	D	36.00	0.00	39.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.03	8.34	0.0	A
A-BCD	0.61	10.09	2.9	B
A-B				
A-C				
D-ABC	0.97	111.11	8.9	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	120.38	0.025	2.97	0.0	7.663	A
A-BCD	132.37	218.69	0.605	129.60	2.8	10.087	B
A-B	0.00			0.00			
A-C	57.63			57.63			
D-ABC	62.00	76.46	0.811	58.70	3.3	44.819	E
C-ABD	0.00	110.73	0.000	0.00	0.0	0.000	A
C-D	50.00			50.00			
C-A	143.00			143.00			

17:15 - 17:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	114.79	0.026	3.00	0.0	8.050	A
A-BCD	126.12	234.68	0.537	126.32	2.6	8.533	A
A-B	0.45			0.45			
A-C	75.42			75.42			
D-ABC	60.00	73.17	0.820	59.49	3.8	61.690	F
C-ABD	0.00	105.46	0.000	0.00	0.0	0.000	A
C-D	50.00			50.00			
C-A	153.00			153.00			

17:30 - 17:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	108.99	0.009	1.02	0.0	8.338	A
A-BCD	111.57	250.14	0.446	112.16	2.0	6.660	A
A-B	0.00			0.00			
A-C	102.43			102.43			
D-ABC	64.00	70.91	0.902	62.18	5.6	84.636	F
C-ABD	0.00	100.26	0.000	0.00	0.0	0.000	A
C-D	40.00			40.00			
C-A	162.00			162.00			

17:45 - 18:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	71.45	0.000	0.01	0.0	0.000	A
A-BCD	147.48	249.75	0.591	146.56	2.9	8.890	A
A-B	0.00			0.00			
A-C	73.52			73.52			
D-ABC	75.00	77.28	0.971	71.75	8.9	111.107	F
C-ABD	0.00	100.33	0.000	0.00	0.0	0.000	A
C-D	43.00			43.00			
C-A	131.00			131.00			

Junctions 9

PICADY 9 - Priority Intersection Module

Version: 9.5.0.6896

For sales and distribution information, program advice and maintenance, contact TRL:
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The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution

Filename: Greenhills Ballymount 2024 wod.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\PICADY
Report generation date: 07/03/2021 17:04:45

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2024 WOD									
Stream B-ACD	0.0	16.97	0.02	C	-18 % [Stream D-ABC]	0.0	8.59	0.03	A	-19 % [Stream D-ABC]
Stream A-BCD	15.8	65.43	0.95	F		3.6	11.35	0.66	B	
Stream D-ABC	16.6	264.45	1.08	F		17.3	197.50	1.07	F	
Stream C-ABD	0.0	0.00	0.00	A		0.0	0.00	0.00	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	15/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units

m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2024 WOD	AM	DIRECT	08:00	09:00	60	15
D2	2024 WOD	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2024 WOD, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		48.52	E

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-18	Stream D-ABC

Arms

Arms

Arm	Name	Description	Arm type
A	Greenhils Road North		Major
B	Minor Road		Minor
C	Greenhills Road South		Major
D	Ballymount Road		Minor

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
A	7.00			50.0	✓	0.00
C	7.00			50.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)

B	One lane	3.00	50	50
D	One lane	3.00	50	50

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/TS)	Slope for A-B	Slope for A-C	Slope for A-D	Slope for B-A	Slope for B-D	Slope for C-A	Slope for C-B	Slope for C-D	Slope for D-B	Slope for D-C
1	A-D	150.730	-	-	-	0.223	0.223	0.223	-	0.223	-	-
1	B-AD	129.627	0.090	0.228	-	-	-	0.144	0.326	0.144	0.090	0.228
1	B-C	163.853	0.096	0.243	-	-	-	-	-	-	0.096	0.243
1	C-B	150.730	0.223	0.223	-	-	-	-	-	-	0.223	0.223
1	D-A	163.853	-	-	-	0.243	0.096	0.243	-	0.096	-	-
1	D-BC	129.627	0.144	0.144	0.326	0.228	0.090	0.228	-	0.090	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2024 WOD	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	182.00	28.00
	B	0.00	0.00	0.00	0.00
	C	194.00	0.00	0.00	65.00
	D	27.00	0.00	21.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	163.00	35.00
	B	0.00	0.00	0.00	0.00
	C	219.00	0.00	0.00	73.00
	D	31.00	0.00	24.00	0.00

Demand (PCU/TS)

08:30 - 08:45

	To				
		A	B	C	D
From	A	0.00	0.00	139.00	63.00
	B	1.00	0.00	0.00	0.00
	C	180.00	0.00	0.00	63.00
	D	29.00	0.00	34.00	0.00

Demand (PCU/TS)

08:45 - 09:00

	To				
		A	B	C	D
From	A	0.00	0.00	129.00	56.00
	B	0.00	0.00	0.00	0.00
	C	200.00	0.00	0.00	81.00
	D	31.00	0.00	28.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

	To				
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.02	16.97	0.0	C
A-BCD	0.95	65.43	15.8	F
A-B				
A-C				
D-ABC	1.08	264.45	16.6	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

08:00 - 08:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	65.72	0.000	0.00	0.0	0.000	A
A-BCD	120.15	237.30	0.506	117.72	2.4	7.554	A
A-B	0.00			0.00			
A-C	89.85			89.85			
D-ABC	48.00	66.70	0.720	45.81	2.2	39.819	E
C-ABD	0.00	105.37	0.000	0.00	0.0	0.000	A
C-D	65.00			65.00			
C-A	194.00			194.00			

08:15 - 08:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	64.43	0.000	0.00	0.0	0.000	A
A-BCD	142.02	219.03	0.648	140.53	3.9	11.853	B
A-B	0.00			0.00			
A-C	55.98			55.98			
D-ABC	55.00	58.83	0.935	51.50	5.7	93.303	F
C-ABD	0.00	108.32	0.000	0.00	0.0	0.000	A
C-D	73.00			73.00			
C-A	219.00			219.00			

08:30 - 08:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	53.98	0.019	0.98	0.0	16.975	C
A-BCD	198.00	207.81	0.953	187.70	14.2	44.173	E
A-B	0.00			0.00			
A-C	4.00			4.00			
D-ABC	63.00	58.50	1.077	56.11	12.6	177.679	F
C-ABD	0.00	110.86	0.000	0.00	0.0	0.000	A
C-D	63.00			63.00			
C-A	180.00			180.00			

08:45 - 09:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	70.53	0.000	0.02	0.0	0.000	A
A-BCD	184.34	199.53	0.924	182.76	15.8	65.432	F
A-B	0.00			0.00			
A-C	0.66			0.66			
D-ABC	59.00	56.43	1.046	54.99	16.6	264.450	F
C-ABD	0.00	111.96	0.000	0.00	0.0	0.000	A
C-D	81.00			81.00			
C-A	200.00			200.00			

2024 WOD, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		31.07	D

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-19	Stream D-ABC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2024 WOD	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To			
		A	B	C	D
From	A	0.00	0.00	153.00	46.00
	B	0.00	0.00	3.00	0.00
	C	150.00	0.00	0.00	52.00
	D	30.00	0.00	35.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To			
		A	B	C	D
From	A	0.00	1.00	174.00	37.00
	B	0.00	0.00	3.00	0.00
	C	161.00	0.00	0.00	52.00
	D	29.00	0.00	34.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To			
		A	B	C	D
From	A	0.00	0.00	196.00	28.00
	B	0.00	0.00	1.00	0.00
	C	169.00	0.00	0.00	42.00
	D	30.00	0.00	37.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To			
		A	B	C	D
From	A	0.00	0.00	191.00	40.00
	B	0.00	0.00	0.00	0.00
	C	137.00	0.00	0.00	45.00
	D	38.00	0.00	41.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.03	8.59	0.0	A
A-BCD	0.66	11.35	3.6	B
A-B				
A-C				
D-ABC	1.07	197.50	17.3	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	118.19	0.025	2.97	0.0	7.809	A
A-BCD	146.99	222.69	0.660	143.48	3.5	11.346	B
A-B	0.00			0.00			
A-C	52.01			52.01			
D-ABC	65.00	72.48	0.897	60.13	4.9	59.653	F
C-ABD	0.00	108.72	0.000	0.00	0.0	0.000	A
C-D	52.00			52.00			
C-A	150.00			150.00			

17:15 - 17:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	112.01	0.027	3.00	0.0	8.255	A
A-BCD	143.72	239.89	0.599	143.86	3.4	9.745	A
A-B	0.39			0.39			
A-C	67.89			67.89			
D-ABC	63.00	68.58	0.919	61.40	6.5	99.800	F
C-ABD	0.00	102.91	0.000	0.00	0.0	0.000	A
C-D	52.00			52.00			
C-A	161.00			161.00			

17:30 - 17:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	105.81	0.009	1.02	0.0	8.589	A
A-BCD	125.73	256.39	0.490	126.66	2.4	7.144	A
A-B	0.00			0.00			
A-C	98.27			98.27			
D-ABC	67.00	66.81	1.003	63.11	10.4	142.664	F
C-ABD	0.00	97.33	0.000	0.00	0.0	0.000	A
C-D	42.00			42.00			
C-A	169.00			169.00			

17:45 - 18:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	66.74	0.000	0.01	0.0	0.000	A
A-BCD	163.14	255.78	0.638	162.00	3.6	9.851	A
A-B	0.00			0.00			
A-C	67.86			67.86			
D-ABC	79.00	73.87	1.069	72.04	17.3	197.501	F
C-ABD	0.00	97.19	0.000	0.00	0.0	0.000	A
C-D	45.00			45.00			
C-A	137.00			137.00			

Junctions 9

PICADY 9 - Priority Intersection Module

Filename: Greenhills Ballymount 2024 wdev 633 units.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\PICADY
Report generation date: 01/01/2022 13:27:56

»2024 WDEV, AM
»2024 WDEV, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2024 WDEV									
Stream B-ACD	0.0	18.42	0.02	C	-20 % [Stream D-ABC]	0.0	8.82	0.03	A	-22 % [Stream D-ABC]
Stream A-BCD	32.0	133.48	1.04	F		5.1	13.30	0.72	B	
Stream D-ABC	31.4	486.97	1.23	F		32.1	358.74	1.17	F	
Stream C-ABD	0.0	0.00	0.00	A		0.0	0.00	0.00	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	15/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units

m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2024 WDEV	AM	DIRECT	08:00	09:00	60	15
D2	2024 WDEV	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2024 WDEV, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		96.78	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-20	Stream D-ABC

Arms

Arms

Arm	Name	Description	Arm type
A	Greenhils Road North		Major
B	Minor Road		Minor
C	Greenhills Road South		Major
D	Ballymount Road		Minor

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
A	7.00			50.0	✓	0.00
C	7.00			50.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)

B	One lane	3.00	50	50
D	One lane	3.00	50	50

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/TS)	Slope for A-B	Slope for A-C	Slope for A-D	Slope for B-A	Slope for B-D	Slope for C-A	Slope for C-B	Slope for C-D	Slope for D-B	Slope for D-C
1	A-D	150.730	-	-	-	0.223	0.223	0.223	-	0.223	-	-
1	B-AD	129.627	0.090	0.228	-	-	-	0.144	0.326	0.144	0.090	0.228
1	B-C	163.853	0.096	0.243	-	-	-	-	-	-	0.096	0.243
1	C-B	150.730	0.223	0.223	-	-	-	-	-	-	0.223	0.223
1	D-A	163.853	-	-	-	0.243	0.096	0.243	-	0.096	-	-
1	D-BC	129.627	0.144	0.144	0.326	0.228	0.090	0.228	-	0.090	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2024 WDEV	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	194.00	32.00
	B	0.00	0.00	0.00	0.00
	C	200.00	0.00	0.00	65.00
	D	29.00	0.00	21.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	175.00	39.00
	B	0.00	0.00	0.00	0.00
	C	224.00	0.00	0.00	73.00
	D	29.00	0.00	24.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To			
		A	B	C	D
From	A	0.00	0.00	151.00	67.00
	B	1.00	0.00	0.00	0.00
	C	185.00	0.00	0.00	63.00
	D	31.00	0.00	34.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To			
		A	B	C	D
From	A	0.00	0.00	141.00	60.00
	B	0.00	0.00	0.00	0.00
	C	205.00	0.00	0.00	81.00
	D	34.00	0.00	28.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.02	18.42	0.0	C
A-BCD	1.04	133.48	32.0	F
A-B				
A-C				
D-ABC	1.23	486.97	31.4	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

08:00 - 08:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	61.53	0.000	0.00	0.0	0.000	A
A-BCD	151.24	246.06	0.615	147.55	3.7	9.197	A
A-B	0.00			0.00			
A-C	74.76			74.76			
D-ABC	50.00	62.99	0.794	47.05	3.0	50.020	F
C-ABD	0.00	102.69	0.000	0.00	0.0	0.000	A
C-D	65.00			65.00			
C-A	200.00			200.00			

08:15 - 08:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	59.93	0.000	0.00	0.0	0.000	A
A-BCD	175.47	228.92	0.767	172.59	6.6	17.061	C
A-B	0.00			0.00			
A-C	38.53			38.53			
D-ABC	53.00	52.86	1.003	48.32	7.6	127.916	F
C-ABD	0.00	105.34	0.000	0.00	0.0	0.000	A
C-D	73.00			73.00			
C-A	224.00			224.00			

08:30 - 08:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	49.81	0.020	0.98	0.0	18.424	C
A-BCD	218.00	210.50	1.036	199.93	24.6	74.563	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	65.00	54.11	1.201	53.09	19.5	266.866	F
C-ABD	0.00	107.48	0.000	0.00	0.0	0.000	A
C-D	63.00			63.00			
C-A	185.00			185.00			

08:45 - 09:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	63.54	0.000	0.02	0.0	0.000	A
A-BCD	201.00	199.76	1.006	193.68	32.0	133.477	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	62.00	50.39	1.230	50.09	31.4	486.969	F
C-ABD	0.00	106.87	0.000	0.00	0.0	0.000	A
C-D	81.00			81.00			
C-A	205.00			205.00			

2024 WDEV, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		54.61	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-22	Stream D-ABC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2024 WDEV	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To			
		A	B	C	D
From	A	0.00	0.00	161.00	48.00
	B	0.00	0.00	3.00	0.00
	C	160.00	0.00	0.00	52.00
	D	33.00	0.00	35.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To			
		A	B	C	D
From	A	0.00	1.00	182.00	39.00
	B	0.00	0.00	3.00	0.00
	C	171.00	0.00	0.00	52.00
	D	33.00	0.00	34.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To			
		A	B	C	D
From	A	0.00	0.00	204.00	31.00
	B	0.00	0.00	1.00	0.00
	C	179.00	0.00	0.00	42.00
	D	33.00	0.00	37.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To			
		A	B	C	D
From	A	0.00	0.00	198.00	43.00
	B	0.00	0.00	0.00	0.00
	C	147.00	0.00	0.00	45.00
	D	41.00	0.00	41.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.03	8.82	0.0	A
A-BCD	0.72	13.30	5.1	B
A-B				
A-C				
D-ABC	1.17	358.74	32.1	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	116.25	0.026	2.97	0.0	7.943	A
A-BCD	164.42	227.38	0.723	159.76	4.7	13.297	B
A-B	0.00			0.00			
A-C	44.58			44.58			
D-ABC	68.00	69.36	0.980	60.85	7.2	78.528	F
C-ABD	0.00	106.94	0.000	0.00	0.0	0.000	A
C-D	52.00			52.00			
C-A	160.00			160.00			

17:15 - 17:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	109.60	0.027	3.00	0.0	8.442	A
A-BCD	163.91	245.43	0.668	163.99	4.6	11.749	B
A-B	0.32			0.32			
A-C	57.77			57.77			
D-ABC	67.00	65.62	1.021	62.56	11.6	160.590	F
C-ABD	0.00	100.68	0.000	0.00	0.0	0.000	A
C-D	52.00			52.00			
C-A	171.00			171.00			

17:30 - 17:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	103.04	0.010	1.02	0.0	8.824	A
A-BCD	150.85	262.11	0.576	151.96	3.5	8.565	A
A-B	0.00			0.00			
A-C	84.15			84.15			
D-ABC	70.00	62.98	1.112	61.84	19.8	250.455	F
C-ABD	0.00	94.79	0.000	0.00	0.0	0.000	A
C-D	42.00			42.00			
C-A	179.00			179.00			

17:45 - 18:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	62.04	0.000	0.01	0.0	0.000	A
A-BCD	187.92	260.48	0.721	186.27	5.1	12.683	B
A-B	0.00			0.00			
A-C	53.08			53.08			
D-ABC	82.00	70.12	1.170	69.63	32.1	358.738	F
C-ABD	0.00	94.38	0.000	0.00	0.0	0.000	A
C-D	45.00			45.00			
C-A	147.00			147.00			

Junctions 9

PICADY 9 - Priority Intersection Module

Filename: Greenhills Ballymount 2029 wod.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\PICADY
Report generation date: 07/03/2021 17:31:31

»2029 WOD, AM
»2029 WOD, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2029 WOD									
Stream B-ACD	0.0	20.09	0.02	C	-24 % [Stream D-ABC]	0.0	9.19	0.03	A	-25 % [Stream D-ABC]
Stream A-BCD	44.8	188.82	1.08	F		6.7	15.41	0.78	C	
Stream D-ABC	57.6	1018.04	1.50	F		51.1	588.61	1.28	F	
Stream C-ABD	0.0	0.00	0.00	A		0.0	0.00	0.00	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	15/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units

m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2029 WOD	AM	DIRECT	08:00	09:00	60	15
D2	2029 WOD	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2029 WOD, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		171.93	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-24	Stream D-ABC

Arms

Arms

Arm	Name	Description	Arm type
A	Greenhils Road North		Major
B	Minor Road		Minor
C	Greenhills Road South		Major
D	Ballymount Road		Minor

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
A	7.00			50.0	✓	0.00
C	7.00			50.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)

B	One lane	3.00	50	50
D	One lane	3.00	50	50

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/TS)	Slope for A-B	Slope for A-C	Slope for A-D	Slope for B-A	Slope for B-D	Slope for C-A	Slope for C-B	Slope for C-D	Slope for D-B	Slope for D-C
1	A-D	150.730	-	-	-	0.223	0.223	0.223	-	0.223	-	-
1	B-AD	129.627	0.090	0.228	-	-	-	0.144	0.326	0.144	0.090	0.228
1	B-C	163.853	0.096	0.243	-	-	-	-	-	-	0.096	0.243
1	C-B	150.730	0.223	0.223	-	-	-	-	-	-	0.223	0.223
1	D-A	163.853	-	-	-	0.243	0.096	0.243	-	0.096	-	-
1	D-BC	129.627	0.144	0.144	0.326	0.228	0.090	0.228	-	0.090	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2029 WOD	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	197.00	31.00
	B	0.00	0.00	0.00	0.00
	C	211.00	0.00	0.00	71.00
	D	29.00	0.00	23.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	177.00	38.00
	B	0.00	0.00	0.00	0.00
	C	237.00	0.00	0.00	79.00
	D	34.00	0.00	26.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To			
		A	B	C	D
From	A	0.00	0.00	151.00	69.00
	B	1.00	0.00	0.00	0.00
	C	195.00	0.00	0.00	69.00
	D	31.00	0.00	37.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To			
		A	B	C	D
From	A	0.00	0.00	140.00	61.00
	B	0.00	0.00	0.00	0.00
	C	217.00	0.00	0.00	88.00
	D	34.00	0.00	30.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.02	20.09	0.0	C
A-BCD	1.08	188.82	44.8	F
A-B				
A-C				
D-ABC	1.50	1018.04	57.6	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

08:00 - 08:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	57.52	0.000	0.00	0.0	0.000	A
A-BCD	154.83	246.32	0.629	150.81	4.0	9.504	A
A-B	0.00			0.00			
A-C	73.17			73.17			
D-ABC	52.00	57.65	0.902	47.38	4.6	70.788	F
C-ABD	0.00	101.57	0.000	0.00	0.0	0.000	A
C-D	71.00			71.00			
C-A	211.00			211.00			

08:15 - 08:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	55.42	0.000	0.00	0.0	0.000	A
A-BCD	180.99	228.25	0.793	177.38	7.6	19.170	C
A-B	0.00			0.00			
A-C	34.01			34.01			
D-ABC	60.00	49.35	1.216	47.97	16.6	235.470	F
C-ABD	0.00	104.20	0.000	0.00	0.0	0.000	A
C-D	79.00			79.00			
C-A	237.00			237.00			

08:30 - 08:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	45.76	0.022	0.98	0.0	20.089	C
A-BCD	220.00	203.17	1.083	195.97	31.7	96.838	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	68.00	48.50	1.402	48.29	36.4	550.246	F
C-ABD	0.00	105.76	0.000	0.00	0.0	0.000	A
C-D	69.00			69.00			
C-A	195.00			195.00			

08:45 - 09:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	56.27	0.000	0.02	0.0	0.000	A
A-BCD	201.00	190.96	1.053	187.90	44.8	188.816	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	64.00	42.79	1.496	42.74	57.6	1018.039	F
C-ABD	0.00	103.47	0.000	0.00	0.0	0.000	A
C-D	88.00			88.00			
C-A	217.00			217.00			

2029 WOD, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		87.27	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-25	Stream D-ABC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2029 WOD	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To			
		A	B	C	D
From	A	0.00	0.00	166.00	49.00
	B	0.00	0.00	3.00	0.00
	C	163.00	0.00	0.00	57.00
	D	32.00	0.00	38.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To			
		A	B	C	D
From	A	0.00	1.00	189.00	40.00
	B	0.00	0.00	3.00	0.00
	C	174.00	0.00	0.00	56.00
	D	32.00	0.00	36.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To			
		A	B	C	D
From	A	0.00	0.00	213.00	31.00
	B	0.00	0.00	1.00	0.00
	C	184.00	0.00	0.00	45.00
	D	32.00	0.00	40.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To			
		A	B	C	D
From	A	0.00	0.00	207.00	44.00
	B	0.00	0.00	0.00	0.00
	C	149.00	0.00	0.00	49.00
	D	41.00	0.00	44.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.03	9.19	0.0	A
A-BCD	0.78	15.41	6.7	C
A-B				
A-C				
D-ABC	1.28	588.61	51.1	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	114.30	0.026	2.97	0.0	8.082	A
A-BCD	175.89	230.10	0.764	170.21	5.7	15.025	C
A-B	0.00			0.00			
A-C	39.11			39.11			
D-ABC	70.00	65.39	1.070	59.64	10.4	105.362	F
C-ABD	0.00	105.15	0.000	0.00	0.0	0.000	A
C-D	57.00			57.00			
C-A	163.00			163.00			

17:15 - 17:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	106.75	0.028	3.00	0.0	8.674	A
A-BCD	179.85	250.59	0.718	179.85	5.7	13.830	B
A-B	0.26			0.26			
A-C	49.88			49.88			
D-ABC	68.00	61.54	1.105	60.24	18.1	243.101	F
C-ABD	0.00	98.06	0.000	0.00	0.0	0.000	A
C-D	56.00			56.00			
C-A	174.00			174.00			

17:30 - 17:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	99.00	0.010	1.02	0.0	9.188	A
A-BCD	164.54	268.87	0.612	166.04	4.2	9.323	A
A-B	0.00			0.00			
A-C	79.46			79.46			
D-ABC	72.00	58.27	1.236	57.91	32.2	403.137	F
C-ABD	0.00	91.07	0.000	0.00	0.0	0.000	A
C-D	45.00			45.00			
C-A	184.00			184.00			

17:45 - 18:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	55.77	0.000	0.01	0.0	0.000	A
A-BCD	207.50	267.09	0.777	204.94	6.7	15.411	C
A-B	0.00			0.00			
A-C	43.50			43.50			
D-ABC	85.00	66.27	1.283	66.12	51.1	588.610	F
C-ABD	0.00	89.89	0.000	0.00	0.0	0.000	A
C-D	49.00			49.00			
C-A	149.00			149.00			

Junctions 9

PICADY 9 - Priority Intersection Module

Filename: Greenhills Ballymount 2029 wdev 633 units.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\PICADY
Report generation date: 01/01/2022 17:13:01

»2029 WDEV, AM
»2029 WDEV, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2029 WDEV									
Stream B-ACD	0.0	23.16	0.03	C	-27 % [Stream D-ABC]	0.0	9.55	0.03	A	-27 % [Stream D-ABC]
Stream A-BCD	78.4	314.98	1.15	F		10.4	23.35	0.86	C	
Stream D-ABC	87.5	2002.36	2.04	F		76.2	933.65	1.40	F	
Stream C-ABD	0.0	0.00	0.00	A		0.0	0.00	0.00	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	15/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units

m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2029 WDEV	AM	DIRECT	08:00	09:00	60	15
D2	2029 WDEV	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2029 WDEV, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		329.52	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-27	Stream D-ABC

Arms

Arms

Arm	Name	Description	Arm type
A	Greenhils Road North		Major
B	Minor Road		Minor
C	Greenhills Road South		Major
D	Ballymount Road		Minor

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
A	7.00			50.0	✓	0.00
C	7.00			50.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)

B	One lane	3.00	50	50
D	One lane	3.00	50	50

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/TS)	Slope for A-B	Slope for A-C	Slope for A-D	Slope for B-A	Slope for B-D	Slope for C-A	Slope for C-B	Slope for C-D	Slope for D-B	Slope for D-C
1	A-D	150.730	-	-	-	0.223	0.223	0.223	-	0.223	-	-
1	B-AD	129.627	0.090	0.228	-	-	-	0.144	0.326	0.144	0.090	0.228
1	B-C	163.853	0.096	0.243	-	-	-	-	-	-	0.096	0.243
1	C-B	150.730	0.223	0.223	-	-	-	-	-	-	0.223	0.223
1	D-A	163.853	-	-	-	0.243	0.096	0.243	-	0.096	-	-
1	D-BC	129.627	0.144	0.144	0.326	0.228	0.090	0.228	-	0.090	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2029 WDEV	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	209.00	35.00
	B	0.00	0.00	0.00	0.00
	C	216.00	0.00	0.00	71.00
	D	31.00	0.00	23.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	189.00	42.00
	B	0.00	0.00	0.00	0.00
	C	242.00	0.00	0.00	79.00
	D	36.00	0.00	26.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To			
		A	B	C	D
From	A	0.00	0.00	163.00	73.00
	B	1.00	0.00	0.00	0.00
	C	200.00	0.00	0.00	69.00
	D	34.00	0.00	37.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To			
		A	B	C	D
From	A	0.00	0.00	152.00	65.00
	B	0.00	0.00	0.00	0.00
	C	222.00	0.00	0.00	88.00
	D	36.00	0.00	30.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.03	23.16	0.0	C
A-BCD	1.15	314.98	78.4	F
A-B				
A-C				
D-ABC	2.04	2002.36	87.5	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

08:00 - 08:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	53.30	0.000	0.00	0.0	0.000	A
A-BCD	192.72	255.38	0.755	185.93	6.8	13.205	B
A-B	0.00			0.00			
A-C	51.28			51.28			
D-ABC	54.00	53.73	1.005	47.01	7.0	98.568	F
C-ABD	0.00	98.89	0.000	0.00	0.0	0.000	A
C-D	71.00			71.00			
C-A	216.00			216.00			

08:15 - 08:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	50.11	0.000	0.00	0.0	0.000	A
A-BCD	224.19	239.40	0.936	214.32	16.7	41.475	E
A-B	0.00			0.00			
A-C	6.81			6.81			
D-ABC	62.00	44.24	1.401	43.71	25.3	372.751	F
C-ABD	0.00	100.78	0.000	0.00	0.0	0.000	A
C-D	79.00			79.00			
C-A	242.00			242.00			

08:30 - 08:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	39.81	0.025	0.97	0.0	23.161	C
A-BCD	236.00	204.69	1.153	201.76	50.9	160.815	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	71.00	42.56	1.668	42.49	53.8	1010.311	F
C-ABD	0.00	100.65	0.000	0.00	0.0	0.000	A
C-D	69.00			69.00			
C-A	200.00			200.00			

08:45 - 09:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	45.53	0.000	0.03	0.0	0.000	A
A-BCD	217.00	190.39	1.140	189.48	78.4	314.983	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	66.00	32.30	2.043	32.29	87.5	2002.362	F
C-ABD	0.00	95.95	0.000	0.00	0.0	0.000	A
C-D	88.00			88.00			
C-A	222.00			222.00			

2029 WDEV, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		139.43	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-27	Stream D-ABC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2029 WDEV	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To			
		A	B	C	D
From	A	0.00	0.00	174.00	52.00
	B	0.00	0.00	3.00	0.00
	C	173.00	0.00	0.00	57.00
	D	36.00	0.00	38.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To			
		A	B	C	D
From	A	0.00	1.00	196.00	42.00
	B	0.00	0.00	3.00	0.00
	C	184.00	0.00	0.00	56.00
	D	35.00	0.00	36.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To			
		A	B	C	D
From	A	0.00	0.00	220.00	33.00
	B	0.00	0.00	1.00	0.00
	C	193.00	0.00	0.00	45.00
	D	36.00	0.00	40.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To			
		A	B	C	D
From	A	0.00	0.00	214.00	46.00
	B	0.00	0.00	0.00	0.00
	C	158.00	0.00	0.00	49.00
	D	44.00	0.00	44.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.03	9.55	0.0	A
A-BCD	0.86	23.35	10.4	C
A-B				
A-C				
D-ABC	1.40	933.65	76.2	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	112.36	0.027	2.97	0.0	8.226	A
A-BCD	200.50	234.93	0.853	191.59	8.9	20.794	C
A-B	0.00			0.00			
A-C	25.50			25.50			
D-ABC	74.00	62.05	1.193	58.33	15.7	147.891	F
C-ABD	0.00	103.36	0.000	0.00	0.0	0.000	A
C-D	57.00			57.00			
C-A	173.00			173.00			

17:15 - 17:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	103.85	0.029	3.00	0.0	8.923	A
A-BCD	206.18	256.77	0.803	206.15	8.9	21.038	C
A-B	0.17			0.17			
A-C	32.66			32.66			
D-ABC	71.00	57.54	1.234	57.11	29.6	389.699	F
C-ABD	0.00	95.40	0.000	0.00	0.0	0.000	A
C-D	56.00			56.00			
C-A	184.00			184.00			

17:30 - 17:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	95.34	0.010	1.02	0.0	9.545	A
A-BCD	191.55	275.43	0.695	194.28	6.2	12.553	B
A-B	0.00			0.00			
A-C	61.45			61.45			
D-ABC	76.00	54.84	1.386	54.73	50.8	649.336	F
C-ABD	0.00	87.70	0.000	0.00	0.0	0.000	A
C-D	45.00			45.00			
C-A	193.00			193.00			

17:45 - 18:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	49.54	0.000	0.01	0.0	0.000	A
A-BCD	233.93	272.74	0.858	229.74	10.4	23.353	C
A-B	0.00			0.00			
A-C	26.07			26.07			
D-ABC	88.00	62.65	1.405	62.60	76.2	933.647	F
C-ABD	0.00	85.96	0.000	0.00	0.0	0.000	A
C-D	49.00			49.00			
C-A	158.00			158.00			

Junctions 9

PICADY 9 - Priority Intersection Module

Filename: Greenhills Ballymount 2039 wod.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\PICADY
Report generation date: 07/03/2021 17:44:41

»2039 WOD, AM
»2039 WOD, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2039 WOD									
Stream B-ACD	0.0	24.82	0.03	C	-29 % [Stream D-ABC]	0.0	10.36	0.03	B	-30 % [Stream D-ABC]
Stream A-BCD	85.2	348.37	1.17	F		26.0	67.90	1.01	F	
Stream D-ABC	107.3	2918.13	2.50	F		104.6	1375.58	1.61	F	
Stream C-ABD	0.0	0.00	0.00	A		0.0	0.00	0.00	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	15/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units

m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2039 WOD	AM	DIRECT	08:00	09:00	60	15
D2	2039 WOD	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2039 WOD, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		435.06	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-29	Stream D-ABC

Arms

Arms

Arm	Name	Description	Arm type
A	Greenhils Road North		Major
B	Minor Road		Minor
C	Greenhills Road South		Major
D	Ballymount Road		Minor

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
A	7.00			50.0	✓	0.00
C	7.00			50.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)

B	One lane	3.00	50	50
D	One lane	3.00	50	50

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/TS)	Slope for A-B	Slope for A-C	Slope for A-D	Slope for B-A	Slope for B-D	Slope for C-A	Slope for C-B	Slope for C-D	Slope for D-B	Slope for D-C
1	A-D	150.730	-	-	-	0.223	0.223	0.223	-	0.223	-	-
1	B-AD	129.627	0.090	0.228	-	-	-	0.144	0.326	0.144	0.090	0.228
1	B-C	163.853	0.096	0.243	-	-	-	-	-	-	0.096	0.243
1	C-B	150.730	0.223	0.223	-	-	-	-	-	-	0.223	0.223
1	D-A	163.853	-	-	-	0.243	0.096	0.243	-	0.096	-	-
1	D-BC	129.627	0.144	0.144	0.326	0.228	0.090	0.228	-	0.090	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2039 WOD	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	210.00	33.00
	B	0.00	0.00	0.00	0.00
	C	225.00	0.00	0.00	76.00
	D	31.00	0.00	24.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	188.00	40.00
	B	0.00	0.00	0.00	0.00
	C	253.00	0.00	0.00	84.00
	D	36.00	0.00	28.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	161.00	73.00
	B	1.00	0.00	0.00	0.00
	C	208.00	0.00	0.00	73.00
	D	33.00	0.00	39.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	150.00	65.00
	B	0.00	0.00	0.00	0.00
	C	231.00	0.00	0.00	94.00
	D	36.00	0.00	32.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	**B**	**C**	**D**
From	**A**	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.03	24.82	0.0	C
A-BCD	1.17	348.37	85.2	F
A-B				
A-C				
D-ABC	2.50	2918.13	107.3	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

08:00 - 08:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	50.40	0.000	0.00	0.0	0.000	A
A-BCD	188.66	254.52	0.741	182.07	6.6	12.671	B
A-B	0.00			0.00			
A-C	54.34			54.34			
D-ABC	55.00	50.36	1.092	45.54	9.5	128.030	F
C-ABD	0.00	98.44	0.000	0.00	0.0	0.000	A
C-D	76.00			76.00			
C-A	225.00			225.00			

08:15 - 08:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	46.71	0.000	0.00	0.0	0.000	A
A-BCD	219.90	236.44	0.930	210.24	16.3	40.110	E
A-B	0.00			0.00			
A-C	8.10			8.10			
D-ABC	64.00	40.11	1.596	39.86	33.6	527.332	F
C-ABD	0.00	100.33	0.000	0.00	0.0	0.000	A
C-D	84.00			84.00			
C-A	253.00			253.00			

08:30 - 08:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	37.21	0.027	0.97	0.0	24.821	C
A-BCD	234.00	199.69	1.172	197.02	53.2	169.679	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	72.00	39.12	1.840	39.09	66.5	1503.927	F
C-ABD	0.00	99.79	0.000	0.00	0.0	0.000	A
C-D	73.00			73.00			
C-A	208.00			208.00			

08:45 - 09:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	39.90	0.000	0.03	0.0	0.000	A
A-BCD	215.00	183.78	1.170	183.08	85.2	348.375	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	68.00	27.16	2.503	27.16	107.3	2918.133	F
C-ABD	0.00	93.83	0.000	0.00	0.0	0.000	A
C-D	94.00			94.00			
C-A	231.00			231.00			

2039 WOD, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		220.66	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-30	Stream D-ABC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2039 WOD	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To			
		A	B	C	D
From	A	0.00	0.00	177.00	53.00
	B	0.00	0.00	3.00	0.00
	C	174.00	0.00	0.00	61.00
	D	35.00	0.00	41.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To			
		A	B	C	D
From	A	0.00	1.00	201.00	53.00
	B	0.00	0.00	3.00	0.00
	C	186.00	0.00	0.00	60.00
	D	34.00	0.00	39.00	0.00

Demand (PCU/TS)

17:30 - 17:45

		To			
		A	B	C	D
From	A	0.00	0.00	227.00	33.00
	B	0.00	0.00	1.00	0.00
	C	196.00	0.00	0.00	48.00
	D	35.00	0.00	42.00	0.00

Demand (PCU/TS)

17:45 - 18:00

		To			
		A	B	C	D
From	A	0.00	0.00	221.00	47.00
	B	0.00	0.00	0.00	0.00
	C	158.00	0.00	0.00	52.00
	D	44.00	0.00	47.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.03	10.36	0.0	B
A-BCD	1.01	67.90	26.0	F
A-B				
A-C				
D-ABC	1.61	1375.58	104.6	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	110.90	0.027	2.97	0.0	8.337	A
A-BCD	210.43	236.59	0.889	199.54	10.9	24.351	C
A-B	0.00			0.00			
A-C	19.57			19.57			
D-ABC	76.00	59.09	1.286	56.24	19.8	189.387	F
C-ABD	0.00	102.02	0.000	0.00	0.0	0.000	A
C-D	61.00			61.00			
C-A	174.00			174.00			

17:15 - 17:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	100.89	0.030	3.00	0.0	9.193	A
A-BCD	255.00	253.45	1.006	239.93	26.0	67.903	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	73.00	49.67	1.470	49.52	43.2	610.202	F
C-ABD	0.00	92.68	0.000	0.00	0.0	0.000	A
C-D	60.00			60.00			
C-A	186.00			186.00			

17:30 - 17:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	87.93	0.011	1.02	0.0	10.357	B
A-BCD	234.37	290.84	0.806	248.15	12.2	35.390	E
A-B	0.00			0.00			
A-C	25.63			25.63			
D-ABC	77.00	47.90	1.608	47.86	72.4	990.196	F
C-ABD	0.00	80.87	0.000	0.00	0.0	0.000	A
C-D	48.00			48.00			
C-A	196.00			196.00			

17:45 - 18:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	41.02	0.000	0.01	0.0	0.000	A
A-BCD	260.55	281.87	0.924	255.68	17.1	42.134	E
A-B	0.00			0.00			
A-C	7.45			7.45			
D-ABC	91.00	58.77	1.549	58.74	104.6	1375.582	F
C-ABD	0.00	79.69	0.000	0.00	0.0	0.000	A
C-D	52.00			52.00			
C-A	158.00			158.00			

Junctions 9

PICADY 9 - Priority Intersection Module

Filename: Greenhills Ballymount 2039 wdev 633 units.j9
Path: C:\Users\martin.rogers\Dropbox\chadwicks\PICADY
Report generation date: 01/01/2022 17:20:21

»2039 WDEV, AM
»2039 WDEV, PM

Summary of junction performance

	AM					PM				
	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2039 WDEV									
Stream B-ACD	0.0	31.38	0.03	D	-31 % [Stream D-ABC]	0.0	10.69	0.03	B	-32 % [Stream D-ABC]
Stream A-BCD	129.6	527.24	1.26	F		29.8	82.49	0.98	F	
Stream D-ABC	152.1	10204.47	6.54	F		130.3	1885.03	1.80	F	
Stream C-ABD	0.0	0.00	0.00	A		0.0	0.00	0.00	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	
Location	
Site number	
Date	15/02/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ICTDOMAIN\martin.rogers
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units

m	kph	PCU	PCU	perTimeSegment	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
	✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2039 WDEV	AM	DIRECT	08:00	09:00	60	15
D2	2039 WDEV	PM	DIRECT	17:00	18:00	60	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2039 WDEV, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		1294.48	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-31	Stream D-ABC

Arms

Arms

Arm	Name	Description	Arm type
A	Greenhils Road North		Major
B	Minor Road		Minor
C	Greenhills Road South		Major
D	Ballymount Road		Minor

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
A	7.00			50.0	✓	0.00
C	7.00			50.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)

B	One lane	3.00	50	50
D	One lane	3.00	50	50

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/TS)	Slope for A-B	Slope for A-C	Slope for A-D	Slope for B-A	Slope for B-D	Slope for C-A	Slope for C-B	Slope for C-D	Slope for D-B	Slope for D-C
1	A-D	150.730	-	-	-	0.223	0.223	0.223	-	0.223	-	-
1	B-AD	129.627	0.090	0.228	-	-	-	0.144	0.326	0.144	0.090	0.228
1	B-C	163.853	0.096	0.243	-	-	-	-	-	-	0.096	0.243
1	C-B	150.730	0.223	0.223	-	-	-	-	-	-	0.223	0.223
1	D-A	163.853	-	-	-	0.243	0.096	0.243	-	0.096	-	-
1	D-BC	129.627	0.144	0.144	0.326	0.228	0.090	0.228	-	0.090	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D1	2039 WDEV	AM	DIRECT	08:00	09:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

08:00 - 08:15

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	222.00	37.00
	B	0.00	0.00	0.00	0.00
	C	230.00	0.00	0.00	76.00
	D	33.00	0.00	24.00	0.00

Demand (PCU/TS)

08:15 - 08:30

		To			
		A	**B**	**C**	**D**
From	**A**	0.00	0.00	200.00	44.00
	B	0.00	0.00	0.00	0.00
	C	258.00	0.00	0.00	84.00
	D	39.00	0.00	28.00	0.00

Demand (PCU/TS)

08:30 - 08:45

		To			
		A	B	C	D
From	A	0.00	0.00	173.00	77.00
	B	1.00	0.00	0.00	0.00
	C	213.00	0.00	0.00	73.00
	D	36.00	0.00	39.00	0.00

Demand (PCU/TS)

08:45 - 09:00

		To			
		A	B	C	D
From	A	0.00	0.00	162.00	69.00
	B	0.00	0.00	0.00	0.00
	C	236.00	0.00	0.00	94.00
	D	39.00	0.00	32.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.03	31.38	0.0	D
A-BCD	1.26	527.24	129.6	F
A-B				
A-C				
D-ABC	6.54	10204.47	152.1	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

08:00 - 08:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	45.98	0.000	0.00	0.0	0.000	A
A-BCD	233.85	263.73	0.887	220.61	13.2	22.057	C
A-B	0.00			0.00			
A-C	25.15			25.15			
D-ABC	57.00	45.95	1.241	42.90	14.1	190.542	F
C-ABD	0.00	95.76	0.000	0.00	0.0	0.000	A
C-D	76.00			76.00			
C-A	230.00			230.00			

08:15 - 08:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	39.74	0.000	0.00	0.0	0.000	A
A-BCD	244.00	236.11	1.033	225.24	32.0	89.751	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	67.00	33.59	1.995	33.51	47.6	1047.221	F
C-ABD	0.00	95.97	0.000	0.00	0.0	0.000	A
C-D	84.00			84.00			
C-A	258.00			258.00			

08:30 - 08:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	29.61	0.034	0.97	0.0	31.384	D
A-BCD	250.00	201.65	1.240	200.64	81.4	269.085	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	75.00	30.68	2.445	30.67	91.9	4232.454	F
C-ABD	0.00	93.06	0.000	0.00	0.0	0.000	A
C-D	73.00			73.00			
C-A	213.00			213.00			

08:45 - 09:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	25.13	0.000	0.03	0.0	0.000	A
A-BCD	231.00	183.00	1.262	182.76	129.6	527.243	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	71.00	10.85	6.543	10.85	152.1	10204.470	F
C-ABD	0.00	84.51	0.000	0.00	0.0	0.000	A
C-D	94.00			94.00			
C-A	236.00			236.00			

2039 WDEV, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs. If HV% at the junction is genuinely zero, please ignore this warning.

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	Right-Left Stagger	Two-way		299.60	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-32	Stream D-ABC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)
D2	2039 WDEV	PM	DIRECT	17:00	18:00	60	15

Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
HV Percentages	2.00	✓

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Scaling Factor (%)
A		✓	100.000
B		✓	100.000
C		✓	100.000
D		✓	100.000

Origin-Destination Data

Demand (PCU/TS)

17:00 - 17:15

		To			
		A	B	C	D
From	A	0.00	0.00	185.00	55.00
	B	0.00	0.00	3.00	0.00
	C	184.00	0.00	0.00	61.00
	D	38.00	0.00	41.00	0.00

Demand (PCU/TS)

17:15 - 17:30

		To			
		A	B	C	D
From	A	0.00	1.00	209.00	45.00
	B	0.00	0.00	3.00	0.00
	C	196.00	0.00	0.00	60.00
	D	37.00	0.00	39.00	0.00

17:30 - 17:45

Demand (PCU/TS)

		To			
		A	B	C	D
From	A	0.00	0.00	235.00	35.00
	B	0.00	0.00	1.00	0.00
	C	206.00	0.00	0.00	48.00
	D	38.00	0.00	42.00	0.00

17:45 - 18:00

Demand (PCU/TS)

		To			
		A	B	C	D
From	A	0.00	0.00	228.00	49.00
	B	0.00	0.00	0.00	0.00
	C	168.00	0.00	0.00	52.00
	D	47.00	0.00	47.00	0.00

Vehicle Mix

Heavy Vehicle Percentages

		To			
		A	B	C	D
From	A	0	0	0	0
	B	0	0	0	0
	C	0	0	0	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-ACD	0.03	10.69	0.0	B
A-BCD	0.98	82.49	29.8	F
A-B				
A-C				
D-ABC	1.80	1885.03	130.3	F
C-ABD	0.00	0.00	0.0	A
C-D				
C-A				

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	108.96	0.028	2.97	0.0	8.490	A
A-BCD	235.01	241.53	0.973	217.01	18.0	36.955	E
A-B	0.00			0.00			
A-C	4.99			4.99			
D-ABC	79.00	55.40	1.426	53.32	25.7	249.295	F
C-ABD	0.00	100.23	0.000	0.00	0.0	0.000	A
C-D	61.00			61.00			
C-A	184.00			184.00			

17:15 - 17:30

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	3.00	96.94	0.031	3.00	0.0	9.580	A
A-BCD	255.00	266.74	0.956	249.59	23.4	66.765	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	76.00	48.03	1.582	47.94	53.7	799.858	F
C-ABD	0.00	89.04	0.000	0.00	0.0	0.000	A
C-D	60.00			60.00			
C-A	196.00			196.00			

17:30 - 17:45

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	1.00	85.21	0.012	1.02	0.0	10.694	B
A-BCD	259.97	295.15	0.881	261.52	21.8	48.855	E
A-B	0.00			0.00			
A-C	10.04			10.04			
D-ABC	80.00	44.50	1.798	44.48	89.3	1380.759	F
C-ABD	0.00	78.37	0.000	0.00	0.0	0.000	A
C-D	48.00			48.00			
C-A	206.00			206.00			

17:45 - 18:00

Stream	Total Demand (PCU/TS)	Capacity (PCU/TS)	RFC	Throughput (PCU/TS)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0.00	32.41	0.000	0.01	0.0	0.000	A
A-BCD	277.00	281.92	0.983	269.01	29.8	82.490	F
A-B	0.00			0.00			
A-C	0.00			0.00			
D-ABC	94.00	52.99	1.774	52.98	130.3	1885.034	F
C-ABD	0.00	74.62	0.000	0.00	0.0	0.000	A
C-D	52.00			52.00			
C-A	168.00			168.00			

Proposed residential development, former Chadwicks site, Greenhills Road, Walkinstown, Dublin 12

Parking and Mobility Management Plan

Client: Steeplefield Ltd

Lohan Donnelly Consulting Engineers

Dr Martin Rogers (MRCL)
Transport Planning Professional
Chartered Civil Engineer and Chartered Town Planner

March 2022

Martin Rogers Consulting Ltd

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APPENDICES

APPENDIX 1 – TRAVEL PLAN PYRAMID

APPENDIX 2 – BUS CONNECTS – GREENHILLS TO CITY CENTRE CONSULTATION REPORT, NOVEMBER 2020

1.0 INTRODUCTION

Dr Martin Rogers has been commissioned to complete a Mobility Management Plan for a proposed 633-unit apartment development at the former Chadwicks site, Greenhils Road, Walkinstown, Dublin 12.

The development comprises the following:

- 633 No. apartments,
- 1330 m2 GFA commercial space, and
- 360 m2 GFA crèche (excluding external play area).

The apartment breakdown is as follows:

- 1-Bedroom units 292 No.
- 2-Bedroom units 280 No.
- 3-Bedroom units 61 No.

It is proposed to provide 439 No. car parking spaces, including 21 No. disabled, with 15 No allocated to the commercial component and 5 No. dedicated GoCar spaces.

It is assumed that the proposed development will open in 2024.

The purpose of the report is as follows:

- Propose a restricted car parking provision for the residential component of the development, arguing that the proposed provision is entirely sustainable given the current modal splits for the journey to work for existing residents living close to the subject site, and
- Given this restricted parking provision, demonstrate the sustainability in transportation terms of residents utilising non-car based forms of travel by demonstrating the high level of service that is provided by the transport infrastructure in place at the site with regards to, walking, cycling, public bus services, national rail, and other Services (taxis, Car-club)
- Identify both physical elements and strategies to be incorporated within the proposed new development which will facilitate and create incentives for both residents of and visitors to the development to use the available modes of public transport along with walking and cycling in preference over private car use.

Section 2 of this report will estimate the car and cycle parking requirement for the overall development. While the full cycle parking requirements will be achieved, a restricted car parking provision will be proposed. The sustainability of this level of car parking provision will be demonstrated using census and canal cordon survey data.

Section 3 details the policy documents at national and local level relating to mobility management.

Sections 4 to 9 contain the mobility management plan for the proposed development.

Section 10 makes some overall concluding comments.

The site is located on the south side of Greenhills Road, adjacent to its junction with Belgard Road, 350 metres south-west of the Walkinstown Roundabout.

A site location map in contained within Figure 1-1 below.

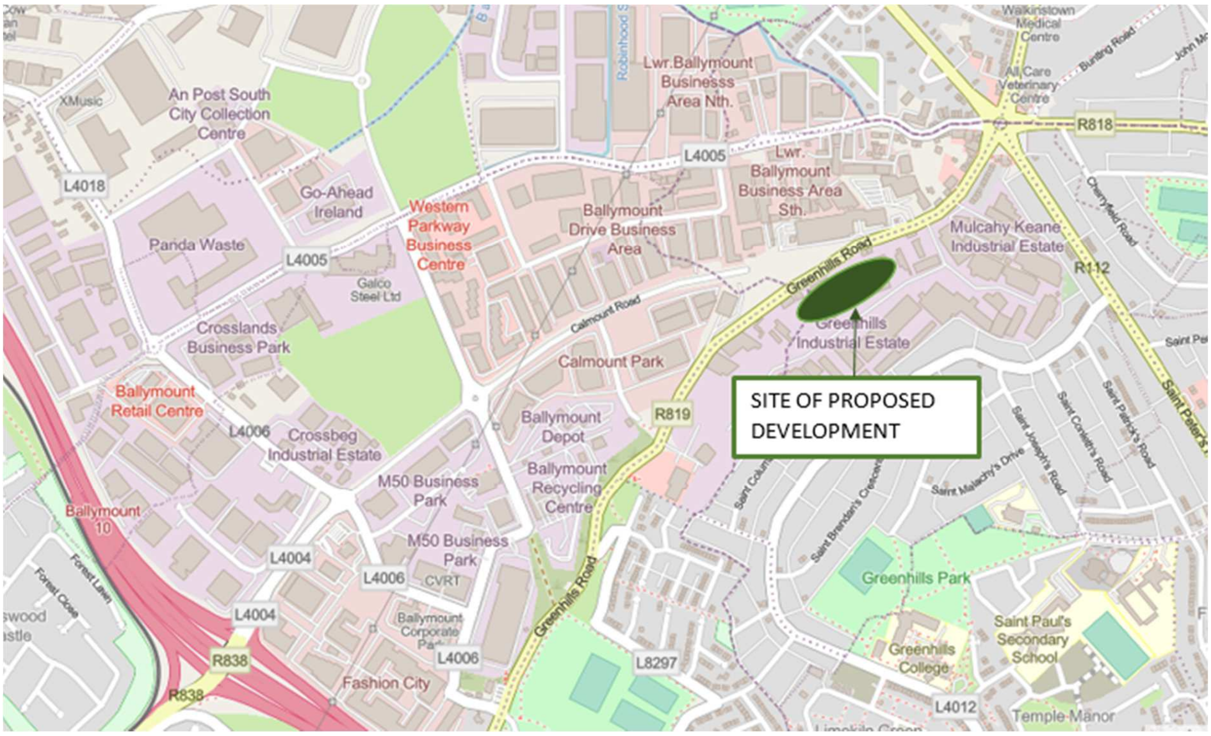

Figure 1-1: Site location map

2.0 SUSTAINABILITY OF CAR PARKING PROVISION AT THE PROPOSED DEVELOPMENT

2.1 INTRODUCTION

This section of the report will detail the car and cycle parking requirements for the proposed development based on the South Dublin Development Plan 2016-2022 and the Sustainable Urban Housing: Design Standards for New Apartments (Guidelines for Planning Authorities) was published by the Department of Housing, Planning and Local Government in December 2020.

The proposed car and cycle parking provision on site will then be detailed, highlighting in particular the intended lower level of provision in relation to car parking for the residential component of the proposed development.

It will be argued that the proposed residential parking provision is entirely sustainable given the current modal splits for the journey to work / college for existing residents living close to the subject site.

This lower level of provision is also seen as being completely consistent with the mobility targets for Dublin city as detailed within the Dublin City Transport Plan. It is also consistent both with minimising the traffic impact of nearby already congested junctions (as detailed within the accompanying traffic impact assessment) and with maximising patronage of the extensive public transport and soft mode options (as detailed within this mobility plan).

2.2 CAR AND CYCLE PARKING REQUIREMENTS AS PER SOUTH DUBLIN COUNTY DEVELOPMENT PLAN 2016 - 2022

2.2.1 PROVISION VERSUS MAXIMUM REQUIREMENTS

Tables 3-1 and 3-2 below detail the maximum car and bicycle parking standards for South Dublin County Council based on the rates contained within their 2016 - 2022 Development Plan Written Statement for the residential commercial and crèche components of the proposed development:

Development type	Area / units	Maximum car parking standards	Maximum parking required
Apartments 1-bed	292 No.	0.75 per unit	219
Apartments 2-bed	280 No.	1.00 per unit	280
Apartments 3-bed	61 No.	1.25 per unit	76
TOTAL			575
		Bike parking standards	Parking required
Apartments	633 No.	1 private secure bicycle space per 5 No. apartments + 1 visitor bicycle space per 10 No. apartments	127 + 63 = 190

Table 2-1: Parking required under South Dublin County Development Plan Standards for residential component

Development type	Area / units	Maximum car parking standards	Parking required
Commercial	1330 m^2	1 per 75 m^2	23
Crèche	360 m^2	0.5 per classroom (10 No. classrooms assumed)	5
TOTAL			32
		Bike parking standards	Parking required
Commercial	1330 m^2	1 per 200 m^2	7
Crèche	360 m^2	None specified	-
TOTAL			7

Table 2-2: Parking required under South Dublin County Development Plan Standards for commercial / crèche component (Zone 2 (non-residential) classification for commercial and crèche)

It is proposed to provide 398 No. car parking spaces plus 21 No. disabled spaces for the residential component, equating to 0.66 car spaces per residential unit.

This level of provision is 70% of the quantum required under the South Dublin County Development Plan maximum standards. However, this provision must also be viewed in relation to the New Apartment Guidelines, the level of compliance with which is detailed within section 2.3 of this report.

This provision must also be viewed in terms of the array of alternative modes potentially available to residents at the proposed development, with high-frequency public transport available via the 9 and 27 routes, and significant cycle parking available.

It is proposed to provide 15 No. car additional parking spaces for the commercial component, 65% of the requirement as detailed within the Development Plan.

In terms of cycle parking provision, it is intended to provide 1363 No. cycle parking spaces (1035 No. for residents and 316 No. for visitors, 7 No. cargo spaces and 5 No. accessible spaces), significantly in excess of the 197 No. spaces required under the Development Plan.

The National Cycle Manual, referred to within the 2020 New Apartment Guidelines, requires 1 space per bedroom plus 0.5 spaces per unit for visitors for the residential component. This would result in a requirement of 1352 No. spaces.

The proposed development will provide 100% of this very onerous requirement.

2.2.2 PROVISION OF DEDICATED CAR CLUB PARKING SPACES

Use of private car is seen within this report as relating to its use for the journey to and from work during the morning and evening peaks. However, in many cases, residents require access to a parking space in order to have a car available to make non-work related trips for shopping and leisure purposes. Such trips can be very infrequent, therefore, the provision of dedicated car parking spaces for such usage constitutes an inefficient use of such resources.

Therefore, an alternative approach is proposed in order to cater for the non-trip-to-work-related car demand of residents at the proposed development. It is proposed to provide 5 No. car club vehicle spaces within the basement car park, available exclusively for residents.

The demand will be monitored on an ongoing basis by those managing the development, and the number of spaces can be increased as required.

Car clubs typically operate with residents signing up to the service being able to reserve the use of the vehicle at certain times / days, paying a rental fee to do so, but saving the user the necessity of owning either a car or a parking space at the development.

It is the intention of the developer to discuss the potential for a car club base at the subject site with GoCar, and established car club operator in the Dublin area.

Results of surveys carried out by GoCar indicate that use is predominantly for private rather than business use, with just less than 60% using the service to replace a private car. The average car is rented out for 1 hour per day. Shopping and leisure related trips were listed as top uses for GoCar.

The provision of 5 No. car club spaces will result in a number of benefits for residents at the proposed development:

- Elimination of the necessity to own a car (and the associated expense) where use of it will be relatively infrequent
- Access to car transport for those using a car infrequently

The provision of car club spaces is also consistent with section 4.23 of the 2018 Design Standards for New Apartments which states that 'for all types of location, where it is sought to eliminate or reduce car parking provision, … 'provision is to be made for alternative mobility solutions including facilities for car sharing club vehicles.'

2.3 CAR PARKING REQUIREMENTS FOR THE RESIDENTIAL COMPONENT BASED ON NEW APPARTMENT GUIDELINES

The most recent version of Sustainable Urban Housing: Design Standards for New Apartments (Guidelines for Planning Authorities) was published by the Department of Housing, Planning and Local Government in December 2020.

Chapter 4 of this report refers specifically to revised car parking requirements for new apartment developments.

Its recommendations can be summarised as follows:
The quantum of car parking is dependent primarily on the location of the subject site. Three categories of location are defined:

Central and/or Accessible Urban Locations:
Apartments in central locations that are well served by public transport, in which situation car parking provision to be wholly eliminated or substantially reduced. These locations are most likely to be in cities, within 15 minutes walking distance of city centres or centrally located employment locations. These locations include sites within 10 minutes walking distance of DART, commuter rail or Luas stops or within 5 minutes walking distance of high frequency (min 10 minute peak hour frequency) bus services.

Intermediate Urban Locations
This applies to apartments in suburban/urban locations served by public transport or close to town centres or employment areas and particularly for housing schemes with more than 45 dwellings per hectare. For this category, planning authorities may consider a reduced overall car parking standard.

Peripheral and/or Less Accessible Urban Locations
It is reasonable to assume that the subject site comes within the first category – a central location, adjacent to a high frequency bus line (27 and 77A), the sites designation within the first classification is entirely appropriate.

Based on this classification, it was concluded that a provision of between 0 and 0.5 parking spaces in total would be appropriate for the proposed development.

The actual car parking provision, at 398 No. spaces plus 21 No. disabled spaces, equates to 0.66 No. car parking spaces per residential unit.

The section immediately below uses mobility information from the 2016 Census to justify this level of car parking provision at the proposed development.

2.4 PROJECTED CAR USAGE IN GENERAL PROXIMITY TO PROPOSED DEVELOPMENT

2.4.1 MODAL SPLIT FOR THE PRIVATE CAR – 2016 CENSUS RESULTS FOR ELECTORAL DISTRICTS IN THE VICINITY OF THE PROPOSED DEVELOPMENT

Modal split data from the 2016 Census for Electoral Districts close to the subject site can assist in providing a case for the sustainability in transportation terms of 64% of residents having access to a car space.

Such evidence can help demonstrate that potential overspill onto the local road network will not occur with the proposed level of car parking provision in place.

In order to demonstrate that the proposed quantum of car parking is sustainable and will not result in overspill, this report will assess existing demand for car travel within the general environs of the subject site using 2016 Census data.

This data enables the proportion of households in the general vicinity of the subject site who do not own a car to be established as well as the proportion of commuters presently living in the area using the private car for their journey to work.

Data from individual electoral districts, overall figures for Dublin City Canal Cordon Counts are also utilised to support the proposed level of car parking provision.

Data has been obtained for the following 5 No. Electoral Districts in the general vicinity of the subject site:

- Terenure-St James (ED containing proposed development)
- Tallaght-Kilmanagh
- Templeogue-Limekiln
- Terenure-Greentrees
- Terenure-Cherryfield

The outline of these 5 No. Electoral Districts are illustrated within Figure 2-1.

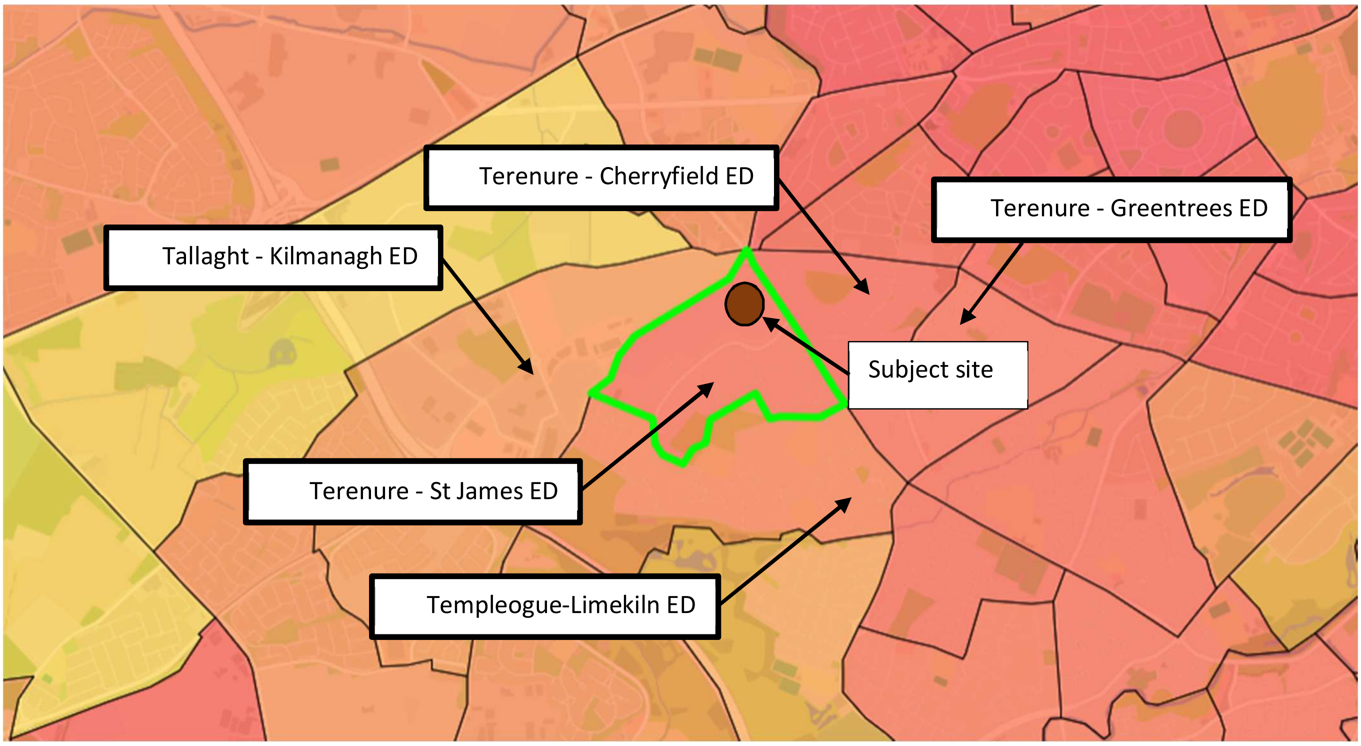

Figure 2-1: 5 No. Electoral Districts analysed

Table 2-3 contains the modal splits for car, bus and DART / Rail travel for the 5 No. Electoral Districts close to the subject site.

Mode	CAR DRIVER (%)	CAR PASSENGER (%)	BUS (%)	LUAS/TRAIN (%)	CYCLING (%)	WALKING (%)	NOT STATED / VAN / HOME (%)
Terenure-St James	56	2	16	1	7	6	12
Tallaght-Kilmanagh	59	3	6	10	4	6	12
Templeogue-Limekiln	58	3	14	1	7	3	14
Terenure-Greentrees	54	3	15	0	10	4	14
Terenure-Cherryfield	54	3	16	1	8	6	14
Weighted Average	56	3	13	3	7	5	13 (3/6/4)

Table 2-3: Modal splits for electoral districts in vicinity of subject site

Thus, for the existing inhabitants in 5 No. Electoral Districts close to the subject site, 56% commute by private car driver as detailed within the 2016 Census, with 16% commuting by bus, train or LUAS and 12% cycling or walking.

2.4.2 MODAL SPLITS FOR THE PRIVATE CAR - 2019 CANAL CORDON COUNTS DOCUMENT

The results within this document detail the volume of vehicles and people crossing the Canal Cordon into Dublin city centre in the morning peak between 7am and 10am. The purpose of collecting this data is to track trends in the modes of travel people are using to travel to the city centre. It indicates the degree of success of various transport management measures / policies in changing commuter travel behaviour.

A comprehensive picture of the modes of travel of commuters was compiled for the period 2006 to 2019.

Table 2-4 below details the modal splits compiled for the 10-year period from 2010 to 2019:

	Percentage for each mode									
Mode	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Private car users	39.8	38.0	37.0	35.4	33.3	32.6	31.8	29.2	28.3	26.7
Pedestrians	8.3	7.9	9.2	9.1	10.2	9.4	10.5	11.8	11.2	11.4
Cyclists	3.3	3.7	4.3	4.7	5.4	5.4	5.9	5.9	5.7	6.0
Public transport	45.9	47.5	46.4	47.9	48.4	49.8	49.1	50.7	52.6	53.5

Table 2-4: Modal share for commuters crossing canal cordon 2010 to 2019.

It can be seen that car usage has gradually reduced over the past 10 years, with the modal split for private car usage now below 27%, with public transport at just above 53%.

In the 2016 to 2019 period, there is thus a 16% drop in car driver usage, with a corresponding increase in sustainable modes.

2.4.3 COMBINING CANAL CORDON AND 2016 CENSUS MODAL SPLITS

If one takes the 2016 Census results and combines these with the reduction in car usage in the 2016 to 2019 period as detailed by the Dublin City Canal Cordon Counts, one will get a revised modal split for private car usage in the 5 No. Electoral Districts close to the proposed development.

The 16% drop in the car driver modal split will result in the modal split for the 5 No. Electoral Districts reducing from 56% to 46%.

Public Transport, cycling and pedestrian modes will all increase proportionally by 16%. Public transport is further increased to 21% given the greater usage of this mode that Bus Connects will promote, with higher frequencies and faster commute times. Cycling is further increased to 15% given the significant on-site parking availability and the improvements to the network planned under the GDA Cycle Framework.

The revised modal splits for the 5 No. Electoral Districts are as follows:

Transport Mode	**Adjusted modal splits based on 16% reduction in car driver usage 2016-2019**
Car driver	46
Car passenger	3
Public transport	21
Cycle	15
Walk	6
Home	5
Not Stated / Other	4

Table 2-5 - Target Modal Splits for proposed development

The adjusted modal splits will form the basis for the day of opening target modal splits at the proposed residential development.

2.5 CONCLUDING COMMENT

This section of the report demonstrates that, given existing travel patterns close to the subject site, and its designation within the New Apartment Guidelines as a 'central / accessible area' within close proximity to a high frequency bus line, a parking provision of 0.64 No. car parking spaces per dwelling unit is sustainable. The allocation of 5 No. dedicated car club spaces will further aid the sustainability of this parking provision.

This low provision will have the effect of minimising the traffic impact of the proposal, an effect referred to in detail within the accompanying traffic assessment. This is very significant given the levels of congestion at the major junctions in proximity to the proposed development.

However, providing a limited number of car parking spaces places an onus on the applicant to demonstrate that the site is configured in such a manner that enables all residents at the proposed development to commute to work by means of a sustainable mode of travel other than the private car.

The remaining sections of this document seek to demonstrate that such is the case for the proposal at the Greenhills Road site.

3.0 GUIDANCE DOCUMENTS ON MOBILITY MANAGEMENT PLANNING

3.1 INTRODUCTION

A Mobility Management Plan (MMP) is a long-term management strategy covering a selected location with the aim to promote and deliver sustainable transport objectives. A Mobility Management Plan consists of a package of measures put in place by an applicant in order to encourage and support more sustainable travel patterns among both residents and visitors at the proposed development.

The package usually includes measures to promote and improve attractiveness of using public transport, cycling, walking, car-sharing / car clubs. It should be considered a dynamic process where a package of measures are identified, piloted and monitored on an ongoing basis.

A MMP prepared at planning stage, before the development is built and occupied, can only highlight potential issues to be included in a subsequent MMP to be prepared once the development has obtained a grant of planning permission and is built and occupied.

The environmental and congestion impacts of car-based transport has resulted in policy changes where the priority of more sustainable forms of travel has increased. The MMP helps to encourage use of modes of travel other than the private car.

The proposed development is located adjacent to both the heavily loaded Walkinstown Roundabout intersection and the high frequency 27 and 77A bus routes.

MMP's are intended to bring the following benefits:

- Greater accessibility of the site.
- Encouraging of safe and viable alternatives for accessing the site.
- Pragmatic initiatives based on appraisal of residents' and visitors travel patterns.
- Reduced overall vehicle mileage and trip volumes.

3.2 GUIDANCE AND POLICY DOCUMENTS

This report was developed with guidance from the documents listed below;

3.2.1 NATIONAL POLICY

Smarter Travel A Sustainable Transport Future 2009 – 2020 (Department of Transport, 2009)
The governments transport policy for the future that targets transportation. It promotes greater integration between spatial planning and transport policy. The aim is to reduce car based commuting from 65% to 45% by 2020.

Regional Spatial and Economic Strategy (Eastern and Midland Regional Assembly, 2019)
This document notes the trends within the Region that indicate an overreliance on the private car for travel to work and education, stating that approximately 46% of Dublin's population commute by private car. Regional Planning Objective 8.7 within this document aims to promote the use of mobility management and travel plans to bring about behaviour change and more sustainable transport use.

National Cycle Policy Framework 2009 (Department of Transport, 2009)
The National Cycle Policy Framework NCPF sets out a national policy for cycling to create a stronger cycling culture and a friendlier environment for cyclists.

Making Residential Travel Plans Work (Department for Transport, UK, 2007)
UK document providing a framework for residential travel plans, detailing the content to be contained within the Travel Plan. This document incorporates the structure advocated by this document.

Sustainable Urban Housing: Design Standards for New Apartments - Guidelines for Planning Authorities (Department of Housing, Local Government and Heritage, December 2020)
This document details new levels of car and cycle parking provision for apartment developments in urban areas.

3.2.2 LOCAL POLICY

South Dublin Development Plan 2016-2022
Section 6.4.2 states that Traffic and Transport Assessments and/or Workforce Travel Plans (also known as Mobility Management Plans) will be required to support development proposals that have the potential to generate significant traffic movements, to demonstrate that there is public transport carrying capacity and road capacity to serve the development. The Council is also committed to the provision of a Traffic Management Centre for the Greater Dublin Area, in association with the NTA.

Transportation Strategy for the Greater Dublin Area 2016-2035 (NTA, 2016)
This document states that development within the existing urban footprint of the Metropolitan Area should be consolidated to achieve a more compact urban form. Policy should allow for the accommodation of a greater population than at present, with much-enhanced public transport system, with the expansion of the built up areas providing for well-designed urban environments linked to high quality public transport networks, enhancing the quality of life for both residents and workers.

Dublin City Centre Transport Study (NTA, 2016)
The Study seeks to address major transport issues facing the core city-centre area, to facilitate the implementation of the Dublin City Council Development Plan, and to safeguard the future growth of the city, specifically in terms of new transport infrastructure. The construction and operation of Luas Cross City will require a significant reconfiguration of current transport arrangements. This study addresses these issues and proposes measures to counter long-standing constraints of the existing City Centre transport network. This will ensure that capacities are in place to meet the demands of future growth in the City, as well as optimising the use of the City Centre's limited road space to maximise the benefits for people living, working and visiting Dublin City Centre. The key objectives include increasing the capacity, reliability and use of public transport into and within the City Centre as well as improving the quality of service for cycling and walking, with particular emphasis on the 'core' City Centre;

The Study advocates significant reductions in the modal split for private cars for the journey to work over the short to medium term in the Greater Dublin Area.

The achievement of these targets requires developments such as the one proposed at the proposed development to advocate sustainable modes of transport for residents travelling to work and college. Achievement of the objectives and targets as outlined within this document. The residential travel plan framework will be entirely consistent with the aims of the Dublin City Centre Transport Study.

Cycling Policy
The National Cycle Manual, adopted in 2011, provides local guidelines on cycle parking provision.

4.0 THE TRAVEL PLAN PYRAMID

The UK document 'Making Residential Travel Plans Work' details the travel plan pyramid that helps demonstrate how successful plans are built on the firm foundations of a good location and site design. A Plan should also combine hard measures – such as new bus stops and cycle ways, and soft measures – such as discounts on season tickets and help with individual journey planning. All measures should be integrated into the design, marketing and occupation of the site. In addition, parking restraint is often crucial to the success of the plan in reducing car use.

An image of the pyramid is contained within Appendix 1.

The travel pyramid, as detailed within 'Making Residential Travel Plans Work', contains the following five key concepts that are central to a good RTP:

- Location - Residents need to be within easy reach of shops and services – so that walking or cycling becomes the natural choice
- Built Environment – Low-density developments are hard work to get round by bike and foot. Encouraging compact development that is walking and cycling friendly, with low parking allowances, is crucial in encouraging sustainable travel choices.
- Travel Plan Coordinator - Successful travel plans need people. The Coordinator plays a crucial role in developing the plan and working with residents and management to ensure the plan meets their needs for access and evolves over time
- Services and facilities - Good public transport and a car club can help reduce the need for on-site parking. Other measures, such as broadband internet access and home deliveries can reduce the need to travel off site.
- Promotional strategy - Welcome packs, public transport discounts and cycling incentives can all help introduce the travel plan to residents and build enthusiasm.

In terms of location and built environment, one can see the significant advantages of the subject site, within easy access of bus facilities, with the layout of the proposed development making cycling and walking safer and more efficient.

This report will demonstrate the central role that will be undertaken by the Travel Plan Coordinator in setting targets, updating the Travel Plan, monitoring use of car club spaces and maximising the circulation of promotional material among residents.

5.0 GREENHILLS ROAD RESIDENTIAL DEVELOPMENT MOBILITY STRATEGY

Section 6 of this report will summarise the existing public transport and cycling facilities at the subject site.

Section 7 takes the existing commuter travel patterns for the area and proposes year-of-opening modal splits for the proposed development. It also contains proposed future improvements public transport, cycling and walking facilities nearby which will assist in the attainment of the stated targets.

Section 8 details the objectives of the Travel Plan Strategy and lists a suite of measures planned to be implemented to facilitate the achievement of these objectives.

Section 9 details the central role of the Travel Plan Coordinator in the attainment of the objectives as set out within Section 8.

6.0 EXISTING PUBLIC TRANSPORT AND CYCLING FACILITIES

6.1 EXISTING BUS INFRASTRUCTURE

The Greenhills Road area is currently connected via the 27 and 77A bus routes, providing good links both to the city centre and the western suburbs.

The frequency of each bus can be seen in Table 6-1:

ROUTE	ORIGIN	DESTINATION	FREQUENCY AM PEAK
Route 27	JOBSTOWN	CLARE HALL VIA CITY CENTRE	6 per hour
Route 77A	CITYWEST	RINGSEND	2 per hour
Route 9	LIMEKILN AVE	CHARLESTOWN	6 per hour
TOTAL			11 PER HOUR

Table 6-1– Dublin Bus Route Frequencies close to proposed development

Figure 6-1 details the routes taken by the 9. 27 and 77A in close proximity to the site of the proposed development.

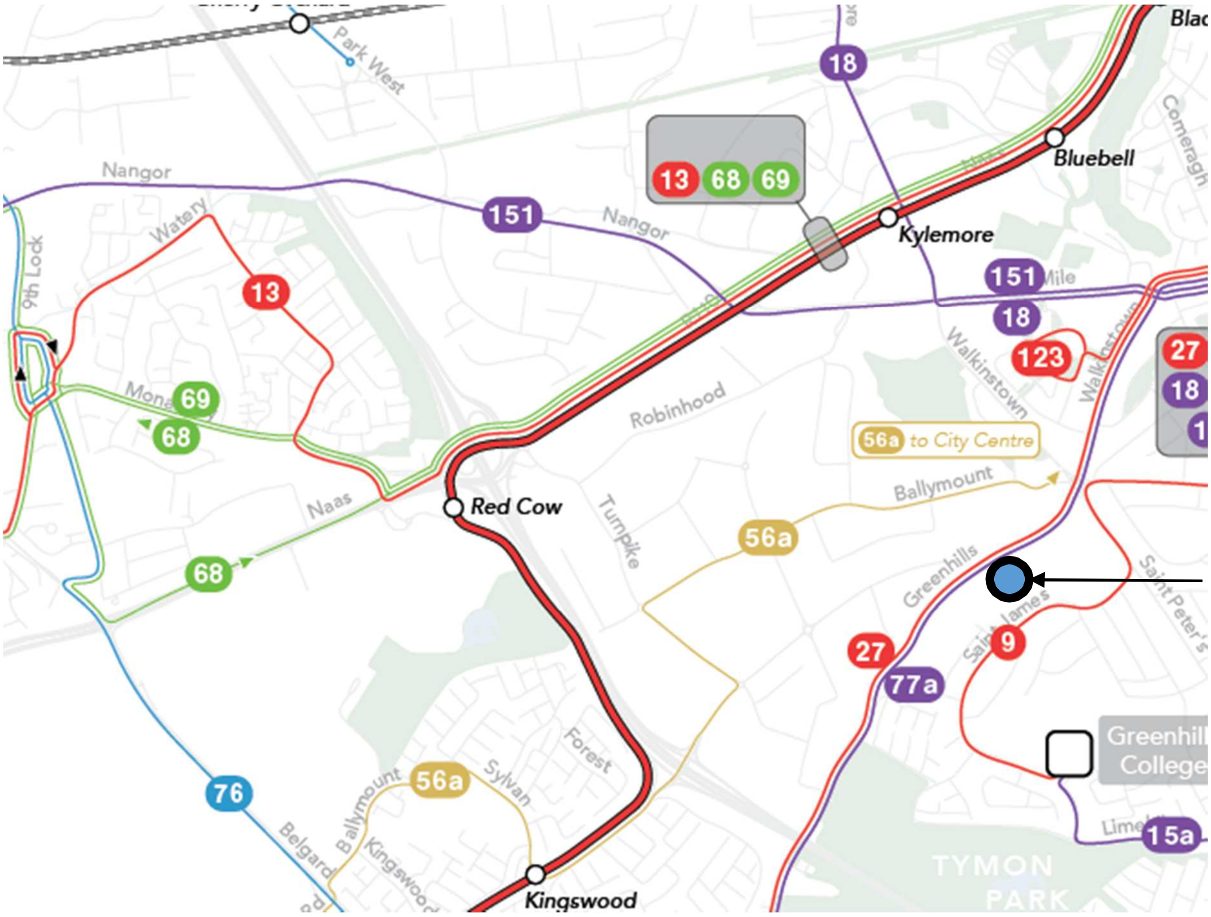

Figure 6-1: Existing bus routes 27, 77A and 123

In addition, the 123 route, with its terminus west of Walkinstown Road within 1km of the site, runs into the city centre 6 times per hour during the morning peak.

With the present bus system along Greenhills Road yielding 14 No. buses per hour during the morning peak, and assuming a maximum capacity of 80 No. passengers, an overall hourly capacity towards town of 1120 No. passengers is derived.

(Assuming the D spine on the Bus Connects route contains the D2, D4 and D5 routes, extending to Tallaght along the Walkinstown Road and Greenhills Road. In Tallaght, D2 would extend past The Square to Jobstown and Citywest, with some similarity to existing Route 27, D4 would extent past The Square to Killinarden Heights and Kiltipper Way, and D5 would split off at Castletymon Road to serve Tymon North and Seskin View on the way to The Square in Tallaght. In addition, the F spine will be accessible to commuters living at the proposed development, as the F3 route passes through Walkinstown Roundabout immediately east of the site. These proposed routes will provide capacity commensurate with the existing network, but with significantly reduced journey times, providing uplift to the desirability of the bus as a preferred modal choice for commuters. See section 7.2.1 below)

In order to estimate the level of demand the proposed development will place on the existing / proposed bus network, we can assume a figure of 2.7 persons per apartment unit of a suitable age to travel to school / college or work. This is a robust figure given the development has an average of 1.6 bedrooms per unit, and is based on 2016 Census figures derived for a standard household of 2.7 persons per household in total. It yields a population for the proposed residential component of the development at 1709.

If we assumes 21% travelling by bus (as detailed within Mobility Management Plan document), this translates into 359 No. bus commuters. If one assumes these journeys are spread over 3 hours in the morning, this translates into an hourly demand on the bus network of 120 No. commuters per hour.
*This figure is only 11% of the computed maximum capacity of the existing bus network. Thus, based on=- frequency and capacity, it can be assumed that the bus network in place will cope more than adequately with the demand induced by the residential component of the proposed development.

6.2 EXISTING CYCLING INFRASTRUCTURE

Figure 6-2 details the existing cycle facilities close to the site:

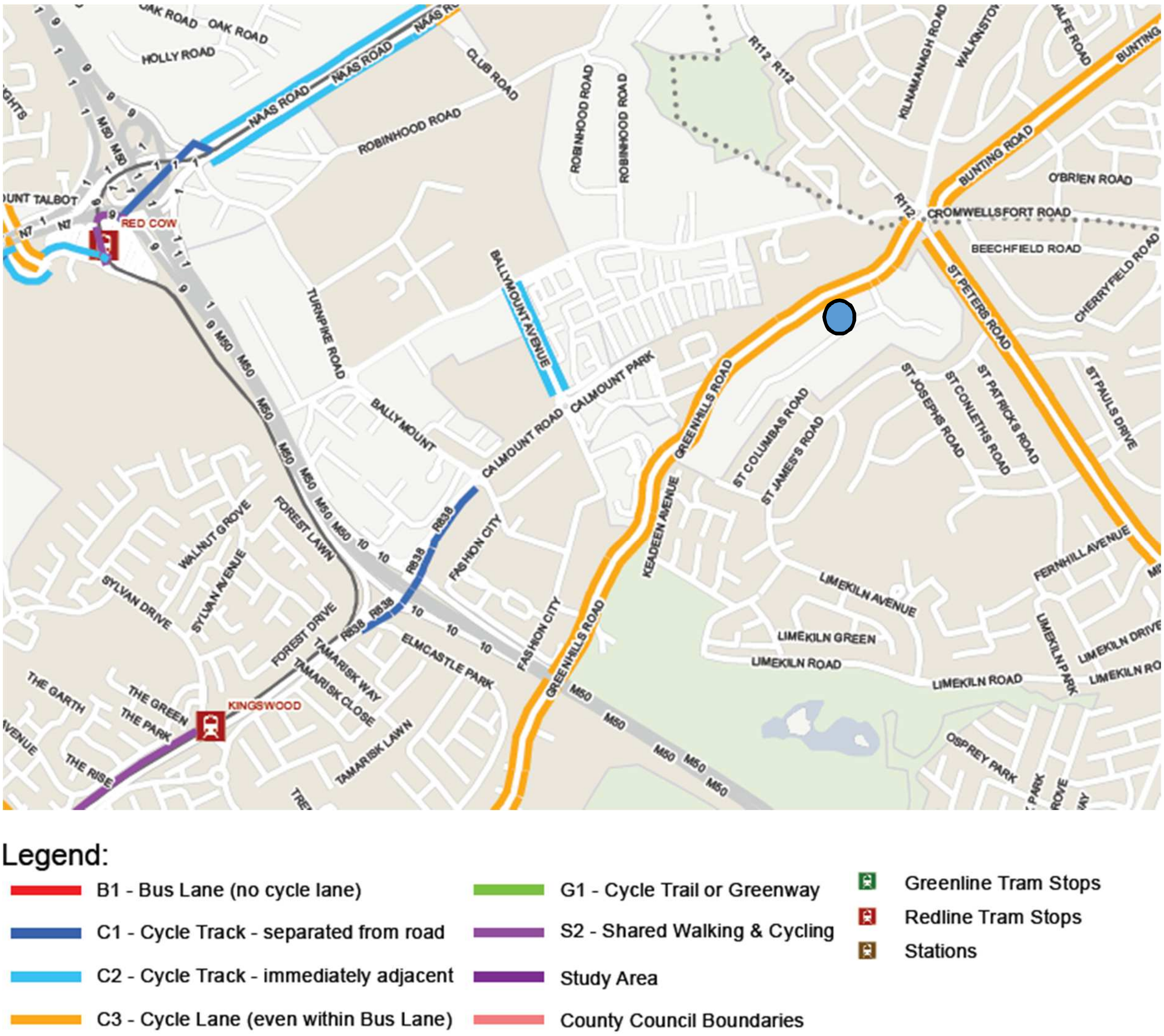

Figure 6-2: cycling facilities in proximity to Chadwicks site

One can see that, while there are relatively limited cycle lanes in the vicinity of the development, with the main link being along the Greenhills Road within the bus lane, the general connectivity to the south city area is good via Walkinstown Roundabout.

7.0 PREDICTED POST-DEVELOPMENT TRAVEL PATTERNS

7.1 INTRODUCTION

Based on the modal split information within section 2 of this report for the Electoral Districts in the general vicinity of the subject site, excluding not-stated modal preferences and stay-at-home workers, Table 7-1 below indicates a target profile for the future residents at the Greenhills Road SHD on the projected day of opening:

Transport Mode	Commuter Usage (%) (day-of-opening)
Car driver	40
Car passenger	3
Car Club User	10
Public transport	21
Cycle	15
Walk	6
Home	5

Table 7-1 - Future Target Modal Splits for Belgard Road / Airton Road SHD

The 10% modal split for car club users is based on the provision of 5 No. Car Club spaces, catering for approximately 63 No. apartment units (10% of 633 No. apartment units). This is in line with GoCar's assertion that 1 No. car club space has the potential to service up to 15 No. residential units.

The 40% plus 10% (50% total vehicle driver modal split) is very marginally above the car driver plus van modal split derived for 2019 within section 2 above (46%).

The section below details the improvements planned to the bus and cycle network that will help insure that the proposed day-of-opening modal splits for the development are maintained if not improved upon into future years.

7.2 FUTURE PLANNED PUBLIC TRANSPORT AND CYCLING NETWORK IMPROVEMENTS

7.2.1 BUS CONNECTS

Figure 7-1 details the Bus Connects proposals, indicating that the core Greenhills to City Centre route running along Greenhills Road.

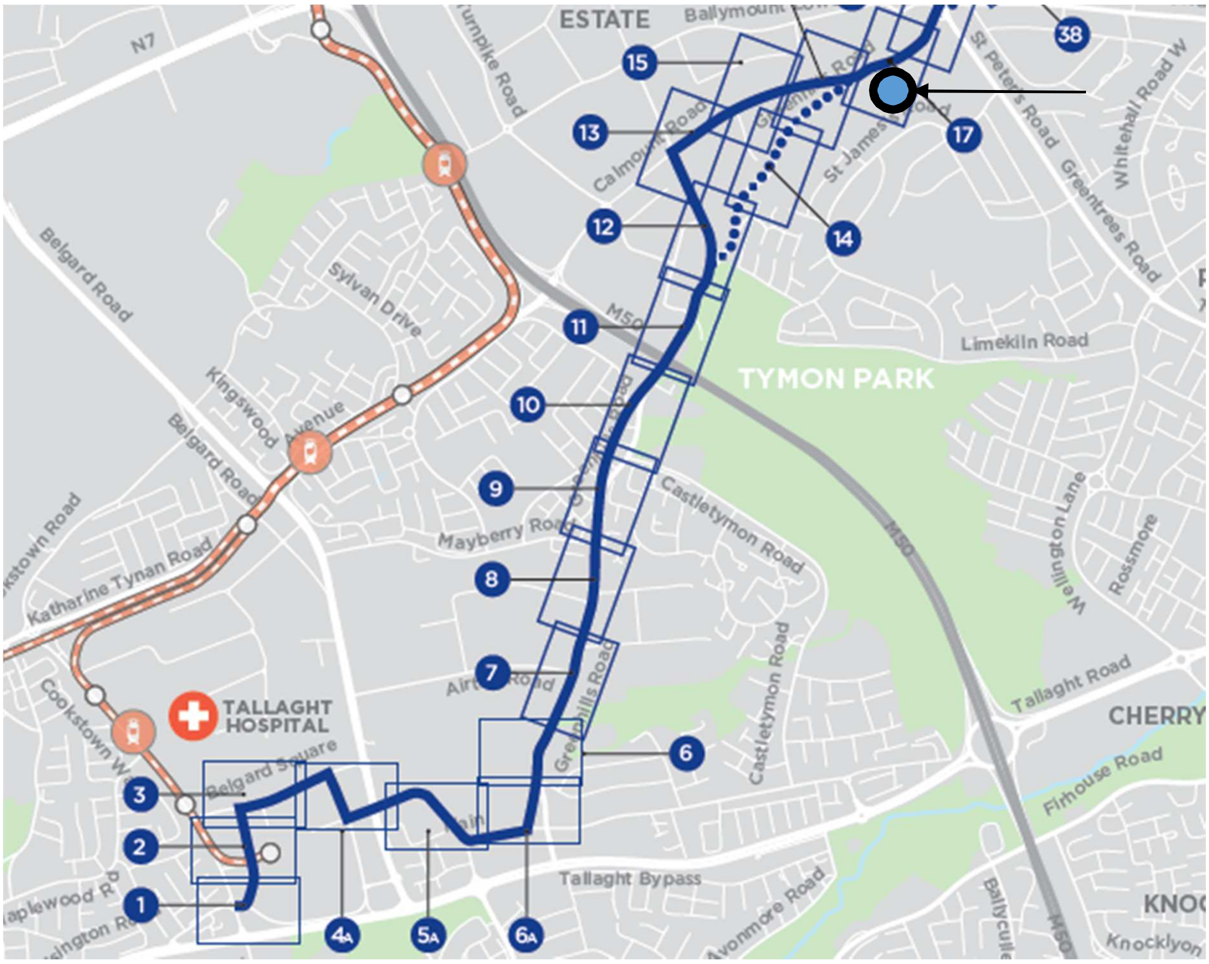

Figure 7-1: Proposed Greenhills to City Centre spine running along Greenhills Road

One can see that there are limited cycle lanes in the vicinity of the development, with the main link being along the Greenhills Road within the bus lane.

7.2.2 GDA CYCLE NETWORK PLAN

Figure 7-2 details the facilities planned within the GDA Cycle Network Plan.

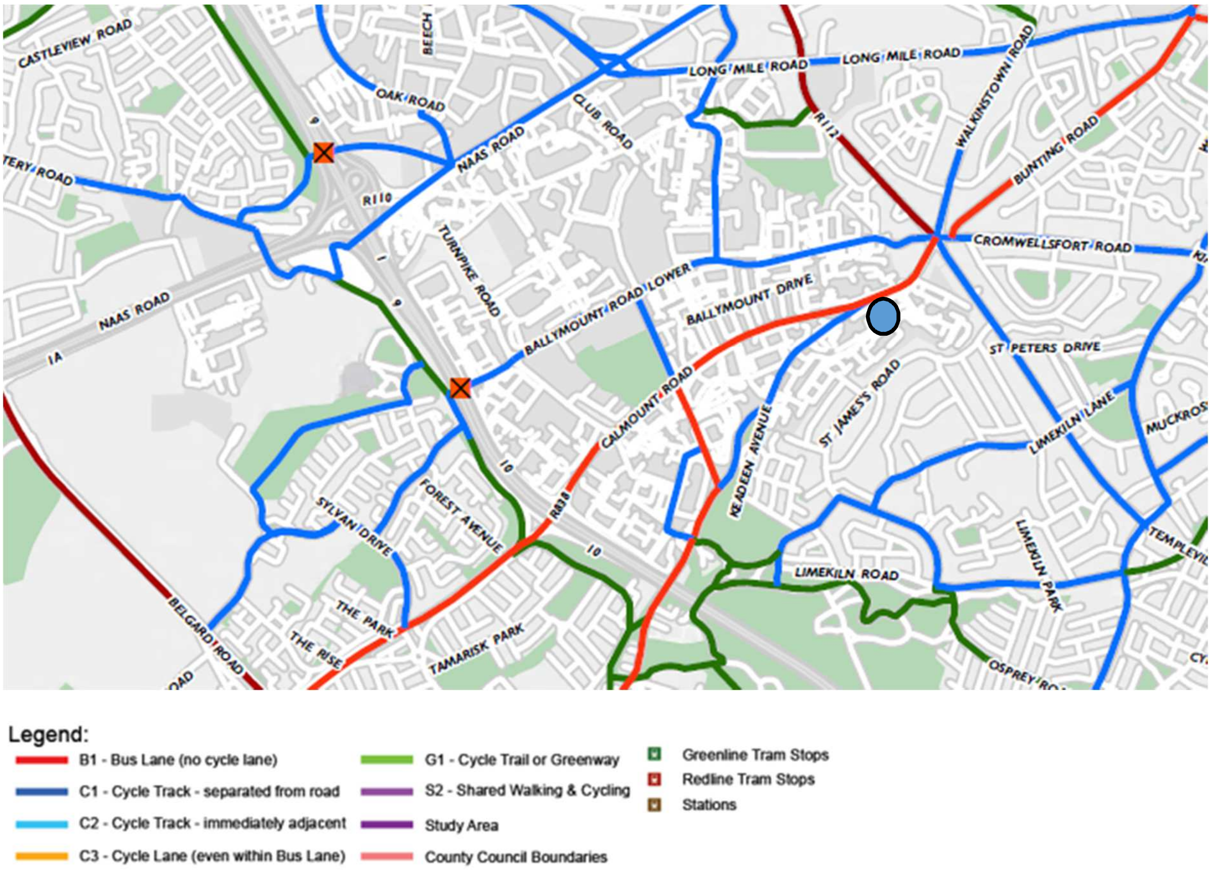

Figure 7-2: Cycle lane improvements detailed within Draft 2021 GDA Cycle Plan

The primary route along Greenhills Road mirrors the proposed Greenhills to City Centre Core bus corridor route detailed above.

8.0 OBJECTIVES OF TRAVEL PLAN STRATEGY

8.1 INTRODUCTION

A Travel Plan Framework is a tool that brings together site management issues relating to transport in a coordinated manner. This document puts in place the objectives of the mobility management strategy for the subject site and the specific measures designed to achieve these objectives.

As the proposal includes relative limited on-site car parking, this strategy aims to provide sustainable transport choices for residents and visitors at the site, thus continuing to minimise private car use for the trip to and from the workplace. Specific measures for achieving effective modal shift away from the private car will be detailed.

The aim of this strategy is thus to introduce measures which will maximise the chances that the modal split targets for year of opening are met and maintained thereafter.

The objectives of the Travel Plan Strategy for the proposed development in order to meet the stated targets for the subject site are as follows:

- To manage the availability of the private car for residents (non-work purposes) (Objective No. 1);
- To encourage residents to use public transport by providing information on the services available as well financial incentives to use public transport. New public transport schemes coming on stream will further aid the achievement of this objective (Objective No. 2);
- To encourage residents to cycle to work, if appropriate, by providing safe parking and general information on the health benefits of cycling (Objective No. 3);
- To encourage to walk to work if appropriate, by providing all necessary information on this mode of travel (Objective No. 4).

A number of the proposals listed to achieve and maintain the modal splits detailed within Table 7-1 above are easy and inexpensive to implement. Other measures require initial co-operation and co-ordination both within and between organisations.

The general morale of residents will be, to an extent, dependent on their general state of health and fitness, particularly where, for some, long periods are spent behind a desk working with computers when they get to their workplace. The profile of their journey to work can be a significantly beneficial factor in regard to increased fitness and wellbeing.

8.2 OBJECTIVE NO. 1 - MANAGE PRIVATE CAR AVAILABILITY FOR RESIDENTS (WORK AND NON-WORK PURPOSES)

The promotion of car sharing among residents using the development website can help decrease the car driver modal share and increase the car passenger percentage for work-related purposes.

Rather than all residents requiring access to a parking space in order to have a car available to make non-work related trips for shopping and leisure purposes, an alternative and more sustainable approach is proposed involving the provision of information on car clubs to residents in order to cater for the non-trip-to-work-related car demand.

It is proposed that the Travel Plan Co-ordinator will provide information on the availability of car club vehicles for residents within the development, with 5 No. spaces being provided initially.

Such actions will have the effect of reducing the modal split for car drivers to 40%, with 10% of commuters using the car club facilities.

8.3 OBJECTIVE NO. 2 - ENCOURAGING GREATER USE OF PUBLIC TRANSPORT FOR THE JOURNEY TO WORK

8.3.1 GENERAL

Public transport will be a favoured transport option for a predicted 21% of residents at the proposed development on its day of opening.

The Bus Connects development, in the longer term, will significantly improve public transport services at the subject site.

8.3.2 PUBLIC TRANSPORT INFORMATION

It is vital that timetable information is available to residents in order to encourage maximum usage of the public transport system. Dublin Bus and LUAS timetables should be posted on the notice board within the apartment complex and / or the web site to be set up by on-site management.

8.4 OBJECTIVE NO. 3 - ENCOURAGING MORE RESIDENTS TO CYCLE TO WORK

Cycling will be a favoured transport option for a predicted 15% of residents at the proposed development on its day-of-opening. There is thus significant scope to increase this modal share further once the GDA cycle plan is implemented.

The provision of 1352 No. cycle parking spaces on site will also help both maintain and strengthen this modal split, providing the possibility of cycle ownership for all residents.

8.5 OBJECTIVE NO. 4 - ENCOURAGING MORE RESIDENTS TO WALK TO WORK

Walking will be a favoured transport option for a predicted 6% of residents at the proposed development on its day of opening.

Maintenance of this modal share will be facilitated by noticeboard and website information on quickest routes to town, nearby districts and closest bus stops / LUAS stop.

9.0 ROLE OF THE TRAVEL PLAN COORDINATOR FOR THE PROPOSED RESIDENTIAL DEVELOPMENT

9.1 APPOINTMENT OF TRAVEL PLAN COORDINATOR

It will be the intention of on-site management at the proposed development' that a Travel Plan Coordinator be appointed to administer, implement, monitor and review travel plan management issues within the residential component of the proposed development. The coordinator will also liaise with the local authority, public transport companies and facility managers on issues relevant to the maximisation by commuters of non-car based journeys to work.

9.2 DUTIES OF THE TRAVEL PLAN COORDINATOR

The application is founded on minimal use of the private car by all residents and the maximization of travel by soft modes and public transport.

The co-ordinator will have a vital role in encouraging and enabling residents at the subject site to adopt the measures listed within the document to achieve the objectives listed above within section 8. The duties of the co-ordinator are detailed below under the following headings:

- Promoting the environmental and health benefits of their travel choices
- Promoting bike use
- Promoting walking to work
- Promoting rail and bus based travel
- Monitoring the modal splits for residents' journey to work

9.2.1 Promoting the environmental and health benefits of their travel choices

It will be the duty of the coordinator to make residents aware of the environmental and health consequences of their travel choices. Various media should be employed in order to communicate this message. These could include a newsletter and a mobility website, and providing information on issues such as available public transport services, where to buy a bike, and the health benefits of cycling / walking.

9.2.2 Promoting bike use

The coordinator can promote the use of this mode of travel using other measures such as the setting-up of a cycle users group so that experienced cyclists within the development can help encourage newcomers to the mode of travel. The coordinator can also help by keeping tool kits and spare parts on site for cyclists to avail of. The web site and newsletter could also be an aid to encouraging the mode of travel by encouraging the potential timesavings involved. In addition, the coordinator can keep in contact with the local authority to monitor the progress in implementation of the proposed cycle track network in the locality.

It would also be possible for management at the proposed residential development to agree a group bicycle insurance scheme for residents at preferential rates in order to maximise its use as a mode of travel to work.

In addition, management might subsidise the cycling mode by purchasing an initial stock of bicycles to loan to residents at preferential rates. Such a scheme would not be expensive and would have the added benefit of raising awareness of it as a mode of travel and generally encouraging cycle use.

9.2.3 Promoting walking to work

As with cycling, the coordinator should promote the health and fitness benefits of walking and its general viability as a method of getting to work. The coordinator can also liaise with the local authority on work being done near the candidate site to make the local road network more pedestrian friendly.

9.2.4 Promoting rail and bus based travel

The coordinator will promote a public transport culture among residents. The coordinator can use the newsletter and website to provide information on public transport, in particular timetable information, fares, bus and / LUAS stop location and route planning, together with information on annual and monthly public transport tickets, carrying potential tax benefits for commuters.

9.2.5 Monitoring the modal splits for the residents' journey to work

In order to maximise the effectiveness of the Travel Plan, the coordinator should be responsible for the ongoing monitoring of the modal splits within the plan, including the carrying out on a regular basis of travel surveys of all on-site residents.

10.0 CONCLUDING COMMENT

This Travel Plan is required to insure the sustainability of the limited provision of car parking at the subject site, consistent with the New Apartment Guidelines but below the maximum provision as detailed by the planning authority.

This report has demonstrated that the proposed reduced car parking provision for the residential development is entirely sustainable based on current car ownership and modal splits for the journey to work for existing residents living within Electoral Districts close to the subject site. It is also entirely in line with recommendations on parking provision set out in the *'Sustainable Urban Housing: Design Standards for New Apartments (Guidelines for Planning Authorities): December 2020'*

A parking provision of 0.64 spaces per apartment unit is sustainable, given that private car usage for the journey to work is projected to be in the region of 40% on the proposed day of opening of the development, with public transport / soft mode usage for the journey to work in the region of 42%. The balance comprises 10% projected to be car club users, 5% staying at home, and 3% travelling as car passengers.

The Residential Travel Plan / Mobility Management Plan within this report aims to achieve a sustainable travel culture for residents at the residential development by outlining a travel strategy, by listing measures to achieve its objectives and by committing to appoint a travel plan coordinator to oversee and monitor progress towards the target modal splits predicted for the site on its day of opening.

MRCL

TRANSPORT
PLANNING PROFESSIONAL

APPENDIX 1

TRAVEL PLAN PYRAMID


The travel plan pyramid
Promotional Strategy
Services & Facilities
public transport; car clubs; parking management; sub-site travel plans etc.
Coordinator
To develop further measures and oversee the plan on an ongoing basis
Built Environment
Site design; public transport infrastructure; facilities to reduce the need to travel; parking provision; off-site measures
Location
Proximity to existing facilities and services

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APPENDIX 2

BUS CONNECTS - GREENHILLS TO CITY CENTRE CONSULTATION REPORT

4. Preferred Route Description

4.1 Overview

The Greenhills to City Centre Core Bus Corridor (CBC) commences on Belgard Square West at the junction with Cookstown Way. A bus interchange will be located in this area and will be a focus for all of the bus routes in the Tallaght area, providing seamless interchange between bus services, Luas and the Town Centre. From here, the CBC is routed along Belgard Square West and Belgard Square North as far as the junction with Belgard Square East.

The CBC route is proposed south along Belgard Square East towards Old Blessington Road and Main Street via the existing signalised Bus Gate at the Technological University Dublin (TUD) entrance. It continues along Main Street to Greenhills Road, continuing along Ballymount Avenue, Calmount Road, and Walkinstown Road as far as the junction with the Long Mile Road. It is proposed to realign the existing Greenhills Road along an existing road reservation area between Parkview and Treepark Road, and through Ballymount Industrial Estate by way of extending both Ballymount Avenue and Calmount Avenue to connect to Greenhills Road at new signalised junctions.

From the junction of the Long Mile Road and Walkinstown Road the CBC is routed along Drimnagh Road, Crumlin Road, Dolphin's Barn, Cork Street, St. Luke's Avenue, The Coombe, and Dean Street to the junction with Patrick Street. The CBC is then routed along Patrick Street and Nicholas Street to the junction with Christchurch Place where it will join the existing traffic management regime in the City Centre.

Priority for buses is provided along the entire route, consisting primarily of dedicated bus lanes in each direction, with alternative measures proposed at particularly constrained locations. Cycle facilities are provided along the length of the corridor where practicable to do so. Where this could not be achieved a parallel alternative cycle route is provided offline to the CBC route. Offline cycle facilities are proposed along Bunting Road, Kildare Road and Clogher Road to link into the Grand Canal cycle route at Parnell Road.

Opportunities for new soft landscaping and Urban Realm improvements will be reviewed with design development throughout the length of the CBC.

The following paragraphs will describe each section of the CBC in more detail, identifying the key design revisions which have been incorporated into the design since the publication of the Preferred Route Option in March 2020.

4.2 Belgard Square South to Greenhills Road – Belgard Square West, Belgard Square North, Belgard Square East, Old Blessington Road, Main Street

The Greenhills to City Centre CBC commences at the existing roundabout junction on Belgard Square South. It is proposed to change the roundabout to a fully signalised junction with improved pedestrian facilities. Belgard Square West is intended to be a bus only route not accessible to general traffic. The revised proposal now indicates an interchange that will act as the focus for all bus routes in the area.

Between Belgard Square South and Tallaght Cross West/Broadfield Hall access to and from these buildings and neighbouring developments will still be permitted from Belgard Square West.

Bus traffic across Old Blessington Road will be controlled by Signal Controlled Priority. Access to and from the Old Blessington Road to Belgard Square West will be permitted.

It is proposed to change the roundabout junction on Belgard Square North at the Tallaght Hospital Entrance and Cookstown Way to a fully signalised junction to accommodate new bus lane and pedestrian facilities. The roundabout junctions at Belgard Square East will also be replaced with new signalised junction arrangements. It is proposed to upgrade the existing cycle facilities and associated junctions on Belgard Square North to provide segregated cycle tracks to and from Tallaght Hospital. This proposed amendment may impact on the existing trees and shrubs along Belgard Square North and require localised land acquisition on a currently undeveloped site.

From Belgard Square East the route largely aligns with the existing bus route for the area and minimises impacts on the existing TUD campus infrastructure and operational procedures. It is proposed to create a new junction with Signal Controlled Priority on Old Greenhills Road at the location of the existing cul de sac, to facilitate bus only turn movements to the Greenhills Road.

4.3 Greenhills Road to Walkinstown Roundabout – Greenhills Road, Ballymount Avenue, Calmount Road, back to re-join Greenhills Road

Between the Old Greenhills Road and the junction with Mayberry Road along the Greenhills Road, it is intended to provide one bus lane, one traffic lane and a cycle track in both directions. To accommodate the road cross section, it is proposed to utilise land take along this section on both the west and east side of the existing Greenhills Road. At the Airton Road junction the road alignment has been altered to improve facilities for cyclists and to make use of space that has already been setback for future road widening.

To improve the operation of the existing junction and minimise land take, it is proposed to introduce a right turn ban from Greenhills Road to the entrance to Harvey Norman and a right turn ban from the Greenhills Road to the Hibernian Industrial Estate. Access from Harvey Norman to Greenhills Road will be maintained at the junction. Right turning vehicles for Harvey Norman will be directed to the Airton Road junction. At this junction, vehicles will be able to turn right and access the Harvey Norman store from this road. Right turning vehicles for the Hibernian Industrial estate will be directed to the next junction (at Agnelli Motor Park) where full access will be maintained.

Between Mayberry Road and Tymon Lane it is proposed to undertake major changes to the local road network. South Dublin County Council has identified this section of Greenhills Road for upgrade under their current County Development Plan. It is intended to implement some of these road construction works as part of this scheme.

A new Greenhills Road will be constructed on the green space south of Birchview Avenue and Treepark Road. A bus only arrangement is proposed on the southbound bus route that will allow busses to use the existing Greenhills Road alignment and reduce the width of a proposed new link road. Tallaght bound through traffic and Castletymon Road traffic will be routed through this new link road. The previously proposed Castletymon Road extension and junction will also be maintained.

The existing M50 bridge crossing will be retained, however it will present a width restriction. Having reviewed the expected operation of the corridor, it has been concluded that an additional new bridge is required to maintain priority for buses and to provide high quality cycle facilities over the M50 in both directions. Additional land take on both sides of the M50 will be required to facilitate the construction of this bridge.

The existing Ballymount Road Upper/Greenhills Road junction adjacent to the existing petrol station is proposed to be closed in line with the South Dublin County Council development plan proposals for the area. Traffic heading for the M50 will be able to do so via the new junction and link road at Keadeen Park.

At Keadeen Park traffic will be directed on to a new road link connecting to Ballymount Avenue. A priority T-junction will be introduced at the new road link to maintain direct access onto Greenhills Road from the south. The junction between Ballymount Avenue and Calmount Road will be upgraded from a roundabout to a signalised junction with improved pedestrian facilities. The bus route will

be directed down Calmount Road. The existing road is intended to be widened to incorporate bus and cycle lanes. It is proposed to connect Calmount Road to Greenhills Road with a new link road. It also is proposed to connect the existing Greenhills Road to Calmount Road with a new link road through Calmount Avenue. Some limited land take will be required to construct a new roundabout at this proposed junction.

Between the Calmount Road and Walkinstown Roundabout, it is proposed to maintain one bus lane, one traffic lane and a cycle track in both directions, which will require some land take primarily along the southside of Greenhills Road. The Walkinstown Roundabout was reviewed to improve cycle and pedestrian accessibility. A two-way segregated cycle track has been proposed to provide connectivity from Greenhills Road to the proposed cycle route on Bunting Road. Parallel signal-controlled pedestrian/cycle crossings are proposed on all arms of the roundabout.

4.4 Walkinstown Roundabout to Dolphin Road – Walkinstown Road, Drimnagh Road, Crumlin Road

On Walkinstown Road between Walkinstown Roundabout and the Long Mile Road, it is proposed to provide one bus lane and one general traffic lane in both directions. There is insufficient space to accommodate dedicated cycle lanes on this section of road. To accommodate this cross section, it is proposed to utilise land take to west of the Walkinstown Road between Walkinstown Avenue and Kilnamanagh Road. Land take to the east of Walkinstown Road may be required between Kilnamanagh Road and Long Mile Road.

It is proposed to introduce a right turn ban from Walkinstown Road to Kilnamanagh Road. Kilnamanagh Road will remain accessible from Walkinstown Road through Walkinstown Drive. It is also intended to introduce a right turn ban for traffic from Walkinstown Road to the southern entrance of the SuperValu supermarket.

To accommodate cyclists on this section of the route, an alternative cycle route is proposed along Bunting Road and St. Marys Road providing a quiet route linking Walkinstown Roundabout with Kildare Road.

It is proposed to upgrade the junction at Long Mile Road and Walkinstown Road to enhance pedestrian and cycling facilities. To enhance cycle facilities and reduce vehicle speeds the proposed left turn slip lane to Walkinstown Road has been removed to improve pedestrian/footpath frontage and minimise cycling conflicts with general traffic. Parking impacts adjacent to shop frontage on Long Mile Road have been reviewed and the proposed arrangement will cater for safer parallel parking and a segregated cycle track.

On Drimnagh Road it is proposed to maintain one bus lane, one general traffic lane and one cycle track in each direction. To allow this revised cross section some limited land take from property between Balfe Road and Kildare Road will be required. The junction at Kildare Road, Saint Mary's Road and Drimnagh Road has been revised to provide improved cycle facilities. This will provide improved cycle connectivity between Drimnagh Road and the proposed alternative cycle route via Kildare Road.

On Crumlin Road it is proposed to install Signal Controlled Priority to maintain priority for buses through this constrained section. This is required due to the size of the front gardens and limitations as a result of the gradients from the road to the front doors of some of the houses. As a result, significantly less land take is required on this section of the corridor. The proposed arrangement requires the closure of Clonard Road and Bangor Drive to facilitate traffic management within this portion of Crumlin Road so that bus priority can be maintained. Access to Bangor Drive and Clonard Road can be achieved via Windmill Road and Old Country Road. Due to width restrictions in the area of Crumlin Road there is insufficient space to provide dedicated cycle lanes. Therefore, it is proposed to redirect cyclists through Kildare Road.

In order to improve local road safety on Kildare Road it is intended to introduce a no entry sign at the junction of Kildare Road and Clonard Road for traffic in both directions. This would prevent general through traffic; however, buses, taxis and cyclists movements will remain unrestricted along Kildare Road. Eastbound traffic would be directed along Clonard Road, through Downpatrick Road on to Bangor Road. Westbound traffic would also be directed up Clonard Road onto the Old County Road. The route will continue along Clogher Road, rather than returning to Crumlin Road. This will provide improved connectivity to the proposed Grand Canal cycle route at Parnell Road.

At the junction between Crumlin Road and Herberton Road, it is proposed to modify the existing layout to improve the kerb alignments and provide improved pedestrian crossing facilities. On the Crumlin Road between Herberton Road and Dolphin Road, it is proposed to maintain one bus lane and one general traffic lane in both directions. There is insufficient road width on this section to provide dedicated cycle tracks.

4.5 Dolphin Road to Christchurch Place – Dolphins Barn, Cork Street, St. Luke's Avenue, Dean Street, Patrick Street, Nicholas Street, Christchurch Place

Between Dolphin Road and South Circular Road it is intended to provide one bus lane, one general traffic lane and one cycle track in each direction. At the South Circular Road junction staggered crossings are proposed to improve pedestrian facilities and reduce traffic impacts for a single crossing with increased green time. A soft landscaping area is proposed on the south eastern corner of the junction to improve the urban realm aspects of the junction area whilst also improving safety.

Between South Circular Road and Ardee Street it is proposed to have one bus lane, one general traffic lane and one cycle track in each direction. It is also intended to upgrade the Ardee Street junction with improved pedestrian facilities. It is proposed to modify the Kevin Street/Dean Street junction to facilitate improved cycle way facilities. There is currently insufficient road width on Dean

Street to facilitate bus lanes so bus priority from St. Luke's Avenue will be maintained through Signal Controlled Priority. Between Dean Street Junction and Christchurch Place it is proposed to have one bus lane, one general traffic lane and one cycle track in each direction. The cross section will maintain the central median and retain the existing trees. Some on-street loading bays will be maintained between Bride Road and Bull Alley Street.

The junction at Christchurch Place/Winetavern Street/High Street is proposed to be realigned to improve pedestrian accessibility and frontage at the Peace Park to the south, and Christchurch Cathedral to the north. The intention of the proposed realignment is to deflect traffic away from the City Centre towards High Street.

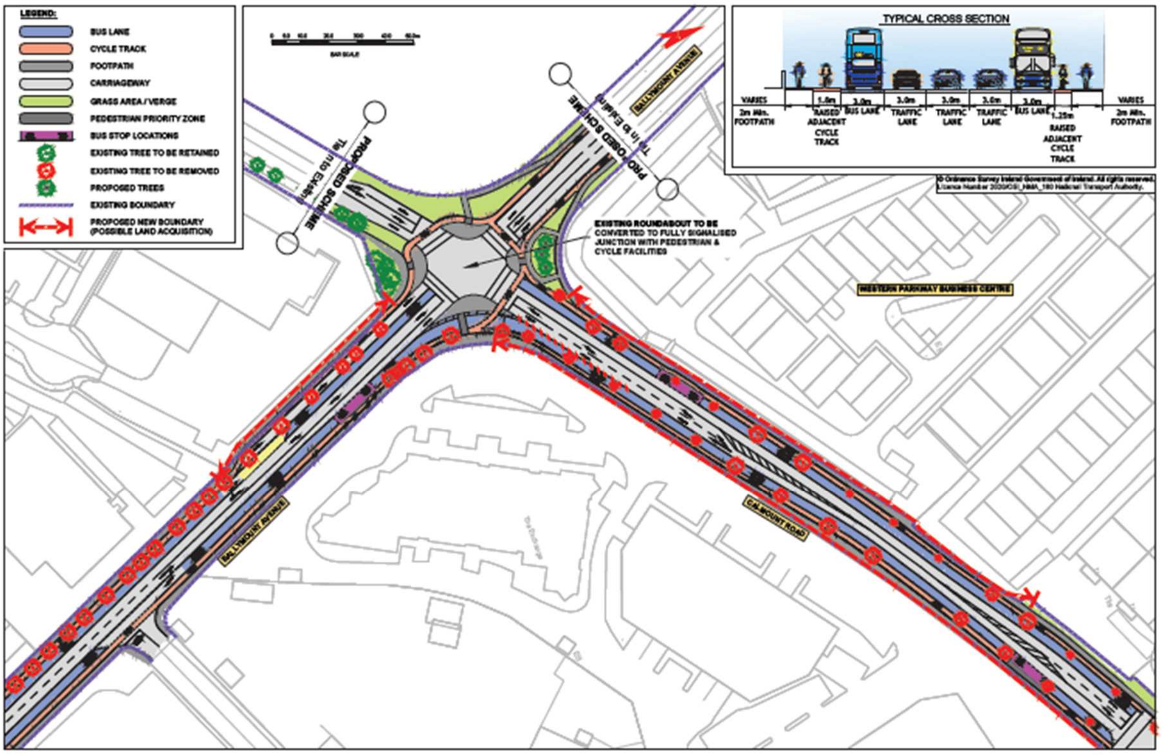
4.6 Key Changes from the Preferred Route Published in March 2020

- The layout of bus stops along the route have been enhanced;
- New priority junction proposed for Greenhills Road at the new Ballymount Avenue link road;
- Calmount Road extension tie-in to Greenhills Road, alignment adjusted northward.

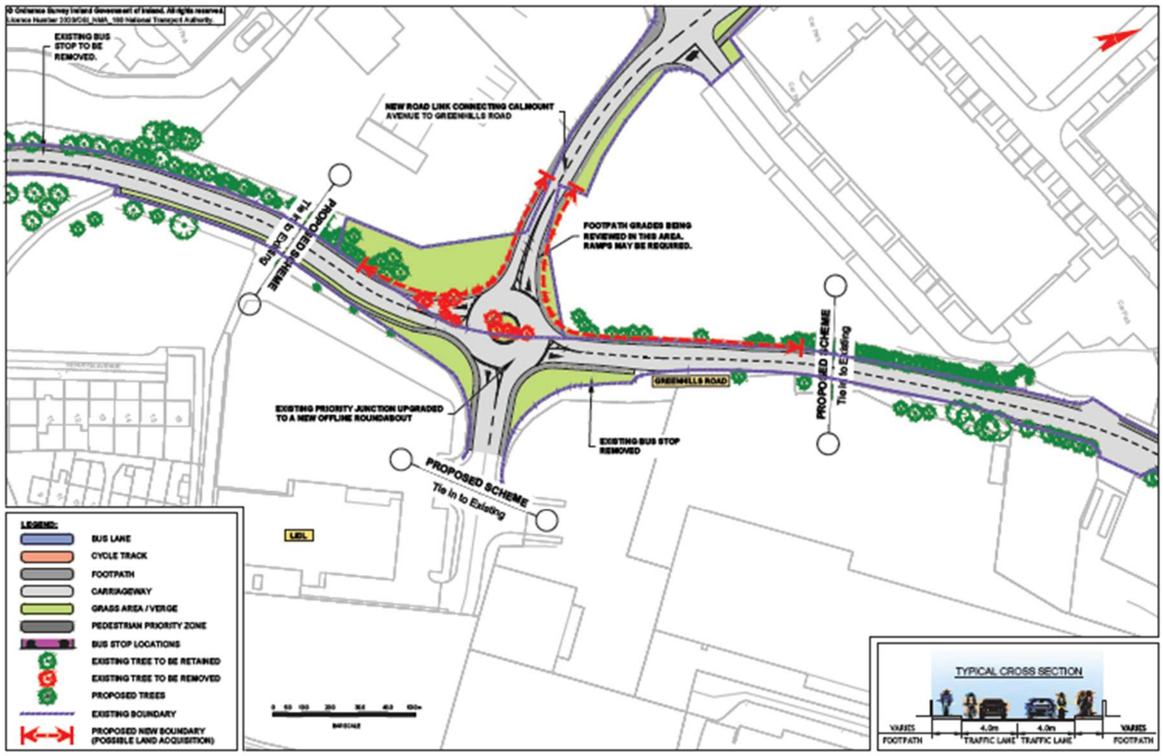
4.7 Key Facts

- Approximate number of properties that may be impacted **120**
- Approximate number of designated on-street parking spaces that may be removed **25**
- Approximate number of roadside trees that may be removed **242**
- Approximate route length: **12kms**
- Approximate cycle route length: **11kms**
- Current bus journey time: **up to 80 mins**
- BusConnects journey time: **30-40 mins**
- Future Bus journey time without BusConnects: **100 mins +**

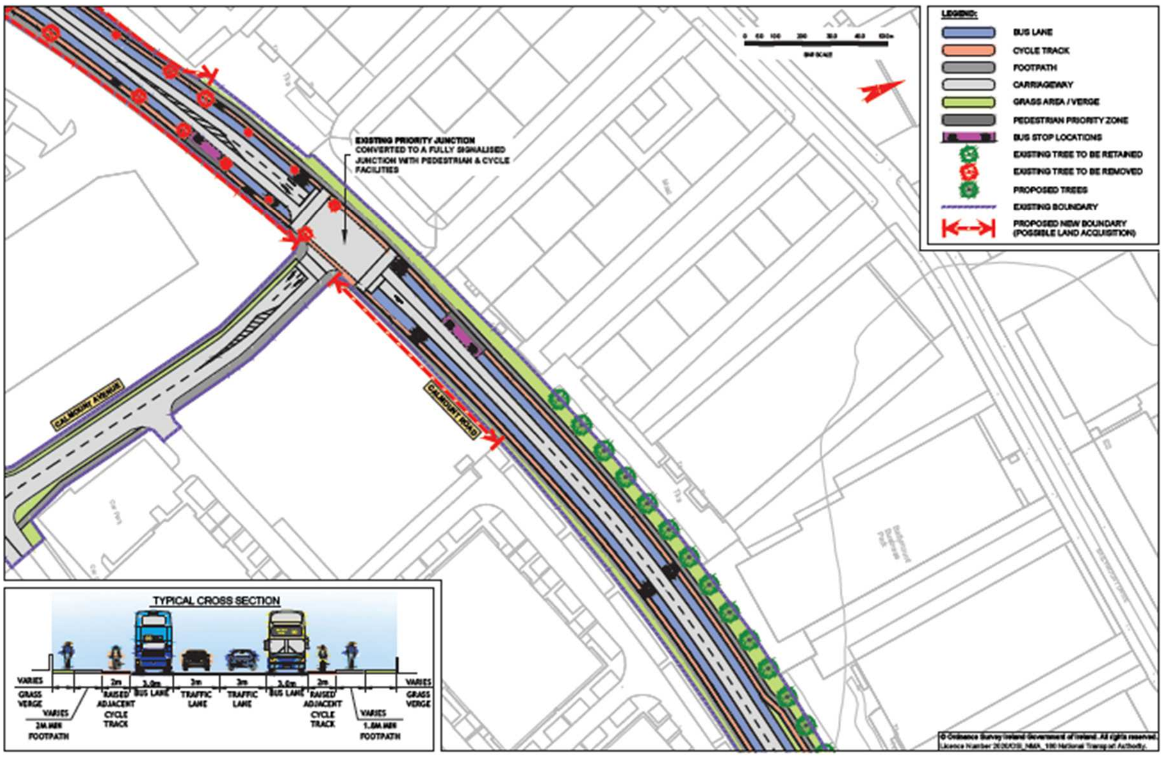
MAP 13: Preferred Route



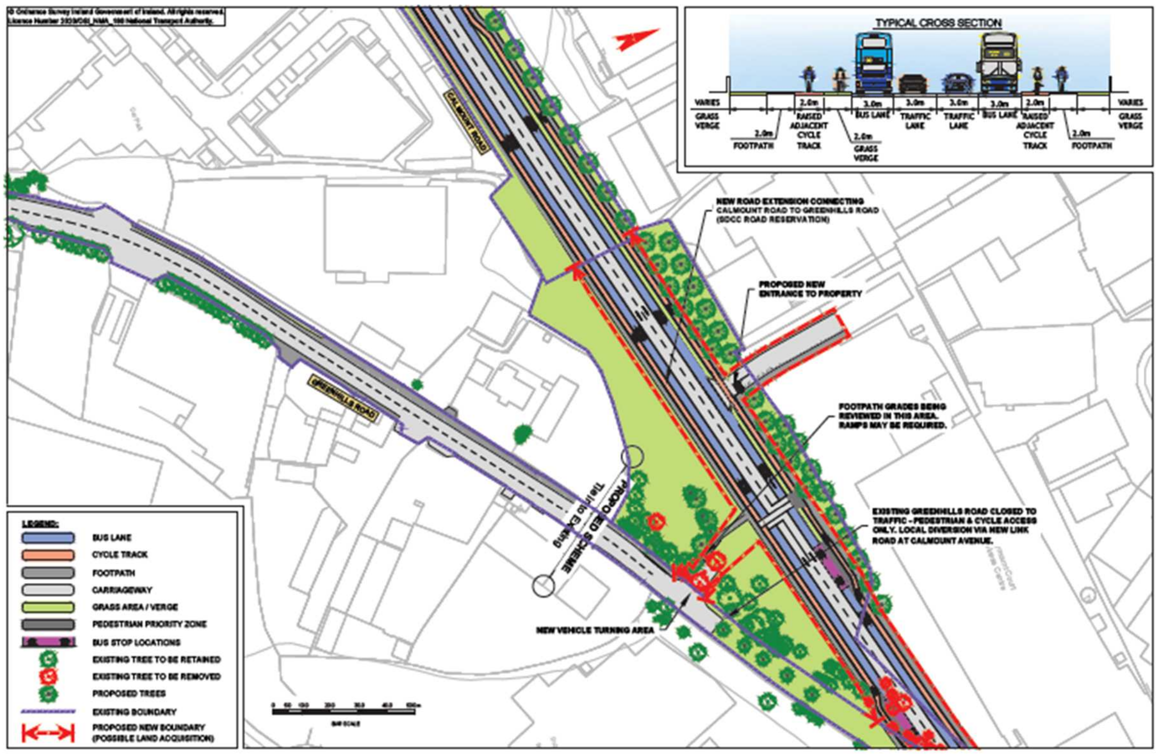
MAP 14: Preferred Route BusConnects Core Bus Corridors / 9: Greenhills > City Centre



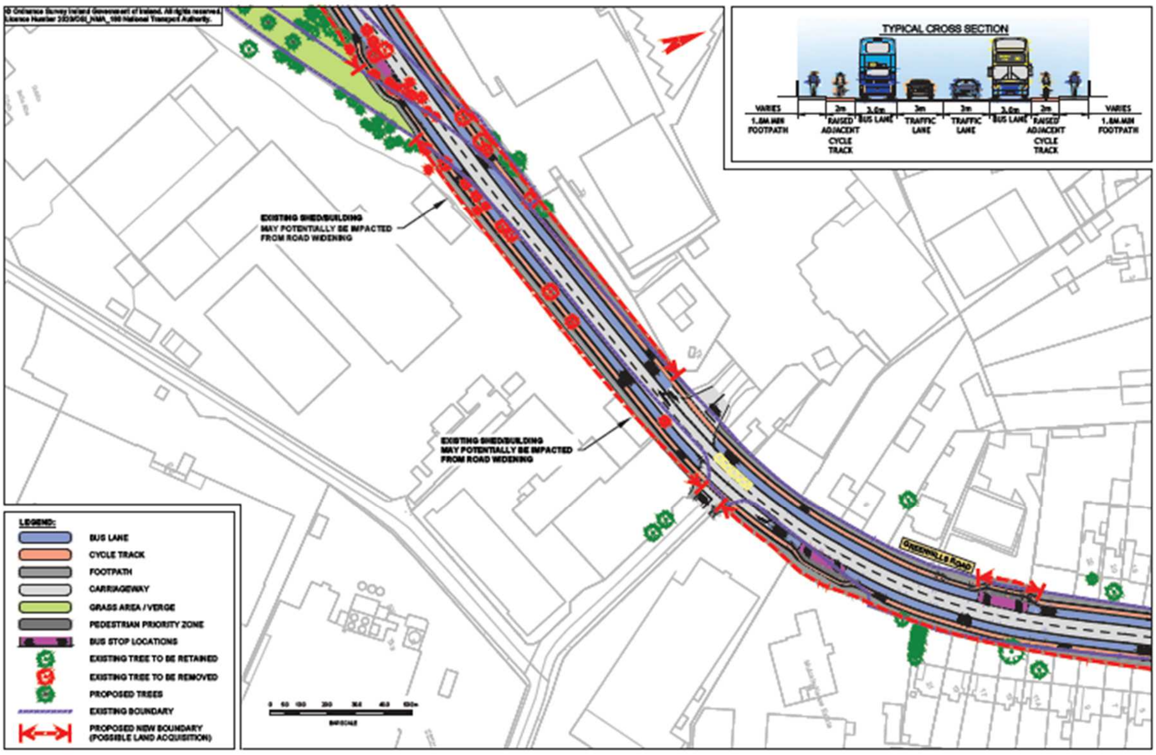
BusConnects Core Bus Corridors / 9: Greenhills > City Centre **MAP 15: Preferred Route**



MAP 16: Preferred Route BusConnects Core Bus Corridors / 9: Greenhills > City Centre

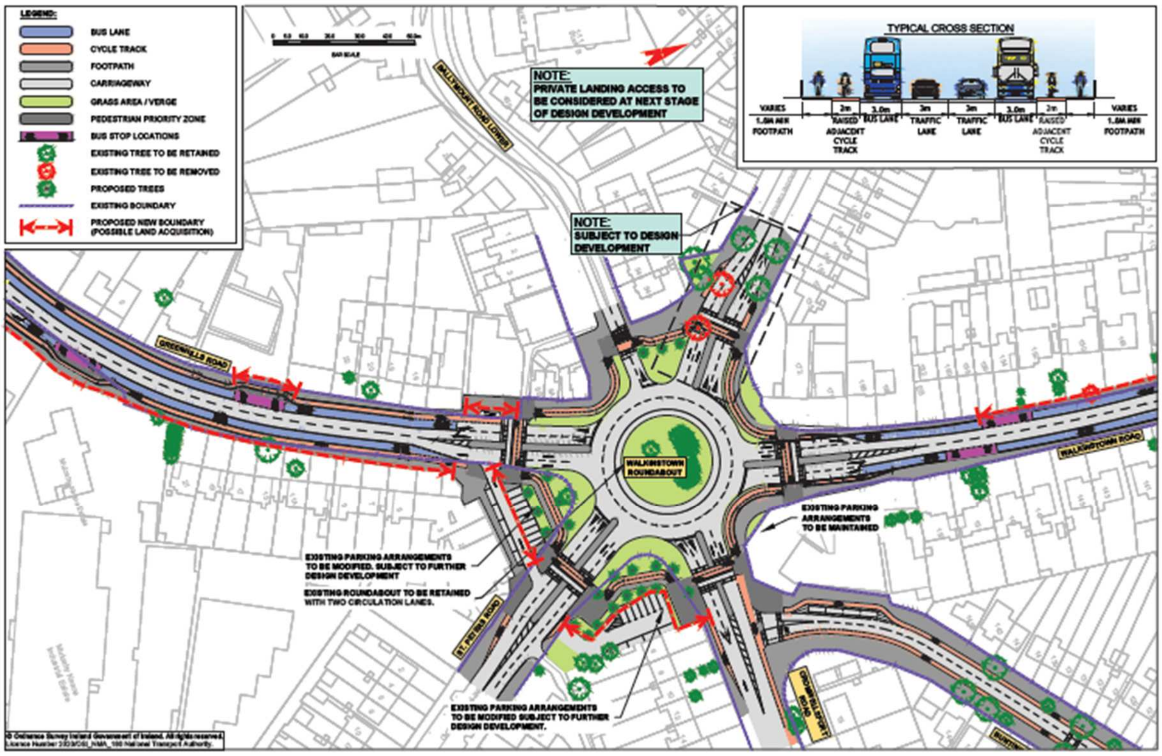


BusConnects Core Bus Corridors / 9: Greenhills > City Centre **MAP 17: Preferred Route**



MAP 18: Preferred Route

BusConnects Core Bus Corridors / 9: Greenhills > City Centre



APPENDIX 15

15.1 TVIA Terminology

15.2 Photomontages & CGIs

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APPENDIX 15A GENERIC TVIA TERMINOLOGY

Terminology	Definition
Access Land	Land where the public have access either by legal right or by informal agreement.
Activity	Activity on site tends to draw the eye whether it is a moving object or light reflection of an object changing with movement and thus the degree of impact is increased. It is sudden changes in contrast ratios that draw the attention of the viewer.
Baseline Studies	Work undertaken to determine and describe the environmental conditions against which any future changes can be measured, predicted or assessed.
Characterisation	The process of identifying areas of similar landscape character, classifying and mapping them and describing their character.
Characteristics	A distinctive element or combination of elements, which make a particular contribution to distinctive landscape character.
Compensation	Measures devised to offset or compensate for residual adverse effects which cannot be prevented / avoided or further reduced.
Cumulative	The additional changes caused by a proposed development in conjunction with other similar Developments or as the combined effect of a set of Developments, taken together.
Cumulative Town /Landscape and Visual Assessment (CLVIA)	The changes to townscape / landscape or visual amenity caused by the proposed development in conjunction with similar Developments or as the combined effect of a set of Developments, taken together.
Designated Landscape	Areas of landscape/ townscape identified as being of importance at international, national or local levels, either defined by statute or identified in Development plans or other documents. e.g., Greenbelt, Conservation Areas, Areas of High Scenic Quality or National Parks
Development	Any proposal that results in a change to the existing landscape and / or visual environment.
Digital Terrain Model	Computerised representation of ground topography in 3D as digital model based on the contour data (either 10m or 50m grid) of the OSI Ordinance Survey Maps.

Direct Effect	An effect that is directly attributable to the proposed development
Distance	The greater the distance, the less detail is observable and the more difficult it is to discern the proposal from its background, diminishing potential impact.
“Do nothing” situation	Continued change/evolution of a landscape in the absence of the proposed development.
Elevation	Viewed from a higher elevation, a proposal is likely to be viewed against a backdrop thus decreasing the degree of impact. Viewed from a lower elevation, a proposal may be seen against the skyline and thus the impact is increased.
Enhancement	Proposals that seek to improve the landscape resource and the visual amenity of the proposed development site and its wider setting, over and above its baseline condition.
Environmental Impact Assessment (EIA)	An Environmental Impact Assessment (EIA) is the process of examining the anticipated environmental effects of a proposed project - from consideration of environmental aspects at design stage, through consultation and preparation of an Environmental Impact Assessment Report (EIAR)
Geographical Information System (GIS)	A system that captures, stores, analyses, manages and presents data linked to location. Its links spatial information to a digital database.
Indirect Effects	Effects that result indirectly from the proposed project as a consequence of the direct effects, often occurring away from the site, or as a result of a sequence of interrelationships or a complex pathway. They may be separated by distance or in time from the source of the effects.
Key Characteristics	The combinations of elements, which are particularly important to the current character of the landscape and help to If the key characteristics which are identified were to change or be lost, there would be significant consequences for the current condition of the landscape.
Land Cover	The surface cover of the land, usually expressed in terms of vegetation cover or lack of it. Related but not the same as Land Use.
Land Use	What land is used for, based on broad categories of functional land cover, such as urban and industrial use and different types of agriculture and forestry.

Landform	The shape and form of the land surface which as resulted from combinations of geology, geomorphology, slope, elevation and physical processes.
Landscape	An area, perceived by people, the character of which is the result of the action and interaction of natural and / or human factors.
Landscape and Visual Assessment (LVA)	A tool used to identify and assess the likely significance of the effects of change resulting from Development both on the landscape as an environmental resource in its own right and on people's views and visual amenity.
Landscape Character	A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse.
Landscape Character Areas (LCA)	Landscape Character Area as defined in local or regional policy guidance. These areas that have been determined to be single unique areas that are distinct geographically or of a particular landscape type. Every LCA is geographically specific and has its own distinctive character and sense of place based upon patterns of geology, landform, land-use, cultural, historical and ecological features.
Landscape Capacity	The degree to which a particular landscape character type or area is able to accommodate change without significant effects on its character, or overall change to the landscape character type.
Landscape Constraints	Components of the landscape resource such as views or mature trees recognised as constraints to Development.
Landscape Effects	Effects on the landscape as a resource in its own right.
Landscape Elements	Individual components, which make up the landscape such as trees and hedgerows.
Landscape Features	Particularly prominent or eye-catching elements in the landscape such as tree clumps, church towers or wooded skylines.
Landscape Patterns	Spatial distributions of landscape elements combining to form patterns, which may be distinctive e.g., hedgerows that combine to form a distinctive field pattern.

Landscape Quality / Condition	A measure of the physical state of the landscape. It may include the extent to which typical character is represented in individual areas, the intactness of the landscape and condition of individual elements.
Landscape Value	The relative value that is attached to different landscapes by society. A landscape may be valued by different stakeholders for a variety of reasons.
Landscape Resource	The combination of elements that contribute to landscape context, character and value.
Magnitude (of effect)	A term that combines judgements about the size and scale of the effect, the extent the area over which it occurs, whether it is reversible or irreversible and whether it is short or long term in duration.
Mitigation	Measures including any process, activity, or design to avoid, reduce, remedy or offset for potential adverse environmental effects arising from a proposed development.
Perception	Combines the sensory (that we receive through our senses) with the cognitive (our knowledge and understanding gained from sources and experiences)
Photomontage	A visualisation which superimposes an image of the proposed development upon a photograph or a series of photographs.
Receptors	Defined aspects of the landscape resource that have the potential to be affected by a proposal.
Seascape	Landscapes with views of coast or seas, and coasts and adjacent marine environments with cultural, historical and archaeological links with each other.
Sensitivity	A term applied to specific receptors, combining judgements of the susceptibility of the receptor to the specific type of change or Development proposed and the value related to that receptor.
Significance	A measure of the importance or gravity of the environmental effect, defined by significance criteria specific to the environmental topic.
Townscape	The character and composition of the built environment including the buildings and relationships between them, the different types of urban open space, including green spaces, and the relationships between buildings and open spaces.

Tranquillity	A state of calm and quietude associated with peace, considered to be a significant asset of landscape.
Visual Amenity	The overall pleasantness of the views people enjoy of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of the people living, working, recreating, visiting or travelling through the area.
Visual Effects	Effects on specific views and the general visual amenity experienced by people.
Visual Receptors	Individuals and / or defined groups of people who have the potential to be affected by the proposal.
Visual Reference Points	Abbreviated to VRP, these are selected locations of viewpoints within the study area towards the proposal that allow analysis of the existing and proposed visual setting.
Combined Views	This occurs when the observer is able to see two or more Developments from one viewpoint and within the same arc of vision.
Successive Views	This occurs where the observer has to turn their head to see the various Developments.
Sequential Views	This occurs when the observer has to move to another viewpoint to see the same or different Developments (i.e., when moving through the landscape).
Size	The greater the proportion of the view taken up by the proposed development the greater the impact. Camouflage brought about by form and colour can alter the degree of impact.
Visualisation	A computer simulation, photomontage or other technique illustrating the predicted appearance of a Development.
Wireframe	A computer generated line drawing of the DTM (digital terrain model) and the proposed development from a known location.
Weather conditions	Visibility is affected by the sun direction during different times of the day. It is also affected by clarity of air. For example, on a bright and sunny morning after a frosty night the air tends to be clear. This is in contrast to a heat haze, which may be experienced during summer months.
Zone of Theoretical Visibility	Often abbreviated to ZTV, this is a digitally produced map showing the areas of land within which a Development is theoretically visible.

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Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

CGIs and Verified Views

Applicant: Steelplefield Limited

March 2022

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Presentation
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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	**Applicant Name: Steelplefield Limited**	**Image Title: CGI 1**
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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: CGI 2
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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	**Applicant Name: Steelplefield Limited**	**Image Title: CGI 3**
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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	**Applicant Name: Steelplefield Limited**	**Image Title: CGI 4**
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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

Applicant Name: Steelplefield Limited

Image Title: CGI 5

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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	**Applicant Name: Steelplefield Limited**	**Image Title: CGI 6**
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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: CGI 7
	CGI & VVMs by 3D DESIGN BUREAU	Tel: 01 288 0186 www.3ddesignbureau.com info@3ddesignbureau.com

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: CGI 8
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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: A 1
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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	**Applicant Name: Steelplefield Limited**	**Image Title: A 1**
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Methodology for Verified View Montages

1. Overview.
This summarised methodology has been prepared by 3D Design Bureau Ltd (3DDB) to explain the production of Verified View Montages (VVM). The preparation and presentation of reliable verifiable visual information is a key component to the writing of Landscape Visual Impact Assessment reports. It should be noted that VVMs are technical images and should be produced and used in a technically appropriate manner. Note: A full version of this methodology can be supplied in PDF upon request.

2. What Is A Verified View Montage (VVM)?
Verified View Montages work by using the correct geospatial insertion of accurate 3d models in the existing landscape (photo) allowing for a photorealistic view of the planned model in its intended location.

3. Methodology

3.1 Project Planning
Following appointment a full list of suggested views are drawn up for review prior to visiting site between 3DDB, the client and the planning consultant. Note: If a LVIA report is being written by a 3rd Party planning consultant, the medium to long range views will be guided by them. After obtaining a full list, it is analysed and a plan for the taking of baseline photographs is put in place. Note: 3D modelling of the proposed scheme can, and usually is, commenced prior to the photographic site visit.

3.2 High resolution Baseline Photography
Every baseline photograph is captured in raw settings using a high-resolution digital SLR camera. This allows for the maximum possible information to be retained in the digital file. It also avoids the file from being altered by any internal camera processing definitions, allowing us to retain the maximum control and fidelity on the end results.
The focal lengths used depend on the surrounding context and proximity to the desired area. We use high quality lenses with focal lengths that allow us to capture enough surrounding context without compromising quality and fidelity, by avoiding excessive barrelling, distortion or aberrations. All shots are taken horizontally with the use of a 50mm lens (where possible). Note: Although the 50mm focal length represents the perceived scale of the human eye, it does NOT represent the human field of view and therefore should not necessarily be used to show the proposed development in its context.
On site and back in the studio, each photo location is correctly recorded and marked as follows
On-Site:
- The tripod location on site is paint marked and photographed in relation to existing elements.
- The location of each photo is manually marked on a printed map while on site.
- The camera height is recorded.

Upon completion of the baseline photo site visit all photographs go through post processing back in the studio. The full set of photos along with a viewpoint location map are issued to the client for review and to choose the best shots that will demonstrate the visual impact that the proposed scheme may/may not have**.**

3.3 Baseline Photo Surveying
When all baseline photos for the VVMs are chosen, each one is marked up in studio. The fixed reference points within each photo are coloured coded and all 'marked up' baseline photos are issued to our qualified topographical surveyor for surveying purposes.
The survey team records the camera/tripod position using GPS & Total Station to an accuracy of +-1cm Northing & Easting and to an accuracy of 2cm Elevation. The 'marked up' fixed reference points identified in each photo are then surveyed to establish exact orientation of the view and to verify the photomontage process.

Methodology for Verified View Montages

3.4 3D Modelling & Visualisation.
Modelling
An accurate digital 3D model of the 'proposed' development is produced in Revit. This is carried out from a combination of the 3rd Party architectural, engineering and landscape drawings. All proposed model information is contained in the one file and it is ALWAYS positioned relative to the existing survey information.
The 'marked up' fixed reference points which have been surveyed, are also modelled along with any other relevant survey information from the supplied topo survey drawing/s. As stated above, the proposed model and survey model information are geospatially positioned relative to one another. This is imperative to ensure the accurate positioning / camera matching of the proposed digital 3D model within each chosen photo.
Visualisation
Once the digital 3D Revit model is complete, our 3D visualisation team take over the project for the visualisation process. This involves the matching of textures, lighting conditions and asset population. This ensures that the 3D model is visually as close as possible to the intended future 'As Built' development.
Software used for the visualisation process is called 3D Studio Max. This is accepted as the industry standard for architectural visualisation work and production of VVMs.

3.5 Camera Matching / Rendering / Post Production
Following the completion the 3D visualisation process (but in some instances prior to this) the following methodology is applied in order for views to be verifiable.
Camera Matching
All of the information recorded at the time of the baseline photographic site visit, that is, camera co-ordinates, angle of view, and direction of view, is programmed into the virtual camera within our 3D software package of choice - 3D studio Max. Insertion of digital cameras within the software with matching attributes of the physical camera is carried out. This careful method ensures that the size, position and height, of the proposed development in each VVM is correct to an accuracy of 0.33% i.e. +/- 1mm on an A3 print.
Rendering
Following the camera matching and visualisation process the view is 'rendered' at high resolution and is superimposed onto its matching baseline photograph using Adobe Photoshop software. The mathematical accuracy is then double checked and verified by ensuring that existing 'marked up' fixed reference point features which were also rendered line up exactly in the photo.
Post Production
Next, the VVM specialist establishes, which existing features, such as buildings, landscape and trees, are in the foreground of the proposed development and those that are in the background, i.e. which features will mask the development and which ones will appear behind the development. When it is found that the development is not visible due to foreground features, its extremities will be indicated with a red outline.

4. RESULTS
The resulting VVM having gone through this extensive procedure is an accurate and verifiable representation of the proposed development as viewed from the selected camera positions. This shows as closely as possible any future impact the proposed development may have on the surrounding environment and existing buildings, presenting a truly valuable tool for planning purposes.

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

Applicant Name: Steelplefield Limited

Image Title: Viewpoint Location Map

CGI & VVMs by 3D DESIGN BUREAU

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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 09:12:21

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Baseline VVM 1
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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

Applicant Name: Steelplefield Limited

Image Title: Proposed VVM 1

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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

Applicant Name: Steelplefield Limited

Image Title: Baseline VVM 2

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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Proposed VVM 2
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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Baseline VVM 3
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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 10:14:54

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Proposed VVM 3
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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 10:31:20

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Baseline VVM 4
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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 10:31:20

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Proposed VVM 4
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Canon EOS 5D Mark IV | EF16-35mm f/4L IS USM | Focal Length 24mm | Date 22/02/2021 10:45:55

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

Applicant Name: Steelplefield Limited

Image Title: Baseline VVM 5

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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 10:45:55

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Proposed VVM 5
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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 11:23:33

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Baseline VVM 6
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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 11:23:33

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

Applicant Name: Steelplefield Limited

Image Title: Proposed VVM 6

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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 11:43:14

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Baseline VVM 7
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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 11:43:14

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Proposed VVM 7
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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 12:08:10

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Baseline VVM 8

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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Proposed VVM 8
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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 24mm	Date 22/02/2021 12:59:23

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Baseline VVM 9
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Canon EOS 5D Mark IV | EF16-35mm f/4L IS USM | Focal Length 24mm | Date 22/02/2021 12:59:23

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

Applicant Name: Steelplefield Limited

Image Title: Proposed VVM 9

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Canon EOS 5D Mark IV | EF16-35mm f/4L IS USM | Focal Length 24mm | Date 22/02/2021 13:19:05

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

Applicant Name: Steelplefield Limited

Image Title: Baseline VVM 10

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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Proposed VVM 10
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Canon EOS 5D Mark IV | EF16-35mm f/4L IS USM | Focal Length 28mm | Date 22/02/2021 13:55:21

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Image Title: Baseline VVM 11

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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

Applicant Name: Steelplefield Limited

Image Title: Proposed VVM 11

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Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12

Applicant Name: Steelplefield Limited

Image Title: Baseline VVM 12

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Canon EOS 5D Mark IV	EF16-35mm f/4L IS USM	Focal Length 16mm	Date 10/11/2021 13:28:04

Project Title: Former Chadwicks Site, Greenhills Road, Walkinstown, Dublin 12	Applicant Name: Steelplefield Limited	Image Title: Proposed VVM 12
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